



Department of Commerce

Division of Industrial Compliance
 John R. Kasich, Governor
 Andre T. Porter, Director

April 2014

At its meeting on April 4, 2014, the Ohio Board of Building Standards adopted the rule changes identified as Amendments Group 88. These rule amendments were adopted for an effective date as shown below.

Amendments Group 88 included the following amended Residential Code of Ohio (RCO) rules. For your use, a summary of the changes is provided below and the text of the rules can be found immediately following this coversheet:

Rule Number	RCO Chapter	Chapter Title	Effective date
4101:8-1-01	1	Administration.	January 1, 2015
4101:8-2-01	2	Definitions.	July 1, 2014
4101:8-3-01	3	Building planning.	July 1, 2014
4101:8-4-01	4	Foundations.	July 1, 2014
4101:8-6-01	6	Wall construction.	July 1, 2014
4101:8-11-01	11	Energy efficiency.	July 1, 2014
4101:8-15-01	15	Exhaust systems.	July 1, 2014
4101:8-20-01	20	Boilers and water heaters.	July 1, 2014
4101:8-44-01	44	Referenced standards.	July 1, 2104

Reason for Amendments: **4101:8-1-01** to clarify that model homes are within the scope of the RCO, to clarify that 2- and 3-family dwellings that share an exit are within the scope of the OBC, to reference Chapter 29 for non-required fire protection systems, to replace entire section 103 with a reference to 4101:7, to clarify that the installing contractor of fire protection systems is to be certified by the State Fire Marshal, to mirror proposed OBC Section 114 product approval process language, to mirror OBC Board Organization Section 116, and to make general editorial corrections; **4101:8-2-01** to revise definitions of “Approved Agency”, “Dwelling”, “Dwelling, One-, Two- or Three-family”, “Dwelling Unit”, “Exit”, “Fire Separation Distance”, and to add definition of “Residential Building”; **4101:8-3-01** to reorganize Section 314 and add language to allow wireless smoke alarms in certain existing conditions, to clarify intent of carbon monoxide alarm requirements, to add beam and header to diagonal cross bracing/girt attachment in Table 324.7, to clarify that roof truss designs must account for all imposed loads required by Section 324.8, and to make general editorial corrections; **4101:8-4-01** to make general editorial corrections; **4101:8-6-01** to add the new simplified bracing section from the 2012 IRC and to make general editorial corrections; **4101:8-11-01** to modify the 2009 IECC to make technical corrections for fireplaces and air barrier requirements consistent with the 2015 IECC language, to delete references to swimming pool accessories, and to make general editorial corrections; **4101:8-15-01** to make general editorial corrections and to clarify the make-up air requirements for kitchen hood systems; **4101:8-20-01** to delete the requirements relating to swimming pool heaters because the code does not currently regulate pools; and **4101:8-44-01** to update the reference to the Ohio Plumbing Code to include March 1, 2013 updates, to update a few of the ASME standards, to delete the TIA to NFPA 70 because pools and spas are not currently within the scope of the RCO, and to make general editorial corrections.

If you should have any questions regarding these rule changes, please call BBS staff at (614)644-2613.

4101:8-1-01 Administration.

[Comment: When a reference is made within this rule to a federal statutory provision, an industry consensus standard, or any other technical publication, the specific date and title of the publication as well as the name and address of the promulgating agency are listed in rule 4101:8-43-01 of the Administrative Code. The application of the referenced standards shall be limited and as prescribed in section 102.5 of rule 4101:8-1-01 of the Administrative Code.]

**SECTION 101
GENERAL**

101.1 Title. Chapters 4101:8-1 to 4101:8-25, 4101:8-29, 4101:8-34, and 4101:8-44 of the Administrative Code are designated as the “Residential Code of Ohio for One-, Two-, and Three-Family Dwellings” for which the designation “RCO” may be substituted. The 2009 edition of the “International Residential Code”, first printing, Chapters 2 ~~through~~ through 24, 29, and 44 as published by the “International Code Council, Inc.” is used as the basis of this document as is incorporated fully except as modified in italic herein. References in these chapters to “this code”, to the “residential code”, or to the “Residential Code of Ohio” in other sections of the Administrative Code shall mean the “Residential Code of Ohio for One-, Two-, and Three-Family Dwellings”.

101.2 Scope. The provisions of the “Residential Code of Ohio for One-, Two-, and Three-Family Dwellings” shall apply to the construction, alteration, movement, enlargement, replacement, repair, equipment, use and occupancy, location, maintenance, removal, and demolition of every one-, two-, or three-family dwelling, any appurtenances connected or attached to such buildings or structures, or any accessory ~~structures~~ structure incidental to that dwelling house. This code also applies to a one-family, two-family, or three-family dwelling house that is used as a model to promote the sale of a similar dwelling house. No building or its equipment or accessories, to which the rules of the board apply shall be erected, constructed, or installed, except in conformity with the rules of the board.

This code also applies to such other residential occupancies as referenced and to the extent indicated in section 310 of the “OBC”.

Exceptions:

1. *Manufactured home units constructed under “24 CFR Part 3280,” “Manufactured Home Construction and Safety Standards” and within the scope of the rules adopted by the Ohio Manufactured Home Commission. This exception does not apply to alterations of, additions to, or changes of occupancy of manufactured homes.*
2. *Multiple single-family dwelling structures more than three stories in height and with more than three dwelling units.*
 - a. *The structure of one-, two-, and three-family dwellings which are more than three stories in height shall comply with the structural requirements of the OBC or section 106.5 of this code.*
3. *Residential buildings attached to occupancies that are within the scope of the OBC shall comply with the requirements of the “OBC”.*
4. *Buildings or structures containing two or three dwelling units with a shared exit shall comply with the requirements of the “OBC.”*
- ~~4.5.~~ *Buildings or structures which are incident to the use for agricultural purposes of the land on which said buildings or structures are located, provided such buildings or structures are not used in the business of retail trade; for the purposes of this section, a building or structure is not considered used in the business of retail trade if fifty per cent or more of the gross income received from sales of products in the building or structure by the owner or operator is from sales of products produced or raised in a normal crop year on farms owned or operated by the seller (see sections 3781.06 and 3781.061 of the Revised Code);*
- ~~5.~~ 6. *Agricultural labor camps;*
- ~~6.~~ 7. *Type A or Type B family day-care homes, except for the inspection required for licensure by the “Ohio Department of Jobs and Family Services (ODJFS)”. This required inspection shall be conducted by the certified building department having jurisdiction in accordance with the inspection checklist found on the board of building standard’s website.;*
- ~~7.~~ 8. *Buildings or structures which are designed, constructed, and maintained in accordance with federal standards and regulations and are used primarily for*

federal and state military purposes where the U.S. secretary of defense, pursuant to 10 U.S.C. Sections 18233(A)(1) and 18237, has acquired by purchase, lease, or transfer, and constructs, expands, rehabilitates, or corrects and equips, such buildings or structures as he determines to be necessary to carry out the purposes of Chapter 1803 of the U.S.C.

~~8.9.~~ Sewerage systems, treatment works, and disposal systems (including the tanks, piping, and process equipment associated with these systems) regulated by the legislative authority of a municipal corporation or the governing board of a county or special district owning or operating a publicly owned treatment works or sewerage system as stated in division (A) of section 6111.032 of the Revised Code.

~~9.10.~~ Building sewer piping.

101.3 Intent. *The purpose of this code is to establish uniform minimum requirements for the erection, construction, repair, alteration, and maintenance of residential buildings, including construction of industrialized units. Such requirements shall relate to the conservation of energy, safety, and sanitation of buildings for their intended use and occupancy with consideration for the following:*

1. Performance. *Establish such requirements, in terms of performance objectives for the use intended. Further, the rules shall consider the following:*

1.1 The impact that the state residential building code may have upon the health, safety, and welfare of the public;

1.2 The economic reasonableness of the residential building code;

1.3 The technical feasibility of the residential building code;

1.4 The financial impact that the residential building code may have on the public's ability to purchase affordable housing.

2. Extent of use. *Permit to the fullest extent feasible, the use of materials and technical methods, devices, and improvements which tend to reduce the cost of construction without affecting minimum requirements for the health, safety, and security of the occupants of buildings without preferential treatment of*

types or classes of materials or products or methods of construction.

3. **Standardization.** *To encourage, so far as may be practicable, the standardization of construction practices, methods, equipment, material and techniques, including methods employed to produce industrialized units.*

This code does not prevent a local governing authority from adopting additional regulations governing residential structures if the regulations comply with this section.

- 3.1. *A local governing authority shall, and any person may, notify the board of building standards of any regulation the local governing authority adopts related to content within the scope of this code and request that the board of building standards ~~to~~ determine whether that regulation conflicts with the state residential building code.*

- 3.1.1. *Not later than sixty days after receiving a notice to review local regulations for conflict, the board shall determine, based upon a recommendation from the advisory committee, whether the regulation conflicts with the state residential building code and shall notify any person who submitted the notice and the local governing authority that adopted the regulation of the board's determination.*

- 3.1.2 *If the board determines that a conflict does not exist, the board shall take no further action with regard to the regulation. If the board determines a conflict exists and the regulation is not necessary to protect the health or safety of the persons within the local governing authority's jurisdiction, the regulation is not valid and the local governing authority may not enforce the regulation.*

- 3.1.3 *If the board determines that a conflict exists and that the regulation is necessary to protect the health or safety of the persons within the local governing authority's jurisdiction, the board shall adopt a rule to incorporate the regulation into the state residential building code. Until the rule becomes a part of the state residential building code, the board shall grant a temporary variance to the local governing authority and any similarly situated local governing authority to which the board determines*

the temporary variance should apply.

101.4 Reasonable application. *The rules of the board and proceedings shall be liberally construed in order to promote its purpose. When the residential building official finds that the proposed design is a reasonable interpretation of the provisions of this code, it shall be approved. Materials, equipment and devices approved by the building officials pursuant to section 114 shall be constructed and installed in accordance with such approval.*

SECTION 102 APPLICABILITY AND JURISDICTIONAL AUTHORITY

102.1 General. *Where, in any specific case, different sections of this code specify different materials, methods of construction or other requirements, the most restrictive shall govern. Where there is a conflict between a general requirement and a specific requirement, the specific requirement shall be applicable.*

102.2 Other laws. *The provisions of this code shall not be deemed to nullify any provisions of state or federal law. Municipal corporations may make further and additional regulations, not in conflict with Chapters 3781. and 3791. of the Revised Code or with the rules of the board of building standards. However approval by the board of building standards of any fixture, device, material, system, assembly or product of a manufacturing process, or method or manner of construction or installation shall constitute approval for their use anywhere in Ohio.*

102.3 Rules of the board. *As provided in division (B) of section 3781.11 of the Revised Code, the rules of the board of building standards shall supersede and govern any order, standard, or rule of the divisions of state fire marshal or industrial compliance in the department of commerce, and the department of health and of counties and townships, in all cases where such orders, standards or rules are in conflict with the rules of the board of building standards, except that rules adopted and orders issued by the fire marshal pursuant to Chapter 3743. of the Revised Code prevail in the event of a conflict.*

The rules of the board of building standards adopted pursuant to section 3781.10 of the Revised Code shall govern any rule or standard adopted by the board pursuant to sections 4104.02 and 4105.011 of the Revised Code.

102.4 Application of references. *References to chapter or section numbers, or to provisions not specifically identified by number, shall be construed to refer to such chapter, section or provision of this code.*

102.5 Referenced codes and standards. *The codes and standards referenced in this code shall be considered part of the requirements of this code to the prescribed extent of each such reference. When a reference is made within the code to a federal statutory provision, an industry consensus standard, or any other technical publication, the specific date and title of the publication as well as the name and address of the promulgating agency are listed in Chapter 44.*

Unless specified otherwise in this code, reference to the term “International Residential Code” shall be changed to “residential code”; reference to “International Fire Code” shall be changed to “fire prevention code”; and reference in design and construction provisions to “one-and two-family dwellings” shall be changed to “one-, two-, and three-family dwellings.”

Because the “International Code Council” has placed design and construction information throughout its model code documents, including into the fire prevention code, any referenced code requirements relating to the design, construction, alteration, movement, enlargement, replacement, repair, equipment, use and occupancy, location, removal, and demolition of every building or structure within the scope of this code, shall be enforced by the residential building official.

Where differences occur between provisions of this code and referenced standards listed in Chapter 44, the provisions of this code shall apply.

102.6 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 thereof, and it shall be presumed that this code would have been adopted without such illegal or invalid parts or provisions.*

102.7 Existing structures. *The provisions of section 113 shall control the alteration, repair, addition, maintenance, and change of occupancy of any existing structure.*

The occupancy of any structure currently existing on the date of adoption of this code shall be permitted to continue without change provided there are no orders

of the residential building official pending, no evidence of fraud, or no serious safety or sanitation hazard. When requested, such approvals shall be in the form of a “Certificate of Occupancy for an Existing Building” in accordance with section 111.

Buildings constructed in accordance with plans which have been approved prior to the effective date of this code are existing buildings.

102.8 Non-required work. *Any component, building element, equipment, system or portion thereof not required by this code shall be permitted to be installed provided that it is constructed or installed in accordance with this code to the extent of the installation.*

102.8.1 Fire protection systems. *Non-required fire protection systems shall be installed in accordance with ~~NFPA 13 or NFPA 13D~~ Chapter 29 to the extent of the intended installation.*

102.8.2 Elevators and lifts. *When a non-required elevator is intended to be installed, it shall be designed and installed in accordance with the residential elevator provisions in ~~Chapter 10~~ Part 5.3 of the ANSI A17.1. Non-required platform (wheelchair) lifts shall be designed and installed in accordance with ASME A18.1.*

102.9 Temporary structures. *The residential building official is authorized to issue approvals for temporary structures. Such approvals shall be in the form of a “Certificate of Occupancy for a Temporary Building” in accordance with section 111.1.5. This section does not apply to time-limited occupancies in existing structures. See section 111.1.4 for time-limited occupancies.*

102.9.1 Conformance. *Temporary structures 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.*

102.9.2 Termination of approval. *The residential building official is authorized to terminate approval for a temporary structure and to order the temporary structure to be discontinued if conditions of the approval have been violated or the structure or use poses an immediate hazard to the public or occupants of the structure.*

102.10 Work exempt from approval. Approval shall not be required for the following:

Building:

1. One-story detached accessory structures used as tool and storage sheds, playhouses and similar uses, provided the floor area does not exceed two hundred square feet (11.15 m^2) and playground structures.
2. Fences not over six feet (1829 mm) high.
3. Retaining walls which are not over four 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 five thousand gallons (18 927 L) and the ratio of height to diameter or width does not exceed two to one.
5. Sidewalks and driveways not more than thirty inches (762 mm) above grade and not over any basement or story below and which are not part of an accessible route.
6. Painting, papering, tiling, carpeting, cabinets, counter tops and similar finish work.
7. Swings and other playground equipment accessory to a one, two, or three-family dwelling.
8. Window awnings supported by an exterior wall which do not project more than fifty-four inches (1372 mm) from the exterior wall and do not require additional support.
9. Decks not exceeding 200 square feet (18.58 m^2) in area, that are not more than 30 inches (762mm) above grade at any point, are not attached to a dwelling, and do not serve the exit door required by section ~~311.4~~ 311.2.

Electrical:

1. *Listed cord-and-plug connected temporary decorative lighting.*
2. *Reinstallation of attachment plug receptacles but not the outlets thereof.*
3. *Replacement of branch circuit overcurrent devices of the required capacity and type 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. *Repairs and Maintenance: Approval shall not be required for 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.*
4. *Gas distribution piping owned and maintained by public or municipal utilities and located upstream of the point of delivery.*

Mechanical:

1. *Portable heating appliances;*
2. *Portable ventilation equipment;*
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 cooler.*
7. *Self-contained refrigeration systems containing ten pounds (4.54 kg) or less of refrigerant or that are actuated by motors of one 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.*
9. *Heating and cooling distribution piping owned and maintained by public or municipal utilities.*

Plumbing:

1. *The repair of leaks in drains, water, soil, waste or vent pipe; provided, however, that if any concealed trap, drain-pipe, 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 an approval shall be obtained and inspection made as provided in this code.*
2. *The clearance of stoppages or the repair 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.*

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

102.10.2 Minor repairs. *Minor repairs to structures may be to residential structures made without application or notice to the residential building official. 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 standpipe, 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.

102.11 Building department jurisdictional limitations. *A municipal, township, or county residential building department that has been certified by the board of building standards, pursuant to section 103.2, shall enforce provisions of the rules of the board and of Chapters 3781. and 3791. of the Revised Code, relating to construction, arrangement, and the erection of residential buildings or parts thereof as defined in the rules of the board in accordance with the certification except as follows:*

1. **Fire.** *The fire chief of municipal corporations or townships, having fire departments, shall enforce all provisions of the rules of the board relating to fire prevention.*
2. **Health.** *The department of health, the boards of health of city or general health districts, or the residential departments of building inspection of municipal corporations, townships, or counties shall enforce such provisions relating to sanitary construction.*
3. **Sewerage and drainage system.** *In accordance with Section 3781.03 of the Revised Code, the department of the city engineer, in cities having such departments, the boards of health of health districts, or the sewer purveyor, as appropriate, shall have complete supervision and regulation of the entire sewerage and drainage system of the jurisdiction, including the building sewer and all laterals draining into the street sewers. Such department or agency shall have control and supervision of the installation and construction of all drains and sewers that become a part of the sewerage system of the jurisdiction and shall issue all the necessary permits and licenses for the construction and installation of all building sewers and of all other lateral drains that empty into the main sewers. Such department or agency shall keep a permanent record of the installation and location of every drain and sewerage system of the city.*

4. **Enforcement.** *This section does not exempt any officer or department from the obligation of enforcing any provision of the rules of the board.*
5. **State Projects.** *Certification does not confer any jurisdiction to a certified building department to:*

5.1 *The construction of buildings by the state of Ohio or on land owned by the state of Ohio including, but is not limited to, its agencies, authorities, boards, commissions, administrative departments, instrumentalities, community or technical college districts, but does not include other political subdivisions.*

Exception: *Local school district building projects funded by the Ohio school facilities commission in accordance with Chapter 3318. of the Revised Code where the local certified building department is authorized by the board to regulate construction of school facilities.*

5.2 *Park districts created pursuant to Chapter 1545. of the Revised Code.*

Note: *The lands owned by Miami university in the city of Oxford and Oxford township in Butler County and leased to private individuals or corporations under the land rent provisions of the Act of February 17, 1809, as set forth at 7 Ohio laws 184, are subject to local certified building department jurisdiction and are exempt from these provisions.*

SECTION 103

CERTIFIED RESIDENTIAL BUILDING DEPARTMENTS, PERSONNEL, AND APPEALS BOARDS

~~**103.1** — **General.** *Before exercising authority in the enforcement of the rules of the Board and before accepting and approving residential plans, municipal, township and county residential building departments and their required personnel shall be certified by the board of building standards as required in section 3781.10 of the Revised Code.*~~

~~*Applications submitted to the board of building standards for certifications shall be made on prescribed forms according to the provisions of this section.*~~

~~**103.2 — Building department certification.** Municipalities, townships, and counties may seek certification by the board of building standards as described in division (E) of section 3781.10 of the Revised Code to exercise enforcement authority, to accept and approve residential construction documents, and to make inspections.~~

~~**103.2.1 — Certification types.** A political subdivision may seek to enforce the rules of the board by requesting either a certification as a residential building department or a residential sub-building department as required in sections 103.2.1.1 or 103.2.1.2. References in this chapter to “residential department” or “building department”, unless specified, shall mean “certified residential building department” or “certified residential sub-building department.”~~

~~**103.2.1.1 — Certification as a residential building department.** Municipalities, townships, and counties shall enforce the rules of the board in conformity with the law and as described in sections 103.2.1.1.1 and 103.2.1.1.2.~~

~~**103.2.1.2 — Municipalities.** Municipalities, in submitting the application described in section 103.2.3, must specify whether the residential department is to be certified to enforce the rules of the board for plumbing and will employ a certified plumbing inspector as required in section 103.3. If a residential department is not to be certified for plumbing, the enforcement shall be done by the local board of health.~~

~~Municipalities may, at any time, make application to the board of building standards to be approved to have the building department certification modified or to include or exclude plumbing enforcement duties in accordance with section 103.2.8.~~

~~**103.2.1.1.2 — Counties and townships.** Counties and townships, in submitting the application described in section 103.2.3 for certification of a residential building department, are not certified to enforce plumbing provisions or employ plumbing inspectors required in section 103.3. As permitted in section 3703.01 of the Revised Code, county residential building departments may enforce plumbing provisions if the county board of health has entered into an agreement with the board of county commissioners to provide plumbing code~~

~~enforcement and employs a plumbing inspector certified as required in division (D) of section 3703.01 of the Revised Code. The county shall specify on its application whether the county residential department will enforce the rules of the board for plumbing and will employ a properly certified plumbing inspector. If, after certification, a county residential building department assumes plumbing code enforcement as required in section 3703.01 of the Revised Code, it shall notify the board.~~

~~Counties and townships may, at any time, make application to the board of building standards to be approved to have the building department certification modified or to include or exclude medical gas piping system enforcement duties in accordance with section 103.2.8.~~

~~**103.2.1.3** — **Certification as a residential sub-building department.** Municipalities, townships, and counties may be certified by the board of building standards to enforce the rules of the board as a residential sub-building department in conformity with the law and as described in sections 103.2.1.2.1 and 103.2.1.2.2. A residential sub-building department has enforcement exercised on their behalf by another certified political subdivision that will perform all enforcement, reporting, and administrative duties.~~

~~**103.2.1.3.1** — **Municipalities.** Municipalities, in submitting the application described in section 103.2.3, must specify whether the department is to be certified as a residential sub-building department and shall indicate which certified residential building department of another political subdivision will enforce the rules of the board in the municipality. The application must also specify how the public in a municipality with a certified residential sub-building department will be provided information on how construction documents will be accepted, reviewed, and approved, and how inspections will be requested and made.~~

~~Municipalities may, at any time, make application to the board of building standards to be approved to have the residential building department certification modified to change its certification from a residential sub-building department to a certified residential building department, or vice versa, in accordance with section 103.2.8.1.~~

~~**103.2.1.3.2** — **Counties and townships.** Counties and townships, in submitting the application described in section 103.2.3, must specify whether the department is to be certified as a residential sub-building department and shall indicate which certified residential building department of another political subdivision will enforce the rules of the board in the county or township. The county or township must also specify how the public in the county or township with a certified residential sub-building department will be provided information on how construction documents will be accepted and approved, and how inspections will be requested and made.~~

~~Counties and townships may, at any time, make application to the board of building standards to be approved to have the residential building department certification modified to change its certification from a residential sub-building department and to a residential certified building department, or vice versa, in accordance with section 103.2.8.1.~~

~~**103.2.2** — **Building department certification requirements.** To qualify for certification, a municipal, township, or county shall comply with the following:~~

- ~~1. **Conformity with law.** The residential department shall submit an application and shall have been created in conformity with the law, shall have adopted ordinances or resolutions, and shall have entered into any agreements or contracts necessary to comply with the rules of the board and section 103.2.3.~~
 - ~~1.1 A political subdivision with a nonresidential building department certified pursuant to OBC section 103.1, qualifies for certification to enforce the Residential Code of Ohio. The political subdivision must submit an application for additional certification in accordance with section 103.2.1. Personnel shall be qualified pursuant to and the department shall comply with the requirements of this section.~~
- ~~2. **Required personnel.** A certified residential building department or residential sub-building department shall have the following personnel~~

~~qualified to execute the duties required for the exercise of enforcement authority, the review and approval of construction documents, and the performance of inspections under the rules of the board. All personnel of municipal, township, or county residential building departments, and persons and employees of persons, firms, or corporations whose responsibilities include the exercise of enforcement authority shall be certified by the board of building standards pursuant to section 103.3 prior to performing such duties;~~

~~2.1 **Residential building official.** The residential building department shall have in its employ or under contract one person appointed by the municipality, township, or county holding a certification as a residential building official.~~

~~2.2 **Residential plans examiner.** The residential building department shall have in its employ or under contract at least one person holding a certification as the residential plans examiner.~~

~~2.3 **Residential building inspector.** The residential building department shall have in its employ or under contract at least one person holding a certification as a residential building inspector.~~

~~2.4 **Residential plumbing inspector.** If the residential department is certified to enforce plumbing provisions, then the residential department shall have in its employ or under contract at least one person holding the appropriate certification as a residential plumbing inspector.~~

~~2.5 **Electrical safety inspector.** The residential building department shall have in its employ or under contract at least one person holding certification as an electrical safety inspector.~~

~~2.6 **Backup personnel.** The residential department shall have in its employ or under contract, alternate personnel meeting the requirements of this rule, to serve in the event of a conflict of interest or the unavailability of the residential building official, residential plans examiner or residential inspectors.~~

- ~~2.7 **Replacement personnel.** When required personnel leave the employ of the residential department, permanent replacement personnel shall be designated in accordance with the rules of the Board within one hundred twenty days.~~
3. ~~**Elective personnel.** The residential department may elect to have the following personnel certified by the board of building standards pursuant to section 103.3 prior to performing such duties;~~
- ~~3.1 **Residential mechanical inspector.** The residential department may also have in its employ or under contract persons holding a residential mechanical inspector certification.~~
- ~~3.4 **Electrical plans examiner.** The residential department may have in its employ or under contract persons holding a certification as an electrical plans examiner.~~
4. ~~**Contract employees.** A municipal corporation, township, or county may contract with a certified residential building department, health district, or with persons, firms, or corporations under contract to furnish services, and meeting the requirements of this rule, to exercise enforcement authority, administer these rules, approve plans and specifications and perform inspections on behalf of such municipal corporation, township, or county, providing such authority is exercised pursuant to such contract and upon application to and approval by the board of building standards;~~
5. ~~**Residential building department office.** The certified residential building department shall have an office conveniently located within the area it serves. The office shall be open and staffed to serve the public need and office hours shall be conspicuously posted. If the residential department contracts for its enforcement services, or is certified as a residential sub-building department, information shall be provided to the public explaining how residential building department services shall be provided;~~
6. ~~**Availability of inspectors.** The residential building department shall be staffed so that all residential inspectors are available for requested inspections as required in section 108.1; and~~

- ~~7. Residential building department certification, to be posted. The certificate issued by the board of building standards to a municipal, township, or county residential building department shall be posted in a conspicuous place within the jurisdiction.~~

~~**103.2.3 Residential building department certification application.** Application for certification of a municipal, township, or county residential building department shall be made on a form prescribed by the board of building standards and shall set forth:~~

- ~~1. Copy of the law creating such a residential department.~~
- ~~2. Copy of a resolution requesting certification of the residential building department to enforce the rules of the board.~~
- ~~3. The proposed budget for the operation of such residential department.~~
- ~~4. A chart showing the organization of the residential building department within the governmental body.~~
- ~~5. Data reflecting the population and the size of the area to be served.~~
- ~~6. The number of and board certifications held by staff to be employed by the residential building department.~~
- ~~7. The names, addresses, and board certifications of persons, firms or corporations contracting to furnish work or services when such persons, firms, or corporations are under contract to furnish architectural, engineering, or inspection services to the municipal corporation, township, or county, and such authority is exercised pursuant to such contract.~~
- ~~8. The names of other municipal corporations, townships, counties, or health districts contracting to furnish work or services when such other municipal corporation, township, county, or health district is under contract to furnish architectural or engineering services to the municipal corporation, township, or county, and such authority is exercised pursuant to such contract and when officers or employees of~~

~~any other municipal corporation, township, county, or health district under contract to furnish inspection services to the municipal corporation, township, or county, when such authority is exercised pursuant to such contract.~~

- ~~9. A copy of the ordinance or resolution authorizing a residential building department to enter into a contract with other municipalities, townships, counties, health districts, persons, firms or corporations to do their plan approval and inspections.~~
- ~~10. A copy of the contract between the residential building department and other municipalities, townships, counties, health districts, persons, firms, or corporations to do their plan approval or inspections.~~
- ~~11. The department within the municipality, township, or county which will be responsible for plumbing inspection, if not within the residential building department.~~
- ~~12. The applicant may attach any other charts, maps, statistical data or other information which it determines may be beneficial to the board in considering the applications for certification.~~
- ~~13. A procedure for plan approval and for performing inspections, a copy of the plan review application, and a copy of the department's approval stamp.~~
- ~~14. The board may allow amendments to applications prior to formal action. Requests for amendments to applications shall be made in writing and conform to all the other provisions of this rule.~~
- ~~15. An explanation of how a local appeals process will be established and operate within the jurisdiction.~~
- ~~16. The original of the documents, papers and charts required in paragraphs one to sixteen of this rule shall be filed with the board.~~
- ~~17. Signature of an authorized representative of the board of township trustees in townships, the board of county commissioners in counties, or the appropriate officials in municipalities.~~

~~18. If the department is requesting certification as a sub-department, the application must also specify how the public in the jurisdiction with a certified residential sub-building department will be provided information on how construction documents will be accepted, reviewed, and approved, and how inspections will be requested and made.~~

~~The board shall hold a hearing to take action on the application. The applicant may be present at the hearing to respond to any questions from the board and all interested persons appearing at such hearing may be given an opportunity to comment. The board may establish a separate application form with waived requirements for jurisdictions with certified non-residential building departments seeking residential certification.~~

~~**103.2.4 Residential building department certification, certification hearing.** Upon receipt of an application, the board of building standard's certification committee shall review the application and make a recommendation to the board of building standards. The committee may ask for additional information to be submitted by the applicant prior to making a recommendation to the board. If the committee requests additional information from the applicant, failure to submit the requested information within ninety days from the date of the request may be cause for disapproval of the application by the board. After receiving a recommendation from the committee, a certification hearing on the application shall be conducted by the board of building standards. An authorized representative of the municipality, township, or county seeking certification present at the certification hearing may give testimony or respond to any questions from the board. The board shall give all interested persons appearing at such certification hearing an opportunity to be heard and explain their positions. A record of the proceeding shall be made by the board.~~

~~**103.2.4.1 Residential building department certification, approval or denial.** Following the public hearing, the board shall act on the application for certification.~~

~~Approval by the board of building standards of an application for certification shall set forth the subject matters for which the municipal, township, or county residential building department under consideration~~

~~is to be certified. After such approval, the appropriate official in municipalities, the board of township trustees in townships, or the board of county commissioners in counties requesting residential certification, shall be furnished a certificate of approval which shall state the conditions and limitations, if any, under which it has been issued.~~

~~If the application is denied in whole or in part by the board of building standards, the appropriate official in municipalities, the board of township trustees in townships, or the board of county commissioners in counties requesting residential certification shall be notified in writing of such denial and the reason therefore and to their rights of appeal pursuant to sections 3781.10, 3781.101, and Chapter 119. of the Revised Code.~~

~~**103.2.5 Residential building department certification, board to maintain list.** The board of building standards shall maintain a current list of all certified nonresidential and residential building departments, their contact information and, if applicable, their contractual relationships with other persons, departments, firms, or corporations that enforce the rules of the board on behalf of the certified residential building department.~~

~~The list of certified nonresidential and residential building departments shall be made available upon request and shall be posted on the board's website at <http://www.com.ohio.gov/dico/BBS.aspx>.~~

~~**103.2.6 Residential building department certification, reports, and assessment.** Certified residential building departments shall submit the following reports and information to the board of building standards:~~

- ~~1. A yearly operational report for the previous year, within ninety calendar days after the end of each calendar year;~~
- ~~2. Written notification of changes in personnel of the building department who enforce the rules of the board, within thirty calendar days after such personnel have been appointed;~~
- ~~3. Replies to any special requests or queries made by the board of building standards, within thirty calendar days of receipt;~~

~~4. Copies of revised contracts or agreements, within thirty calendar days after the department creates or changes a contractual relationship with another department or firm.~~

~~**103.2.6.1 — Board assessment.** Each political subdivision that prescribes fees pursuant to division (E) of section 3781.102 of the Revised Code shall also collect on behalf of the board of building standards an assessment equal to one per cent of those fees imposed for approvals, for the acceptance and approval of plans and specifications, and for performing inspections.~~

~~**103.2.6.1.1 — Assessment report.** The residential building official shall report on the prescribed form and remit monthly by check, the amount of the assessments collected on behalf of the board not later than sixty days following the end of each month in which the assessments are collected. In the case of residential building departments under contract to exercise enforcement authority pursuant to section 103.2.1.2, the residential building official shall report and remit to the Board for all certified residential sub-building departments. Checks shall be made payable to the “Treasurer, State of Ohio”.~~

~~**103.2.7 — Residential building department certification, revocation or suspension.** Upon petition to the board of building standards by any person affected by the exercise of the authority granted under such certification, or by the board on its own motion, in accordance with division (E) of section 3781.10 of the Revised Code, a residential department certification may be revoked or suspended.~~

~~**103.2.7.1 — Residential building department certification, hearings and appeals.** Hearings shall be held by the board of building standards and appeals shall be permitted on any proceedings for certification as provided in section 119.07 of the Revised Code and in sections 103.3.6.1.1 and 103.3.6.1.2.~~

~~**103.2.7.1.1 — Complaint process.** Upon receipt of a written complaint against a certified residential building department that is substantiated by demonstrable evidence or upon the board’s own motion:~~

- ~~1. The board shall decide whether the information submitted warrants causing a formal investigation to be initiated or sending a notice for public hearing as outlined in item 4 below;~~
- ~~2. If a formal investigation is warranted, the certified jurisdiction shall be notified that an investigation has been initiated by the board;~~
- ~~3. Upon completion of the investigation, findings shall be reported to the board.~~
- ~~4. The board may dismiss the complaint, table the matter for future action, or initiate action to suspend or revoke the certification. If the board issues an order to suspend or revoke the certification, it shall:
 - ~~4.1 Notify the certified jurisdiction of the charges by certified mail, return receipt requested. The certified jurisdiction shall be informed that a hearing, if desired, must be requested within thirty days from the date of the mailing to request a hearing before the board. The order shall inform the certified jurisdiction that it may be represented by counsel at the hearing. Failure by the certified jurisdiction to request a hearing within thirty days from the date of the mailing of the notification may cause the board, after a hearing, to uphold the order revoking or suspending certification;~~
 - ~~4.2 Schedule a hearing to be held seven to fifteen days after receipt of the request. The board may continue or postpone the hearing upon application by the party or upon its own motion;~~
 - ~~4.3 The board may appoint a hearing officer to conduct a hearing.~~
 - ~~4.4 A hearing will be conducted during which parties and witnesses can be examined and offer testimony, in a~~~~

~~manner that prevents unnecessary delay, and that ensures the development of a clear and adequate record.~~

~~4.4.1. The hearing shall be conducted pursuant to the provisions of sections 3781.10, 3781.101, and 119.09 of the Revised Code;~~

~~4.5 If a hearing officer has been appointed, then within thirty days after the hearing, the hearing officer shall submit a written report of the findings of fact and recommendations to the board for its consideration.~~

~~5. Following the hearing the party affected shall be sent a certified copy of the board's action and informed by certified mail, return receipt requested, that the jurisdiction may appeal the order within fifteen days to the court of common pleas in Franklin county pursuant to sections 3781.10, 3781.101, and 119.12 of the Revised Code.~~

~~**103.2.7.2 — Revocation or suspension.** In the event of suspension or revocation of a residential building department certification, the jurisdiction shall, within fifteen days of being notified of such suspension or revocation, surrender to the secretary of the board of building standards the certificate previously issued under section 103.2.4.1. The residential department, upon suspension or revocation, shall no longer hold out to the public that it is authorized to issue certificates of plan approval for the construction, repair, alteration of residential buildings or for performing inspections for which it has been suspended or certification revoked.~~

~~**103.2.7.3 Probationary status.** In the event of an investigation in which the board decides not to immediately suspend or revoke a residential building department's certification, as outlined in section 103.2.7.2, the board may place the residential department on probationary status for a period of time and require remedial action as the board deems appropriate. During this time the residential department shall comply with the training, reporting, auditing, or other remedial action required by the board. The board is authorized to revoke or suspend the residential~~

~~department's certification for failure to comply with such remedial requirements pursuant to section 103.2.7.2.~~

~~103.2.8 — Special residential building department requirements.~~

~~**103.2.8.1 — Changes in jurisdictional authority.** The residential department shall submit an application to have its existing residential building department certification modified. The application shall also include a transition plan identifying all outstanding projects that have received a certificate of plans approval but have yet to be issued a certificate of occupancy. The transition plan shall indicate how and by whom code enforcement duties for those projects will be continued and completed and how paid and pending fees will be assessed and/or shared to prevent duplicative fees and/or enforcement duties.~~

~~**103.2.8.2 — Surrender of residential department certification.** The political subdivision shall submit a written notification to the board declaring its intention to surrender its existing residential building department certification. The notification shall also include a transition plan identifying all outstanding projects that have received a certificate of plans approval but have yet to be issued a certificate of occupancy. The transition plan shall indicate how and by whom code enforcement duties for those projects will be continued and completed and how paid and pending fees will be assessed and/or shared to prevent duplicative fees and/or enforcement duties. All documents, reports, and project files will be transferred to the jurisdiction that will assume enforcement authority.~~

~~**103.2.8.2.1 — Township certification when a county is or becomes certified.** A township may not submit an application pursuant section 103.2 to exercise enforcement authority, to accept and approve construction documents, and to make inspections that is located in a county that is already certified. If a township is certified and the county subsequently is certified by the board, the township's certification is preempted by the county one year after the county certification is effective or at an earlier date as the board of township trustees approves.~~

~~**103.2.8.3 — Structures with shared jurisdictional authority.** When a residential department receives an application for plan approval for a~~

~~structure or portion of a structure which, when built, would involve shared jurisdictional authority, the residential building official shall immediately notify the owner that the structure involves shared jurisdictional authority and the process, determined below, that will be used in approvals and inspections for the project and shall:~~

- ~~1. Determine which other political subdivision(s) has jurisdiction for a portion of the structure;~~
- ~~2. Determine the name and contact information for the residential building official for any other political subdivision(s) which has jurisdiction for a portion of the structure;~~
- ~~3. Determine, with the advice of legal counsel, and after discussion with the residential building official(s) of the other political subdivision(s) identified above, how and by whom code enforcement duties for the project shall be completed;~~
- ~~4. Determine how, when, and which enforcement records shall be provided to the various parties;~~
- ~~5. Determine how paid and pending fees will be assessed and/or shared to prevent duplicative fees and/or enforcement duties; and~~
- ~~6. Establish by whom, when, and to whom the certificate of occupancy shall be issued and distributed.~~

~~**103.3 Residential building department personnel certification.** The residential department shall have personnel qualified to execute the duties required to enforce the rules of the board. Only those certified individuals employed by or under contract with a particular political subdivision are authorized to exercise enforcement authority within that same jurisdiction.~~

~~**Exception:** Inspectors performing residential industrialized unit inspections on behalf of the board of building standards.~~

~~**103.3.1 Residential building department personnel certification classifications.** The certifications issued by the Board of Building Standards for residential departments are as follows:~~

- ~~1. Residential building official.~~
- ~~2. Residential plans examiner.~~

~~2.1 Residential plans examiner trainee.~~

~~2.2 Electrical plans examiner.~~

~~3. Residential building inspector.~~

~~3.1 Residential building inspector trainee.~~

~~4. Residential mechanical inspector.~~

~~4.1 Residential mechanical inspector trainee.~~

~~5. Electrical safety inspector.~~

~~5.1 Electrical safety inspector trainee.~~

~~6. Residential industrialized unit inspector.~~

~~7. Residential plumbing inspector.~~

~~7.1 Residential plumbing inspector trainee.~~

~~**103.3.2 Multiple personnel certifications held.** A person may hold more than one residential certification.~~

~~**103.3.3 Conflict of interest.** No certified employee or person who contracts for services within the jurisdictional area of a residential department shall perform services for the residential department which would require that person or employee to exercise authority or make an evaluation of any work furnished by him or by a private contractor that employs him on a full time, part time, or incidental basis. Further, such employee or person shall not engage in conduct that is prohibited or considered a conflict of interest pursuant to Chapter 102. of the Revised Code.~~

~~**103.3.4 Seals.** No holder of a residential certification issued by the board of building standards is authorized to secure a seal in any form or of any type for use in the performance of any of their duties.~~

~~**103.3.5 Experience requirements of the applicant.**~~

- ~~1. Only experience directly related to buildings or structures within the scope of groups regulated by the "OBC" or regulated by the "RCO" shall be acceptable for any certification.~~
- ~~2. In addition to the experience described in item 1 above, enforcement, inspection, or plans examination experience performed in compliance with any of the following shall also be acceptable for certification:
 - ~~2.1 For an agency or jurisdiction outside the state of Ohio enforcing a model residential building code of a national model code organization or a code adopted for residential buildings or structures of the types regulated by the rules of the board; or~~
 - ~~2.2 An employee of a certified residential or non residential building department who is a holder of a board certification other than that for which application is being made. Certified residential building department employees who are applicants for residential plumbing inspector certification and do not comply with section 103.3.5.6 shall enter the plumbing inspector trainee program; or~~
 - ~~2.3 Certification by the department of Commerce, division of industrial compliance, as a plumbing inspector when application is made for board certification as a residential plumbing inspector; or~~
 - ~~2.4 In evaluating experience of an applicant, the board of building standards shall not credit experience gained while acting in violation of rules adopted by the board to establish equivalent experience. The board of building standards may credit experience which provides knowledge of different construction methods, processes, or types as it determines applicable, but shall not credit construction experience that does not provide required knowledge including, but not limited to, the installation of floor and wall coverings, the installation of roofing materials or roofing systems, or the finishing of concrete.~~
 - ~~2.5 Certification by the board as a non-residential building official, master plans examiner, or building inspector.~~~~

~~3. For a residential building, mechanical, or plumbing inspector applicant, one year of the required experience may be obtained through education credit pursuant to section 103.3.12.6.~~

~~**103.3.5.1 — Residential building official.** An applicant for a building official certification shall meet one of the following requirements:~~

- ~~1. Ohio registration as an architect or professional engineer;~~
- ~~2. At least five years experience as a residential contractor or non-residential contractor or superintendent with responsibility for obtaining approvals and inspections of structures regulated by the rules of the board; or~~
- ~~3. Experience as specified in section 103.3.5(2).~~

~~**103.3.5.2 — Residential plans examiner.** An applicant for a residential plans examiner certification shall meet one of the following requirements:~~

- ~~1. Ohio registration as an architect or professional engineer; or~~
- ~~2. At least five years experience in building design and construction for residential or non-residential buildings or structures regulated by the rules of the board;~~
- ~~3. Experience specified in section 103.3.5(2); or~~
- ~~4. Successful completion of a trainee program pursuant to section 103.3.12.~~

~~**103.3.5.3 — Electrical plans examiner.** An applicant for an electrical plans examiner certification shall meet the following requirement:~~

- ~~1. At least five years experience as a full time electrical safety inspector in a certified building department.~~

~~**103.3.5.4 — Residential building inspector.** An applicant for a residential building inspector certification shall meet one of the following~~

~~requirements:~~

- ~~1. At least three years experience as a contractor or supervisor for residential or non residential buildings or structures regulated by the rules of the board;~~
- ~~2. At least three years experience as a skilled tradesman for work subject to inspection under a code adopted for buildings or structures regulated by this code or the OBC;~~
- ~~3. Experience specified in section 103.3.5(2); or~~
- ~~4. Successful completion of a trainee program pursuant to section 103.3.12.~~

~~**103.3.5.5 Residential mechanical inspector.** An applicant for a residential mechanical inspector certification shall meet one of the following requirements:~~

- ~~1. At least three years as an HVAC system contractor or supervisor for residential or non residential buildings regulated by the rules of the board;~~
- ~~2. At least three years experience as a skilled tradesman for HVAC systems and the associated refrigeration, fuel gas, and heating piping for residential or non residential buildings regulated by the rules of the board;~~
- ~~3. Experience specified in section 103.3.5(2); or~~
- ~~4. Successful completion of a trainee program pursuant to section 103.3.12.~~

~~**103.3.5.6 Residential plumbing inspector.** An applicant for a plumbing inspector certification shall meet one of the following requirements:~~

- ~~1. At least seven years experience as a plumbing contractor or supervisor for residential or non residential buildings or structures regulated by the rules of the board);~~
- ~~2. At least seven years experience as a skilled tradesman for plumbing work subject to inspection under a code adopted for buildings or structures regulated by this code or the OBC;~~
- ~~3. Experience specified in section 103.3.5(2); or~~
- ~~4. Successful completion of a trainee program pursuant to section 103.3.12.~~

~~**103.3.5.7 — Electrical safety inspector.** An applicant for an electrical safety inspector “(ESI)” certification shall meet one of the following requirements:~~

- ~~1. Journeyman electrician or equivalent for four years, two years as an electrician foreman, and two years experience as a building department “ESI” trainee;~~
- ~~2. Journeyman electrician or equivalent for four years and three years experience as a building department “ESI” trainee;~~
- ~~3. Four years experience as a building department “ESI” trainee;~~
- ~~4. Journeyman electrician or equivalent for six years; or~~
- ~~5. An electrical engineer registered in the state of Ohio;~~

~~**103.3.5.8 — Residential industrialized unit inspector.** An applicant for a residential industrialized unit inspector certification shall meet one of the following requirements:~~

- ~~1. At least three years experience as a construction contractor or supervisor for residential or non residential buildings or structures within the scope of groups regulated by the rules of the board, or~~

- ~~2. At least three years experience as a skilled tradesman for work subject to inspection under a code adopted for buildings or structures regulated by this code or the OBC;~~
- ~~3. Experience specified in section 103.3.5(2); or~~

~~**103.3.6 Examination requirements for certification.** Applicants shall furnish evidence of passing the appropriate board approved examinations issued by a national model code organization or testing agency or entity recognized by the board for each residential certification type listed in section 103.3.1. Individuals are not required to have an application on file with the board before they can begin testing. Examinations may be completed before application is made for certification by the board.~~

~~**Exception:** Individuals seeking board certification as a residential building official, plans examiner, or building inspector holding board certification as a non residential building official, master plans examiner, or building inspector.~~

~~**103.3.6.1 Interim approval.** If, at the time of application for a residential building official, plans examiner, inspector certification, the applicant has not passed the examinations required in this section, but has met all other requirements for the appropriate classification, the board may grant an interim certification for a one-time, eighteen-month period during which the applicant shall pass the prescribed examinations. The interim certification shall expire eighteen months from date of approval if the applicant fails to show evidence of successfully completing the examinations within the interim period.~~

~~**103.3.7 Personnel certification application, filing and processing.** Applications for certification shall be sent to the office of the board. The application shall expire if not approved within one year of receipt by the board.~~

~~Each applicant shall also submit, with the application, evidence sufficient to show the board that the applicant is qualified. Such evidence may include proof of the statements made in the application, documentary evidence, affidavits, transcripts, diplomas, published data, photographs, or legible reproductions of the same, or any other documentation.~~

~~**103.3.7.1 — Certification process.** Upon receipt of a completed application, the board of building standard's certification committee shall review the application and any recommendation received from the Residential Construction Advisory Committee, and shall make a recommendation to the board of building standards. The committee may ask for additional information to be submitted by the applicant prior to making a recommendation to the board. If the committee requests additional information from the applicant, failure to submit the requested information within ninety days from the date of the request may be cause for disapproval of the application by the board. After receiving a recommendation from the personnel committee, the board shall hold a certification hearing to take action on the application. The applicant may be present at the hearing to respond to any questions from the board and all interested persons appearing at such hearing may be given an opportunity to comment.~~

~~**103.3.7.1.1 — Certification, approval or denial.** Following the hearing, the board may approve, table pending further review and/or receipt of additional documentation, deny the application for residential certification, or take such other action as the board deems appropriate. If the board requests additional information, failure to submit the requested information within ninety days from the date of the request shall be cause for disapproval of the application by the board. The board may require personal appearance by the applicant at the public hearing. Failure to appear shall at the time and place designated by the board for the public hearing may be cause for disapproval of the application by the board.~~

~~If the application is denied, in whole or in part, by the board of building standards, the applicant shall be notified in writing of such denial, the reason for the denial, and their rights of appeal pursuant to sections 3781.10, 3781.101, and Chapter 119 of the Revised Code.~~

~~**103.3.7.1.2 — Records.** The board shall retain, as a part of applications which have been approved, any or all documents submitted or electronic versions of such documents, which shall be properly marked for identification and ownership.~~

~~**103.3.7.1.3 — Board action.** All applications shall be considered~~

~~individually by the board and the action taken shall be recorded in the minutes, noted on the application form, and the applicant notified as required.~~

~~**103.3.8 Issuance of certificate and renewal.** An appropriate certificate shall be issued to the applicant upon meeting of the qualification requirements of section 103.3, and payment of an initial fee of thirty dollars. The certificate shall state the residential certification classification being approved, expiration date, and limitations, if any, under which it has been issued.~~

~~The same fee shall apply to applicants granted interim approval and the term of the certification, if subsequently issued, shall begin on the date of interim approval.~~

~~**103.3.8.1 — Renewal.** The certificate holder shall renew at three year intervals.~~

~~**103.3.8.2 — Applications for renewal.** Applications for renewal of a residential certification shall be submitted to the board of building standards at least thirty days prior to the expiration date. In addition to a completed application form prescribed by the board, applicants for renewal shall submit a certification renewal fee of thirty dollars and evidence of having attended board sponsored required continuing education courses or their board approved equivalents and successfully completed thirty hours of approved educational courses prior to the expiration of the current certification.~~

~~**103.3.8.3 — Failure to renew.** Any individual whose residential certification has expired through failure to renew may obtain a renewal within one year from the date of its expiration provided the holder has met all requirements for renewal, including payment of the renewal fee. All applications for renewal of expired residential certifications shall be processed as renewals during the one year period following expiration. All applications for renewal of expired residential certification submitted more than one year following the expiration shall be processed as a new application. In addition, a holder of an expired residential certification that submits an application for renewal more than one year following the expiration shall also be required to satisfy the continuing education requirements prior to recertification. The holder of a residential~~

~~certification that has expired shall not perform any duties for which a certification is required.~~

~~**103.3.9 Continuing education.** Holders of board certifications shall attend mandatory continuing education courses and complete a total of at least thirty hours of board approved continuing education in their respective classification prior to the expiration date of the certification.~~

~~**103.3.9.1 Applications for approval.** Applications for continuing education course approval shall be on forms prescribed by the board and submitted at least seven (7) days prior to the meeting of the board's education committee. (A meeting schedule is available on the board of building standards' web page at <http://www.com.ohio.gov/dico/BBS.aspx>.)~~

~~**103.3.9.2 Application review.** Upon receipt of a complete application for course approval, the board of building standards education committee shall review the application and make a recommendation to the board. Following receipt of the committee's recommendation, the board may approve, table pending further review and/or receipt of additional documentation, deny the application for course approval, or take such other action as the board deems appropriate.~~

~~**103.3.9.2.1 Course approval.** Continuing education course approvals will expire on December 31 of each year. Approved courses will be issued a course approval number with the prefix "BBSyyyy" based on the calendar year of the current code cycle. The instructor or sponsor of any course(s) intended to be taught in a subsequent year, upon or near the expiration date of a current approval, shall resubmit an application for each course requesting an update. If approved, the instructor or sponsor shall receive a new approval and approval number for each course for the subsequent year. Any application for a course update shall be processed administratively as long as the course content has not changed.~~

~~**103.3.9.3 Course credit.** Board approved courses shall establish hour equivalencies for continuing education credit for each of the classifications requested. Course credit shall only be given for training in the respective classification. Courses approved for more than one certification classification may be applied to each certification for which~~

~~training is required. No credit shall be approved for duplicate courses within the same certification period. Instructors of board approved courses may apply course hours taught toward their own board certification continuing education requirements except for duplicate courses within the same certification period.~~

~~**103.3.9.4** — **Approved course sponsor requirements.** The following are requirements that apply to all approved continuing education courses:~~

- ~~1. Date(s), time(s), and location(s) the course will be taught shall be provided to the board prior to the course presentation;~~
- ~~2. If course content is modified, the course must be resubmitted for course approval;~~
- ~~3. When promoting an approved course, the instructor shall make full and accurate disclosure regarding course title, course approval number, number of contact hours, certifications for which approval has been given, and all fees to be charged;~~
- ~~4. Course sponsors shall provide participants with a certificate of completion containing the name of the participant, title of approved course, BBS approval number, date and location of session, number of contact hours awarded, certification types for which course is approved, and signature of authorized sponsor or instructor;~~
- ~~5. The sponsors of an approved continuing education course shall provide the board with a legible copy of a list of participants who completed the course including: course name, date, and location of the session;~~
- ~~6. Participants must attend the complete course(s) as presented by the instructor to receive the contact hours approved by the board. No partial credit shall be given to any participant failing to complete the entire course as approved. The sponsor shall verify the participant's attendance and completion of the course; and,~~

~~7. The board does not provide retroactive approval for continuing education courses presented prior to submission of an application for approval.~~

~~**103.3.9.5** — **Failure to complete.** Failure to complete the number of hours required shall result in forfeiture of the certification. It shall be the responsibility of the certificate holder to furnish the board with proof of completion of all board approved courses for which credit is sought.~~

~~**103.3.10** — **Residential personnel certification, revocation or suspension.** In accordance with division (E) of section 3781.10 of the Revised Code, a residential personnel certification may be revoked or suspended on written complaint to the board of building standards by any person affected by the exercise of the authority granted under such certification, or by the board on its own motion.~~

~~**103.3.10.1** — **Complaint process.** Upon receipt of a written complaint against a holder of a board certification that is substantiated by demonstrable evidence or upon the board's own motion:~~

- ~~1. The board shall decide whether the information submitted warrants causing an investigation to be initiated or sending a notice of opportunity for hearing as outlined in item 4 below;~~
- ~~2. If a formal investigation is warranted, the subject of the investigation shall be notified that an investigation has been initiated by the board;~~
- ~~3. Upon completion of the investigation, findings shall be reported to the board.~~
- ~~4. The board may dismiss the complaint, table the matter for future action, or initiate action to suspend or revoke the residential certification. If the board issues an order to suspend or revoke the certification, it shall:
 - ~~4.1 Notify the certificate holder of the charges, pursuant to section 103.3.10.2 by certified mail, return receipt requested. The certificate holder shall be informed that a hearing, if~~~~

~~desired, must be requested within thirty days from the date of the mailing to request a hearing before the board. The order shall inform the certificate holder that counsel may represent the certificate holder at the hearing. Failure by the certificate holder to request a hearing within thirty days from the date of the mailing of the notification may cause the board, after a hearing, to uphold an order revoking or suspending certification;~~

~~4.2 Schedule a hearing to be held seven to fifteen days after receipt of the request. The board may continue or postpone the hearing upon application by the party or upon its own motion;~~

~~4.3 The board may appoint a hearing officer to conduct a hearing.~~

~~4.4 A hearing will be conducted during which parties and witnesses can be examined and offer testimony, in a manner that prevents unnecessary delay, and that ensures the development of a clear and adequate record.~~

~~4.4.1. The hearing shall be conducted pursuant to the provisions of sections 3781.10, 3781.101, and 119.09 of the Revised Code;~~

~~4.5 If a hearing officer has been appointed, then within thirty days after the hearing, the hearing officer shall submit a written report of the findings of fact and recommendations to the board for its consideration.~~

~~5. Following the hearing the party affected shall be sent a certified copy of the board's action and informed by certified mail, return receipt requested, that the certificate holder may appeal the order within fifteen days to the court of common pleas in Franklin county pursuant to sections 3781.10, 3781.101, and 119.12 of the Revised Code.~~

~~**103.3.10.2 Grounds for revocation or suspension.** The board, upon its own motion or upon written complaint of any person affected by the enforcement of the board's rules, the approval of plans and specifications, or the making of inspections, shall investigate the actions of the holder of a certificate if there is an allegation implying one or more of the following:~~

- ~~1. The practice of fraud or deceit in obtaining the certificate;~~
- ~~2. A felony or crime involving moral turpitude;~~
- ~~3. Gross negligence, incompetence, misconduct in performance of duties, or engaging in conduct that is considered a conflict of interest;~~
- ~~4. Failure to complete the continuing education requirements prior to expiration date of the certificate;~~
- ~~5. Violation of the duties described in section 104.~~

~~**103.3.10.3 Revocation or suspension.** In the event of suspension or revocation of a certification, the individual shall no longer hold out to the public or any jurisdiction that the individual is certified to exercise enforcement authority or holds the board certification which has been suspended or certification revoked.~~

~~**103.3.10.4 Probationary status.** In the event of an investigation in which the board decides not to immediately suspend or revoke an individual's certification, the board may place the individual on probationary status for a period of time and require remedial action as the board deems appropriate. During this time the individual shall comply with the training, reporting, auditing, or other remedial action. The board is authorized to revoke or suspend the individual's certification for failure to comply with such remedial requirements.~~

~~**103.3.11 Elective temporary suspension.** Residential certifications may be placed in elective temporary suspension upon written request to and approval by the board. Except for emergency circumstances, requests shall be in writing at least sixty days prior to the residential certification expiration date and supported by satisfactory evidence that the holder is withdrawing from~~

~~active employment for which the certification is required.~~

~~**103.3.11.1 Restoring certification.** Residential certifications placed in elective temporary suspension for a period of time not to exceed one three-year term following the expiration date may be restored to active status by the board upon written request. The request shall be supported by satisfactory evidence that the holder has completed thirty hours of continuing education for that residential certification and any board-sponsored mandatory training required, or their board-approved equivalents, during the time the residential certification was in suspension prior to the date of reinstatement. Payment of the thirty dollar renewal fee shall accompany the request.~~

~~**103.3.11.2 Failure to restore certification.** Residential certifications placed in elective temporary suspension for a period of time exceeding one three year term following the original residential certification expiration date may be restored to active status by the board upon written request supported by evidence of passing of the appropriate examinations prescribed by the board, pursuant to section 103.3.6, and payment of the thirty dollar renewal fee.~~

~~**103.3.12 Trainee program requirements.** Individuals seeking residential certification as a trainee shall meet the requirements of this section.~~

~~**103.3.12.1 Trainee applicants.** Trainees shall meet the following requirements:~~

- ~~1. A trainee applicant shall be a full-time employee of a political subdivision.~~
- ~~2. A trainee applicant shall be under the direct supervision of a trainee supervisor.~~
- ~~3. A residential building inspector or residential mechanical inspector trainee applicant shall also have at least one year experience as a skilled tradesman for work subject to inspection under a residential or non-residential code adopted for buildings or structures regulated by this code or the "OBC," or shall submit~~

~~evidence of eligibility for education credit pursuant to section 103.3.12.6.~~

- ~~4. A residential plumbing inspector trainee applicant shall have at least three years experience in the installation of plumbing subject to inspection under either a residential or non residential code adopted for buildings or structures regulated by this code or the "OBC," or submit evidence of eligibility for education credit pursuant to section 103.3.12.6.~~

103.3.12.2 — Trainee supervisors. ~~A trainee supervisor shall:~~

- ~~1. Be a full time employee of the same political subdivision as the trainee and shall be available to the trainee during normal working hours;~~
- ~~2. Currently possess the residential certification for which the trainee is being trained;~~
- ~~3. Be responsible for no more than two trainees at one time and shall immediately notify the board of the trainee(s) under supervision;~~
- ~~4. Notify the board of any change in supervisor or trainee status within thirty days;~~
- ~~5. Supervise, check, and sign the trainee's inspections and reports or a residential plans examiner trainee's plans examinations; and~~
- ~~6. Provide to the board a report documenting at least twenty five inspections or plans examinations made yearly by the trainee under the direct supervision of the trainee supervisor, with an evaluation of the trainee at the end of the first six months of the program, at the end of one year, and annually afterward.~~

103.3.12.3 — Trainee sponsor requirements. ~~The trainee sponsor (county, township, or municipal corporation) shall:~~

- ~~1. Direct the residential building official to certify to the board that the trainee is a full time employee of the county, township, or~~

~~municipal corporation and is under the direct supervision of an individual possessing the residential certification for which the trainee is being trained; and~~

~~2. Provide the trainee with a copy of the current rules of the board.~~

~~**103.3.12.4 — Trainee certification.** The board shall issue a trainee certification to each applicant who has met the qualification requirements. The certification shall expire four years from the date of applicant approval by the board. After a minimum of two years and upon satisfactory completion of the trainee program pursuant to section 103.3.12.5, the trainee may apply for certification in the respective classification. The trainee certification is not renewable and upon expiration the individual may not reapply as a new trainee for a period of one year.~~

~~**103.3.12.5 — Trainee course and work requirements.** A residential building, mechanical, or plumbing inspector trainee shall attend and successfully complete one hundred hours of approved building code education courses. The trainee shall perform at least twenty five inspections annually while in the trainee program under the direct supervision of the trainee supervisor. The trainee shall also complete the appropriate examination requirements in section 103.3.6 prior to the completion of the trainee program.~~

~~A residential plans examiner trainee shall perform at least twenty five plans examinations yearly under the direct supervision of the trainee supervisor and complete at least one hundred hours of approved continuing building code education courses. The trainee shall also complete the appropriate examination requirements in section 103.3.6 prior to the completion of the trainee program.~~

~~**103.3.12.6 — Education credit.** An applicant for a residential building, mechanical, or plumbing inspector, or trainee certification may obtain credit for one year of the required experience through education, if one of the following is met:~~

- ~~1. The applicant shall document nine hundred or more contact hours of training in an Ohio department of education approved vocational education program at the high school or adult level; or~~
- ~~2. The applicant shall document the completion of a baccalaureate degree or an associate degree program in building design or construction.~~

~~**103.3.12.6.1** — **Documentation.** Supporting documentation may include a certificate of completion, a career passport, a transcript, a college degree or diploma granted by an accredited or state sponsored institution.~~

~~**103.3.12.6.2** — **Vocational educational programs.** Education credit shall not be prorated or combined for partial or full credit and shall be awarded only upon successful completion of a specific educational program. Miscellaneous course work or isolated classes shall not be considered.~~

~~Vocational instructional programs that are acceptable for credit include:~~

- ~~1. Air conditioning, heating, and ventilation.~~
- ~~2. Carpentry.~~
- ~~3. Electricity.~~
- ~~4. Masonry.~~
- ~~5. Plumbing and pipefitting.~~
- ~~6. Fire fighting.~~

~~**103.3.12.6.3** — **Associate degree programs.** Technical education instructional programs offering associate degrees include:~~

- ~~1. Architectural/construction technology.~~

~~2. Heating and air conditioning technology.~~

~~3. Fire science technology.~~

~~4. The successful completion of other specific technical education instructional programs offering degrees may be considered by the board if the training is directly related to the design and construction of buildings or structures within the scope of groups regulated by the rules of the board.~~

~~**103.3.12.6.4** — **Other programs.** The successful completion of other specific vocational instructional programs of a minimum of nine hundred contact hours may be considered by the board if the training is directly related to the design and construction of buildings or structures regulated by the rules of the board.~~

Refer to division 4101:7 of the Administrative Code for existing relocated building department, building department personnel, and boards of building appeals certification requirements.

SECTION 104 DUTIES AND RESPONSIBILITIES

104.1 General. Personnel of residential building departments that have been certified by the board of building standards, pursuant to ~~section 103~~rule 4101:7-3-01 of the Administrative Code, shall be responsible for performing the duties described in this section.

104.2 Residential building department personnel duties and responsibilities. Municipal, township, or county residential building departments certified by the board shall have personnel qualified to perform the enforcement duties and responsibilities described in this section.

104.2.1 Residential building official. The residential building official is responsible for the enforcement of the rules of the board and of Chapters 3781. and 3791. of the Revised Code relating to the construction, arrangement, and the erection of residential buildings or parts thereof and may perform duties outlined in this section and in sections 104.2.2.1 and 104.2.3.1 below. All residential building officials shall conduct themselves in

a professional, courteous, impartial, responsive, and cooperative manner. Residential building officials shall be responsible to assure that a system is in place to track and audit all projects, to assure that all residential building department personnel perform their duties in accordance with this section, and for the overall administration of a residential building department as follows:

104.2.1.1 Applications and plan approvals. *The residential building official shall receive applications, examine or cause the submitted construction documents to be examined, ascertain by such examinations whether the construction indicated and described is in accordance with the requirements of this code, and shall issue plan approvals for the construction, erection, alteration, demolition, and moving of buildings and structures.*

104.2.1.2 Orders. *The residential building official shall issue all orders in accordance with section 109 to ensure compliance with this code.*

104.2.1.3 Inspections. *If the plans for the erection, construction, repair, alteration, relocating, or equipment of a building are subject to inspection by the residential building official, under section 108, the residential building official shall make such inspections as the building official is authorized to make or shall cause to be made such inspections, investigations, and determinations as are necessary to determine whether or not the work which has been performed and the installations which have been made are in conformity with the approved construction documents.*

104.2.1.4 Residential department records. *The residential building official shall keep official records of applications received, certificate of plan approvals issued, notices and orders issued, certificates of occupancy, and other such records required by the rules of the board of building standards. Such information shall be retained in the official permanent record for each project. One set of approved residential construction documents shall be retained by the residential building official for a period of not less than one hundred eighty days from date of completion of the permitted work, or as required by the residential department's document retention regulations.*

104.2.1.5 Department reports. *The residential building official shall be responsible for the submission of reports and any requested special information to the board of building standards as required in section 103.2.6. Failure to submit these reports in a timely manner as required by rule or by special request or inquiry of the board of building standards may be grounds for board action as described in section 103.3.10.*

104.2.2 Residential plans examiners. *A residential plans examiner is responsible for the examination of construction documents in accordance with section 107, within the limits of their certification, to determine compliance with the rules of the board and may perform duties outlined in this section and in section 104.2.3.1 below. All residential plan examiners shall effectively communicate the results of their plan review to the owner or the owner's representative and the residential building official. A residential plans examiner shall conduct themselves in a professional, courteous, impartial, responsive, and cooperative manner.*

104.2.2.1 Residential plans examiner. *A residential plans examiner is responsible for the examination of all types of residential construction documents to determine compliance with the rules of the board.*

104.2.2.1.1 Residential plans examiner trainee. *A residential plans examiner trainee is responsible for the examination of all types of residential construction documents to determine compliance with the rules of the board under the direct supervision of an individual holding a residential plans examiner certification.*

104.2.2.1.2 Electrical plans examiner. *An electrical plans examiner is responsible for the examination of construction documents related to electrical systems to determine compliance with the rules of the board.*

If the department does not have in its employ or under contract persons holding the electrical plans examiner certification, then the examination of the construction documents for compliance with the electrical provisions of the code shall be done by the residential plans examiner.

104.2.3 Residential inspectors. *A residential inspector is responsible for performing inspections and determining that work, for which they are certified to make inspections, is performed in compliance with the approved residential construction documents. All residential inspectors shall inspect the work to the extent of the approval given when residential construction documents were approved by the residential building official and for which the inspection was requested. All residential inspectors shall effectively communicate the results of their inspections as required by section 108, and shall conduct themselves in a professional, courteous, impartial, responsive, and cooperative manner.*

104.2.3.1 Residential building inspector. *A residential building inspector is responsible to determine compliance with the approved residential construction documents in accordance with section 108.*

A residential building inspector trainee is designated to determine compliance with approved residential construction documents, in accordance with section 108, under the direct supervision of an individual holding a residential building inspector certification.

104.2.3.2 Residential plumbing inspector. *A residential plumbing inspector is responsible to determine plumbing system compliance with approved residential construction documents in accordance with section 108.*

A residential plumbing inspector trainee is designated to determine plumbing system compliance with approved residential construction documents, in accordance with section 108, under the direct supervision of an individual holding a residential plumbing inspector certification.

104.2.3.3 Electrical safety inspector. *An electrical safety inspector is responsible to determine electrical systems compliance with approved construction documents in accordance with section 108.*

An electrical safety inspector trainee is designated to determine electrical systems compliance with approved construction documents, in accordance with section 108, under the direct supervision of an individual holding an electrical safety inspector certification.

104.2.3.4 Elective inspectors. Residential building departments may elect to employ inspectors designated as responsible for making inspections to determine that work is performed in compliance with approved construction documents certified as follows:

104.2.3.4.1 Residential mechanical inspector. A residential mechanical inspector is responsible to determine compliance with the approved residential construction documents for heating, ventilating and air conditioning (HVAC) systems, and the associated refrigeration, fuel gas, and heating piping systems in accordance with section 108.

If the residential department does not have in its employ or under contract persons holding the residential mechanical inspector certification, then the enforcement of the mechanical provisions shall be done by the residential building inspector;

A residential mechanical inspector trainee is designated to determine compliance with the approved residential construction documents for heating, ventilating and air conditioning (HVAC) systems, and the associated refrigeration, fuel gas, and heating piping systems, in accordance with section 108, under the direct supervision of an individual holding a residential mechanical inspector certification.

104.2.4 Liability. Liability of certified residential building department personnel for any tortious act will be determined by Ohio courts to the applicable provisions of Chapter 2744. of the Revised Code.

104.3 Violation of duties. Any person affected by the improper actions of any residential building department, residential building official, residential plans examiner, residential inspector, or fire protection system designer certified by the board of building standards may file a written complaint with the board. Complaints will be processed by the board in accordance with the procedures outlined in the applicable certification rule found in division 4101:7 of the Administrative Code.

SECTION 105 APPROVALS

105.1 Approvals required. Any owner or authorized agent who intends to construct, enlarge, alter, repair, move, or change the occupancy of a residential building or structure, or portion thereof, or to erect, install, enlarge, alter, repair, remove, convert or replace any electrical, gas, mechanical, plumbing system, other residential building service equipment, or piping system the installation of which is regulated by this code, or to cause any such work to be done, shall first make application to the residential building official of a certified residential building department and obtain the required approval.

105.1.1 Nonconformance approval. When residential construction documents are submitted which do not conform with the requirements of the rules of the board, such documents may be approved by the residential building official provided such nonconformance is not considered to result in a serious hazard and the owner or owner's representative subsequently submits revised residential construction documents showing evidence of compliance with the applicable provisions of the rules of the board. In the event such residential construction documents are not received within thirty days, the residential building official shall issue an adjudication order revoking the plan approval.

105.1.2 Conditional approval. When residential construction documents are submitted which cannot be approved under the other provisions of this rule, the residential building official, may at the request of the owner or owner's representative, issue a conditional plan approval when an objection to any portion of the residential construction documents results from conflicting interpretations of the code, or compliance requires only minor modifications to the building design or construction. No conditional approval shall be issued where the objection is to the application of specific technical requirements of the code or correction of the objection would cause extensive changes in the building design or construction. A conditional approval is a conditional license to proceed with construction or materials up to the point where construction or materials objected to by the agency are to be incorporated into the building. The conditions objected to shall be in writing from the residential building official which shall be an adjudication order denying the issuance of a license and may be appealed in accordance with section 3781.19 of the Revised Code.

In the absence of fraud or a serious safety or sanitation hazard, all items previously examined shall be conclusively presumed to comply with Chapters 3781. and 3791. of the Revised Code and the rules of the board.

Reexamination of the residential construction documents shall be limited to those items in the adjudication order. A conditional plan approval is not a phased plan approval.

105.1.3 Previous approvals. *This code shall not require changes in the residential construction documents, construction or designated occupancy of a structure for which a lawful approval has previously been issued or otherwise lawfully authorized, and the construction of which has been pursued in good faith within one year of the approval of residential construction documents. One extension shall be granted for an additional year if requested by the owner at least ten days in advance of the expiration of the approval and upon payment of any fee not to exceed one hundred dollars.*

If, after the start of construction, work is delayed or suspended for more than six months, the approval is invalid. Two extensions shall be granted for six months if requested by the owner at least ten days in advance of the expiration of the approval and upon payment of any fee for each extension not to exceed one hundred dollars.

105.1.4 Phased approval. *The residential building official shall issue an approval for the residential construction of foundations or any other part of a building, structure, or building service equipment before the residential construction documents for the whole building, structure or building service equipment have been submitted, provided that adequate information and detailed statements have been filed complying with applicable requirements of this code. The holder of such approval 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 an approval for the entire structure will be granted. Such approvals shall be issued for various stages in the sequence of construction provided that all information and data required by the code for that portion of the building or structure has been submitted. The holder of a phased plan approval may proceed only to the point for which approval has been given.*

105.2 Validity of approval. *The construction, erection, and alteration of a building, and any addition thereto, and the equipment and maintenance thereof, shall conform to required plans which have been approved by the residential building official, except for minor deviations which do not involve a violation of the rules of the board. In the absence of fraud or a serious safety or sanitation*

hazard, any residential structure built in accordance with approved plans shall be conclusively presumed to comply with Chapters 3781. and 3791. of the Revised Code and the rules of the board.

Exception: *Industrialized units shall be constructed to conform to the plans approved by the board.*

105.3 Expiration. *The approval of plans or drawings and specifications or data in accordance with this rule is invalid if construction, erection, alteration, or other work upon the building has not commenced within twelve months of the approval of the residential construction documents.*

One extension shall be granted for an additional twelve-month period if requested by the owner at least ten days in advance of the expiration of the approval and upon payment of a fee not to exceed one hundred dollars.

105.4 Extension. *If, in the course of construction, work is delayed or suspended for more than six months, the approval of residential construction documents is invalid. Two extensions shall be granted for six months each if requested by the owner at least ten days in advance of the expiration of the approval and upon payment of a fee for each extension of not more than one hundred dollars.*

105.5 Certificate of plan approval. *After residential construction documents have been approved in accordance with section 107, the residential building official shall furnish the owner/applicant a certificate of plan approval.*

105.5.1 Content. *The form of the certificate shall be as prescribed by the residential building official and shall show the serial number of the certificate, the address at which the building or equipment under consideration is or is to be located, the name and address of the owner, the signature of the residential building official who issued the certificate, and such other information as is necessary to facilitate and ensure the proper enforcement of the rules of the board.*

105.5.2 Duplicate issued upon request. *Upon application by the owner, the residential building official shall issue a duplicate certificate of plan approval to replace a lost or destroyed original.*

SECTION 106
CONSTRUCTION DOCUMENTS

106.1 Submittal documents. Residential construction documents and other data shall be submitted in two or more sets with each application for an approval. Before beginning the construction of any building for which construction documents are required under section 105, the owner or the owner's representative shall submit construction documents to the residential building official of a certified residential building department for approval. When construction documents have been found to be in compliance with the rules of the board of building standards in accordance with section 107 by a certified residential building department, that determination of compliance shall be deemed sufficient to obtain approval for construction pursuant to section 105.2 and the residential building official shall issue the certificate of plan approval. Construction documents for the installation of industrialized units shall be submitted to the residential building official for approval in accordance with the provisions of section 106.1.4.

106.1.1 Professionally prepared construction documents. Construction documents which have been prepared by a registered design professional who prepared the same as conforming to the requirements of the rules of the board pertaining to design loads, stresses, strength, and stability, or other requirements involving technical analysis, need be examined only to the extent necessary to determine conformity of such residential construction documents with other requirements of this code.

106.1.2 Residential fire protection system construction documents. Residential construction documents for fire protection systems authorized to be submitted by individuals certified pursuant to Chapter 4101:2-87 of the Administrative Code shall:

1. When submitted under the signature of an individual certified under section 3781.105 of the Revised Code, be processed in the same manner as construction documents submitted under the signature of a registered design professional. Any statistical data, reports, explanations, plan description, or information that would not also be required for a similar submission by a registered design professional need not be submitted by a certified designer.

2. *If certified by a registered design professional or individual certified under section 3781.105 of the Revised Code as conforming to requirements of the rules of the board pertaining to design loads, stresses, strength, stability, or other requirements involving technical analysis, be examined by the building department official only to the extent necessary to determine conformity of such construction documents with other requirements of this Code.*
3. *Indicate thereon the individual and company installing the fire protection systems who shall be certified by the fire marshal pursuant to section 3737.65 of the Revised Code. In the event that the installer is not known at the time of plan approval, partial plan approval shall be granted subject to subsequent submission by addendum of the name of the qualified installer prior to installation of any part of the fire protection systems.*

106.1.3 Information on construction documents. *Residential construction documents shall be dimensioned and drawn upon suitable material. Electronic media documents are permitted to be submitted when approved by the residential building official. Construction documents shall be coordinated and 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. Construction documents, adequate for the scope of the project, shall include information necessary to determine compliance with this code.*

1. **Index.** *An index of drawings located on the first sheet;*
2. **Site plan.** *A site plan showing a north orientation arrow, the size and location of new residential construction and all existing structures on the site, all property and interior lot line locations with setback and side yard dimensions and distances from buildings to lot lines, the locations of the nearest streets, the established street grades, the locations, types and sizes of all utility lines, the location of any fences, and the elevations of all proposed finished grades; and it shall be drawn in accordance with an accurate boundary line survey. 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 residential building official is authorized to waive or modify the requirement for a*

site plan when the application for approval is for alteration or repair or when otherwise warranted.

2.1 Residential buildings or structures located in flood hazard areas.

Construction documents submitted for residential buildings or structures located in communities with identified flood hazard areas, pursuant to section 1612, shall include the current FEMA “Flood Hazard Boundary Map” (FHBM), “Flood Insurance Rate Map” (FIRM) or “Flood Boundary Floodway Map” (FBFM) for the project location. The required site plan shall include building elevations using the same datum as the related flood hazard map. The owner shall be responsible for the compliance with local flood damage prevention regulations for additional critical elevation information for the project site. The elevation certification and dry flood proofing certification, when required for buildings or structures located in communities with identified flood hazard areas, shall be submitted to the residential building official.

2.2 Site accessibility plan. *For structures of four or more dwellings, information in plan view and details shall be submitted indicating compliance with the accessibility provisions of this code for the exterior of the building in addition to any accessible features of the interior. When applicable, the plans shall include: the exterior accessible route between all facilities required to be connected; ramp locations and elevations along the exterior accessible route; number of and details for the required accessible van and car parking spaces and passenger loading areas; location and detail of required accessibility signage; grade/topographic elevations before and after proposed grading when site impracticality is intended to be applied.*

3. Floor plans. *Complete floor plans, including plans of full or partial basements and full or partial attics. Floor plans must show all relevant information such as door swings, stairs and ramps, windows, shafts, all portions of the means of egress, etc., and shall be sufficiently dimensioned to describe all relevant space sizes. Wall materials shall be described by cross-hatching (with explanatory key), by notation, or by other clearly understandable method. Spaces must be identified by how each space is intended to be used.*

4. **Exterior wall envelope.** ~~The residential construction documents shall provide details of the exterior wall envelope as required, including~~ The exterior envelope shall be described in sufficient detail to determine compliance with this code and the referenced standards. Details or elevations shall be provided which describe floor to floor dimensions, flashing, intersections with dissimilar materials, corners, end details, control joints, intersections at roof, eaves, or parapets, means of drainage, water-resistive membrane, all elevations necessary to completely describe the exterior of the residential building including floor to floor dimensions, and details around openings, location and type of vapor retarders, window and door “U”-values, and insulation location and “R”-values. The supporting documentation shall fully describe the exterior wall system, which was tested, where applicable, as well as the test procedure used.
5. **Sections.** Cross sections, wall sections, details including typical connections as required to fully describe the residential building construction showing wall, ceiling, floor and roof materials. Residential construction documents shall describe the exterior wall envelope in sufficient detail to determine compliance with this code.
6. **Structure.** Complete structural description of the residential building including size and location of all structural elements used in the design of the residential building and other data as required to fully describe the structural system;.
7. **Ratings.** The fire-resistance ratings of all structural elements as required by this code, data substantiating all required fire-resistance ratings including details showing how penetrations will be made for electrical, mechanical, plumbing, and communication conduits, pipes, and systems, and the materials and methods for maintaining the required structural integrity, fire-resistance rating, and firestopping;.
8. **System descriptions.** Description of the mechanical, plumbing and electrical systems, including: materials; location and type of fixtures and equipment; materials, and sizes of all ductwork; location and type of heating, ventilation, air conditioning and other mechanical equipment; and all lighting and power equipment;.

9. **Additional information.** *Additional graphic or text information as may be reasonably required by the residential building official to allow the review of special or extraordinary construction methods or equipment.*

106.1.3.1 Fire protection system drawings. *Construction documents for the fire protection system(s) shall be submitted to indicate conformance with this code and shall be approved prior to the start of system installation.*

106.1.3.2 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.*

106.1.4 Industrialized units. *When construction includes the use of industrialized units approved by the board, documentation shall be provided to the building official describing how they are to be used. Before these items are installed or used, the following shall be submitted:*

1. *A copy of the construction documents approved by the board; and*
2. *Details pertaining to on-site interconnection of modules or assemblies.*

Exception: *When construction includes the use of industrialized units for one-, two-, and three- family dwellings and their accessory structures, the documents shall be provided to the residential building official. If no residential department is certified in a jurisdiction, construction documents for one-, two-, or three-family dwellings comprised of industrialized units are not required to be submitted for approval.*

106.1.4.1. Definitions.

Closed construction. *An assembly of materials or products manufactured in such a manner that its structural, plumbing, electrical, environmental control, or fire protection elements or components are concealed and are not readily accessible for inspection at the site of its erection, without disassembly, damage, or destruction. Closed construction includes assemblies where only one of the components is not accessible for inspection. (For example, an accessory structure where all the electrical conductors and components are exposed for inspection and its roof and*

wall panels have exposed structural members but the floor panel structural members are not exposed.)

Industrialized units. *Industrialized units are prefabricated components comprised of closed construction manufactured at a location remote from the site of intended use and transported to a building site for its subsequent use. Industrialized units are not restricted to housing for one-, two-, and three-family dwellings, but ~~includes~~include all prefabricated forms of building elements and assembled construction units, intended for both structural and service equipment purposes in all buildings of all groups. Prefabricated shop assemblies may be shipped in structurally complete units ready for installation in the building structure or in knock-down and packaged form for assembly at the site.*

106.1.4.2 General terms. *Such terms as heart modules or cores, modules, modulars, service cores, prefabs, sectional or sectionalized, panels or panelized construction, and specific terms including "prefabricated-subassembly, -building, -unit, -unit service equipment" shall be considered industrialized units. They may be self-sufficient or interdependent as a unit or group of units and used together or incorporated with standard construction methods to form a completed structural entity.*

For a complete description of the Ohio industrialized unit program refer to OBC Section 113.

106.2 Evidence of responsibility. *Required residential construction documents, when submitted for review as required under section 107, shall bear the identification of the person primarily responsible for their preparation.*

106.3 Amended construction documents. *If substantive changes to the residential building are contemplated after first document submission, or during construction, those changes must be submitted to the residential building official for review and approval prior to those changes being executed. The residential building official may waive this requirement in the instance of an emergency repair, or similar instance.*

106.4 Alternative materials and methods of construction and equipment. *For approval of a device, material or assembly that does not conform to the*

performance requirements in this code, section 114 shall apply.

106.5 Alternative engineered design. *The design, documentation, inspection, testing and approval of an alternative engineered system shall comply with sections 106.5.1 to 106.5.3.*

106.5.1 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. Materials, equipment or components shall be designed and installed in accordance with the manufacturer's installation instructions.*

106.5.2 Submittal. *A registered design professional shall indicate on the application that the system is an alternative engineered design. The approval and permanent approval records shall indicate that an alternative engineered design was part of the approved installation. Where special conditions exist, the residential building official is authorized to require additional construction documents to be prepared by a registered design professional.*

106.5.3 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.*

Exception: *Approval of alternative materials, products, assemblies and methods of construction in accordance with Section 114.3.2.*

SECTION 107 PLAN APPROVAL PROCESS

107.1 Plan review required. *Where the rules of the board are applicable under section 101.2, before a residential building or addition to a residential building is constructed or erected, and before a residential building is altered or relocated, or residential building equipment is installed, or a resubmission of construction documents is required or received, residential construction documents relating to the work and equipment under consideration shall be prepared in conformity with section 106 and be submitted to the residential building department for examination and approval.*

107.2 Application for plan approval. *To obtain a plan approval, the owner or the owner's representative shall first file an application in writing on a form furnished by the residential building department for that purpose. Such application shall:*

- 1. Identify and describe the work to be covered for which application is made for approval.*
- 2. Describe the land on which the proposed work is to be done, street address or similar description that will readily identify and locate the proposed building or work.*
- 3. Be accompanied by residential construction documents and other information as required in section ~~106.3~~ 106.1.*
- 4. Be signed by the owner, or the owner's authorized agent.*
- 5. Give such other data and information as required by the residential building official.*
- 6. Identify and clearly indicate whether the project or portion of a project intends to utilize an industrialized unit.*
- 7. Identify and clearly indicate whether the project or portion of a project intends to utilize an assembly of individually listed or labeled products.*

107.2.1 Time limitation of application. *The approval of construction documents under this section is a "license" and the failure to approve such construction documents as submitted within thirty days after filing or the disapproval of such construction documents is an "adjudication order denying the issuance of a license" requiring the opportunity for an "adjudication hearing" as provided by sections 119.07 to 119.13 of the Revised Code and as modified by sections 3781.031 and 3781.19 of the Revised Code. In accordance with section 109, an adjudication order denying the issuance of a license shall specify the reasons for such denial.*

If residential construction documents have been reviewed for compliance with the rules of the board, an adjudication order has been issued to the owner and the owner's representative, and the owner has neither exercised the right to

appeal pursuant to section 110 nor resubmitted corrected documents, the application is invalid six months from the date of the issuance of the adjudication order.

107.3 Order of plan review. *Residential construction documents submitted for approval shall be examined for compliance with the rules of the board in the order received, unless otherwise consented to by the building owners affected by deferred examination.*

107.4 Review of plans. *When residential construction documents have been submitted to the residential building department for review and approval, the building official shall review as appropriate or shall cause the residential construction documents to be examined for compliance with the rules of the board by assigning the examination duty to an appropriately certified individual. The residential building official or plans examiner shall first determine whether the construction documents are adequate as required in section 106.*

107.4.1 Inadequate construction documents. *If residential construction documents are determined to be incomplete or inadequate for examination, the residential plans examiner shall report the findings to the residential building official. The residential plans examiner shall examine the construction documents to the extent possible and identify what information from section 106 is missing and needed to complete the required examination. Upon receipt and review of the report, the residential building official shall proceed as required in section 107.6.*

107.4.2 Resubmitted documents. *If residential construction documents are resubmitted in response to an adjudication order, the review for compliance shall be limited to determining that the item of non-compliance, and any work affected, has been corrected and shall not be deemed to authorize another review of unmodified construction documents previously determined to comply.*

107.4.3 Sealed construction documents. *Residential construction documents, if prepared by an Ohio registered design professional to conform to the requirements of the rules of the board pertaining to design loads, stresses, strength, and stability, or other requirements involving technical analysis, need be examined only to the extent necessary to determine conformity of such construction documents with other requirements of the rules of the board.*

107.5 Plan review, compliance with rules of the board. *If the residential construction documents are determined to comply with the rules of the board, the residential plans examiner shall communicate the findings and recommend the conditions and type of approval to the residential building official.*

107.5.1 Residential building official approval. *The residential building official shall evaluate the residential plans examiner's recommendations. When the residential construction documents have been determined to conform to the applicable provisions of the rules of the board, the residential building official shall endorse or stamp such plans as approved and issue the certificate of plan approval in accordance with section 105.5.*

107.5.2 Posting. *The certificate of plan approval shall be posted in a conspicuous location on the site. The owner and the contractor shall preserve and keep the certificate posted until the final inspections have been completed.*

107.6 Plan review, items of noncompliance. *When the residential construction documents are examined and items of noncompliance with the rules of the board are found, the residential building official shall proceed as required in either section 107.6.1 or section 107.6.2.*

107.6.1 Communication process for items of non-compliance.

1. *Item(s) of non-compliance shall be communicated to the owner or the owner's representative and the following options shall be offered:*
 - 1.1 *The owner will revise the construction documents and resubmit to the department.*
 - 1.2 *The items of noncompliance will not be brought into compliance and will be referred to the residential building official as indicated in item 4 below.*
2. *The owner or the owner's representative shall indicate which option (item 1 above) will be exercised.*
3. *Notations of the communication shall be made on a plan review record. The notations shall include the residential plans examiner's name, the*

date of the communication with the owner or the owner's representative, the observed items of noncompliance, the code citation related to the item(s) of noncompliance, the action necessary to correct the item(s) of noncompliance, the option chosen by the owner or the owner's representative, the name of the person communicated with, and the estimated dates of compliance and resubmission, if applicable.

4. *If the owner or the owner's representative indicates that the work will not be brought into compliance with the rules of the board or requests an adjudication order, the residential plans examiner shall report to the building official in accordance with section 107.6.2.*

107.6.2 Residential building official determination of noncompliance. *The residential building official shall evaluate the results of the plans examination and render a final determination as to whether the items of non-compliance are to be communicated to the owner in the form of an adjudication order complying with section 109. The residential building official shall also determine whether any approvals are possible, and issue the appropriate approval as described in section 105.*

107.7 Approved residential construction document sets. *One set of approved residential construction documents shall be kept by the residential building official. The other set(s) shall be returned to the applicant, kept at the work site, along with manufacturers' installation instructions and product information, and shall be available for use by the residential inspectors.*

SECTION 108 INSPECTION PROCESS

108.1 General. *After residential construction documents have been approved, construction or work may proceed in accordance with the approved documents. Construction or work for which an approval is required shall be subject to inspection. It shall be the duty of the owner or the owner's duly authorized representative to notify the residential building department when work is ready for inspection. Access to and means for inspection of such work shall be provided for any inspections that are required by this code.*

It shall be the duty of the owner or the owner's authorized representative to cause the work to remain accessible and exposed for inspection purposes. Such construction or work shall remain accessible and exposed for inspection purposes until the work has been inspected to verify compliance with the approved construction documents, but failure of the inspectors to inspect the work within four days, exclusive of Saturdays, Sundays, and legal holidays, after the work is ready for inspection, allows the work to proceed.

Subsequent work is allowed to proceed only to the point of the next required inspection.

108.2 Required inspections. *At the time that the certificate of plan approval is issued, the residential building official shall provide to the owner, or the owner's representative, a list of all required inspections for each project. The required inspection list shall be created from the applicable inspections set forth in sections 108.2.1 to ~~108.2.14~~ 108.2.12. The residential building official, upon notification from the owner or the owner's agent that the work is ready for inspection, shall cause the inspections set forth in the required inspection list to be made by an appropriately certified residential inspector in accordance with the approved residential construction documents.*

108.2.1 Lot line markers required. *Before any work is started in the construction of a residential building or an addition to a residential building to which the rules of the board are applicable under section 101.2, all boundary lines shall be clearly marked at their intersections with permanent markers or with markers which are offset at a distance which is of record with the owner.*

108.2.2 Footing or foundation inspection. *Footing and foundation inspections shall be made after excavations for footings are complete 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 is ready mixed in accordance with "ASTM C 94", the concrete need not be on the job.*

108.2.3 Concrete slab and under-floor inspection. *Concrete slab and under-floor inspections shall be made after in-slab and under-floor reinforcing steel and building service equipment, conduit, insulation, vapor retarder, piping*

accessories and other ancillary equipment items are in place, but before any concrete is placed or floor sheathing installed, including the subfloor.

108.2.4 Lowest floor elevation. *The elevation certification required in section 322 shall be submitted to the residential building official.*

108.2.5 Frame inspection. *Framing inspections shall be made after the roof deck or sheathing, all framing, fire blocking and bracing are in place and pipes, chimneys and vents to be concealed are complete and the rough electrical, plumbing, heating wires, pipes and ducts are approved.*

108.2.6 Lath or gypsum board inspection. *Lath and gypsum board inspections shall be made after lathing and gypsum board, interior and exterior, is in place, but before any plastering is applied or before gypsum board joints and fasteners are taped and finished.*

Exception: *Gypsum board that is not part of a fire-resistive assembly or a shear assembly.*

108.2.7 Fire-resistant penetrations. *Protection of joints and penetrations in fire-resistance-rated assemblies shall not be concealed from view until inspected and approved.*

108.2.8 Energy efficiency inspections. *Inspections shall be made to determine compliance with Chapter 11 and shall include, but not be limited to, inspections for: envelope insulation “R” and “U” values, fenestration “U” value, duct system “R” value, infiltration air barriers, caulking/sealing of openings in envelope and ductwork, and “HVAC” and water heating equipment efficiency.*

108.2.9 Testing of residential building service equipment. *Inspections shall be made of all residential building services equipment to ensure that it has been installed in accordance with the approved construction documents, the equipment listings, and the manufacturer’s installation instructions. Inspections shall include, but not be limited to, inspections for the following systems and their associated components: mechanical heating and ventilating systems, mechanical exhaust systems, plumbing systems, fire protection systems, and electrical systems.*

108.2.10 Other inspections. *In addition to the inspections specified above, the residential building official is authorized to ~~make~~ cause to be made or require other inspections of any residential construction work to be made to ascertain compliance with the provisions of this code.*

Where applications are submitted for projects of unusual magnitude of construction, the building official may require inspections or full-time project representation by a registered design professional or inspection agency. This inspector/project representative shall keep daily records and submit reports as required by the building official.

Exception: *Where the building official requires full-time project inspection, the installation of a fire protection system may be inspected by a person certified under section 3781.105 of the Revised Code. The person shall be certified in the appropriate subfield of fire protection systems being inspected – automatic sprinkler, fire alarm, or special hazards systems design.*

108.2.11 Inspections, compliance with construction documents. *When an inspector from the department having jurisdiction finds that completed work is in accordance with the approved construction documents, the inspector shall communicate the findings to the owner's on-site representative, shall make a note of the satisfactory inspection on an on-site inspection record and in the inspector's log, and communicate the findings to the building official. The building official, after review of the findings, shall issue the certificate of occupancy in accordance with section 111.*

108.2.12 Industrialized unit inspections. *If the project will include the use of industrialized units approved by the board, the residential building official shall cause inspections to be made for on-site construction to complete the installation of the industrialized unit in conformance with the applicable provisions of the rules of the board. Such inspections shall include:*

- 1. Connection to on-site construction, interconnection of modules, connection to utilities. The inspections and conducting of required tests shall not require the destruction or disassembly of any factory-constructed component authorized by the board.*

2. *Inspection of the unit for damage resulting from transportation, improper protection of exposed parts from inclement weather or other causes. Damage shall be repaired as required by the residential building official to comply with the applicable provisions of the rules of the board;*
3. *Inspection of the unit to determine if it is marked by an insignia furnished by the board; and*
4. *Inspect the unit to determine if the floor plan, exterior elevations, and exposed details are in conformance with the construction documents approved by the board.*

108.3 Inspection agencies. *The residential building official is authorized to accept reports of approved inspection agencies, provided such agencies are approved in accordance with the rules of the board of building standards.*

108.4 Right of entry. *The residential building official, or the residential building official's 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 credentials are presented to the occupant and that entry is requested and obtained. Where permission to enter has not been obtained, is denied, or the residential building official has probable cause to believe that there exists in a structure or upon a premises a condition which is a serious hazard, the residential building official shall proceed as required in section 109 and shall also have recourse to the remedies provided by law to secure entry.*

108.5 Inspections, compliance with residential construction documents. *When an individual certified to make inspections from the residential department having jurisdiction finds that completed work is in accordance with the approved residential construction documents, the certified individual shall communicate the findings to the owner's on-site representative, ~~and~~ shall make a note of the satisfactory inspection on an on-site inspection record and in the residential inspector's log, and communicate their findings to the residential building official. The residential building official, after review of the findings, shall issue the certificate of occupancy in accordance with section 111.*

108.6 Inspections, observation of violations, unsafe conditions, or serious hazards. *When an individual certified to make inspections from the residential*

department having jurisdiction finds that any work in connection with the location, erection, construction, repair, alteration, moving, or equipment of a residential building is contrary to the approved residential construction documents for the same, the residential building inspector shall proceed as required in either section 108.6.1 or 108.7.

108.6.1 Communication process for work contrary to approved construction documents.

- 1. Communicate the nature of the differences to the owner or the owner's on-site representative and offer the following options*
 - 1.1 The owner will bring the item of noncompliance into compliance,*
 - 1.2 The owner will revise the construction documents and resubmit to the residential department,*
 - 1.3 The items of noncompliance will not be brought into compliance and will be referred to the residential building official as indicated in item 4 below.*
- 2. The owner or the owner's on-site representative shall indicate which option (item 1 above) will be exercised*
- 3. Notations on the on-site inspection record and in the residential inspector's log shall be made. The notations shall include the name of the certified individual authorized to make the inspections, the date of the inspection, the type of inspection, the observed items of noncompliance, the option chosen by the owner or the owner's on-site representative, the name of the person communicated with, and the estimated dates of compliance and follow-up inspections, if applicable.*
- 4. If the owner or the owner's on-site representative indicates that the work will not be brought into compliance with the approved residential construction documents, the individual certified to make inspections shall submit a report to the residential building official for the final determination of noncompliance in accordance with section 108.7.*

108.6.2 Observation of violations not shown on plans. If an individual

certified to make inspections, in the course of performing the assigned or requested inspections, observes a code violation that was either shown incorrectly or not adequately addressed or detailed in the approved residential construction documents, the certified individual shall communicate the finding to the residential building official so that the residential building official can make a determination of whether the code violation is of such significance to warrant communicating the finding to the owner or the owner's representative as a recommended change.

108.6.3 Observation of unsafe conditions or serious hazards. *If an individual certified to make inspections, in the course of performing the assigned or requested inspections, observes an unsafe condition or a serious hazard, the certified individual shall communicate that condition to the owner or the owner's on-site representative and shall report the findings immediately to the residential building official so that the residential building official can make a final determination of whether the violation constitutes a serious hazard which requires the issuance of an adjudication order as required in section 109.*

108.6.4 Industrialized units, observations of noncompliance. *When an individual certified to make inspections from the residential department having jurisdiction finds that a residential industrialized unit has been constructed contrary to the residential construction documents approved by the board, the certified individual shall report the nonconformance to the residential building official. The residential building official shall notify the board of all violations of section 108.2.13. The board or its designee and the residential building official shall determine the corrective action to be taken before the residential building is approved to be occupied.*

108.7 Residential building official determination of noncompliance. *The residential building official shall evaluate any report of items of noncompliance and render a final determination as to whether the items of non-compliance are to be communicated to the owner in the form of an adjudication order complying with section 109. The residential building official shall also determine whether any approvals are possible.*

108.8 ~~Testing of residential building service equipment~~Acceptance, performance, and operational testing. *~~Building service equipment~~Acceptance, performance, and operational testing shall be ~~tested~~ conducted as required in the*

applicable code or referenced standard. Advanced notice of the test schedule shall be given to the building official. The residential building official may require that the tests be conducted in the presence of the building official or certified residential inspector. Testing and inspection records shall be made available to the residential building official or inspector, upon request, at all times during the fabrication of the systems and the erection of the building.

108.8.1 New, altered, extended or repaired systems. *New systems and parts of existing systems, which have been altered, extended, renovated or repaired, shall be tested as prescribed herein to disclose leaks and defects.*

108.8.2 Apparatus, material and labor for tests. *Apparatus, material and labor required for testing a system or part thereof shall be furnished by the owner or the owner's representative. Required tests shall ~~be made by the owner and shall~~ be conducted by and at the expense of the owner or the owner's representative.*

108.8.3 Reinspection and testing. *Where any work or installation does not pass an initial test or inspection, the inspector shall proceed as outlined in section 108.6.*

Section 109

Orders, Violations, and Unsafe Buildings

109.1 Adjudication orders required. *When the residential building official denies any approval or takes action in response to findings of non-compliance, such action shall be initiated by issuing an adjudication order, prior to seeking any remedy, civil or criminal. Every adjudication order shall:*

1. *Clearly identify the section of law or rules violated;*
 - 1.1 *Clearly identify, in a contrasting and obviously marked manner, all violations related to accessibility.*
2. *Specifically indicate which detail, installation, site preparation, material, appliance, device, addition, alteration to structures, residential construction documents, assemblages or procedures are necessary to change to comply with the order;*

2.1 When issued to stop work, the order shall also clearly indicate the specific work that is required to cease, when the work must cease and the conditions under which the cited work will be permitted to resume. The order to stop work shall be given to the owner of the property involved, to the owner's agent and the person doing the work.

- 3. Include notice of the procedure for appeal and right to a hearing if requested within thirty days of the mailing of the order. The order shall also indicate that, at the hearing, the owner may be represented by counsel, present arguments or contentions orally or in writing, and present evidence and examine witnesses appearing for or against the owner;*
- 4. Specify a reasonable period of time in which to bring the item(s) on the order into compliance;*
- 5. Include the signature of the residential building official;*
- 6. The order shall be sent by certified mail, return receipt requested, to the owner and any individual designated as a representative or agent by the owner in such matters.*

109.2 Response to orders. *The person receiving an order shall exercise their right to appeal within 30 days of the mailing of the order, comply with the order, or otherwise be released from the order by the residential building official.*

109.3 Prosecution and penalties. *When an owner fails to comply with section 109.2, the owner may be prosecuted and is subject to a fine of not more than five hundred dollars as provided for in section 3791.04 of the Revised Code.*

109.3.1 Unlawful continuance. *Failure to cease work after receipt of an order to stop work is hereby declared a public nuisance.*

109.4 Unsafe buildings. *Structures or existing equipment that are unsafe or unsanitary due to inadequate means of egress facilities, inadequate light and ventilation, or which constitute a fire hazard, or are otherwise dangerous to human life, shall be deemed a serious hazard. Where a residential building is found to be a serious hazard, such hazard shall be eliminated or the residential building shall be vacated, and where such residential building, when vacated,*

remains a serious hazard, it shall be razed.

109.4.1 Orders, injunction proceedings. *Where the residential building official finds that a residential building is a serious hazard and the owner of such building fails, in the time specified in an order from the residential building official, to eliminate such hazard, or to vacate or raze the residential building, the residential building official shall proceed under section 3781.15 of the Revised Code.*

109.4.2 Restoration. *Where the residential structure or equipment is determined to be unsafe by the residential building official, it is permitted to be restored to a safe condition. To the extent that repairs, alterations or additions are intended to be made or a change of occupancy occurs during the restoration of the structure, such repairs, alterations, additions or change of occupancy shall comply with this chapter.*

SECTION 110 APPEALS

110.1 Hearing and right of appeal, local board of building appeals. *In order to hear and decide appeals of orders, decisions, or determinations made by the residential building official relative to the application of this code, there shall be a local appeals process established within the certified jurisdiction. Adjudication hearings shall be in accordance with sections 119.09 to 119.13 of the Revised Code, as required by section 3781.031 of the Revised Code.*

SECTION 111 CERTIFICATE OF OCCUPANCY

111.1 Approval required to occupy. *No residential building or structure, in whole or in part, shall be used or occupied until the residential building official has issued an approval in the form of a certificate of occupancy. The certificate of occupancy shall indicate the conditions under which the residential building shall be used. The building owner shall only use the structure in compliance with the certificate of occupancy and any stated conditions. The residential structure and all approved building service equipment shall be maintained in accordance with the approval. When a residential building or structure is entitled thereto (constructed according to the approved construction documents, final tests and inspections are completed, and no orders of the building official are outstanding,*

or as permitted in this section), the residential building official shall issue a certificate of occupancy in a timely manner.

111.1.1 New residential buildings. A residential building or structure erected shall not be used or occupied, in whole or in part, until the certificate of occupancy has been issued by the residential building official. Occupancy of spaces within a residential building which are unaffected by the work of work shall be allowed to continue if the residential building official determines the existing spaces can be occupied safely until the completion of the work.

111.1.2 Residential building alterations or additions. A residential building or structure enlarged, extended or altered, in whole or in part, shall not be occupied or used until a certificate of occupancy has been issued. Occupancy of spaces within a building which are unaffected by the work of alteration shall be allowed to continue if the residential building official determines the existing spaces can be occupied safely until the completion of the alteration.

111.1.3 Partial occupancy. Upon the request of the owner or owner's representative, a residential building official shall issue a certificate of occupancy before the completion of the entire work, provided that the residential building official determines that the space can be safely occupied prior to full completion of the residential building, structure, or portion without endangering life or public welfare. The certificate shall indicate the extent of the areas approved for occupancy and any time limits for completion of the work.

111.1.4 Time-limited occupancy. A residential building or structure hereafter changed in part from one occupancy to another for a limited time may receive a certificate of occupancy reflecting that time-limited occupancy provided:

1. There are no violations of law or orders of the residential building official pending;
2. It is established after inspection and investigation that the proposed use is not deemed to endanger public safety and welfare ~~safely~~;
3. The residential building official has approved the use for an alternative purpose on a temporary basis;

4. *The residential building official has issued a certificate of occupancy indicating any special conditions under which the building or part of the residential building can be used for the alternative purpose within the time limit specified.*

111.1.5 Temporary structures occupancy. *A residential building intended to be erected, placed and used for a period of time not to exceed one hundred eighty days that has been determined by the residential building official to be in compliance with section 102.9 shall be issued a "Certificate of Occupancy for Temporary Structures." The residential building official is authorized to grant extensions for demonstrated cause.*

111.2 Existing residential buildings. *Upon written request from the owner of an existing residential building or structure, the residential building official shall issue a certificate of occupancy, provided there are not violations of law or orders of the residential building official pending, and it is established after inspection and investigation that the alleged occupancy of the residential building or structure has previously existed. This code shall not require the removal, alteration or abandonment of, or prevent the continuance of, the occupancy of a lawfully existing residential building or structure, unless such use is deemed to endanger public safety and welfare.*

111.3 Certificate issued. *The certificate shall certify compliance with the provisions of this code, Chapters 3781. and 3791. of the Revised Code, and the purpose for which the residential building or structure may be used in its several parts. The certificate of occupancy shall contain the following:*

1. *The plan approval application number.*
2. *The name and address of the owner.*
3. *A description of that portion of the structure for which the certificate is issued.*
4. *The signature of all residential building officials having jurisdiction. When more than one residential building official has jurisdiction for a building (when the certification of the residential building department is limited for such systems as plumbing or piping systems) each shall sign the certificate of occupancy with an indication of the scope of their individual approvals.*

5. *The edition of the residential code under which the plan approval was issued.*
6. *When an automatic sprinkler system is provided, the type and description of the system shall be indicated.*
7. *Any special stipulations and conditions of the plan approval including any variances granted to the requirements of this code.*

111.4 Validity of a certificate of occupancy. *The certificate of occupancy represents an approval that is valid only when the residential building or structure is used as approved and certifies conformance with applicable provisions of the “Residential Code of Ohio for One-, Two-, and Three-family Dwellings” and Chapters 3781. and 3791. of the Revised Code. The approval is conditioned upon the building systems and equipment being maintained and tested in accordance with the approval, the “RCO”, and applicable equipment and systems schedules.*

111.5 Connection of service utilities. *No connections shall be made from a utility, source of energy, fuel or power to any residential building or system that is regulated by this code for which a plan approval and inspections are required, until approved by the residential building official.*

111.6 Temporary connection. *The residential building official shall approve the temporary connection of the residential building or system to the utility source of energy, fuel or power.*

SECTION 112 CHANGES TO THE CODE

112.1 Changes, board of building standards. *The board may adopt, amend, or rescind the rules of the board on its own motion or in response to an application for changes filed pursuant to this section.*

112.2 Changes, application to the board. *Any person may apply to the board to adopt, amend, or rescind rules of the board. The application for rule change shall be on forms and in format prescribed by the board. Twelve printed copies of the application shall be filed with the secretary of the board.*

112.3 Changes, application to the residential construction advisory committee. *In addition to section 112.2, any person may apply to the residential construction advisory committee to recommend to the board that it adopt, amend, or rescind provisions of the RCO. The application for rule change shall be on forms and in format prescribed by the board and directed to the chairperson of the residential construction advisory committee. Twelve printed copies of the application shall be filed with the secretary of the board.*

112.4 Processing applications for changes. *When the secretary of the board receives a conforming application for an adoption, amendment, or annulment of a provision of the rules of the board, the secretary shall promptly deliver or mail a copy of the application to each member of the board or to each member of the residential construction advisory committee for a recommendation to the board as appropriate.*

After receiving an application for the adoption, amendment, or annulment of a provision of the rules of the board or a recommendation of the residential construction advisory committee, the board shall proceed under sections 3781.101 and 3781.12 of the Revised Code.

SECTION 113 EXISTING BUILDINGS AND STRUCTURES

113.1 General . *Provisions within this section shall control the alteration, repair, addition and change of occupancy if existing residential buildings.*

113.2 Maintenance. *Residential buildings, structures and the building equipment shall be maintained in a safe and sanitary condition and in accordance with the condition(s) established in current and any previous plan approvals and certificates of occupancy. Devices or safeguards which are required by this code shall be maintained in conformance with the code edition under which installed. The owner or the owner's designated agent shall be responsible for the maintenance.*

The requirements of this chapter shall not provide the basis for removal or abrogation of fire protection and safety systems and devices in existing structures without approval of the residential building official.

113.3 Definitions. *The following terms shall, for the purposes of this section and*

as used elsewhere in the code, have the following meanings:

CHANGE OF OCCUPANCY. *A change in the purpose or level of activity within a structure that involves a change in the application of the requirements of the code.*

HISTORIC BUILDINGS. *A residential building meeting one of the following criteria:*

- 1. Listed or preliminarily determined to be eligible for listing in the “National Register of Historic Places”; or*
- 2. Determined by the secretary of the U.S. 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; or*
- 3. Designated as historic under a state or local historic preservation program that is approved by the U.S. department of interior.*

113.4 Additions and alterations. *Additions or alterations to residential buildings shall conform with the requirements of the code for new construction and shall be approved by the residential building official. Additions or alterations shall not be made to an existing residential building or structure which will cause the existing residential building or structure to be in violation of any provisions of this code. Portions of the structure not altered and not affected by the alteration are not required to comply with the code requirements for a new structure.*

Exception: *For residential buildings and structures in flood hazard areas, any additions, alterations or repairs that constitute substantial improvement of the existing structure, shall comply with the flood design requirements for new construction and all aspects of the existing structure shall be brought into compliance with the requirements for new construction for flood design.*

113.5 Alterations to and replacement of systems, components and materials. *Alterations to and replacements of an existing system (egress, fire protection, mechanical, plumbing, etc.) and materials or building components not otherwise provided for in this section, shall conform to that required for new construction to the extent of the alteration. The existing systems, materials, or components shall*

not be required to comply with all of the requirements of this code for new construction except to the extent that they are affected by the alteration. Alterations to and replacements of existing systems, materials, or components shall not cause them to become unsafe, hazardous, overloaded, or become less effective than when originally installed, constructed, and/or approved.

113.6 Replacement and repairs to systems, components and materials. *Replacement of residential building components, and repairs to existing systems and materials or building components not otherwise provided for in this section, shall not be required to meet the provisions for new construction, provided such work is done in accordance with the conditions of the existing approval in the same manner and arrangement as was in the existing system, is not less safe than when originally installed and is approved.*

113.6.1 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.*

113.6.2 Used materials and equipment. *The use of used materials which meet the requirements of this code for new materials is permitted. Used equipment, appliances, and devices shall not be reused unless approved by the residential building official.*

113.7 Changes in occupancy. *A residential building, accessory structure, or space within a residential building shall not change in its use or purpose unless it is made to comply with the requirements of this code for such use and approved by the residential building official. An approval is not required when the code requirements are the same for both uses.*

113.7.1 Use of a residential building for other purposes. *No change of occupancy to uses within the scope of the OBC shall be made to any existing residential building, space within, or accessory structure unless such building is made to comply with the requirements of the OBC for such occupancy and approved by the building official with OBC enforcement authority.*

113.7.2 Type A family day care homes. *A residential building that is intended to be used in whole or in part as a licensed type A family day-care home shall be inspected in accordance with the type A family day-care home*

checklist (available from the board of building standards). The residential building official shall issue a report of the findings to the Ohio department of jobs and family services.

113.8 Moved structures. *Residential structures moved shall be safe and sanitary and any repair, alteration, or change in occupancy shall comply with the provisions of this code for new structures. Field work, building location, foundations and foundation connections, wind loads, seismic loads, snow loads, and flood loads, shall comply with the requirements of this code.*

The residential building official shall be authorized to inspect, or require inspection at the expense of the owner, the various components of a relocated building to verify that they have not sustained damage. Building service equipment, mechanical, plumbing, and fire protection systems shall be tested to assure that they are in operating condition. Any repairs or alterations required as a result of such inspections shall be approved and completed prior to issuance of the certificate of occupancy.

113.9 Historic buildings. *The provisions of this code relating to the construction, repair, alteration, addition, restoration and movement of residential structures, and change of occupancy shall not be mandatory for historic buildings where such residential buildings are judged by the residential building official not to constitute a distinct life safety hazard.*

113.9.1 Flood hazard areas. *Within flood hazard areas established, the residential building shall be brought into conformance with section 322.*

Exception: *Historic buildings.*

SECTION 114 PRODUCTS AND MATERIALS

~~**114.1 Approved materials, products, assemblies and methods of construction.** *Materials, products, assemblies and methods of construction approved by the residential building official shall be constructed and installed in accordance with such approval. Materials, devices, products and assemblies listed in directories indicated in Table 114.3 are authorized for use in accordance with all of the following:*~~

~~1. *Approved by the residential building official;*~~

- ~~2. Installed/used in accordance with the listing;~~
- ~~3. When used as an assembly, installed/used in compliance with this code;~~
- ~~4. The listing is current;~~
- ~~5. The extent of the listing does not include in its scope, elements of design, construction or installation otherwise in conflict with the provisions of this code such as fire resistance, structural design, etc.~~

~~**114.1.1 Definitions.** The following words and terms shall, for the purposes of this section, have the meanings shown herein:~~

~~**Assembly.** A preassembled grouping of materials, products and/or devices designed to act as a whole. This does not include industrialized units regulated by section 113.~~

~~**Insignia.** A mark or label prescribed in accordance with board procedures.~~

~~**Material.** A manufactured form or substance designed to act as a whole.~~

~~**Method of construction.** A procedure or system intended to result in a finished building, structure or portion thereof.~~

~~**Product.** A material or device designed and manufactured to perform a predetermined function. Appliances, assemblies and equipment are also considered products.~~

~~**114.1.2 Used materials and products.** The use of used materials and products which meet the requirements of this code for new materials and products is permitted. Used products and materials shall not be reused unless approved by the residential building official.~~

~~**114.2 Alternative materials, products, assemblies and methods of construction.** The provisions of this code are not intended to prevent the installation of any material or to prohibit any material, product, assembly or method of construction not specifically prescribed by this code, provided that any such alternative has~~

been approved. An alternative material, product or method of construction shall be approved in accordance with either section 114.2.1 or section 114.2.2.

Exception: *Industrialized units constructed in accordance with the “OBC”.*

~~**114.2.1 Research reports and listings.** Any material, product, assembly or method of construction not specifically provided for in this code, shall have a valid research report or listing from an evaluation service listed in “OBC Appendix P” and shall be deemed to be approved provided it complies with the conditions listed in the report and Chapters 3781. and 3791. of the Revised Code.~~

~~**114.2.2 Board approval.** Any material, product, assembly or method of construction not specifically provided for in this code may be approved by the board of building standards upon application under the procedures prescribed by the board and as outlined in the provisions of Chapter 1 of the “OBC”~~

~~**114.3 Materials, products and assembly directories.** “Table 114.3” lists directories for materials, products and assemblies accepted for specified performances.~~

**TABLE 114.3
MATERIALS, PRODUCTS AND ASSEMBLY DIRECTORIES**

<i>Title</i>	<i>Agency</i>	<i>–Edition</i>
<i>Building Materials Directory</i>	<i>UL</i>	<i>2009</i>
<i>Electrical Appliances and Utilization Equipment Directory</i>	<i>UL</i>	<i>2008</i>
<i>Electrical Construction Materials Directory</i>	<i>UL</i>	<i>2008</i>
<i>Fire Protection Equipment Directory</i>	<i>UL</i>	<i>2009</i>
<i>Fire Resistance Directory Vols. 1, 2A, 2B, and 3</i>	<i>UL</i>	<i>2009</i>
<i>Flammable and Combustible Liquids and Gases Equipment Directory</i>	<i>UL</i>	<i>2008</i>
<i>Hazardous Location Equipment Directory</i>	<i>UL</i>	<i>2008</i>
<i>CSA Website http://directories.csa-international.org/</i>	<i>CSA^{1,4}</i>	<i>N/A</i>
<i>Intertek ETL www.intertek-etlsemko.com</i>	<i>Intertek²</i>	<i>N/A</i>
<i>Approval Guide www.approvalguide.com</i>	<i>FM⁵</i>	<i>N/A</i>
<i>Fire Resistance Design Manual (GA 600 18th ed.)</i>	<i>GA³</i>	<i>2006</i>

Footnotes:

1.— Canadian Standards Association or CSA International (formerly AGA)

2.— Website only Select “ETL Listed Directory or WH&OPL Mark Directory”

3.— Gypsum Association

4. ~~Website only~~ Select "Gas Appliances."

5. ~~Website only~~ free registration

~~**114.4 Approved agencies.** When test reports are required to be submitted to the residential building official or where materials or assemblies are required by this code to be marked or labeled, the agency performing the tests, marking or the labeling shall be an approved agency.~~

Section 114
Products and materials

114.1 General. Any material, product, assembly or method of construction used in a building or structure shall be approved by the building official. The provisions of this section describe the product approval process intended by the board of building standards in accordance with Section 3781.10 (C) of the Revised Code.

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

Accreditation. The formal recognition of a conformity assessment body's adherence and operation under a documented quality system whereby a third party (Accreditation Body) attests to technical competence and the specific scope of accreditation of the conformity assessment body .

Accreditation body. An authoritative body that is an established, independent, internationally recognized, third-party organization that performs accreditation to ascribe initial recognition and monitors, on an cyclical basis, the competency, integrity, and performance of conformity assessment bodies in accordance with established standards.

Assembly. A preassembled grouping of materials, products and/or components designed to act as a whole. This does not include industrialized units regulated by section 113.

Calibration laboratory. An established, independent, nationally recognized and accredited, third-party organization that regularly provides calibration services such as, but not limited to, tolerance testing to ensure the accuracy of measuring equipment used in

construction.

Conformity assessment body. A body that performs conformity assessment services and can be an object of accreditation, such as a testing laboratory, inspection body, product certification body.

Evaluation service. An established, independent, nationally recognized and accredited, third-party conformity assessment body that is accredited as a product certification body and performs technical evaluations of building materials, products, and methods of construction where code requirements are not clear or the innovative products do not have national consensus standards. The evaluation of the product results in the issuance of a research report establishing the code compliance and conditions of its use based upon multiple sources of information including test reports, test data, performance data, or acceptance criteria, and can be approved for installation by the building official in accordance with the rules of the board.

Fabricator inspection agency. An established, independent, nationally recognized and accredited, third-party conformity assessment body regularly engaged in fabrication of construction materials and methods of construction.

Field evaluation body. An established, independent, nationally recognized and accredited, third-party conformity assessment body regularly engaged in furnishing field inspection, observation, testing, or reporting services for construction materials, products, and methods of construction.

Industry trade association certification program. A certification program operated by an established and nationally recognized organization, founded and funded by businesses that operate in a specific industry, where the main focus is to monitor quality assurance among associated members.

Insignia. A mark or label prescribed in accordance with board procedures.

Inspection body. *An established, independent, nationally recognized and accredited, third-party conformity assessment body regularly engaged in furnishing inspection, observation, testing, or reporting services for construction materials, products, and methods of construction. Such services include, but are not limited to geotechnical inspections, environmental inspections, mechanical and metallurgical analysis, non-destructive testing and evaluation, chemical analysis, and structural and product testing.*

Listing agency. *An established, independent, nationally recognized and accredited, third-party conformity assessment body that is accredited as a product certification body and conducts tests on materials, products, or methods of construction to certify products that meet the criteria for compliance with nationally recognized codes and standards. The product certification body allows its insignia of conformity to be placed on a material or product by the manufacturer, identifying that the material or product has been certified by the product certification body. The product certification body maintains a list or directory of all of the materials and products that they have certified and the conditions of their use.*

Material. *A manufactured form or substance designed to act as a whole.*

Method of construction. *A procedure or system intended to result in a finished building, structure or portion thereof.*

Product. *A material or device designed and manufactured to perform a predetermined function. Appliances, assemblies and equipment are also considered products.*

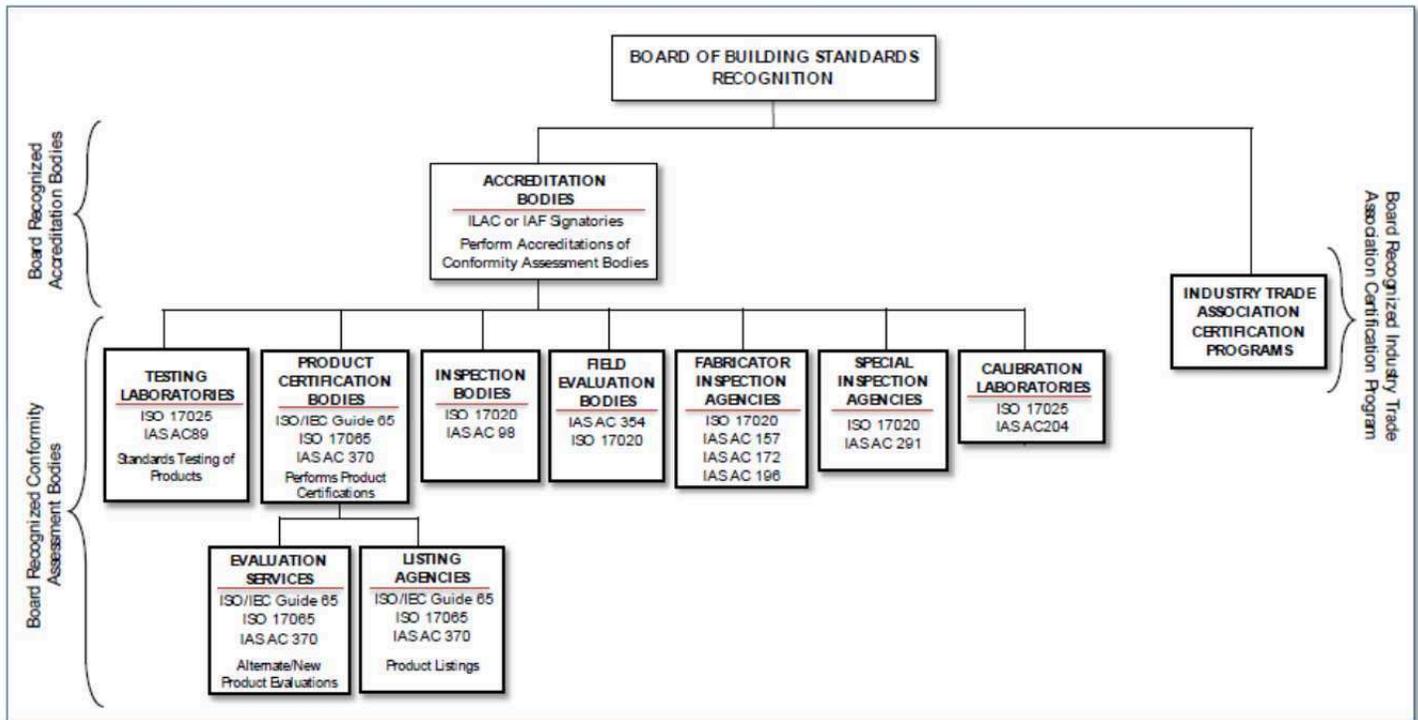
Product certification body. *An established, independent, nationally recognized and accredited, third-party conformity assessment body regularly engaged in conducting evaluation services, inspections and tests on materials and products to certify compliance with nationally recognized codes and standards. Product Certification Bodies are sub-classified as either Evaluation Services or Listing Agencies.*

Recognition. *An acceptance by the board of building standards of an accreditation body, a conformity assessment body, or an industry trade association certification program in accordance with the rules of the board of building standards.*

Special inspection agency. *An established, independent, nationally recognized and accredited, third-party conformity assessment body regularly engaged in performing special inspections as required by Chapter 17.*

Testing laboratory. *An established, independent, nationally recognized and accredited, third-party conformity assessment body regularly engaged in conducting tests of materials, products, or methods of construction to determine compliance with a specification or testing standard. The testing laboratory issues a report documenting the test results.*

Figure 114.2
ORGANIZATION OF BOARD RECOGNIZED BODIES AND CERTIFICATION PROGRAMS



ILAC – International Laboratory Accreditation Cooperation
 IAF – International Accreditation Forum
 ISO – International Organization for Standardization
 IAS – International Accreditation Service
 IEC – International Electrotechnical Commission

114.3 Building official approval process. *The building official shall approve the use of products in accordance with Sections 114.3.1 through 114.3.3.*

114.3.1 Materials, products, assemblies and methods of construction prescribed in the code.

114.3.1.1 Testing laboratories. *When test reports are required to be submitted or when the rules of the Board require materials, products, assemblies and methods of construction to conform to specific referenced standards, the building official shall verify that the proposed material, product, assembly, and method of construction has been tested by a testing laboratory recognized by the board and published on the list titled “Recognized Conformity Assessment Bodies” found on the board’s website at <http://www.com.ohio.gov/dico/bbs/>.*

The building official shall verify that the testing laboratory is accredited to perform the specific tests prescribed in the code by verifying the testing laboratory’s “scope of accreditation” found on the testing laboratory’s website.

Exception: *Acceptance, performance, and operational testing reports submitted in accordance with Section 108.8 are permitted to be prepared and submitted by the individual performing the acceptance, performance, and operational tests. Board recognition is not required for persons conducting acceptance, performance, or operational tests.*

114.3.1.2 Listing agencies. *When the rules of the Board require materials, products, assemblies and methods of construction to be marked or listed and labeled in accordance with a specific referenced standard, the building official shall verify that the proposed material, product, assembly, and method of construction has been listed and labeled by a listing agency recognized by the board and published on the list titled “Recognized Conformity Assessment Bodies” found on*

the board's website at <http://www.com.ohio.gov/dico/bbs/>.

Building officials are authorized to approve listed and labeled materials, products, assemblies and methods of construction after verifying all of the following additional information:

1. The product is listed on the product certification body's website directory.

2. The listing is current.

3. The product is proposed to be installed/used in accordance with the listing.

4. When used as an assembly, the assembly is proposed to be installed/used in compliance with this code.

5. The extent of the listing does not include in its scope, elements of design, construction or installation otherwise in conflict with the provisions of this code such as fire-resistance and structural design.

114.3.2 Alternative materials, products, assemblies and methods of construction not prescribed in the code. *The provisions of this code are not intended to prevent the installation of any material or to prohibit any material, product, assembly or method of construction not specifically prescribed by this code, provided that any such alternative shall have a valid research report or listing from an evaluation service recognized by the board and published on a list titled "Recognized Conformity Assessment Bodies" found on the board's website at <http://www.com.ohio.gov/dico/bbs/>.*

The alternative material, product, assembly, or method of construction shall be deemed to be approved provided it complies with the conditions listed in the research report or listing found on the evaluation service's website.

Exceptions:

1. Alternative materials, products, assemblies, or methods of

- construction submitted pursuant to section 106.5.*
2. Industrialized units shall be approved and constructed in accordance with section 113.1 of this chapter.

114.3.3 Used materials and products. *The use of used materials and products which meet the requirements of this code for new materials and products is permitted. Used products and materials shall not be reused unless approved by the building official.*

114.4 Process for board-recognition of “Accreditation Bodies,” “Conformity Assessment Bodies,” and “Industry Trade Association Certification Programs.” *All accreditation bodies, conformity assessment bodies, and industry trade association certification programs shall be recognized by the board in accordance with division 4101:7 of the Administrative Code.*

Section 115
Board Organization

115.1 Meetings.

1. Meeting schedule. *No later than December thirty-first of each year, the board shall establish a schedule of the dates, times, and locations of all regular board meetings and meetings of board committees for the following calendar year. Such schedule shall be posted on the board's website: <http://www.com.ohio.gov/dico/bbs/>.*

2. Meeting location. *All meetings of the board shall be held in offices of the Ohio department of commerce, training room #1, 6606 Tussing Rd., Reynoldsburg, Ohio, 43068, unless otherwise designated.*

115.2 Notices. *Prior to all regular or special meetings of the board, the executive secretary shall distribute the agenda, including meeting date, time, and location, by electronic mail to any person who has requested such information.*

115.3 Rules. *All rules of the board shall be adopted in accordance with Chapter 119. of the Revised Code.*

115.4 Board committees and duties. *The board shall have three standing committees.*

1. Code committee. *The code committee provides general oversight of the board's rule promulgation and code development activities. The committee reviews proposed rule changes and petitions for code changes and shall make recommendations to the board for action.*

2. Education committee. *The education committee provides general oversight to the board's continuing education program. The committee reviews continuing education course applications submitted for approval pursuant to paragraph (G) of rule 4101:7-3-01 of the Administrative Code and shall make recommendations to the board for action on the applications.*

3. Certification committee. *The certification committee provides general oversight to the board's personnel and building department certification*

program. The committee reviews personnel and building department certification applications submitted for approval pursuant to paragraph (G) of rule 4101:7-3-01 of the Administrative Code and shall make recommendations to the board for action on the applications.

Effective: 01/01/2015

R.C. 119.032 review dates: 01/01/2018

CERTIFIED ELECTRONICALLY

Certification

04/14/2014

Date

Promulgated Under: 119.03
Statutory Authority: 3781.10(A)
Rule Amplifies: 3781.01, 3781.06, 3781.10, 3781.11, 3791.04, 4740.14
Prior Effective Dates: 5/27/06, 7/1/07, 1/1/08, 1/1/09, 1/1/13

4101:8-2-01 Definitions.

[Comment: When a reference is made within this rule to a federal statutory provision, an industry consensus standard, or any other technical publication, the specific date and title of the publication as well as the name and address of the promulgating agency are listed in rule 4101:8-44-01 of the Administrative Code. The application of the referenced standards shall be limited and as prescribed in section 102.5 of rule 4101:8-1-01 of the Administrative Code.]

**SECTION 201
GENERAL**

201.1 Scope. Unless otherwise expressly stated, the following words and terms shall, for the purposes of this code, have the meanings indicated in this chapter.

201.2 Interchangeability. Words used in the present tense include the future; words in the masculine gender include the feminine and neuter; the singular number includes the plural and the plural, the singular.

201.3 Terms defined in other codes. Where terms are not defined in this code such terms shall have meanings ascribed to them in other codes *adopted and referenced by the Board of Building Standards*.

201.4 Terms not defined. Where terms are not defined through the methods authorized by this section, such terms shall have ordinarily accepted meanings such as the context implies.

**SECTION 202
DEFINITIONS**

ACCESSIBLE. Signifies access that requires the removal of an access panel or similar removable obstruction.

ACCESSIBLE, READILY. Signifies access without the necessity for removing a panel or similar obstruction.

ACCESSORY STRUCTURE. A *building*, the use of which is incidental to that of the dwelling(s) and which is located on the same lot.

ADDITION. An extension or increase in floor area or height of a building or structure.

ADHERED STONE OR MASONRY VENEER. Stone or masonry veneer secured and supported through the adhesion of an approved bonding material applied to an approved backing.

AIR ADMITTANCE VALVE. A one-way valve designed to allow air into the plumbing drainage system when 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.

AIR BARRIER. Material(s) assembled and joined together to provide a barrier to air leakage through the building envelope. An air barrier may be a single material, or a combination of materials.

AIR BREAK (DRAINAGE SYSTEM). An arrangement in which a discharge pipe from a fixture, appliance or device drains indirectly into a receptor below the flood-level rim of the receptor, and above the trap seal.

AIR CIRCULATION, FORCED. A means of providing space conditioning utilizing movement of air through ducts or plenums by mechanical means.

AIR-CONDITIONING SYSTEM. A system that consists of heat exchangers, blowers, filters, supply, exhaust and return-air systems, and shall include any apparatus installed in connection therewith.

AIR GAP, DRAINAGE SYSTEM. The unobstructed vertical distance through free atmosphere between the outlet of a waste pipe and the flood-level rim of the fixture or receptor into which it is discharging.

AIR GAP, WATER-DISTRIBUTION SYSTEM. The unobstructed vertical distance through free atmosphere between the lowest opening from a water supply discharge to the flood-level rim of a plumbing fixture.

AIR-IMPERMEABLE INSULATION. An insulation having an air permeance equal to or less than 0.02 L/s-m² at 75 Pa pressure differential tested according to ASTM E 2178 or E 283.

ALTERATION. *The* construction or renovation to an existing structure other than repair or addition.

ANCHORED STONE OR MASONRY VENEER. Stone or masonry veneer secured with approved mechanical fasteners to an approved backing.

ANCHORS. See “Supports.”

ANTISIPHON. A term applied to valves or mechanical devices that eliminate siphonage.

APPLIANCE. A device or apparatus that is manufactured and designed to utilize energy and for which this code provides specific requirements.

APPROVED. *Refers to approval by the building official as the result of review, investigation, inspection and testing in accordance with the provisions of this code.*

APPROVED AGENCY. ~~An established and recognized agency regularly engaged in conducting tests or furnishing inspection services, when such agency has been approved by the building official~~ An established and accredited testing laboratory, listing agency, inspection body, or field evaluation body recognized by the board of building standards providing services consistent with their accreditation and the code section requiring the approved agency service.

ASPECT RATIO. The ratio of longest to shortest perpendicular dimensions, or for wall sections, the ratio of height to length.

ATTIC. The unfinished space between the ceiling assembly of the top story and the roof assembly.

ATTIC, HABITABLE. A finished area, not considered a story, complying with all of the following requirements:

1. The occupiable floor area is at least 70 square feet (17 m²), in accordance with Section 304,
2. The occupiable floor area has a ceiling height in accordance with Section 305, and
3. The occupiable space is enclosed by the roof assembly above, knee walls (if applicable) on the sides and the floor-ceiling assembly below.

BACKFLOW, DRAINAGE. A reversal of flow in the drainage system.

BACKFLOW PREVENTER. A device or means to prevent backflow.

BACKFLOW PREVENTER, REDUCED-PRESSURE-ZONE TYPE. 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 atmosphere internally loaded to a normally open position between two tightly closing shutoff valves and with means for testing for tightness of the checks and opening of relief means.

BACKFLOW, WATER DISTRIBUTION. The flow of water or other liquids into the potable water-supply piping from any sources other than its intended source. Backsiphonage is one type of backflow.

BACKPRESSURE. Pressure created by any means in the water distribution system, which by being in excess of the pressure in the water supply mains causes a potential backflow condition.

BACKPRESSURE, LOW HEAD. A pressure less than or equal to 4.33 psi (29.88 kPa) or the pressure exerted by a 10-foot (3048 mm) column of water.

BACKSIPHONAGE. The flowing back of used or contaminated water from piping into a potable water-supply pipe due to a negative pressure in such pipe.

BACKWATER VALVE. A device installed in a drain or pipe to prevent backflow of sewage.

BASEMENT. That portion of a building that is partly or completely below grade (see “Story above grade”).

BASEMENT WALL. The opaque portion of a wall that encloses one side of a basement and has an average below grade wall area that is 50 percent or more of the total opaque and non-opaque area of that enclosing side.

BASIC WIND SPEED. Three-second gust speed at 33 feet (10 058 mm) above the ground in Exposure C (see Section 301.2.1) as given in Figure 301.2(4).

BATHROOM GROUP. A group of fixtures, including or excluding a bidet, consisting of a water closet, lavatory, and bathtub or shower. Such fixtures are located together on the same floor level.

BEND. 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 (see “Elbow” and “Sweep”).

BOILER. *A closed vessel in which water is heated, steam is superheated, or any combination thereof, under pressure to vacuum for use externally to itself by the direct application of heat from the combustion of fuels, or from electricity or nuclear energy. The term boiler includes fired units for heating or vaporizing liquids other than water where these units are separate from processing systems and are complete within themselves.*

BOND BEAM. A horizontal grouted element within masonry in which reinforcement is embedded.

BRACED WALL LINE. A straight line through the building plan that represents the location of the lateral resistance provided by the wall bracing.

BRACED WALL LINE, CONTINUOUSLY SHEATHED. A braced wall line with structural sheathing applied to all sheathable surfaces including the areas above and below openings.

BRACED WALL PANEL. A full-height section of wall constructed to resist in-plane shear loads through interaction of framing members, sheathing material and anchors. The panel’s length meets the requirements of its particular bracing method, and contributes toward the total amount of bracing required along its braced wall line in accordance with Section 602.10.1.

BRANCH. Any part of the piping system other than a riser, main or stack.

BRANCH, FIXTURE. See “Fixture branch, drainage.”

BRANCH, HORIZONTAL. See “Horizontal branch, drainage.”

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.

BRANCH, MAIN. A water-distribution pipe that extends horizontally off a main or riser to convey water to branches or fixture groups.

BRANCH, VENT. A vent connecting two or more individual vents with a vent stack or stack vent.

BTU/H. The listed maximum capacity of an appliance, absorption unit or burner expressed in British thermal units input per hour.

BUILDING. Building shall mean any one-, two-*and three*-family dwelling *detached from other structures* used, or designed or intended to be used for human habitation, for living, sleeping, cooking or eating purposes, or any combination thereof, and shall include accessory structures thereto. *For the purposes of this code, "building" may also mean structures comprised of multiple single-family dwellings when such structures qualify in accordance with OBC section 310.1.*

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 exterior walls and conveys the drainage to the building sewer.

BUILDING, EXISTING. Existing building is a building erected prior to the adoption of this code, or one for which a legal *approval* has been issued.

BUILDING LINE. The line established by law, beyond which a building shall not extend, except as specifically provided by law.

BUILDING OFFICIAL. *An individual who has received and maintains a certification of "Residential Building Official" in accordance with rules of the board of building standards.*

BUILDING SERVICES PIPING. *Piping systems and their component parts that are part of a building system and that promote the safe, sanitary, and energy efficient occupancy of a building. "Building services piping" includes, but is not limited to, cold and hot potable water distribution for plumbing fixtures; sanitary lines leading from plumbing fixtures; nonflammable medical gas systems; medical oxygen systems; medical vacuum systems; fire protection piping systems and compressed air in dry systems; refrigeration, chilled water, condenser, cooling tower water, brine, and water/antifreeze systems; steam, steam condensate, and hot water piping systems; heating and cooling piping systems; and fuel oil piping and fuel gas piping for heating, cooling, and cooking applications.*

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.

BUILDING THERMAL ENVELOPE. The basement walls, exterior walls, floor, roof and any other building element that enclose conditioned spaces.

BUILT-UP ROOF COVERING. Two or more layers of felt cemented together and surfaced with a cap sheet, mineral aggregate, smooth coating or similar surfacing material.

CAP PLATE. The top plate of the double top plates used in structural insulated panel (SIP) construction. The cap plate is cut to match the panel thickness such that it overlaps the wood structural panel facing on both sides.

CEILING HEIGHT. The clear vertical distance from the finished floor to the finished ceiling.

CEMENT PLASTER. A mixture of portland or blended cement, portland cement or blended cement and hydrated lime, masonry cement or plastic cement and aggregate and other approved materials as specified in this code.

CHANGE OF OCCUPANCY. *A change in the purpose or level of activity within a structure that involves a change in the application of the requirements of the code.*

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.

CHIMNEY CONNECTOR. A pipe that connects a fuel-burning appliance to a chimney.

CHIMNEY TYPES.

Residential-type appliance. An approved chimney for removing the products of combustion from fuel-burning, residential-type appliances producing combustion gases not in excess of 1,000°F (538°C) under normal operating conditions, but capable of producing combustion gases of 1,400°F (760°C) during intermittent forces firing for periods up to 1 hour. All temperatures

shall be measured at the appliance flue outlet. Residential-type appliance chimneys include masonry and factory-built types.

CIRCUIT VENT. A vent that connects to a horizontal drainage branch and vents two traps to a maximum of eight traps or trapped fixtures connected into a battery.

CLADDING. The exterior materials that cover the surface of the building envelope that is directly loaded by the wind.

CLEANOUT. An accessible opening in the drainage system used for the removal of possible obstruction.

CLOSED CONSTRUCTION. *An assembly of materials or products manufactured in such a manner that its structural, plumbing, electrical, environmental control, or fire protection elements or components are concealed and are not readily accessible for inspection at the site of its erection, without disassembly, damage, or destruction. Closed construction includes assemblies where only one of the components is not accessible for inspection. (For example, an equipment enclosure where all the electrical conductors and components are exposed for inspection and its roof and wall panels have exposed structural members but the floor panel structural members are not exposed, would be required to be approved by the board in accordance with section 113 of the "OBC".) Also see definition of "Industrialized units".*

CLOSET. A small room or chamber used for storage.

CODE, BUILDING, MECHICAL AND PLUMBING. *When reference is made within this code to building code, mechanical code or plumbing code, those references shall have the following meanings:*

***Building code or This code.** The Residential Code of Ohio, this edition.*

***Mechanical code.** The current edition of the Ohio Mechanical Code.*

***Plumbing code.** The current edition of the Ohio Plumbing Code.*

COMBINATION WASTE AND VENT SYSTEM. A specially designed system of waste piping embodying the horizontal wet venting of one or more

sinks or floor drains by means of a common waste and vent pipe adequately sized to provide free movement of air above the flow line of the drain.

COMBUSTIBLE MATERIAL. Any material not defined as noncombustible.

COMBUSTION AIR. The air provided to fuel-burning equipment including air for fuel combustion, draft hood dilution and ventilation of the equipment enclosure.

COMMON VENT. A single pipe venting two trap arms within the same branch interval, either back-to-back or one above the other.

CONDENSATE. The liquid that separates from a gas due to a reduction in temperature, e.g., water that condenses from flue gases and water that condenses from air circulating through the cooling coil in air conditioning equipment.

CONDENSING APPLIANCE. An appliance that condenses water generated by the burning of fuels.

CONDITIONED AIR. Air treated to control its temperature, relative humidity or quality.

CONDITIONED AREA. That area within a building provided with heating and/or cooling systems or appliances capable of maintaining, through design or heat loss/gain, 68°F (20°C) during the heating season and/or 80°F (27°C) during the cooling season, or has a fixed opening directly adjacent to a conditioned area.

CONDITIONED FLOOR AREA. The horizontal projection of the floors associated with the conditioned space.

CONDITIONED SPACE. *An area or room within a building being heated or cooled, containing uninsulated ducts, or with a fixed opening directly into an adjacent conditioned space.*

CONSTRUCTION DOCUMENTS. Written, graphic and pictorial documents prepared or assembled for describing the design, location and physical characteristics of the elements of a project necessary for obtaining *an approval*. Construction drawings shall be drawn to an appropriate scale.

CONTAMINATION. An 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.

CONTINUOUS WASTE. A drain from two or more similar adjacent fixtures connected to a single trap.

CONTROL, LIMIT. An automatic control responsive to changes in liquid flow or level, pressure, or temperature for limiting the operation of an appliance.

CONTROL, PRIMARY SAFETY. A safety control responsive directly to flame properties that senses the presence or absence of flame and, in event of ignition failure or unintentional flame extinguishment, automatically causes shutdown of mechanical equipment.

CONVECTOR. A system-incorporating heating element in an enclosure in which air enters an opening below the heating element, is heated and leaves the enclosure through an opening located above the heating element.

CORE. The light-weight middle section of the structural insulated panel composed of foam plastic insulation, which provides the link between the two facing shells.

CORROSION RESISTANCE. The ability of a material to withstand deterioration of its surface or its properties when exposed to its environment.

COURT. A space, open and unobstructed to the sky, located at or above grade level on a lot and bounded on three or more sides by walls or a building.

CRIPPLE WALL. A framed wall extending from the top of the foundation to the underside of the floor framing of the first story above grade plane.

CROSS CONNECTION. Any connection between two otherwise separate piping systems whereby there may be a flow from one system to the other.

DALLE GLASS. A decorative composite glazing material made of individual pieces of glass that are embedded in a cast matrix of concrete or epoxy.

DAMPER, VOLUME. A device that will restrict, retard or direct the flow of air in any duct, or the products of combustion of heat-producing equipment, vent connector, vent or chimney.

DEAD END. A branch leading from a DWV system terminating at a developed length of 2 feet (610 mm) or more. Dead ends shall be prohibited except as an approved part of a rough-in for future connection.

DEAD LOADS. The weight of all materials of construction incorporated into the building, including but not limited to walls, floors, roofs, ceilings, stairways, built-in partitions, finishes, cladding, and other similarly incorporated architectural and structural items, and fixed service equipment.

DECORATIVE GLASS. A carved, leaded or Dalle glass or glazing material whose purpose is decorative or artistic, not functional; whose coloring, texture or other design qualities or components cannot be removed without destroying the glazing material; and whose surface, or assembly into which it is incorporated, is divided into segments.

DESIGN PROFESSIONAL. See “Registered design professional.”

DEVELOPED LENGTH. The length of a pipeline measured along the center line of the pipe and fittings.

DIAMETER. Unless specifically stated, the term “diameter” is the nominal diameter as designated by the approved material standard.

DIAPHRAGM. A horizontal or nearly horizontal system acting to transmit lateral forces to the vertical resisting elements. When the term “diaphragm” is used, it includes horizontal bracing systems.

DILUTION AIR. Air that enters a draft hood or draft regulator and mixes with flue gases.

DIRECT-VENT APPLIANCE. A fuel-burning appliance with a sealed combustion system that draws all air for combustion from the outside atmosphere and discharges all flue gases to the outside atmosphere.

DRAFT. The pressure difference existing between the appliance or any component part and the atmosphere, that causes a continuous flow of air and products of combustion through the gas passages of the appliance to the atmosphere.

Induced draft. The pressure difference created by the action of a fan, blower or ejector, that is located between the appliance and the chimney or vent termination.

Natural draft. The pressure difference created by a vent or chimney because of its height, and the temperature difference between the flue gases and the atmosphere.

DRAFT HOOD. A device built into an appliance, or a part of the vent connector from an appliance, which is designed to provide for the ready escape of the flue gases from the appliance in the event of no draft, backdraft or stoppage beyond the draft hood; prevent a backdraft from entering the appliance; and neutralize the effect of stack action of the chimney or gas vent on the operation of the appliance.

DRAFT REGULATOR. A device that functions to maintain a desired draft in the appliance by automatically reducing the draft to the desired value.

DRAFT STOP. A material, device or construction installed to restrict the movement of air within open spaces of concealed areas of building components such as crawl spaces, floor-ceiling assemblies, roof-ceiling assemblies and attics.

DRAIN. Any pipe that carries soil and water-borne wastes in a building drainage system.

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 (see “Durham fitting”).

DUCT SYSTEM. A continuous passageway for the transmission of air which, in addition to ducts, includes duct fittings, dampers, plenums, fans and accessory air-handling equipment and appliances.

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.

DWELLING. Any building ~~or portion of a building~~ that exclusively contains one ~~or more~~, two, or three dwelling units ~~used, each of which may be occupied by a family and no more than five lodgers or boarders,~~ intended, or designed to be built, used, rented, leased, let or hired out to be occupied, or that is occupied for living purposes. ~~Each unit must have independent means of egress with no more than five lodgers or boarders per, physically separated from adjacent structures, and with an independent exit from each dwelling unit.~~

DWELLING, ONE-, TWO-, OR THREE-FAMILY. ~~A structure, exclusively comprised of one, two or three dwelling units and physically separated from adjacent structures. Each dwelling unit is intended for occupancy by a family and no more than five lodgers or boarders. For this code to be applicable, shared means of egress for two and three family dwellings shall be limited to those open to the exterior. See Dwelling.~~

DWELLING UNIT. A single unit providing complete independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking and sanitation. *The dwelling unit may include any accessory space intended for the exclusive use of the occupants of an individual dwelling unit such as a private garage, greenhouse, etc.*

DWV. Abbreviated term for drain, waste and vent piping as used in common plumbing practice.

EFFECTIVE OPENING. The minimum cross-sectional area at the point of water-supply discharge, measured or expressed in terms of diameter of a circle and if the opening is not circular, the diameter of a circle of equivalent cross-sectional area. (This is applicable to air gap.)

ELBOW. A pressure pipe fitting designed to provide an exact change in direction of a pipe run. An elbow provides a sharp turn in the flow path (see “Bend” and “Sweep”).

EMERGENCY ESCAPE AND RESCUE OPENING. An operable exterior window, door or similar device that provides for a means of escape and access for rescue in the event of an emergency.

EQUIPMENT (OR FIXTURE). *Any plumbing, heating, electrical, ventilating, air conditioning, refrigerating and fire protection devices and components of systems other than appliances, and elevators, dumb waiters, and other mechanical facilities or installations that are related to building services.*

EQUIVALENT LENGTH. For determining friction losses in a piping system, the effect of a particular fitting equal to the friction loss through a straight piping length of the same nominal diameter.

ESCARPMENT. With respect to topographic wind effects, a cliff or steep slope generally separating two levels or gently sloping areas.

ESSENTIALLY NONTOXIC TRANSFER FLUIDS. Fluids having a Gosselin rating of 1, including propylene glycol; mineral oil; polydimethyloil oxane; hydrochlorofluorocarbon, chlorofluorocarbon and hydrofluorocarbon refrigerants; and FDA-approved boiler water additives for steam boilers.

ESSENTIALLY TOXIC TRANSFER FLUIDS. Soil, water or gray water and fluids having a Gosselin rating of 2 or more including ethylene glycol, hydrocarbon oils, ammonia refrigerants and hydrazine.

EVAPORATIVE COOLER. A device used for reducing air temperature by the process of evaporating water into an airstream.

EXCESS AIR. Air that passes through the combustion chamber and the appliance flue in excess of that which is theoretically required for complete combustion.

EXHAUST HOOD, FULL OPENING. An exhaust hood with an opening at least equal to the diameter of the connecting vent.

EXISTING INSTALLATIONS. Any plumbing system regulated by this code that was legally installed prior to the effective date of this code, or for which *an approval* has been issued.

EXIT. *That portion of a means of egress system between the exit access and the exit discharge or public way. Exit components include exterior exit doors at the level of exit discharge, interior exit stairways, interior exit ramps, exit passageways, exterior exit stairways and exterior exit ramps and horizontal exits.*

EXTERIOR INSULATION AND FINISH SYSTEMS (EIFS). EIFS are nonstructural, nonload-bearing exterior wall cladding systems that consist of an insulation board attached either adhesively or mechanically, or both, to the substrate; an integrally reinforced base coat; and a textured protective finish coat.

EXTERIOR INSULATION AND FINISH SYSTEMS (EIFS) WITH DRAINAGE. An EIFS that incorporates a means of drainage applied over a water-resistive barrier.

EXTERIOR WALL. An above-grade wall that defines the exterior boundaries of a building. Includes between-floor spandrels, peripheral edges of floors, roof and basement knee walls, dormer walls, gable end walls, walls enclosing a mansard roof and basement walls with an average below-grade wall area that is less than 50 percent of the total opaque and non-opaque area of that enclosing side.

FACING. The wood structural panel facings that form the two outmost rigid layers of the structural insulated panel.

FACTORY-BUILT CHIMNEY. A listed and labeled chimney composed of factory-made components assembled in the field in accordance with the manufacturer's instructions and the conditions of the listing.

FENESTRATION. Skylights, roof windows, vertical windows (whether fixed or moveable); opaque doors; glazed doors; glass block; and combination opaque/glazed doors.

FIBER-CEMENT SIDING. A manufactured, fiber-reinforcing product made with an inorganic hydraulic or calcium silicate binder formed by chemical reaction and reinforced with discrete organic or inorganic nonasbestos fibers, or both. Additives which enhance manufacturing or product performance are permitted. Fiber-cement siding products have either smooth or textured faces and are intended for exterior wall and related applications.

FIREBLOCKING. Building materials installed to resist the free passage of flame to other areas of the building through concealed spaces.

FIREPLACE. An assembly consisting of a hearth and fire chamber of noncombustible material and provided with a chimney, for use with solid fuels.

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

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

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

FIREPLACE STOVE. A free-standing, chimney-connected solid-fuel-burning heater designed to be operated with the fire chamber doors in either the open or closed position.

FIREPLACE THROAT. The opening between the top of the firebox and the smoke chamber.

FIRE-RETARDANT-TREATED WOOD. Pressure-treated lumber and plywood that exhibit reduced surface burning characteristics and resist propagation of fire.

Other means during manufacture. A process where the wood raw material is treated with a fire-retardant formulation while undergoing creation as a finished product.

Pressure process. A process for treating wood using an initial vacuum followed by the introduction of pressure above atmospheric.

FIRE SEPARATION DISTANCE. The distance measured from the building face to *the* closest interior lot line, *to* the centerline of a street, an alley or public way, or *to* an imaginary line between two buildings on the *property*. The distance shall be measured at a right angles angle from the ~~lot line~~ face of the wall.

FIXTURE. See "Plumbing fixture."

FIXTURE (OR EQUIPMENT). *Any plumbing, heating, electrical, ventilating, air conditioning, refrigerating and fire protection devices and components of systems other than appliances, and elevators, dumb waiters, and other mechanical facilities or installations that are related to building services.*

FIXTURE BRANCH, DRAINAGE. A drain serving two or more fixtures that discharges into another portion of the drainage system.

FIXTURE BRANCH, WATER-SUPPLY. A water-supply pipe between the fixture supply and a main water-distribution pipe or fixture group main.

FIXTURE DRAIN. The drain from the trap of a fixture to the junction of that drain with any other drain pipe.

FIXTURE FITTING.

Supply fitting. A fitting that controls the volume and/or directional flow of water and is either attached to or accessible from a fixture or is used with an open or atmospheric discharge.

Waste fitting. A combination of components that conveys the sanitary waste from the outlet of a fixture to the connection of the sanitary drainage system.

FIXTURE GROUP, MAIN. The main water-distribution pipe (or secondary branch) serving a plumbing fixture grouping such as a bath, kitchen or laundry area to which two or more individual fixture branch pipes are connected.

FIXTURE SUPPLY. The water-supply pipe connecting a fixture or fixture fitting to a fixture branch.

FIXTURE UNIT, DRAINAGE (d.f.u.). A measure of probable discharge into the drainage system by various types of plumbing fixtures, used to size DWV piping systems. The drainage fixture-unit value for a particular fixture depends on its volume rate of drainage discharge, on the time duration of a single drainage operation and on the average time between successive operations.

FIXTURE UNIT, WATER-SUPPLY (w.s.f.u.). A measure of the probable hydraulic demand on the water supply by various types of plumbing fixtures used to size water-piping systems. The water-supply fixture-unit value for a particular fixture depends on its volume rate of supply, on the time duration of a single supply operation and on the average time between successive operations.

FLAME SPREAD. The propagation of flame over a surface.

FLAME SPREAD INDEX. A comparative measure, expressed as a dimensionless number, derived from visual measurements of the spread of flame versus time for a material tested in accordance with ASTM E 84.

FLIGHT. A continuous run of rectangular treads or winders or combination thereof from one landing to another.

FLOOD-LEVEL RIM. The edge of the receptor or fixture from which water overflows.

FLOOR DRAIN. A plumbing fixture for recess in the floor having a floor-level strainer intended for the purpose of the collection and disposal of waste water used in cleaning the floor and for the collection and disposal of accidental spillage to the floor.

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

FLOW PRESSURE. The static pressure reading in the water-supply pipe near the faucet or water outlet while the faucet or water outlet is open and flowing at capacity.

FLUE. See “Vent.”

FLUE, APPLIANCE. The passages within an appliance through which combustion products pass from the combustion chamber to the flue collar.

FLUE COLLAR. The portion of a fuel-burning appliance designed for the attachment of a draft hood, vent connector or venting system.

FLUE GASES. Products of combustion plus excess air in appliance flues or heat exchangers.

FLUSH VALVE. A device located at the bottom of a flush tank that is operated to flush water closets.

FLUSHOMETER TANK. A device integrated within an air accumulator vessel that is designed to discharge a predetermined quantity of water to fixtures for flushing purposes.

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.

FOAM BACKER BOARD. Foam plastic used in siding applications where the foam plastic is a component of the siding.

FOAM PLASTIC INSULATION. A plastic that is intentionally expanded by the use of a foaming agent to produce a reduced-density plastic containing voids consisting of open or closed cells distributed throughout the plastic for thermal insulating or acoustic purposes and that has a density less than 20 pounds per cubic foot (320 kg/m³) unless it is used as interior trim.

FOAM PLASTIC INTERIOR TRIM. Exposed foam plastic used as picture molds, chair rails, crown moldings, baseboards, handrails, ceiling beams, door trim and window trim and similar decorative or protective materials used in fixed applications.

FUEL-PIPING SYSTEM. All piping, tubing, valves and fittings used to connect fuel utilization equipment to the point of fuel delivery.

FULLWAY VALVE. A valve that in the full open position has an opening cross-sectional area equal to a minimum of 85 percent of the cross-sectional area of the connecting pipe.

FURNACE. *A completely self-contained heating unit that is designed to supply heated air to spaces remote from or adjacent to the appliance location.*

GLAZING AREA. The interior surface area of all glazed fenestration, including the area of sash, curbing or other framing elements, that enclose conditioned space. Includes the area of glazed fenestration assemblies in walls bounding conditioned basements.

GRADE. The finished ground level adjoining the building at all exterior walls.

GRADE FLOOR OPENING. A window or other opening located such that the sill height of the opening is not more than 44 inches (1118 mm) above or below the finished ground level adjacent to the opening.

GRADE, PIPING. See "Slope."

GRADE PLANE. A reference plane representing the average of the finished ground level adjoining the building at all exterior walls. Where the finished ground level slopes away from the exterior walls, the reference plane shall be established by the lowest points within the area between the building and the lot

line or, where the lot line is more than 6 ft (1829 mm) from the building between the structure and a point 6 ft (1829 mm) from the building.

GRIDDED WATER DISTRIBUTION SYSTEM. A water distribution system where every water distribution pipe is interconnected so as to provide two or more paths to each fixture supply pipe.

GROSS AREA OF EXTERIOR WALLS. The normal projection of all exterior walls, including the area of all windows and doors installed therein.

GROUND-SOURCE HEAT PUMP LOOP SYSTEM. Piping buried in horizontal or vertical excavations or placed in a body of water for the purpose of transporting heat transfer liquid to and from a heat pump. Included in this definition are closed loop systems in which the liquid is recirculated and open loop systems in which the liquid is drawn from a well or other source.

GUARD. A building component or a system of building components located near the open sides of elevated walking surfaces that minimizes the possibility of a fall from the walking surface to the lower level.

HABITABLE SPACE. A space in a building for living, sleeping, eating or cooking. Bathrooms, toilet rooms, closets, halls, storage or utility spaces and similar areas are not considered habitable spaces.

HANDRAIL. A horizontal or sloping rail intended for grasping by the hand for guidance or support.

HANGERS. See “Supports.”

HAZARDOUS LOCATION. Any location considered to be a fire hazard for flammable vapors, dust, combustible fibers or other highly combustible substances.

HEAT PUMP. An appliance having heating or heating/cooling capability and that uses refrigerants to extract heat from air, liquid or other sources.

HEATING DEGREE DAYS (HDD). The sum, on an annual basis, of the difference between 65°F (18°C) and the mean temperature for each day as determined from “NOAA Annual Degree Days to Selected Bases Derived from the 1960-1990 Normals” or other weather data sources acceptable to the *building* official.

HEIGHT, BUILDING. The vertical distance from grade plane to the average height of the highest roof surface.

HEIGHT, STORY. The vertical distance from top to top of two successive tiers of beams or finished floor surfaces; and, for the topmost story, from the top of the floor finish to the top of the ceiling joists or, where there is not a ceiling, to the top of the roof rafters.

HIGH-EFFICACY LAMPS. Compact fluorescent lamps, T-8 or smaller diameter linear fluorescent lamps or lamps with a minimum efficacy of:

1. 60 lumens per watt for lamps over 40 watts.
2. 50 lumens per watt for lamps over 15 watts to 40 watts.
3. 40 lumens per watt for lamps 15 watts or less.

HIGH-TEMPERATURE (H.T.) CHIMNEY. A high temperature chimney complying with the requirements of UL 103. A Type H.T. chimney is identifiable by the markings "Type H.T." on each chimney pipe section.

HILL. With respect to topographic wind effects, a land surface characterized by strong relief in any horizontal direction.

HISTORIC BUILDING. *A residential building meeting one of the following criteria:*

1. *Listed or preliminarily determined to be eligible for listing in the "National Register of Historic Places"; or*
2. *Determined by the secretary of the U.S. 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; or*
3. *Designated as historic under a state or local historic preservation program that is approved by the U.S. department of interior.*

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.

HORIZONTAL PIPE. Any pipe or fitting that makes an angle of less than 45 degrees (0.79 rad) with the horizontal.

HOT WATER. Water at a temperature greater than or equal to 110°F (43°C).

HURRICANE-PRONE REGIONS. *Deleted.*

HYDROGEN GENERATING APPLIANCE. A self-contained package or factory-matched packages of integrated systems for generating gaseous hydrogen. Hydrogen generating appliances utilize electrolysis, reformation, chemical, or other processes to generate hydrogen.

IGNITION SOURCE. A flame, spark or hot surface capable of igniting flammable vapors or fumes. Such sources include appliance burners, burner ignitions and electrical switching devices.

INDIRECT WASTE PIPE. A waste pipe that discharges into the drainage system through an air gap into a trap, fixture or receptor.

INDIVIDUAL SEWAGE DISPOSAL SYSTEM. A system for disposal of sewage by means of a septic tank or mechanical treatment, designed for use apart from a public sewer to serve a single establishment or building.

INDIVIDUAL VENT. A pipe installed to vent a single-fixture drain that connects with the vent system above or terminates independently outside the building.

INDIVIDUAL WATER SUPPLY. A supply other than an approved public water supply that serves one or more families.

INDUSTRIALIZED UNITS. *Industrialized units are prefabricated components comprised of closed construction manufactured at a location remote from the site of intended use and transported to a building site for its subsequent use. Industrialized units are not restricted to housing for one-, two-, and three-family dwellings, but includes all prefabricated forms of building elements and assembled construction units, intended for both structural and service equipment purposes in all buildings of all groups. Prefabricated shop assemblies may be shipped in structurally complete units ready for installation in the building structure or in knock-down and packaged form for assembly at the site. Industrialized units must be approved by the board in accordance with section 113 of the OBC. Also see definition of CLOSED CONSTRUCTION.*

INSULATING CONCRETE FORM (ICF). A concrete forming system using stay-in-place forms of rigid foam plastic insulation, a hybrid of cement and foam insulation, a hybrid of cement and wood chips, or other insulating material for constructing cast-in-place concrete walls.

INSULATING SHEATHING. An insulating board having a minimum thermal resistance of R-2 of the core material.

JURISDICTION. *The municipality, township or county governmental unit with a residential building department certified by the board of building standards.*

KITCHEN. Kitchen shall mean an area used, or designated to be used, for the preparation of food.

LABEL. An identification applied on a product by the manufacturer which contains the name of the manufacturer, the function and performance characteristics of the product or material, and the name and identification of an approved agency and that indicates that the representative sample of the product or material has been tested and evaluated by an approved agency. (See also “Manufacturer’s designation” and “Mark.”)

LABELED. *Devices, equipment or materials to which have been affixed a label, seal, symbol or other identifying mark of a testing laboratory, inspection agency or other organization concerned with product evaluation that maintains periodic inspection of the production of the above labeled items that attests to compliance with a specific standard.*

LIGHT-FRAME CONSTRUCTION. A type of construction whose vertical and horizontal structural elements are primarily formed by a system of repetitive wood or cold-formed steel framing members.

LISTED AND LISTING. *Terms referring to equipment that is shown in a list published by an approved testing agency qualified and equipped for experimental testing and maintaining an adequate periodic inspection of current productions and whose listing states that the equipment complies with nationally recognized standards when installed in accordance with the manufacturer’s installation instructions.*

LIVE LOADS. Those loads produced by the use and occupancy of the building or other structure and do not include construction or environmental loads such as wind load, snow load, rain load, earthquake load, flood load or dead load.

LIVING SPACE. Space within a dwelling unit utilized for living, sleeping, eating, cooking, bathing, washing and sanitation purposes.

LOAD-BEARING ELEMENT. *Any column, girder, beam, joist, truss, rafter, wall, floor or roof sheathing that supports any vertical load in addition to its own weight, and/or any lateral load.*

LOT. A portion or parcel of land considered as a unit.

LOT LINE. A line dividing one lot from another, or from a street or any public place.

MACERATING TOILET SYSTEMS. A system comprised of a sump with macerating pump and with connections for a water closet and other plumbing fixtures, that is designed to accept, grind and pump wastes to an approved point of discharge.

MAIN. The principal pipe artery to which branches may be connected.

MAIN SEWER. See “Public sewer.”

MANIFOLD WATER DISTRIBUTION SYSTEMS. A fabricated piping arrangement in which a large supply main is fitted with multiple branches in close proximity in which water is distributed separately to fixtures from each branch.

MANUFACTURED HOME. *A dwelling constructed under “24 CFR Part 3280,” “Manufactured Home Construction and Safety Standards”. [Note: Typically, a “Manufactured Home” will be constructed on a steel chassis and have a small (approximately 1-1/2” x 3”) metal plate with inscribed HUD regulation reference numbers attached to the exterior end wall of the unit.]*

MANUFACTURER’S DESIGNATION. An identification applied on a product by the manufacturer indicating that a product or material complies with a specified standard or set of rules. (See also “Mark” and “Label.”)

MANUFACTURER'S INSTALLATION INSTRUCTIONS. Printed instructions included with equipment as part of the conditions of listing and labeling.

MARK. An identification applied on a product by the manufacturer indicating the name of the manufacturer and the function of a product or material. (See also "Manufacturer's designation" and "Label.")

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

MASONRY HEATER. A masonry heater is a solid fuel burning heating appliance constructed predominantly of concrete or solid masonry having a mass of at least 1,100 pounds (500 kg), excluding the chimney and foundation. It is designed to absorb and store a substantial portion of heat from a fire built in the firebox by routing exhaust gases through internal heat exchange channels in which the flow path downstream of the firebox includes at least one 180-degree (3.14-rad) change in flow direction before entering the chimney and which deliver heat by radiation through the masonry surface of the heater.

MASONRY, SOLID. Masonry consisting of solid masonry units laid contiguously with the joints between the units filled with mortar.

MASONRY UNIT. Brick, tile, stone, glass block or concrete block conforming to the requirements specified in Section 2103 of the *Ohio Building Code*.

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

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

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

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

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

MASS WALL. Masonry or concrete walls having a mass greater than or equal to 30 pounds per square foot (146 kg/m^2), solid wood walls having a mass greater than or equal to 20 pounds per square foot (98 kg/m^2), and any other walls having a heat capacity greater than or equal to $6 \text{ Btu/ft}^2 \cdot ^\circ\text{F}$ [$266 \text{ J}/(\text{m}^2 \cdot \text{K})$].

MEAN ROOF HEIGHT. The average of the roof eave height and the height to the highest point on the roof surface, except that eave height shall be used for roof angle of less than or equal to 10 degrees (0.18 rad).

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

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 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.

Power 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.

MECHANICAL EXHAUST SYSTEM. A system for removing air from a room or space by mechanical means.

MECHANICAL SYSTEM. A system specifically addressed and regulated in this code and composed of components, devices, appliances and equipment.

METAL ROOF PANEL. An interlocking metal sheet having a minimum installed weather exposure of at least 3 square feet (0.28 m^2) per sheet.

METAL ROOF SHINGLE. An interlocking metal sheet having an installed weather exposure less than 3 square feet (0.28 m^2) per sheet.

MEZZANINE, LOFT. An intermediate level or levels between the floor and ceiling of any story with an aggregate floor area of not more than one-third of the area of the room or space in which the level or levels are located.

MINOR REPAIR. See “Repair, Minor”.

MODIFIED BITUMEN ROOF COVERING. One or more layers of polymer modified asphalt sheets. The sheet materials shall be fully adhered or mechanically attached to the substrate or held in place with an approved ballast layer.

MULTIPLE STATION SMOKE ALARM. Two or more single station alarm devices that are capable of interconnection such that actuation of one causes all integral or separate audible alarms to operate.

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

NATURALLY DURABLE WOOD. The heartwood of the following species with the exception that an occasional piece with corner sapwood is permitted if 90 percent or more of the width of each side on which it occurs is heartwood.

Decay resistant. Redwood, cedar, black locust and black walnut.

Termite resistant. Alaska yellow cedar, redwood, Eastern red cedar and Western red cedar including all sapwood of Western red cedar.

NONCOMBUSTIBLE MATERIAL. Materials that pass the test procedure for defining noncombustibility of elementary materials set forth in ASTM E 136.

NONCONDITIONED SPACE. A space that is not a conditioned space by insulated walls, floors or ceilings.

NOSING. The leading edge of treads of stairs and of landings at the top of stairway flights.

OCCUPIED SPACE. The total area of all buildings or structures on any lot or parcel of ground projected on a horizontal plane, excluding permitted projections as allowed by this code.

OFFSET. A combination of fittings that makes two changes in direction bringing one section of the pipe out of line but into a line parallel with the other section.

OWNER. Any person, agent, firm or corporation having a legal or equitable interest in the property.

PANEL THICKNESS. Thickness of core plus two layers of structural wood panel facings.

PELLET FUEL-BURNING APPLIANCE. A closed combustion, vented appliance equipped with a fuel feed mechanism for burning processed pellets of solid fuel of a specified size and composition.

PELLET VENT. A vent listed and labeled for use with a listed pellet fuel-burning appliance.

PERMIT. An *approval indicated in an* official document or certificate issued by the *residential building official* that authorizes performance of a specified activity. *Also see "APPROVED"*.

PERSON. An individual, heirs, executors, administrators or assigns, and also includes a firm, partnership or corporation, its or their successors or assigns, or the agent of any of the aforesaid.

PITCH. See "Slope."

PLATFORM CONSTRUCTION. A method of construction by which floor framing bears on load bearing walls that are not continuous through the story levels or floor framing.

PLENUM. A chamber that forms part of an air-circulation system other than the occupied space being conditioned.

PLUMBING. *The practice, materials and fixtures utilized in the installation, maintenance, extension and alteration of all piping, fixtures, appliances and 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.*

PLUMBING APPLIANCE. An energized household appliance with plumbing connections, such as a dishwasher, food-waste grinder, clothes washer or water heater.

PLUMBING APPURTENANCE. A device or assembly that is an adjunct to the basic plumbing system and demands no additional water supply nor adds 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. Examples include filters, relief valves and aerators.

PLUMBING FIXTURE. A receptor or device that requires both a water-supply connection and a discharge to the drainage system, such as water closets, lavatories, bathtubs and sinks. Plumbing appliances as a special class of fixture are further defined.

PLUMBING SYSTEM. Includes the water supply and distribution pipes, plumbing fixtures, supports and appurtenances; soil, waste and vent pipes; sanitary drains and building sewers to an approved point of disposal.

POLLUTION. An impairment of the quality of the potable water to a degree that does not create a hazard to the public health but that does adversely and unreasonably affect the aesthetic qualities of such potable water for domestic use.

PORTABLE-FUEL-CELL APPLIANCE. A fuel cell generator of electricity, which is not fixed in place. A portable-fuel-cell appliance utilizes a cord and plug connection to a grid-isolated load and has an integral fuel supply.

POSITIVE ROOF DRAINAGE. The drainage condition in which consideration has been made for all loading deflections of the roof deck, and additional slope has been provided to ensure drainage of the roof within 48 hours of precipitation.

POTABLE WATER. Water free from impurities present in amounts sufficient to cause disease or harmful physiological effects and conforming in bacteriological and chemical quality to the requirements of the public health authority having jurisdiction.

PRECAST CONCRETE. A structural concrete element cast elsewhere than its final position in the structure.

PRECAST CONCRETE FOUNDATION WALLS. Preengineered, precast concrete wall panels that are designed to withstand specified stresses and used to build below-grade foundations.

PRESSURE-RELIEF VALVE. A pressure-actuated valve held closed by a spring or other means and designed to automatically relieve pressure at the pressure at which it is set.

PUBLIC SEWER. A common sewer directly controlled by public authority.

PUBLIC WATER MAIN. A water-supply pipe for public use controlled by public authority.

PUBLIC WAY. Any street, alley or other parcel of land open to the outside air leading to a public street, which has been deeded, dedicated or otherwise permanently appropriated to the public for public use and that has a clear width and height of not less than 10 feet (3048 mm).

PURGE. To clear of air, gas or other foreign substances.

QUICK-CLOSING VALVE. A valve or faucet that closes automatically when released manually or controlled by mechanical means for fast-action closing.

R-VALUE, THERMAL RESISTANCE. The inverse of the time rate of heat flow through a building thermal envelope element from one of its bounding surfaces to the other for a unit temperature difference between the two surfaces, under steady state conditions, per unit area ($h \cdot ft^2 \cdot ^\circ F/Btu$).

RAMP. A walking surface that has a running slope steeper than 1 unit vertical in 20 units horizontal (5-percent slope).

RECEPTOR. A fixture or device that receives the discharge from indirect waste pipes.

REFRIGERANT. A substance used to produce refrigeration by its expansion or evaporation.

REFRIGERANT COMPRESSOR. A specific machine, with or without accessories, for compressing a given refrigerant vapor.

REFRIGERATING SYSTEM. A combination of interconnected parts forming a closed circuit in which refrigerant is circulated for the purpose of extracting, then rejecting, heat. A direct refrigerating system is one in which the evaporator or condenser of the refrigerating system is in direct contact with the air or other substances to be cooled or heated. An indirect refrigerating system is one in which a secondary coolant cooled or heated by the refrigerating system is circulated to the air or other substance to be cooled or heated.

REGISTERED DESIGN PROFESSIONAL. *Any architect holding a certificate issued under sections 4703.10 and 4703.36 of the Revised Code or any engineer holding a certificate issued under section 4733.14 of the Revised Code.*

RELIEF VALVE, VACUUM. A valve that automatically opens and closes a vent for relieving a vacuum within the hot water supply system, depending on whether the vacuum is above or below a predetermined value.

REPAIR. The reconstruction or renewal of any part of an existing building for the purpose of its maintenance.

REPAIR, MINOR. *The reconstruction or renewal of any part of an existing building for the purpose of its maintenance when the work has limited impact on access, safety or health. Minor repairs do not include the cutting away of any wall, partition or portions of walls, the removal or cutting of any structural beam or load bearing support, or the removal or change of any required element of accessibility, means of egress, or rearrangement of parts of a structure affecting the egress requirements. Minor repairs do not include addition to, alteration of, replacement or relocation of any standpipe, water supply, sewer, drainage, drain leader, gas, soil, waste, vent or similar piping, electric wiring or mechanical or fire protection equipment.*

REROOFING. The process of recovering or replacing an existing roof covering. See "Roof recover."

RESIDENTIAL BUILDING. *A one-family, two-family, or three-family dwelling house, and any accessory structure incidental to that dwelling house. "Residential building" includes a one-family, two-family, or three-family dwelling house that is used as a model to promote the sale of a similar dwelling house. "Residential building" does not include an industrialized unit as defined by division (C)(3) of Section 3781.06 of the Revised Code, a manufactured home as defined by division (C)(4) of Section 3781.06 of the Revised Code, or a mobile home as defined by division (O) of Section 4501.01 of the Revised Code.*

RESIDENTIAL BUILDING OFFICIAL. *An individual who has received and maintains a certification of “Residential Building Official” in accordance with rules of the board of building standards.*

RETURN AIR. Air removed from an approved conditioned space or location and recirculated or exhausted.

RIDGE. With respect to topographic wind effects, an elongated crest of a hill characterized by strong relief in two directions.

RISER. A water pipe that extends vertically one full story or more to convey water to branches or to a group of fixtures.

ROOF ASSEMBLY. A system designed to provide weather protection and resistance to design loads. The system consists of a roof covering and roof deck or a single component serving as both the roof covering and the roof deck. A roof assembly includes the roof deck, vapor retarder, substrate or thermal barrier, insulation, vapor retarder, and roof covering.

ROOF COVERING. The covering applied to the roof deck for weather resistance, fire classification or appearance.

ROOF COVERING SYSTEM. See “Roof assembly.”

ROOF DECK. The flat or sloped surface not including its supporting members or vertical supports.

ROOF RECOVER. The process of installing an additional roof covering over a prepared existing roof covering without removing the existing roof covering.

ROOF REPAIR. Reconstruction or renewal of any part of an existing roof for the purposes of its maintenance.

ROOFTOP STRUCTURE. An enclosed structure on or above the roof of any part of a building.

ROOM HEATER. A freestanding heating appliance installed in the space being heated and not connected to ducts.

ROUGH-IN. The installation of all parts of the plumbing system that must be completed prior to the installation of fixtures. This includes DWV, water supply and built-in fixture supports.

RUNNING BOND. The placement of masonry units such that head joints in successive courses are horizontally offset at least one-quarter the unit length.

***SAFE.** As applied to a building, means free from danger or hazard to the life, safety, health or welfare of persons occupying or frequenting it, or of the public, and from danger of settlement, movement, disintegration, or collapse, whether such danger arises from the method or materials of its construction or from equipment installed therein, for the purpose of lighting, heating, the transmission or utilization of electric current, or from its location or otherwise.*

***SANITARY.** As applied to a building, means free from danger or hazard to the health of persons occupying or frequenting it or to that of the public, if such danger arises from the method or materials of its construction or from any equipment installed therein for the purpose of lighting, heating, ventilating, or plumbing.*

SANITARY SEWER. A sewer that carries sewage and excludes storm, surface and groundwater.

SCUPPER. An opening in a wall or parapet that allows water to drain from a roof.

SEISMIC DESIGN CATEGORY (SDC). A classification assigned to a structure based on its occupancy category and the severity of the design earthquake ground motion at the site.

SEPTIC TANK. A water-tight receptor that receives the discharge of a building sanitary drainage system and is constructed so as to separate solids from the liquid, digest organic matter through a period of detention, and allow the liquids to discharge into the soil outside of the tank through a system of open joint or perforated piping or a seepage pit.

***SERIOUS HAZARD.** A hazard of considerable consequence to safety or health through the design, location, construction, or equipment of a building, or the condition thereof, which hazard has been established through experience to be of certain or probable consequence, or which can be determined to be, or which is obviously such a hazard.*

SEWAGE. Any liquid waste containing animal matter, vegetable matter or other impurity in suspension or solution.

SEWAGE PUMP. A permanently installed mechanical device for removing sewage or liquid waste from a sump.

SHALL. The term, when used in the code, is construed as mandatory.

SHEAR WALL. A general term for walls that are designed and constructed to resist racking from seismic and wind by use of masonry, concrete, cold-formed steel or wood framing in accordance with Chapter 6 of this code and the *applicable* limitations in Section 301.2 of this code.

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.

SINGLE PLY MEMBRANE. A roofing membrane that is field applied using one layer of membrane material (either homogeneous or composite) rather than multiple layers.

SINGLE STATION SMOKE ALARM. An assembly incorporating the detector, control equipment and alarm sounding device in one unit that is operated from a power supply either in the unit or obtained at the point of installation.

SKYLIGHT AND SLOPED GLAZING. See Section 308.6.1.

SKYLIGHT, UNIT. See Section 308.6.1.

SLIP JOINT. A mechanical-type joint used primarily on fixture traps. The joint tightness is obtained by compressing a friction-type washer such as rubber, nylon, neoprene, lead or special packing material against the pipe by the tightening of a (slip) nut.

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

SMOKE-DEVELOPED INDEX. A comparative measure, expressed as a dimensionless number, derived from measurements of smoke obscuration versus time for a material tested in accordance with ASTM E 84.

SOIL STACK OR PIPE. A pipe that conveys sewage containing fecal material.

SOLAR HEAT GAIN COEFFICIENT (SHGC). The solar heat gain through a fenestration or glazing assembly relative to the incident solar radiation ($\text{Btu/h} \cdot \text{ft}^2 \cdot ^\circ\text{F}$).

SOLID MASONRY. Load-bearing or nonload-bearing construction using masonry units where the net cross-sectional area of each unit in any plane parallel to the bearing surface is not less than 75 percent of its gross cross-sectional area. Solid masonry units shall conform to ASTM C 55, C 62, C 73, C 145 or C 216.

SPLINE. A strip of wood structural panel cut from the same material used for the panel facings, used to connect two structural insulated panels. The strip (spline) fits into a groove cut into the vertical edges of the two structural insulated panels to be joined. Splines are used behind each facing of the structural insulated panels being connected as shown in Figure 613.8.

STACK. Any main vertical DWV line, including offsets, that extends one or more stories as directly as possible to its vent terminal.

STACK BOND. The placement of masonry units in a bond pattern is such that head joints in successive courses are vertically aligned. For the purpose of this code, requirements for stack bond shall apply to all masonry laid in other than running bond.

STACK VENT. The extension of soil or waste stack above the highest horizontal drain connected.

STACK VENTING. A method of venting a fixture or fixtures through the soil or waste stack without individual fixture vents.

STAIR. A change in elevation, consisting of one or more risers.

STAIRWAY. One or more flights of stairs, either interior or exterior, with the necessary landings and platforms connecting them to form a continuous and uninterrupted passage from one level to another within or attached to a building, porch or deck.

STANDARD TRUSS. Any construction that does not permit the roof/ceiling insulation to achieve the required R-value over the exterior walls.

STATIONARY FUEL CELL POWER PLANT. A self-contained package or factory-matched packages which constitute an automatically-operated assembly of integrated systems for generating useful electrical energy and recoverable thermal energy that is permanently connected and fixed in place.

STORM SEWER, DRAIN. A pipe used for conveying rainwater, surface water, subsurface water and similar liquid waste.

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.

STORY ABOVE GRADE PLANE. Any story having its finished floor surface entirely above grade plane, 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. Is more than 6 feet (1829 mm) above grade plane.
2. Is more than 6 feet (1829 mm) above the finished ground level for more than 50 percent of the total building perimeter.
3. Is more than 12 feet (3658 mm) above the finished ground level at any point.

STRUCTURAL INSULATED PANEL (SIP). A structural sandwich panel that consists of a light-weight foam plastic core securely laminated between two thin, rigid wood structural panel facings.

STRUCTURE. That which is built or constructed.

SUBSOIL DRAIN. A drain that collects subsurface water or seepage water and conveys such water to a place of disposal.

SUMP. A tank or pit that receives sewage or waste, located below the normal grade of the gravity system and that must be emptied by mechanical means.

SUMP PUMP. A pump installed to empty a sump. These pumps are used for removing storm water only. The pump is selected for the specific head and volume of the load and is usually operated by level controllers.

SUNROOM. A one-story structure attached to a dwelling with a glazing area in excess of 40 percent of the gross area of the structure's exterior walls and roof.

SUPPLY AIR. Air delivered to a conditioned space through ducts or plenums from the heat exchanger of a heating, cooling or ventilating system.

SUPPORTS. Devices for supporting, hanging and securing pipes, fixtures and equipment.

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").

TEMPERATURE-AND-PRESSURE-RELIEF (T AND P) VALVE. A combination relief valve designed to function as both a temperature-relief and pressure-relief valve.

TEMPERATURE-RELIEF VALVE. A temperature-actuated valve designed to discharge automatically at the temperature at which it is set.

TERMITE-RESISTANT MATERIAL. Pressure-preservative treated wood in accordance with the AWPA standards in Section 318.1, naturally durable termite-resistant wood, steel, concrete, masonry or other approved material.

THERMAL ISOLATION. Physical and space conditioning separation from conditioned space(s) consisting of existing or new walls, doors and/or windows. The conditioned space(s) shall be controlled as separate zones for heating and cooling or conditioned by separate equipment.

THERMAL RESISTANCE, R-VALUE. The inverse of the time rate of heat flow through a body from one of its bounding surfaces to the other for a unit temperature difference between the two surfaces, under steady state conditions, per unit area ($\text{h} \cdot \text{ft}^2 \cdot ^\circ\text{F}/\text{Btu}$).

THERMAL TRANSMITTANCE, U-FACTOR. The coefficient of heat transmission (air to air) through a building envelope component or assembly, equal to the time rate of heat flow per unit area and unit temperature difference between the warm side and cold side air films ($\text{Btu}/\text{h} \cdot \text{ft}^2 \cdot ^\circ\text{F}$).

TOWNHOUSE. A single-family dwelling unit constructed in a group of three or more attached units in which each unit extends from foundation to roof.

TRAP. A fitting, either separate or built into a fixture, that provides a liquid seal to prevent the emission of sewer gases without materially affecting the flow of sewage or waste water through it.

TRAP ARM. That portion of a fixture drain between a trap weir and the vent fitting.

TRAP PRIMER. A device or system of piping to maintain a water seal in a trap, typically installed where infrequent use of the trap would result in evaporation of the trap seal, such as floor drains.

TRAP SEAL. The trap seal is the maximum vertical depth of liquid that a trap will retain, measured between the crown weir and the top of the dip of the trap.

TRIM. Picture molds, chair rails, baseboards, handrails, door and window frames, and similar decorative or protective materials used in fixed applications.

TRUSS DESIGN DRAWING. The graphic depiction of an individual truss, which describes the design and physical characteristics of the truss.

TYPE L VENT. A listed and labeled vent conforming to UL 641 for venting oil-burning appliances listed for use with Type L vents or with gas appliances listed for use with Type B vents.

U-FACTOR, THERMAL TRANSMITTANCE. The coefficient of heat transmission (air to air) through a building envelope component or assembly, equal to the time rate of heat flow per unit area and unit temperature difference between the warm side and cold side air films ($\text{Btu/h} \cdot \text{ft}^2 \cdot ^\circ\text{F}$).

UNDERLAYMENT. One or more layers of felt, sheathing paper, nonbituminous saturated felt, or other approved material over which a roof covering, with a slope of 2 to 12 (17-percent slope) or greater, is applied.

VACUUM BREAKERS. A device which prevents backsiphonage of water by admitting atmospheric pressure through ports to the discharge side of the device.

VAPOR PERMEABLE MEMBRANE. A material or covering having a permeance rating of 5 perms ($2.9 \cdot 10^{-10} \text{ kg/Pa} \cdot \text{s} \cdot \text{m}^2$) or greater, when tested in

accordance with the desiccant method using Procedure A of ASTM E 96. A vapor permeable material permits the passage of moisture vapor.

VAPOR RETARDER CLASS. A measure of the ability of a material or assembly to limit the amount of moisture that passes through that material or assembly. Vapor retarder class shall be defined using the desiccant method with Procedure A of ASTM E 96 as follows:

Class I: 0.1 perm or less

Class II: $0.1 < \text{perm} \leq 1.0$ perm

Class III: $1.0 < \text{perm} \leq 10$ perm

VEHICULAR ACCESS DOOR. A door that is used primarily for vehicular traffic at entrances of buildings such as garages and parking lots, and that is not generally used for pedestrian traffic.

VENT. A passageway for conveying flue gases from fuel-fired appliances, or their vent connectors, to the outside atmosphere.

VENT COLLAR. See “Flue collar.”

VENT CONNECTOR. That portion of a venting system which connects the flue collar or draft hood of an appliance to a vent.

VENT DAMPER DEVICE, AUTOMATIC. A device intended for installation in the venting system, in the outlet of an individual, automatically operated fuel burning appliance and that is designed to open the venting system automatically when the appliance is in operation and to close off the venting system automatically when the appliance is in a standby or shutdown condition.

VENT GASES. Products of combustion from fuel-burning appliances, plus excess air and dilution air, in the venting system above the draft hood or draft regulator.

VENT STACK. A vertical vent pipe installed to provide circulation of air to and from the drainage system and which extends through one or more stories.

VENT SYSTEM. Piping installed to equalize pneumatic pressure in a drainage system to prevent trap seal loss or blow-back due to siphonage or back pressure.

VENTILATION. The natural or mechanical process of supplying conditioned or unconditioned air to, or removing such air from, any space.

VENTING. Removal of combustion products to the outdoors.

VENTING SYSTEM. A continuous open passageway from the flue collar of an appliance to the outside 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.

VERTICAL PIPE. Any pipe or fitting that makes an angle of 45 degrees (0.79 rad) or more with the horizontal.

VINYL SIDING. A shaped material, made principally from rigid polyvinyl chloride (PVC), that is used to cover exterior walls of buildings.

WALL, RETAINING. A wall not laterally supported at the top, that resists lateral soil load and other imposed loads.

WALLS. Walls shall be defined as follows:

Load-bearing wall is a wall supporting any vertical load in addition to its own weight.

Nonbearing wall is a wall which does not support vertical loads other than its own weight.

WASTE. Liquid-borne waste that is free of fecal matter.

WASTE PIPE OR STACK. Piping that conveys only liquid sewage not containing fecal material.

WATER-DISTRIBUTION SYSTEM. Piping which conveys water from the service to the plumbing fixtures, appliances, appurtenances, equipment, devices or other systems served, including fittings and control valves.

WATER HEATER. Any heating appliance or equipment that heats potable water and supplies such water to the potable hot water distribution system.

WATER MAIN. A water-supply pipe for public use.

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.

WATER-RESISTIVE BARRIER. A material behind an exterior wall covering that is intended to resist liquid water that has penetrated behind the exterior covering from further intruding into the exterior wall assembly.

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-SUPPLY SYSTEM. The water-service pipe, the water-distributing pipes and the necessary connecting pipes, fittings, control valves and all appurtenances in or adjacent to the building or premises.

WEATHER-RESISTIVE. Protection of exterior wall and roof assemblies of a building providing resistance to wind, precipitation and other weather conditions.

WET VENT. A vent that also receives the discharge of wastes from other fixtures.

WIND-BORNE DEBRIS REGION. *Deleted.*

WINDER. A tread with nonparallel edges.

WOOD/PLASTIC COMPOSITE. A composite material made primarily from wood or cellulose-based materials and plastic.

WOOD STRUCTURAL PANEL. A panel manufactured from veneers; or wood strands or wafers; bonded together with waterproof synthetic resins or other suitable bonding systems. Examples of wood structural panels are plywood, OSB or composite panels.

YARD. An open space, other than a court, unobstructed from the ground to the sky, except where specifically provided by this code, on the lot on which a building is situated.

Effective: 07/01/2014

R.C. 119.032 review dates: 01/01/2018

CERTIFIED ELECTRONICALLY

Certification

04/14/2014

Date

Promulgated Under: 119.03
Statutory Authority: 3781.10(A)
Rule Amplifies: 3781.01, 3781.06, 3781.10, 3781.11, 3791.04, 4740.14
Prior Effective Dates: 5/27/06, 7/1/07, 1/1/13

4101:8-3-01 Building planning.

[Comment: When a reference is made within this rule to a federal statutory provision, an industry consensus standard, or any other technical publication, the specific date and title of the publication as well as the name and address of the promulgating agency are listed in rule 4101:8-44-01 of the Administrative Code. The application of the referenced standards shall be limited and as prescribed in section 102.5 of rule 4101:8-1-01 of the Administrative Code.]

**SECTION 301
DESIGN CRITERIA**

301.1 Application. Buildings and structures, and all parts thereof, shall be constructed to safely support all loads, including dead loads, live loads, roof loads, flood loads, snow loads, wind loads and seismic loads as prescribed by this code. The construction of buildings and structures in accordance with the provisions of this code shall result in a system that provides a complete load path that meets all requirements for the transfer of all loads from their point of origin through the load-resisting elements to the foundation. Buildings and structures constructed as prescribed by this code are deemed to comply with the requirements of this section.

301.1.1 Alternative provisions. As an alternative to the requirements in Section 301.1 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 *Ohio Building Code*.

1. American Forest and Paper Association (AF&PA) Wood Frame Construction Manual (WFCM).
2. American Iron and Steel Institute (AISI) Standard for Cold-Formed Steel Framing—Prescriptive Method for One- and Two-Family Dwellings (AISI S230).
3. ICC-400 Standard on the Design and Construction of Log Structures.

301.1.2 Construction systems. The requirements of this code are based on platform and balloon-frame construction for light-frame buildings. The requirements for concrete and masonry buildings are based on a balloon

framing system. Other systems must have equivalent detailing to ensure force transfer, continuity and compatible deformations.

301.1.3 Engineered design. When a building of otherwise conventional construction contains structural elements exceeding the limits of Section 301 or otherwise not conforming to this code, these elements shall be designed in accordance with accepted engineering practice. The extent of such design need only demonstrate compliance of nonconventional elements with other applicable provisions and shall be compatible with the performance of the conventional framed system. Engineered design in accordance with the *Ohio Building Code* is permitted for all buildings and structures, and parts thereof, included in the scope of this code.

301.2 Climatic and geographic design criteria. Buildings shall be constructed in accordance with the provisions of this code as limited by the provisions of this section. Additional criteria shall be established by the local jurisdiction and set forth in Table 301.2(1).

301.2.1 Wind limitations. Buildings and portions thereof shall be limited by wind speed, as defined in Table 301.2(1) and construction methods in accordance with this code. Basic wind speeds shall be determined from Figure 301.2(4). Where different construction methods and structural materials are used for various portions of a building, the applicable requirements of this section for each portion shall apply. Where loads for wall coverings, curtain walls, roof coverings, exterior windows, skylights, garage doors and exterior doors are not otherwise specified, the loads listed in Table 301.2(2) adjusted for height and exposure using Table 301.2(3) 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 905.2.6.

301.2.1.1 Design criteria. In regions where the basic wind speeds from Figure 301.2(4) equal or exceed 100 miles per hour (45 m/s) in hurricane-prone regions, or 110 miles per hour (49 m/s) elsewhere, the design of buildings shall be in accordance with one of the following methods. The elements of design not addressed by those documents in Items 1 through 4 shall be in accordance with this code.

1. American Forest and Paper Association (AF&PA) Wood Frame Construction Manual for One-and Two-Family Dwellings (WFCM); or
2. International Code Council (ICC) Standard for Residential Construction in High Wind Regions (ICC-600); or
3. Minimum Design Loads for Buildings and Other Structures (ASCE-7); or
4. American Iron and Steel Institute (AISI), Standard for Cold-Formed Steel Framing—Prescriptive Method For One-and Two-Family Dwellings (AISI S230).
5. Concrete construction shall be designed in accordance with the provisions of this code.
6. Structural insulated panel (SIP) walls shall be designed in accordance with the provisions of this code.

TABLE 301.2(1)
CLIMATIC AND GEOGRAPHIC DESIGN CRITERIA

GROUND SNOW LOAD	WIND DESIGN		SEISMIC DESIGN CATEGORY ^f	SUBJECT TO DAMAGE FROM			WINTER DESIGN TEMP ^c	ICE BARRIER UNDERLAYMENT REQUIRED ^b	FLOOD HAZARDS ^e	AIR FREEZING INDEX ⁱ	MEAN ANNUAL TEMP ^j
	Speed ^d (mph)	Topographic effects ^k		Weathering ^a	Frost line depth ^b	Termite ^c					
Refer to Figure 301.2(5)	90		A or B per Section 301.2.2 301.2.2.1	Severe		Moderate to Heavy	Refer to table in footnote.	Yes		Refer to Figure 403.3(2) or Table 403.3(2)	

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 C 34, C 55, C 62, C 73, C 90, C 129, C 145, C 216 or C 652.
- b. The jurisdiction shall fill in the frost line depth column with the minimum depth of footing below finish grade.
- c. Indicates the need for protection depending on whether there has been a history of local subterranean termite damage.
- d. Wind exposure category shall be determined on a site-specific basis in accordance with Section 301.2.1.4.
- e. The outdoor design dry-bulb temperature *shall be determined from the following table:*

STATION	HEATING DEGREE DAYS (Yearly Total)	DESIGN TEMPERATURES	DEGREES NORTH LATITUDE
Akron-Canton	6,037	6°	41°00'
Cincinnati	4,410	6°	39°10'
Cleveland	6,351	5°	41°20'
Columbus	5,660	5°	41°00'
Dayton	5,622	4°	39°50'
Mansfield	6,403	5°	41°50'
Sandusky	5,796	6°	41°30'

Toledo	6,494	1°	41°40'
Youngstown	6,417	4°	41°20'

- from the *tabulated* temperatures shall be permitted to reflect local climates or local weather experience as *documented* by the building official.
- f. The seismic design category shall be determined from Section 301.2.2.1.
 - g. 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 Flood Insurance Study and (c) the panel numbers and dates of all currently effective FIRMs and FBFMs or other flood hazard map adopted by the authority having jurisdiction, as amended.
 - h. In accordance with Sections 905.2.7.1, 905.4.3.1, 905.5.3.1, 905.6.3.1, 905.7.3.1 and 905.8.3.1.
 - i. The air freezing index shall also be permitted to be determined from the 100-year (99%) value on the National Climatic Data Center data table “Air Freezing Index- USA Method (Base 32°)” at www.ncdc.noaa.gov/fpsf.html.
 - j. The jurisdiction shall fill in this part of the table with the mean annual temperature from the National Climatic Data Center data table “Air Freezing Index-USA Method (Base 32°F)” at www.ncdc.noaa.gov/fpsf.html.
 - k. In accordance with Section 301.2.1.4, where there is local historical data documenting structural damage to buildings due to topographic wind speed-up effects, the jurisdiction shall fill in this part of the table with “YES.” Otherwise, the jurisdiction shall indicate “NO” in this part of the table.

**TABLE 301.2(2)
COMPONENT AND CLADDING LOADS FOR A BUILDING WITH A MEAN ROOF HEIGHT
OF 30 FEET LOCATED IN EXPOSURE B (psf)^{a, b, c, d, e}**

	ZONE	EFFECTIVE WIND AREA (feet ²)	BASIC WIND SPEED (mph—3-second gust)																							
			85		90		100		105		110		120		125		130		140		145		150		170	
			1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Roof > 0 to 10 degrees	1	10	10.0	-13.0	10.0	-14.6	10.0	-18.0	10.0	-19.8	10.0	-21.8	10.5	-25.9	11.4	-28.1	12.4	-30.4	14.3	-35.3	15.4	-37.8	16.5	-40.5	21.1	-52.0
	1	20	10.0	-12.7	10.0	-14.2	10.0	-17.5	10.0	-19.3	10.0	-21.2	10.0	-25.2	10.7	-27.4	11.6	-29.6	13.4	-34.4	14.4	-36.9	15.4	-39.4	19.8	-50.7
	1	50	10.0	-12.2	10.0	-13.7	10.0	-16.9	10.0	-18.7	10.0	-20.5	10.0	-24.4	10.0	-26.4	10.6	-28.6	12.3	-33.2	13.1	-35.6	14.1	-38.1	18.1	-48.9
	1	100	10.0	-11.9	10.0	-13.3	10.0	-18.5	10.0	-18.2	10.0	-19.9	10.0	-23.7	10.0	-25.7	10.0	-27.8	11.4	-32.3	12.2	-34.6	13.0	-37.0	16.7	-47.6
	2	10	10.0	-21.8	10.0	-24.4	10.0	-30.2	10.0	-33.3	10.0	-36.5	10.5	-43.5	11.4	-47.2	12.4	-51.0	14.3	-59.2	15.4	-63.5	16.5	-67.9	21.1	-87.2
	2	20	10.0	-19.5	10.0	-21.8	10.0	-27.0	10.0	-29.7	10.0	-32.6	10.0	-38.8	10.7	-42.1	11.6	-45.6	13.4	-52.9	14.4	-56.7	15.4	-60.7	19.8	-78.0
	2	50	10.0	-16.4	10.0	-18.4	10.0	-22.7	10.0	-25.1	10.0	-27.5	10.0	-32.7	10.0	-35.5	10.6	-38.4	12.3	-44.5	13.1	-47.8	14.1	-51.1	18.1	-65.7
	2	100	10.0	-14.1	10.0	-15.8	10.0	-19.5	10.0	-21.5	10.0	-23.6	10.0	-28.1	10.0	-30.5	10.0	-33.0	11.4	-38.2	12.2	-41.0	13.0	-43.9	16.7	-56.4
	3	10	10.0	-32.8	10.0	-36.8	10.0	-45.4	10.0	-50.1	10.0	-55.0	10.5	-65.4	11.4	-71.0	12.4	-76.8	14.3	-89.0	15.4	-95.5	16.5	-102.2	21.1	-131.3
	3	20	10.0	-27.2	10.0	-30.5	10.0	-37.6	10.0	-41.5	10.0	-45.5	10.0	-54.2	10.7	-58.8	11.6	-63.6	13.4	-73.8	14.4	-79.1	15.4	-84.7	19.8	-108.7
	3	50	10.0	-19.7	10.0	-22.1	10.0	-27.3	10.0	-30.1	10.0	-33.1	10.0	-39.3	10.0	-42.7	10.6	-46.2	12.3	-53.5	13.1	-57.4	14.1	-61.5	18.1	-78.9
	3	100	10.0	-14.1	10.0	-15.8	10.0	-19.5	10.0	-21.5	10.0	-23.6	10.0	-28.1	10.0	-30.5	10.0	-33.0	11.4	-38.2	12.2	-41.0	13.0	-43.9	16.7	-56.4
Roof > 10 to 30 degrees	1	10	10.0	-11.9	10.0	-13.3	10.4	-16.5	11.4	-18.2	12.5	-19.9	14.9	-23.7	16.2	-25.7	17.5	-27.8	20.3	-32.3	21.8	-34.6	23.3	-37.0	30.0	-47.6
	1	20	10.0	-11.6	10.0	-13.0	10.0	-16.0	10.4	-17.6	11.4	-19.4	13.6	-23.0	14.8	-25.0	16.0	-27.0	18.5	-31.4	19.9	-33.7	21.3	-36.0	27.3	-46.3
	1	50	10.0	-11.1	10.0	-12.5	10.0	-15.4	10.0	-17.0	10.0	-18.6	11.9	-22.2	12.9	-24.1	13.9	-26.0	16.1	-30.2	17.3	-32.4	18.5	-34.6	23.8	-44.5
	1	100	10.0	-10.8	10.0	-12.1	10.0	-14.9	10.0	-16.5	10.0	-18.1	10.5	-21.5	11.4	-23.3	12.4	-25.2	14.3	-29.3	15.4	-31.4	16.5	-33.6	21.1	-43.2
	2	10	10.0	-25.1	10.0	-28.2	10.4	-34.8	11.4	-38.3	12.5	-42.1	14.9	-50.1	16.2	-54.3	17.5	-58.7	20.3	-68.1	21.8	-73.1	23.3	-78.2	30.0	-100.5
	2	20	10.0	-22.8	10.0	-25.6	10.0	-31.5	10.4	-34.8	11.4	-38.2	13.6	-45.4	14.8	-49.3	16.0	-53.3	18.5	-61.8	19.9	-66.3	21.3	-71.0	27.3	-91.2
	2	50	10.0	-19.7	10.0	-22.1	10.0	-27.3	10.0	-30.1	10.0	-33.0	11.9	-39.3	12.9	-42.7	13.9	-46.1	16.1	-53.5	17.3	-57.4	18.5	-61.4	23.8	-78.9
	2	100	10.0	-17.4	10.0	-19.5	10.0	-24.1	10.0	-26.6	10.0	-29.1	10.5	-34.7	11.4	-37.6	12.4	-40.7	14.3	-47.2	15.4	-50.6	16.5	-54.2	21.1	-69.6
	3	10	10.0	-25.1	10.0	-28.2	10.4	-34.8	11.4	-38.3	12.5	-42.1	14.9	-50.1	16.2	-54.3	17.5	-58.7	20.3	-68.1	21.8	-73.1	23.3	-78.2	30.0	-100.5
	3	20	10.0	-22.8	10.0	-25.6	10.0	-31.5	10.4	-34.8	11.4	-38.2	13.6	-45.4	14.8	-49.3	16.0	-53.3	18.5	-61.8	19.9	-66.3	21.3	-71.0	27.3	-91.2

	3	50	10.0	-19.7	10.0	-22.1	10.0	-27.3	10.0	-30.1	10.0	-33.0	11.9	-39.3	12.9	-42.7	13.9	-46.1	16.1	-53.5	17.3	-57.4	18.5	-61.4	23.8	-78.9
	3	100	10.0	-17.4	10.0	-19.5	10.0	-24.1	10.0	-26.6	10.0	-29.1	10.5	-34.7	11.4	-37.6	12.4	-40.7	14.3	-47.2	15.4	-50.6	16.5	-54.2	21.1	-69.6
Roof > 30 to 45 degrees	1	10	11.9	-13.0	13.3	-14.6	16.5	-18.0	18.2	-19.8	19.9	-21.8	23.7	-25.9	25.7	-28.1	27.8	-30.4	32.3	-35.3	34.6	-37.8	37.0	-40.5	47.6	-52.0
	1	20	11.6	-12.3	13.0	-13.8	16.0	-17.1	17.6	-18.8	19.4	-20.7	23.0	-24.6	25.0	-26.7	27.0	-28.9	31.4	-33.5	33.7	-35.9	36.0	-38.4	46.3	-49.3
	1	50	11.1	-11.5	12.5	-12.8	15.4	-15.9	17.0	-17.5	18.6	-19.2	22.2	-22.8	24.1	-24.8	26.0	-25.8	30.2	-31.1	32.4	-33.3	34.6	-35.7	44.5	-45.8
	1	100	10.8	-10.8	12.1	-12.1	14.9	-14.9	16.5	-16.5	18.1	-18.1	21.5	-21.5	23.3	-23.3	25.2	-25.2	29.3	-29.3	31.4	-31.4	33.6	-33.6	43.2	-43.2
	2	10	11.9	-15.2	13.3	-17.0	16.5	-21.0	18.2	-23.2	19.9	-25.5	23.7	-30.3	25.7	-32.9	27.8	-35.6	32.3	-41.2	34.6	-44.2	37.0	-47.3	47.6	-60.8
	2	20	11.6	-14.5	13.0	-16.3	16.0	-20.1	17.6	-22.2	19.4	-24.3	23.0	-29.0	25.0	-31.4	27.0	-34.0	31.4	-39.4	33.7	-42.3	36.0	-45.3	46.3	-58.1
	2	50	11.1	-13.7	12.5	-15.3	15.4	-18.9	17.0	-20.8	18.6	-22.9	22.2	-27.2	24.1	-29.5	26.0	-32.0	30.2	-37.1	32.4	-39.8	34.6	-42.5	44.5	-54.6
	2	100	10.8	-13.0	12.1	-14.6	14.9	-18.0	16.5	-19.8	18.1	-21.8	21.5	-25.9	23.3	-28.1	25.2	-30.4	29.3	-35.3	31.4	-37.8	33.6	-40.5	43.2	-52.0
	3	10	11.9	-15.2	13.3	-17.0	16.5	-21.0	18.2	-23.2	19.9	-25.5	23.7	-30.3	25.7	-32.9	27.8	-35.6	32.3	-41.2	34.6	-44.2	37.0	-47.3	47.6	-60.8
	3	20	11.6	-14.5	13.0	-16.3	16.0	-20.1	17.6	-22.2	19.4	-24.3	23.0	-29.0	25.0	-31.4	27.0	-34.0	31.4	-39.4	33.7	-42.3	36.0	-45.3	46.3	-58.1
	3	50	11.1	-13.7	12.5	-15.3	15.4	-18.9	17.0	-20.8	18.6	-22.9	22.2	-27.2	24.1	-29.5	26.0	-32.0	30.2	-37.1	32.4	-39.8	34.6	-42.5	44.5	-54.5
	3	100	10.8	-13.0	12.1	-14.6	14.9	-18.0	16.5	-19.8	18.1	-21.8	21.5	-25.9	23.3	-28.1	25.2	-30.4	29.3	-35.3	31.4	-37.8	33.6	-40.5	43.2	-52.0
Wall	4	10	13.0	-14.1	14.6	-15.8	18.0	-19.5	19.8	-21.5	21.8	-23.6	25.9	-28.1	28.1	-30.5	30.4	-33.0	35.3	-38.2	37.8	-41.0	40.5	-43.9	52.0	-56.4
	4	20	12.4	-13.5	13.9	-15.1	17.2	-18.7	18.9	-20.6	20.8	-22.6	24.7	-26.9	26.8	-29.2	29.0	-31.6	33.7	-36.7	36.1	-39.3	38.7	-42.1	49.6	-54.1
	4	50	11.6	-12.7	13.0	-14.3	16.1	-17.6	17.8	-19.4	19.5	-21.3	23.2	-25.4	25.2	-27.5	27.2	-29.8	31.6	-34.6	33.9	-37.1	36.2	-39.7	46.6	-51.0
	4	100	11.1	-12.2	12.4	-13.6	15.3	-16.8	16.9	-18.5	18.5	-20.4	22.0	-24.2	23.9	-26.3	25.9	-28.4	30.0	-33.0	32.2	-35.4	34.4	-37.8	44.2	-48.6
	5	10	13.0	-17.4	14.6	-19.5	18.0	-24.1	19.8	-26.6	21.8	-29.1	25.9	-34.7	28.1	-37.6	30.4	-40.7	35.3	-47.2	37.8	-50.6	40.5	-54.2	52.0	-69.6
	5	20	12.4	-16.2	13.9	-18.2	17.2	-22.5	18.9	-24.8	20.8	-27.2	24.7	-32.4	26.8	-35.1	29.0	-38.0	33.7	-44.0	36.1	-47.2	38.7	-50.5	49.6	-64.9
	5	50	11.6	-14.7	13.0	-16.5	16.1	-20.3	17.8	-22.4	19.5	-24.6	23.2	-29.3	25.2	-31.8	27.2	-34.3	31.6	-39.8	33.9	-42.7	36.2	-45.7	46.6	-58.7
	5	100	11.1	-13.5	12.4	-15.1	15.3	-18.7	16.9	-20.6	18.5	-22.6	22.0	-26.9	23.9	-29.2	25.9	-31.6	30.0	-36.7	32.2	-39.3	34.4	-42.1	44.2	-54.1

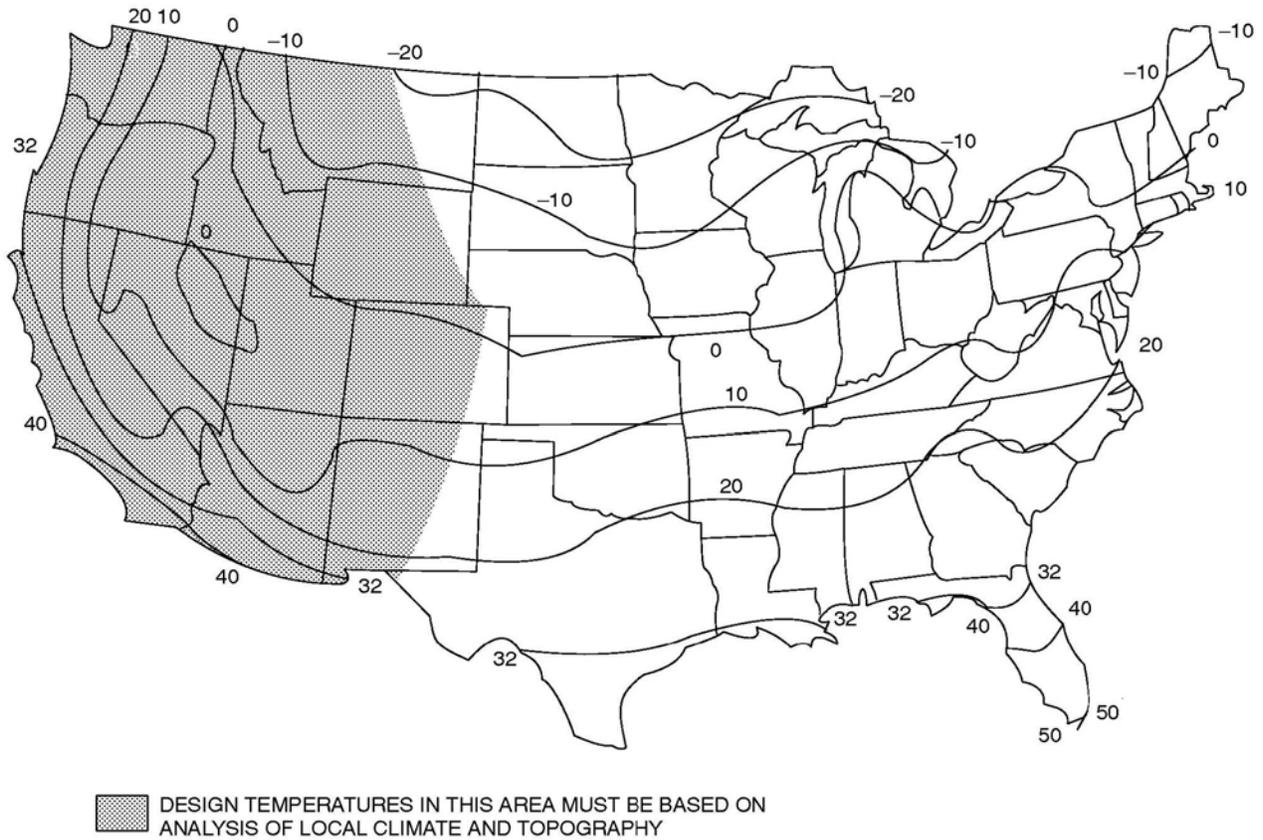
For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m², 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa.

Notes:

- a. The effective wind area shall be equal to the span length multiplied by an effective width. This width shall be permitted to be not be less than one-third the span length. For cladding fasteners, the effective wind area shall not be greater than the area that is tributary to an individual fastener.
- b. For effective areas between those given above, the load may be interpolated; otherwise, use the load associated with the lower effective area.
- c. Table values shall be adjusted for height and exposure by multiplying by the adjustment coefficient in Table 301.2(3).
- d. See Figure 301.2(7) for location of zones.
- e. Plus and minus signs signify pressures acting toward and away from the building surfaces.

**TABLE 301.2(3)
HEIGHT AND EXPOSURE ADJUSTMENT COEFFICIENTS FOR TABLE 301.2(2)**

MEAN ROOF HEIGHT	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: °C = [(°F)-32]/1.8.

FIGURE 301.2(1)
ISOLINES OF THE 97½ PERCENT WINTER (DECEMBER, JANUARY AND FEBRUARY)
DESIGN TEMPERATURES (°F)

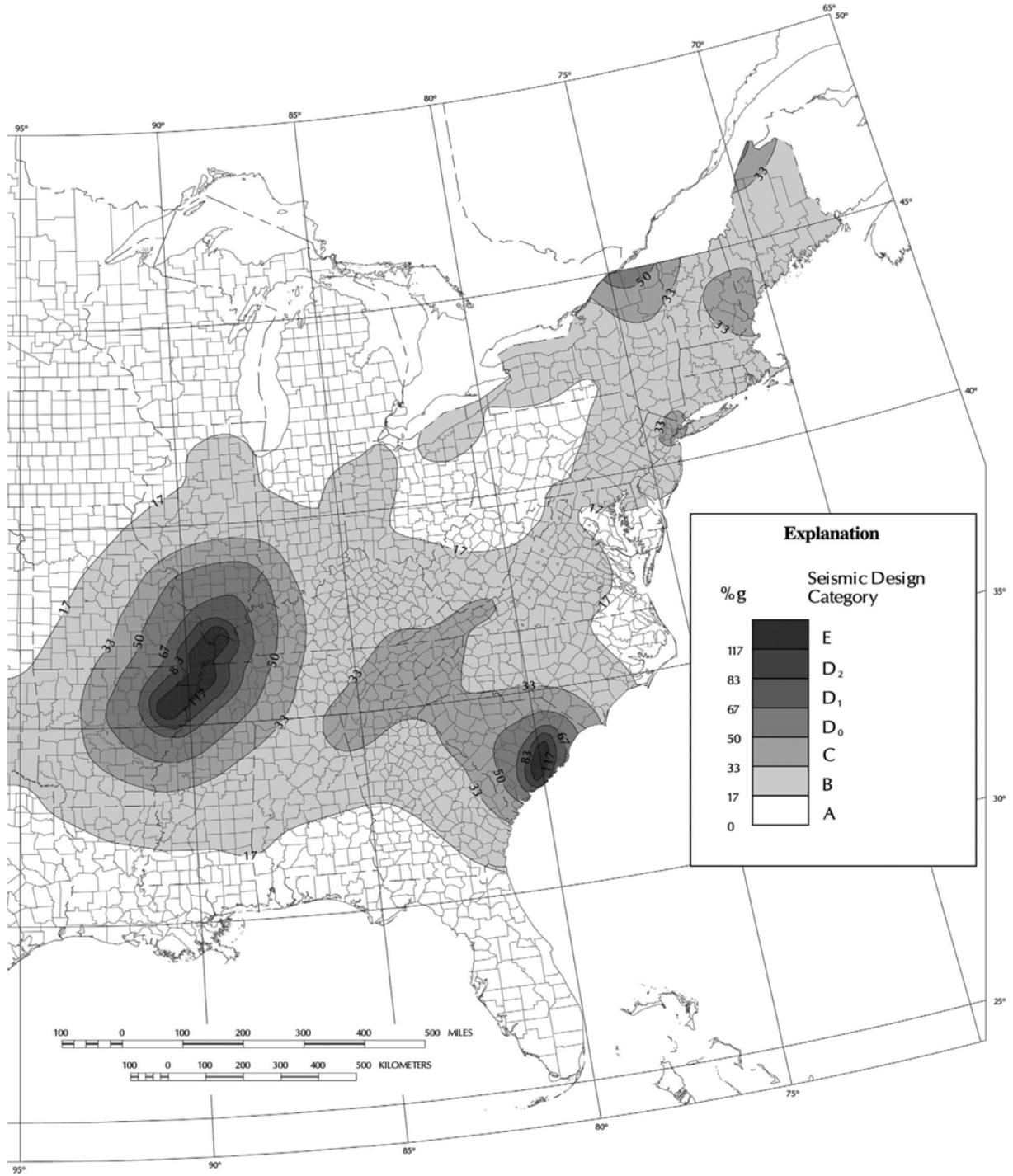
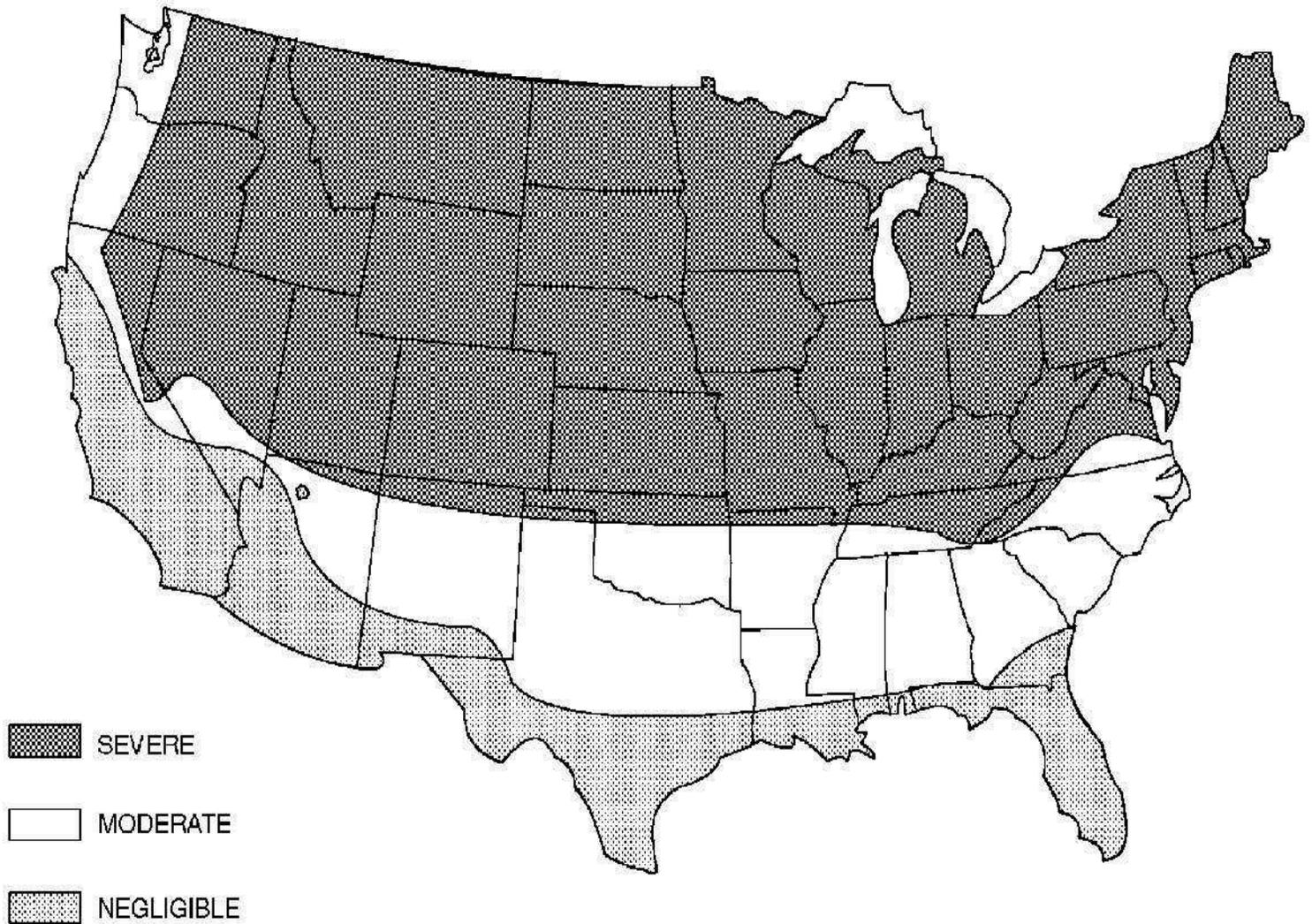


FIGURE 301.2(2)
SEISMIC DESIGN CATEGORIES—SITE CLASS D



- a.* Note: Lines defining areas are approximate only. Local conditions may be more or less severe than indicated by the regional classification. A severe classification is where weather conditions result in significant snowfall combined with extended periods during which there is little or no natural thawing causing deicing salts to be used extensively.

FIGURE 301.2(3)
WEATHERING PROBABILITY MAP FOR CONCRETE

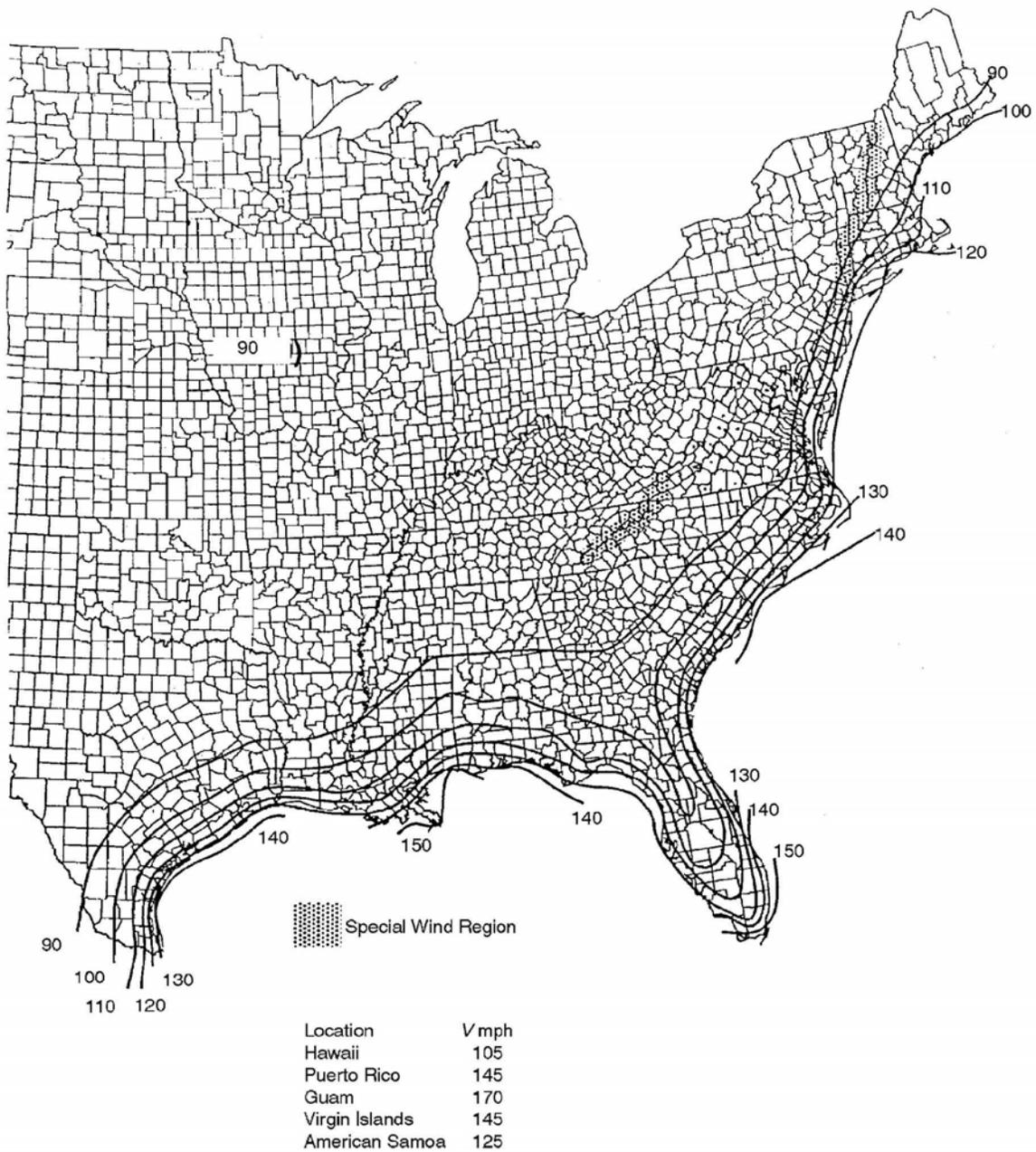


FIGURE 301.2(4)
BASIC WIND SPEEDS FOR 50-YEAR MEAN RECURRENCE
INTERVAL

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

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



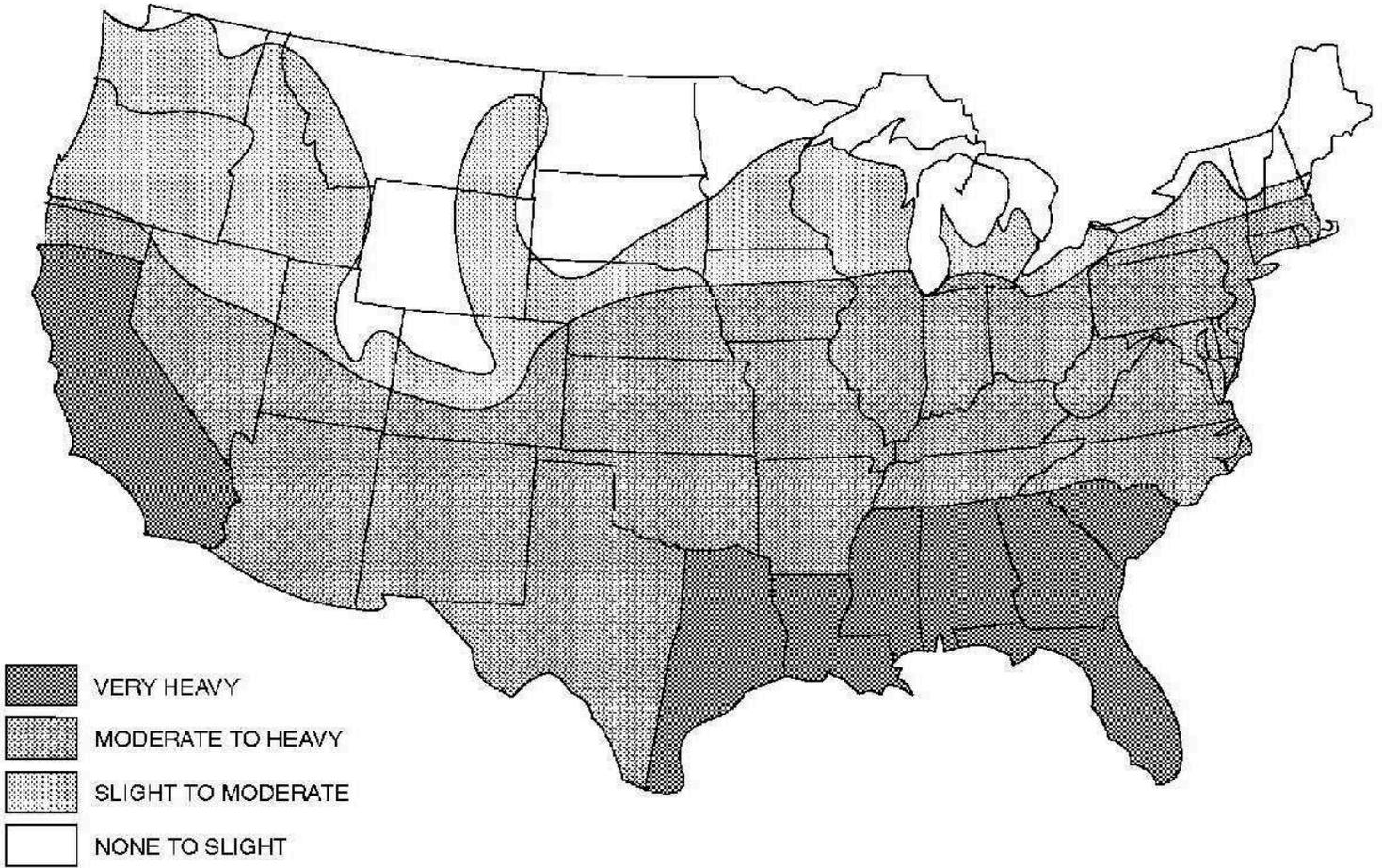
For SI: 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 mile = 1.61 km

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

To convert lb/sq ft to kN/m², multiply by 0.0479.

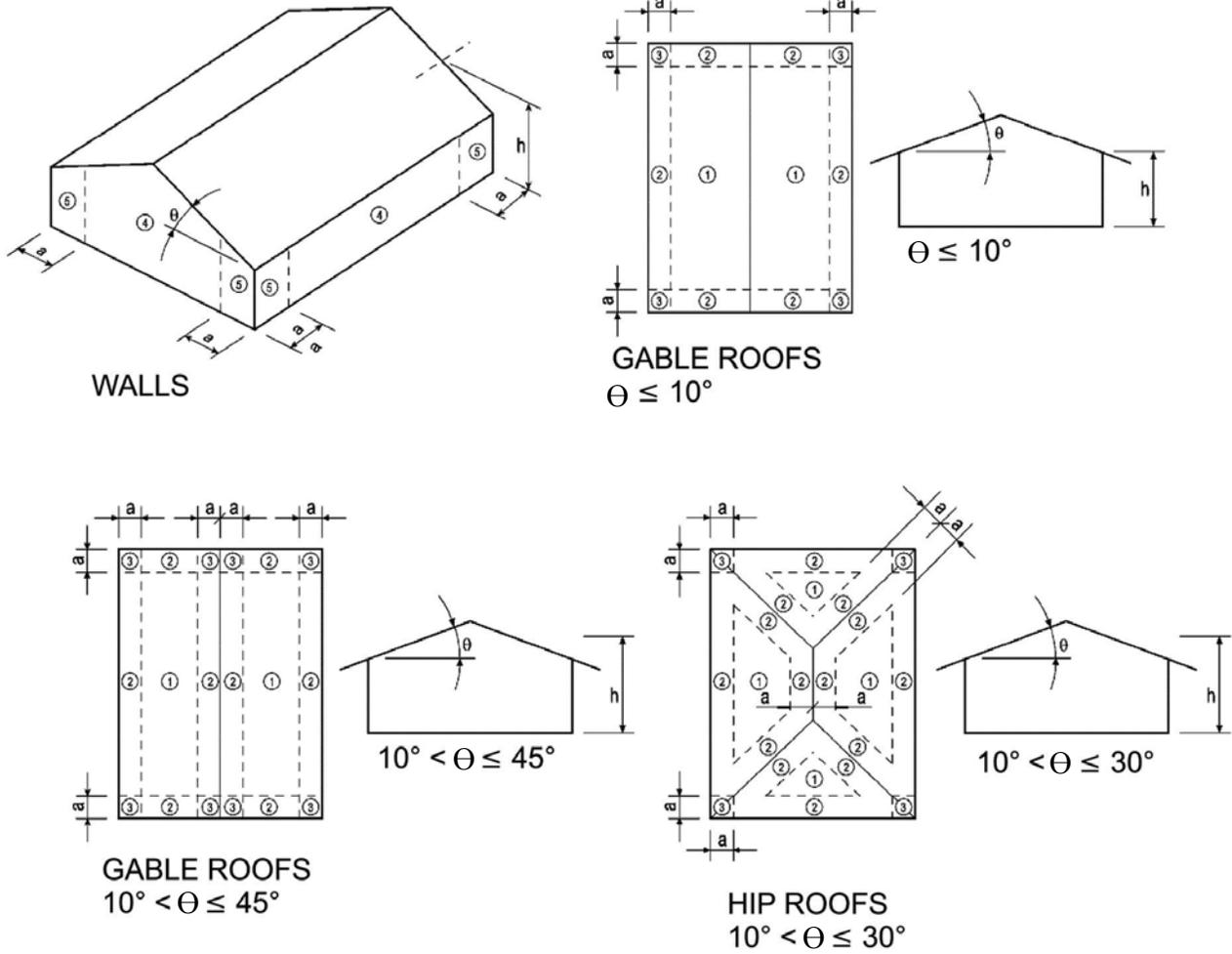
To convert feet to meters, multiply by 0.3048.

FIGURE 301.2(5)
GROUND SNOW LOADS, P_g , FOR THE UNITED STATES (lb/ft²)



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

FIGURE 301.2(6)
TERMITE INFESTATION PROBABILITY MAP



For SI: 1 foot = 304.8 mm, 1 degree = 0.0175 rad.
 Note: a = 4 feet in all cases.

FIGURE 301.2(7)
COMPONENT AND CLADDING PRESSURE ZONES

301.2.1.2 Protection of openings. Windows in buildings located in windborne debris regions shall have glazed openings protected from windborne debris. Glazed opening protection for windborne debris shall meet the requirements of the Large Missile Test of ASTM E 1996 and ASTM E 1886 referenced therein. Garage door glazed opening protection for windborne debris shall meet the requirements of an approved impact resisting standard or ANSI/DASMA 115.

Exception: Wood structural panels with a minimum thickness of $\frac{7}{16}$ inch (11 mm) and a maximum span of 8 feet (2438 mm) shall be permitted for opening protection in one- and two-story buildings. Panels shall be precut ~~and~~ so that they can be 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 301.2(2) or ASCE 7, with the permanent corrosion-resistant attachment hardware provided and anchors permanently installed on the building. Attachment in accordance with Table 301.2.1.2 is permitted for buildings with a mean roof height of 33 feet (10 058 mm) or less where windspeeds do not exceed 130 miles per hour (58 m/s).

**TABLE 301.2.1.2
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	16	10	8
No. 10 wood screw based anchor with 2-inch embedment length	16	12	9
¼-inch lag screw based anchor with 2-inch embedment length	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 130 mph wind speeds and a 33-foot mean roof height.
- b. Fasteners shall be installed at opposing ends of the wood structural panel. Fasteners shall be located a minimum of 1 inch from the edge of the panel.
- c. Anchors shall penetrate through the exterior wall covering with an embedment length of 2 inches minimum into the building frame. Fasteners shall be located a minimum of 2½ inches from the edge of concrete block or concrete.
- d. Where panels are attached to masonry or masonry/stucco, they shall be attached using vibration-resistant anchors having a minimum ultimate withdrawal capacity of 1500 pounds.

301.2.1.3 Wind speed conversion. When referenced documents are based on fastest mile wind speeds, the three-second gust wind *velocities* of

Figure 301.2(4) shall be converted to fastest mile wind *velocities* using Table 301.2.1.3.

TABLE 301.2.1.3
EQUIVALENT BASIC WIND SPEEDS^a

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

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

a. Linear interpolation is permitted.

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

1. Exposure A. Large city centers with at least 50 percent of the buildings having a height in excess of 70 feet (21 336 mm). Use of this exposure category shall be limited to those areas for which terrain representative of Exposure A prevails in the upwind direction for a distance of at least 0.5 mile (0.8 km) or 10 times the height of the building or other structure, whichever is greater. Possible channeling effects or increased velocity pressures due to the building or structure being located in the wake of adjacent buildings shall be taken into account.
2. Exposure B. Urban and suburban areas, wooded areas, or other terrain with numerous closely spaced obstructions having the size of single-family dwellings or larger. Exposure B shall be assumed unless the site meets the definition of another type exposure.
3. Exposure C. Open terrain with scattered obstructions, including surface undulations or other irregularities, having heights generally less than 30 feet (9144 mm) extending more than 1,500 feet (457 m) from the building site in any quadrant. This exposure shall also apply to any building located within Exposure B type terrain where the building is directly adjacent to open areas of Exposure C type

terrain in any quadrant for a distance of more than 600 feet (183 m). This category includes flat open country, grasslands and shorelines in hurricane prone regions.

4. Exposure D. Flat, unobstructed areas exposed to wind flowing over open water (excluding shorelines in hurricane prone regions) for a distance of at least 1 mile (1.61 km). Shorelines in Exposure D include inland waterways, the Great Lakes, and coastal areas of California, Oregon, Washington and Alaska. This exposure shall apply only to those buildings and other structures exposed to the wind coming from over the water. Exposure D extends inland from the shoreline a distance of 1500 feet (457 m) or 10 times the height of the building or structure, whichever is greater

301.2.1.5 Deleted.

301.2.1.5.1 Deleted.

301.2.2 Seismic provisions. The seismic provisions of this code shall apply to buildings constructed in Seismic Design Categories C, D₀, D₁ and D₂, as determined in accordance with this section.

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

301.2.2.1 Determination of seismic design category. Buildings shall be assigned a seismic design category in accordance with Figure 301.2(2).

301.2.2.1.1 Alternate determination of seismic design category. The Seismic Design Categories and corresponding Short Period Design Spectral Response Accelerations, S_{DS} shown in Figure 301.2(2) are based on soil Site Class D, as defined in Section 1613.5.2 of the *Ohio* Building Code. If soil conditions are other than Site Class D, the Short Period Design Spectral Response Accelerations, S_{DS} , for a site can be determined according to Section 1613.5 of the *Ohio* Building Code. The value of S_{DS} determined according to Section 1613.5 of the *Ohio* Building Code is permitted to be used to set the seismic design category according to Table 301.2.2.1.1, and to interpolate between values in Tables ~~602.10.1, 603.7~~ 602.10.3(3), 603.9.2(1) and other seismic design requirements of this code.

TABLE 301.2.2.1.1
SEISMIC DESIGN CATEGORY DETERMINATION

CALCULATED S_{DS}	SEISMIC DESIGN CATEGORY
$S_{DS} \leq 0.17g$	A
$0.17g < S_{DS} \leq 0.33g$	B
$0.33g < S_{DS} \leq 0.50g$	C
$0.50g < S_{DS} \leq 0.67g$	D ₀
$0.67g < S_{DS} \leq 0.83g$	D ₁
$0.83g < S_{DS} \leq 1.17g$	D ₂
$1.17g < S_{DS}$	E

301.2.2.1.2 Alternative determination of Seismic Design Category

E. Buildings located in Seismic Design Category E in accordance with Figure 301.2(2) are permitted to be reclassified as being in Seismic Design Category D₂ provided 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 *Ohio* Building Code. Buildings located in Seismic Design Category E per Table R301.2.2.1.1, but located in Seismic Design Category D per the *Ohio* Building Code, may be designed using the Seismic Design Category D₂ 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 D₂ of this code:
 - 2.1. All exterior shear wall lines or braced wall panels are in one plane vertically from the foundation to the uppermost story.
 - 2.2. Floors shall not cantilever past the exterior walls.
 - 2.3. The building is within all of the requirements of Section 301.2.2.2.5 for being considered as regular.

301.2.2.2 Seismic Design Category C. Structures assigned to Seismic Design Category C shall conform to the requirements of this section.

301.2.2.2.1 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 301.2.2. Dead loads for walls above grade shall not exceed:

1. Fifteen pounds per square foot (720 Pa) for exterior light-frame wood walls.
2. 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. 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. Roof and ceiling dead loads not exceeding 25 pounds per square foot (1190 Pa) shall be permitted provided the wall bracing amounts in Chapter 6 are increased in accordance with Table 301.2.2.2.1.
2. Light-frame walls with stone or masonry veneer shall be permitted in accordance with the provisions of Sections 702.1 and 703.
3. Fireplaces and chimneys shall be permitted in accordance with Chapter 10.

**TABLE 301.2.2.2.1
WALL BRACING ADJUSTMENT FACTORS BY ROOF COVERING DEAD LOAD^a**

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

For SI: 1 pound per square foot = 0.0479 kPa.

a. Linear interpolation shall be permitted.

301.2.2.2.2 Stone and masonry veneer. Anchored stone and masonry veneer shall comply with the requirements of Sections 702.1 and 703.

301.2.2.2.3 Masonry construction. Masonry construction shall comply with the requirements of Section 606.11.2.

301.2.2.2.4 Concrete construction. Detached one-, two and three-family dwellings with exterior above-grade concrete walls shall comply with the requirements of Section 611, PCA 100 or shall be designed in accordance with ACI 318. Townhouses with above-grade exterior concrete walls shall comply with the requirements of PCA 100 or shall be designed in accordance with ACI 318.

301.2.2.2.5 Irregular buildings. Prescriptive construction as regulated by this code shall not be used for irregular structures located in Seismic Design Categories C, D₀, D₁ and D₂. 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. When the forces associated with the irregularity are resisted by a structural system designed in accordance with accepted engineering practice, design of the remainder of the building shall be permitted using the provisions of this code. A building or portion of a building shall be considered to be irregular when one or more of the following conditions occur:

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

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

1. Floor joists are nominal 2 inches by 10 inches (51 mm by 254 mm) or larger and spaced not more than 16 inches (406 mm) on center.
 2. The ratio of the back span to the cantilever is at least 2 to 1.
 3. Floor joists at ends of braced wall panels are doubled.
 4. For wood-frame construction, a continuous rim joist is connected to ends of all cantilever joists. When spliced, the rim joists shall be spliced using a galvanized metal tie not less than 0.058 inch (1.5 mm) (16 gage) and 1½ inches (38 mm) wide fastened with six 16d nails on each side of the splice or a block of the same size as the rim joist of sufficient length to fit securely between the joist space at which the splice occurs fastened with eight 16d nails on each side of the splice; and
 5. Gravity loads carried at the end of cantilevered joists are limited to uniform wall and roof loads and the reactions from headers having a span of 8 feet (2438 mm) or less.
2. When a section of floor or roof is not laterally supported by shear walls or braced wall lines on all edges.

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

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

Exception: For wood light-frame wall construction, one end of a braced wall panel shall be permitted to extend more than 1 foot (305 mm) over an opening not more than 8 feet (2438 mm) wide in the wall below provided that the opening includes a header in accordance with the following:

1. The building width, loading condition and framing member species limitations of Table 502.5(1) shall apply; and
 2. Not less than one 2 × 12 or two 2 × 10 for an opening not more than 4 feet (1219 mm) wide; or
 3. Not less than two 2 × 12 or three 2 × 10 for an opening not more than 6 feet (1829 mm) wide; or
 4. Not less than three 2 × 12 or four 2 × 10 for an opening not more than 8 feet (2438 mm) wide; and
 5. The entire length of the braced wall panel does not occur over an opening in the wall below.
4. When an opening in a floor or roof exceeds the lesser of 12 feet (3658 mm) or 50 percent of the least floor or roof dimension.
 5. When portions of a floor level are vertically offset.

Exceptions:

1. Framing supported directly by continuous foundations at the perimeter of the building.

2. For wood light-frame construction, floors shall be permitted to be vertically offset when the floor framing is lapped or tied together as required by Section 502.6.1.
6. When shear walls and braced wall lines do not occur in two perpendicular directions.
7. When stories above-grade partially or completely braced by wood wall framing in accordance with Section 602 or steel wall framing in accordance with Section 603 include masonry or concrete construction. When this irregularity applies, the entire story shall be designed in accordance with accepted engineering practice.

Exception: Fireplaces, chimneys and masonry veneer as permitted by this code. ~~When this irregularity applies, the entire story shall be designed in accordance with accepted engineering practice.~~

301.2.2.3 Seismic Design Categories D₀, D₁ and D₂. Structures assigned to Seismic Design Categories D₀, D₁ and D₂ shall conform to the requirements for Seismic Design Category C and the additional requirements of this section.

301.2.2.3.1 Height limitations. Wood framed buildings shall be limited to three stories above grade or the limits given in Table ~~602.10.1.2(2)~~ 602.10.3(3). Cold-formed steel framed buildings shall be limited to less than or equal to three stories above grade in accordance with AISI S230. Mezzanines as defined in Section 202 shall not be considered as stories. Structural insulated panel buildings shall be limited to two stories above grade.

301.2.2.3.2 Stone and masonry veneer. Anchored stone and masonry veneer shall comply with the requirements of Sections 702.1 and 703.

301.2.2.3.3 Masonry construction. Masonry construction in Seismic Design Categories D₀ and D₁ shall comply with the requirements of Section ~~606.11.3~~ 606.12.3. Masonry construction in Seismic Design Category D₂ shall comply with the requirements of Section ~~606.11.4~~ 606.12.4.

301.2.2.3.4 Concrete construction. Buildings with exterior above-grade concrete walls shall comply with PCA 100 or shall be designed in accordance with ACI 318.

301.2.2.3.5 Cold-formed steel framing in Seismic Design Categories D₀, D₁ and D₂. In Seismic Design Categories D₀, D₁ and D₂ in addition to the requirements of this code, cold-formed steel framing shall comply with the requirements of AISI S230.

301.2.2.3.6 Masonry chimneys. Masonry chimneys shall be reinforced and anchored to the building in accordance with Sections 1003.3 and 1003.4.

301.2.2.3.7 Anchorage of water heaters. Water heaters shall be anchored against movement and overturning in accordance with Section 1307.2.

301.2.2.4 Seismic Design Category E. Buildings in Seismic Design Category E shall be designed in accordance with the *Ohio* Building Code, except when the seismic design category is reclassified to a lower seismic design category in accordance with Section 301.2.2.1.

301.2.3 Snow loads. 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.

301.2.4 Floodplain construction. Buildings and structures constructed in whole or in part in flood hazard areas (including A or V Zones) as established in Table 301.2(1) shall be designed and constructed in accordance with Section 322.

Exception: Buildings and structures located in whole or in part in identified floodways shall be designed and constructed in accordance with ASCE 24.

301.2.4.1 Alternative provisions. As an alternative to the requirements in Section 322.3 for buildings and structures located in whole or in part in coastal high hazard areas (V Zones), ASCE 24 is permitted subject to the limitations of this code and the limitations therein.

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

1. For wood wall framing, the laterally unsupported bearing wall stud height permitted by Table 602.3(5) plus a height of floor framing not to exceed 16 inches (406 mm).

Exception: For wood framed wall buildings with bracing in accordance with Tables ~~602.10.1.2(1)~~602.10.3(1) and ~~602.10.1.2(2)~~602.10.3(2), the wall stud clear height used to determine the maximum permitted story height may be increased to 12 feet (3658 mm) without requiring an engineered design for the building wind and seismic force resisting systems provided that the length of bracing required by Table ~~602.10.1.2(1)~~602.10.3(1) is increased by multiplying by a factor of 1.10 and the length of bracing required by Table ~~602.10.1.2(2)~~602.10.3(2) is increased by multiplying by a factor of 1.20. Wall studs are still subject to the requirements of this section.

2. For steel wall framing, a stud height of 10 feet (3048 mm), plus a height of floor framing not to exceed 16 inches (406 mm).
3. For masonry walls, a maximum bearing wall clear height of 12 feet (3658 mm) plus a height of floor framing not to exceed 16 inches (406 mm).

Exception: An additional 8 feet (2438 mm) is permitted for gable end walls.

4. For insulating concrete form walls, the maximum bearing wall height per story as permitted by Section 611 tables plus a height of floor framing not to exceed 16 inches (406 mm).
5. For structural insulated panel (SIP) walls, the maximum bearing wall height per story as permitted by Section 614 tables shall not exceed 10 feet (3048 mm) plus a height of floor framing not to exceed 16 inches (406 mm).

Individual walls or walls studs shall be permitted to exceed these limits as permitted by Chapter 6 provisions, provided story heights are not exceeded. Floor framing height shall be permitted to exceed these limits provided the story height does not exceed 11 feet 7 inches (3531 mm). An engineered design shall be provided for the wall or wall framing members when they exceed the limits of Chapter 6. Where the story height limits are exceeded, an engineered design shall be provided in accordance with the *Ohio* Building Code for the overall wind and seismic force resisting systems.

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

301.5 Live load. The minimum uniformly distributed live load shall be as provided in Table 301.5.

TABLE 301.5
MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS
(in pounds per square foot)

USE	LIVE LOAD
Attics without storage ^b	10
Attics with limited storage ^{b, g}	20
Habitable attics and attics served with fixed stairs	30
Balconies (exterior) and decks ^c	40
Fire escapes	40
Guardrails and handrails ^d	200 ^h
Guardrail in-fill components ^f	50 ^h
Passenger vehicle garages ^a	50 ^a
Rooms other than sleeping room	40
Sleeping rooms	30
Stairs	40 ^c

For SI: 1 pound per square foot = 0.0479 kPa, 1 square inch = 645 mm², 1 pound = 4.45 N.

- a. Elevated garage floors shall be capable of supporting a 2,000-pound load applied over a 20-square-inch area.
- b. Attics without storage are those where the maximum clear height between joist and rafter is less than 42 inches, or where there are not two or more adjacent trusses with the same web configuration capable of containing a rectangle 42 inches high by 2 feet wide, or greater, located within the plane of the truss. For attics without storage, this live load need not be assumed to act concurrently with any other live load requirements.
- c. Individual stair treads shall be designed for the uniformly distributed live load or a 300-pound concentrated load acting over an area of 4 square inches, whichever produces the greater stresses.

- d. A single concentrated load applied in any direction at any point along the top.
- e. See Section 502.2.2 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. For attics with limited storage and constructed with trusses, this live load need be applied only to those portions of the bottom chord where there are two or more adjacent trusses with the same web configuration capable of containing a rectangle 42 inches high or greater by 2 feet wide or greater, located within the plane of the truss. The rectangle shall fit between the top of the bottom chord and the bottom of any other truss member, provided that each of the following criteria is met.
 - 1. The attic area is accessible by a pull-down stairway or framed opening in accordance with Section 807.1.
 - 2. The truss has a bottom chord pitch less than 2:12.
 - 3. Required insulation depth is less than the bottom chord member depth.

The bottom chords of trusses meeting the above criteria for limited storage shall be designed for the greater of the actual imposed dead load or 10 psf, uniformly distributed over the entire span.
- h. Glazing used in handrail assemblies and guards shall be designed with a safety factor of 4. The safety 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.

301.6 Roof load. The roof shall be designed for the live load indicated in Table 301.6 or the snow load indicated in Table 301.2(1), whichever is greater.

**TABLE 301.6
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 m², 1 pound per square foot = 0.0479 kPa, 1 inch per foot = 83.3 mm/m.

301.7 Deflection. The allowable deflection of any structural member under the live load listed in Sections 301.5 and 301.6 shall not exceed the values in Table 301.7.

TABLE 301.7

ALLOWABLE DEFLECTION OF STRUCTURAL MEMBERS^{a, b, c, d, e}

STRUCTURAL MEMBER	ALLOWABLE DEFLECTION
Rafters having slopes greater than 3:12 with no finished ceiling attached to rafters	L/180
Interior walls and partitions	H/180
Floors and plastered ceilings	L/360
All other structural members	L/240
Exterior walls with plaster or stucco finish	H/360
Exterior walls—wind loads ^a with brittle finishes	H/240
Exterior walls—wind loads ^a with flexible finishes	L/120 ^d
Lintels supporting masonry veneer walls ^e	L/600

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

- a. The wind load shall be permitted to be taken as 0.7 times the Component and Cladding loads for the purpose of the determining deflection limits herein.
- b. 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 703.7.2.

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

SECTION 302 FIRE-RESISTANT CONSTRUCTION

302.1 Exterior walls. Construction, projections, openings and penetrations of exterior walls of dwellings and accessory buildings shall comply with Table 302.1.

Exceptions:

1. Walls, projections, openings or penetrations in walls perpendicular to the line used to determine the fire separation distance.
2. Walls of dwellings and accessory structures located on the same lot.

3. Detached tool sheds and storage sheds, playhouses and similar structures exempted from *approval by Section 102.10* 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 feet (610 mm) of a lot line are permitted to have roof eave projections not exceeding 4 inches (102 mm).
5. Foundation vents installed in compliance with this code are permitted.

Where referenced in this code, an unoccupied space on an adjoining property may be included in the required fire separation distance, provided that the adjoining property is dedicated or deeded so as to preclude, for the life of the structure, the erection of any building or structure on such space (see section 3781.02 of the Revised Code).

302.2 Residential structures with more than two dwelling units. *In structures with more than two dwelling units, each grouping of two dwelling units shall be separated from an adjacent dwelling unit or an adjacent grouping of two dwelling units by two wall assemblies, each having a fire resistance rating of one hour when tested in accordance with ASTM E119 or UL 263 and/or a floor ceiling assembly having a fire resistance rating of two hours when tested in accordance with ASTM E119 or UL 263 .*

Alternatively, each grouping of two dwelling units shall be separated from an adjacent dwelling unit or an adjacent grouping of two dwelling units by a common wall assembly having a fire resistance rating of not less than two hours when tested in accordance with ASTM E119 or UL 263 and/or a floor ceiling assembly having a fire resistance rating of two hours when tested in accordance with ASTM E119 or UL 263. This option is only permissible if the common wall does not contain plumbing or mechanical equipment, ducts or vents in the cavity of the common wall. The common wall shall be rated for fire exposure from both sides and shall extend to and be tight against exterior walls and the underside of the roof sheathing. Penetrations of electrical outlet boxes shall be in accordance with Section 302.4.

Additionally, within any grouping of two dwelling units, separated as indicated above, the individual dwelling units shall be separated vertically and horizontally from adjacent dwelling units by wall and/or floor assemblies having a fire

resistance rating of not less than one hour when tested in accordance with ASTM E119 or UL 263 .

When assemblies are required to be fire-resistance-rated, the supporting construction of such assemblies shall have an equal or greater fire-resistive rating.

302.2.1 Continuity. The fire-resistance-rated wall or assembly separating townhouses 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, including wall extensions through and separating attached enclosed accessory structures.

302.2.2 Parapets. Parapets constructed in accordance with Section 302.2.3 shall be constructed for townhouses as an extension of exterior walls or common walls in accordance with the following:

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

Exception: A parapet is not required in the two cases above when the roof is covered with a minimum class C roof covering, and the roof decking or sheathing is of noncombustible materials or approved fire-retardant-treated wood for a distance of 4 feet (1219 mm) on each side of the wall or walls, or one layer of ⁵/₈-inch (15.9 mm) Type X gypsum board is installed directly beneath the roof decking or sheathing, supported by a minimum of nominal 2-inch (51 mm) ledgers attached to the sides of the roof framing members, for a minimum distance of 4 feet (1219 mm) on each side of the wall or walls.

3. A parapet is not required where roof surfaces adjacent to the wall or walls are at different elevations and the higher roof is more than 30 inches (762 mm) above the lower roof. The common wall construction from the lower roof to the underside of the higher roof

deck shall have not less than a 1-hour fire-resistance rating. The wall shall be rated for exposure from both sides.

**TABLE 302.1
EXTERIOR WALLS**

EXTERIOR WALL ELEMENT		MINIMUM FIRE-RESISTANCE RATING	MINIMUM FIRE SEPARATION DISTANCE
Walls	(Fire-resistance rated)	1 hour-tested in accordance with ASTM E 119 or UL 263 with exposure <i>from</i> both sides	< 5 feet
	(Not fire-resistance rated)	0 hours	≥ 5 feet
Projections	(Fire-resistance rated)	1 hour on the underside	≥ 2 feet to 5 feet
	(Not fire-resistance rated)	0 hours	5 feet
Openings in walls	Not allowed	N/A	< 3 feet
	25% maximum of wall area	0 hours	3 feet
	Unlimited	0 hours	5 feet
Penetrations	All	Comply with Section 302.4	< 5 feet
		None required	5 feet

For SI: 1 foot = 304.8 mm.

N/A = Not Applicable.

302.2.3 Parapet construction. Parapets shall have the same fire-resistance rating as that required for the supporting wall or walls. On any side adjacent to a roof surface, the parapet shall have noncombustible faces for the uppermost 18 inches (457 mm), to include counterflashing and coping materials. Where the roof slopes toward a parapet at slopes greater than 2 units vertical in 12 units horizontal (16.7-percent slope), the parapet shall extend to the same height as any portion of the roof within a distance of 3 feet (914 mm), but in no case shall the height be less than 30 inches (762 mm).

302.2.4 Structural independence. Each individual *dwelling unit* shall be structurally independent.

Exceptions:

1. Foundations supporting exterior walls or common walls.
2. Structural roof and wall sheathing from each unit may fasten to the common wall framing.
3. Nonstructural wall and roof coverings.

4. Flashing at termination of roof covering over common wall.
5. *Dwelling units* separated by a common 2-hour fire-resistance-rated wall as provided in Section 302.2 .
6. *Dwelling units stacked vertically*.

302.3 Two-family dwellings. Dwelling units in two-family dwellings shall be separated from each other by wall and/or floor assemblies having not less than a 1-hour fire-resistance rating when tested in accordance with ASTM E 119 or UL 263. Fire-resistance-rated floor-ceiling and wall assemblies shall extend to and be tight against the exterior wall, and wall assemblies shall extend from the foundation to the underside of the roof sheathing.

Exceptions:

A fire-resistance rating of ½ hour shall be permitted in buildings equipped throughout with an automatic sprinkler system installed in accordance with NFPA 13.

302.3.1 Supporting construction. When floor assemblies are required to be fire-resistance rated, the supporting construction of such assemblies shall have an equal or greater fire-resistance rating.

302.4 Dwelling unit rated penetrations. Penetrations of wall or floor/ceiling assemblies required to be fire-resistance rated in accordance with Section 302.2 or 302.3 shall be protected in accordance with this section.

302.4.1 Through penetrations. Through penetrations of fire-resistance-rated wall or floor assemblies shall comply with Section 302.4.1.1 or 302.4.1.2.

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

1. In concrete or masonry wall or floor assemblies, concrete, grout or mortar shall be permitted where installed to the full thickness of the wall or floor assembly or the thickness required to maintain the fire-resistance rating, provided:
 - 1.1 The nominal diameter of the penetrating item is a maximum of 6 inches (152 mm); and

1.2 The area of the opening through the wall does not exceed 144 square inches (92 900 mm²).

- 2 The material used to fill the annular space shall prevent the passage of flame and hot gases sufficient to ignite cotton waste where subjected to ASTM E 119 or UL 263 time temperature fire conditions under a minimum positive pressure differential of 0.01 inch of water (3 Pa) at the location of the penetration for the time period equivalent to the fire resistance rating of the construction penetrated.

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

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

302.4.2 Membrane penetrations. Membrane penetrations shall comply with Section 302.4.1. Where walls are required to have a fire-resistance rating, recessed fixtures shall be installed so that the required fire-resistance rating will not be reduced.

Exceptions:

1. Membrane penetrations of maximum 2-hour fire-resistance-rated walls and partitions by steel electrical boxes that do not exceed 16 square inches (0.0103 m²) in area provided the aggregate area of the openings through the membrane does not exceed 100 square inches (0.0645 m²) in any 100 square feet (9.29 m)² of wall area. The annular space between the wall membrane and the box shall not exceed ¹/₈ inch (3.1 mm). Such boxes on opposite sides of the wall shall be separated by one of the following:
 - 1.1. By a horizontal distance of not less than 24 inches (610 mm) where the wall or partition is constructed with individual noncommunicating stud cavities;

- 1.2. By a horizontal distance of not less than the depth of the wall cavity when the wall cavity is filled with cellulose loose-fill, rockwool or slag mineral wool insulation;
 - 1.3. By solid fire blocking in accordance with Section 302.11;
 - 1.4. By protecting both boxes with listed putty pads; or
 - 1.5. By other listed materials and methods.
2. Membrane penetrations by listed electrical boxes of any materials provided the boxes have been tested for use in fire-resistance-rated assemblies and are installed in accordance with the instructions included in the listing. The annular space between the wall membrane and the box shall not exceed $\frac{1}{8}$ inch (3.1 mm) unless listed otherwise. Such boxes on opposite sides of the wall shall be separated by one of the following:
 - 2.1. By the horizontal distance specified in the listing of the electrical boxes;
 - 2.2. By solid fireblocking in accordance with Section 302.11;
 - 2.3. By protecting both boxes with listed putty pads; or
 - 2.4. By other listed materials and methods.
 3. The annular space created by the penetration of a fire sprinkler provided it is covered by a metal escutcheon plate.

302.5 Dwelling/garage opening/penetration protection. Openings and penetrations through the walls or ceilings separating the dwelling from the garage shall be in accordance with Sections 302.5.1 through 302.5.3.

302.5.1 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 $1\frac{3}{8}$ inches (35 mm) in thickness, solid or honeycomb core steel doors not less than $1\frac{3}{8}$ inches (35 mm) thick, or 20-minute fire-rated doors.

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

302.5.3 Other penetrations. Penetrations through the separation required in Section ~~309.2~~ 302.6 shall be protected as required by Section 302.11, Item 4.

302.6 Dwelling/garage fire separation. The garage shall be separated as required by Table 302.6. Openings in garage walls shall comply with Section 302.5. This provision does not apply to garage walls that are perpendicular to the adjacent dwelling unit wall.

**TABLE 302.6
DWELLING/GARAGE SEPARATION¹.**

SEPARATION	MATERIAL
From the residence and attics	Not less than ½-inch gypsum board or equivalent applied to the garage side
From all habitable rooms above the garage	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 ½-inch gypsum board or equivalent
Garages located less than 3 feet from a dwelling unit on the same lot	Not less than ½-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.

1. To determine fire resistance equivalents, refer to section 302.14

302.7 Under-stair protection. Enclosed accessible space under stairs shall have walls, under-stair surface and any soffits protected on the enclosed side with ½-inch (12.7 mm) gypsum board.

302.8 Foam plastics. For requirements for foam plastics see Section 316.

302.9 Flame spread index and smoke-developed index for wall and ceiling finishes. Flame spread and smoke index for wall and ceiling finishes shall be in accordance with Sections 302.9.1 through 302.9.4.

302.9.1 Flame spread index. Wall and ceiling finishes shall have a flame spread index of not greater than 200.

Exception: Flame spread index requirements for finishes shall not apply to trim defined as picture molds, chair rails, baseboards and handrails; to doors and windows or their frames; or to materials that are less than 1/28

inch (0.91 mm) in thickness cemented to the surface of walls or ceilings if these materials exhibit flame spread index values no greater than those of paper of this thickness cemented to a noncombustible backing.

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

302.9.3 Testing. Tests shall be made in accordance with ASTM E 84 or UL 723.

302.9.4 Alternate test method. As an alternate to having a flame-spread index of not greater than 200 and a smoke developed index of not greater than 450 when tested in accordance with ASTM E 84 or UL 723, wall and ceiling finishes, other than textiles, shall be permitted to be tested in accordance with NFPA 286. Materials tested in accordance with NFPA 286 shall meet the following criteria:

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

1. During the 40 kW exposure, flames shall not spread to the ceiling.
2. During the 160 kW exposure, the interior finish shall comply with the following:
 - 2.1 Flame shall not spread to the outer extremity of the sample on any wall or ceiling.
 - 2.2 Flashover, as defined in NFPA 286, shall not occur.
- 3 The total smoke released throughout the NFPA 286 test shall not exceed 1,000 m².

302.10 Flame spread index and smoke developed index for insulation. Flame spread and smoke developed index for insulation shall be in accordance with Sections 302.10.1 through 302.10.5.

302.10.1 Insulation. Insulation materials, including facings, such as vapor retarders and vapor-permeable membranes installed within floor-ceiling assemblies, roof-ceiling assemblies, wall assemblies, crawl spaces and attics

shall have a flame spread index not to exceed 25 with an accompanying smoke-developed index not to exceed 450 when tested in accordance with ASTM E 84 or UL 723.

Exceptions:

1. When such materials are installed in concealed spaces, the flame spread index and smoke-developed index limitations do not apply to the facings, provided that the facing is installed in substantial contact with the unexposed surface of the ceiling, floor or wall finish.
2. Cellulose loose-fill insulation, which is not spray applied, complying with the requirements of Section 302.10.3, shall only be required to meet the smoke-developed index of not more than 450.

302.10.2 Loose-fill insulation. Loose-fill insulation materials that cannot be mounted in the ASTM E 84 or UL 723 apparatus without a screen or artificial supports shall comply with the flame spread and smoke-developed limits of Section 302.10.1 when tested in accordance with CAN/ULC S102.2.

Exception: Cellulose loose-fill insulation shall not be required to be tested in accordance with CAN/ULC S102.2, provided such insulation complies with the requirements of Section 302.10.1 and Section 302.10.3.

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

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

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

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

Fireblocking shall be provided in wood-frame 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).
2. At all 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 302.7.
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 E 136 requirements.
5. For the fireblocking of chimneys and fireplaces, see Section 1003.19.
6. *In buildings or structures with more than one dwelling, fireblocking of cornices is required at the line of dwelling unit separation.*

302.11.1 Fireblocking materials. Except as provided in Section 302.11, Item 4, fireblocking shall consist of the following materials:

1. Two-inch (51 mm) nominal lumber.
2. Two thicknesses of 1-inch (25.4 mm) nominal lumber with broken lap joints.
3. One thickness of $\frac{23}{32}$ -inch (18.3 mm) wood structural panels with joints backed by $\frac{23}{32}$ -inch (18.3 mm) wood structural panels.
4. One thickness of $\frac{3}{4}$ -inch (19.1 mm) particleboard with joints backed by $\frac{3}{4}$ -inch (19.1 mm) particleboard.
5. One-half-inch (12.7 mm) gypsum board.

6. One-quarter-inch (6.4 mm) cement-based millboard.
7. Batts or blankets of mineral wool or glass fiber or other approved materials installed in such a manner as to be securely retained in place.

302.11.1.1 Batts or blankets of mineral or glass fiber. Batts or blankets of mineral or glass fiber or other approved nonrigid materials shall be permitted for compliance with the 10-foot (3048 mm) horizontal fireblocking in walls constructed using parallel rows of studs or staggered studs.

302.11.1.2 Unfaced fiberglass. Unfaced fiberglass batt insulation used as fireblocking shall fill the entire cross section of the wall cavity to a minimum height of 16 inches (406 mm) measured vertically. When piping, conduit or similar obstructions are encountered, the insulation shall be packed tightly around the obstruction.

302.11.1.3 Loose-fill insulation material. Loose-fill insulation material shall not be used as a fireblock unless specifically tested in the form and manner intended for use to demonstrate its ability to remain in place and to retard the spread of fire and hot gases.

302.11.2 Fireblocking integrity. The integrity of all fireblocks shall be maintained.

302.12 Draftstopping. In combustible construction where there is usable space both above and below the concealed space of a floor/ceiling assembly, draftstops shall be installed so that the area of the concealed space does not exceed 1,000 square feet (92.9 m²). Draftstopping shall divide the concealed space into approximately equal areas. Where the assembly is enclosed by a floor membrane above and a ceiling membrane below, draftstopping shall be provided in floor/ceiling assemblies under the following circumstances:

1. Ceiling is suspended under the floor framing.
2. Floor framing is constructed of truss-type open-web or perforated members.

302.12.1 Materials. Draftstopping materials shall not be less than ½-inch (12.7 mm) gypsum board, ¾-inch (9.5 mm) wood structural panels or other

approved materials adequately supported. Draftstopping shall be installed parallel to the floor framing members unless otherwise approved by the building official. The integrity of the draftstops shall be maintained.

302.13 Combustible insulation clearance. Combustible insulation shall be separated a minimum of 3 inches (76 mm) from recessed luminaires, fan motors and other heat-producing devices.

Exception: Where heat-producing devices are listed for lesser clearances, combustible insulation complying with the listing requirements shall be separated in accordance with the conditions stipulated in the listing.

Recessed luminaires installed in the building thermal envelope shall meet the requirements of Section 1102.4.5.

302.14 Fire resistance determination for assemblies and materials. *When this chapter requires a fire resistive assembly or component, and there is no available evidence matching the assembly or component to a rated assembly or component tested in accordance with ASTM E 119 or UL 263, the fire resistance rating of the assembly or component can be evaluated by using section 721 in the "Ohio Building Code" or "Resource A, Guidelines on Fire Ratings of Archaic Materials and Assemblies in the International Existing Buildings Code."*

When this code requires an assembly or component to serve in a fire resistive manner but the assembly or component is not required to be fire resistance rated, equivalent fire resistive values can be derived from section 721 in the "Ohio Building Code" or "Resource A, Guidelines on Fire Ratings of Archaic Materials and Assemblies in the International Existing Building Code."

SECTION 303 LIGHT, VENTILATION AND HEATING

303.1 Habitable rooms. All 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, doors, louvers or other approved openings to the outdoor air. Such openings shall be provided with ready access or shall otherwise be readily controllable by the building occupants.

The minimum openable area to the outdoors shall be 4 percent of the floor area being ventilated.

Exceptions:

1. The glazed areas need not be openable where the opening is not required by Section 310 and an approved mechanical ventilation system capable of producing 0.35 air change per hour in the room is installed or a whole-house mechanical ventilation system is installed capable of supplying outdoor ventilation air of 15 cubic feet per minute (cfm) (78 L/s) per occupant computed on the basis of two occupants for the first bedroom and one occupant for each additional bedroom.
2. The glazed areas need not be installed in rooms where Exception 1 above is satisfied and artificial light is provided 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.
3. Use of sunroom additions and patio covers, as defined in Section 202, 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.

303.2 Adjoining rooms. For the purpose of determining light and ventilation requirements, any room shall be considered as a portion of an adjoining room when at least one-half of the area of the common wall is open and unobstructed and provides an opening of not less than one-tenth of the floor area of the interior room but not less than 25 square feet (2.3 m²).

Exception: Openings required for light and/or ventilation shall be permitted to open into a thermally isolated sunroom addition or patio cover, provided that there is an openable area between the adjoining room and the sunroom addition or patio cover of not less than one-tenth of the floor area of the interior room but not less than 20 square feet (2 m²). The minimum openable area to the outdoors shall be based upon the total floor area being ventilated.

303.3 Bathrooms. Bathrooms, water closet compartments and other similar rooms shall be provided with aggregate glazing area in windows of not less than 3 square feet (0.3 m²), one-half of which must be openable.

Exception: The glazed areas shall not be required where artificial light and a mechanical ventilation system are provided. The minimum ventilation rates

shall be 50 cubic feet per minute (24 L/s) for intermittent ventilation or 20 cubic feet per minute (10 L/s) for continuous ventilation. Ventilation air from the space shall be exhausted directly to the outside.

303.4 Opening location. Outdoor intake and exhaust openings shall be located in accordance with Sections 303.4.1 and 303.4.2.

303.4.1 Intake openings. Mechanical and gravity outdoor air intake openings shall be located a minimum of 10 feet (3048 mm) from any hazardous or noxious contaminant, such as vents, chimneys, plumbing vents, streets, alleys, parking lots and loading docks, except as otherwise specified in this code. Where a source of contaminant is located within 10 feet (3048 mm) of an intake opening, such opening shall be located a minimum of 2 feet (610 mm) below the contaminant source.

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

303.4.2 Exhaust openings. Exhaust air shall not be directed onto walkways.

303.5 Outside opening protection. Air exhaust and intake openings that terminate outdoors shall be protected with corrosion-resistant screens, louvers or grilles having a minimum opening size of ¼ inch (6 mm) and a maximum opening size of ½ inch (13 mm), in any dimension. Openings shall be protected against local weather conditions. Outdoor air exhaust and intake openings shall meet the provisions for exterior wall opening protectives in accordance with this code.

303.6 Stairway illumination. All interior and exterior stairways shall be provided with a means to illuminate the stairs, including the landings and treads. Interior stairways shall be provided with an artificial light source located in the immediate vicinity of each landing of the stairway. For interior stairs the artificial light sources shall be capable of illuminating treads and landings to levels not less than 1 foot-candle (11 lux) measured at the center of treads and landings. Exterior stairways shall be provided with an artificial light source located in the immediate vicinity of the top landing of the stairway. Exterior stairways providing access to a basement from the outside grade level shall be provided with an artificial light source located in the immediate vicinity of the bottom landing of the stairway.

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

303.6.1 Light activation. Where lighting outlets are installed in interior stairways, there shall be a wall switch at each floor level to control the lighting outlet where the stairway has six or more risers. The illumination of exterior stairways shall be controlled from inside the dwelling unit.

Exception: Lights that are continuously illuminated or automatically controlled.

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

Exceptions:

1. Required glazed openings may face into a roofed porch where the porch abuts a street, yard or court and the longer side of the porch is at least 65 percent unobstructed and the ceiling height is not less than 7 feet (2134 mm).
2. Eave projections shall not be considered as obstructing the clear open space of a yard or court.
3. Required glazed openings may face into the area under a deck, balcony, bay or floor cantilever provided a clear vertical space at least 36 inches (914 mm) in height is provided.

303.7.1 Sunroom additions. Required glazed openings shall be permitted to open into sunroom additions or patio covers that abut a street, yard or court if in excess of 40 percent of the exterior sunroom walls are open, or are enclosed only by insect screening, and the ceiling height of the sun-room is not less than 7 feet (2134 mm).

303.8 Required heating. When the winter design temperature in Table 301.2(1) is below 60°F (16°C), every dwelling unit shall be provided with heating facilities capable of maintaining a minimum room temperature of 68°F (20°C) at a point 3 feet (914 mm) above the floor and 2 feet (610 mm) from exterior walls in all

habitable rooms at the design temperature. The installation of one or more portable space heaters shall not be used to achieve compliance with this section.

SECTION 304 MINIMUM ROOM AREAS

304.1 Minimum area. Every dwelling unit shall have at least one habitable room that shall have not less than 120 square feet (11 m²) of gross floor area.

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

Exception: Kitchens.

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

Exception: Kitchens.

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

SECTION 305 CEILING HEIGHT

305.1 Minimum height. Habitable space, hallways, bathrooms, toilet rooms, laundry rooms and portions of basements containing these spaces shall have a ceiling height of not less than 7 feet (2134 mm).

Exceptions:

1. For rooms with sloped ceilings, at least 50 percent of the required floor area of the room must have a ceiling height of at least 7 feet (2134 mm) and no portion of the required floor area may have a ceiling height of less than 5 feet (1524 mm).
2. Bathrooms shall have a minimum ceiling height of 6 feet 8 inches (2032 mm) at the center of the front clearance area for fixtures as shown in Figure 307.1. The ceiling height above fixtures shall be such that the fixture is capable of being used for its intended purpose. A

shower or tub equipped with a showerhead shall have a minimum ceiling height of 6 feet 8 inches (2032 mm) above a minimum area 30 inches (762 mm) by 30 inches (762 mm) at the showerhead.

305.1.1 Basements. Portions of basements that do not contain habitable space, hallways, bathrooms, toilet rooms and laundry rooms shall have a ceiling height of not less than 6 feet 8 inches (2032 mm).

Exceptions:

1. Beams, girders, ducts or other obstructions may project to within 6 feet 4 inches (1931 mm) of the finished floor.
2. *Habitable spaces created in existing basements shall be permitted to have ceiling heights of not less than 6 feet 8 inches (2032 mm). Obstructions may project to within 6 feet, 4 inches of the basement floor.*

**SECTION 306
SANITATION**

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

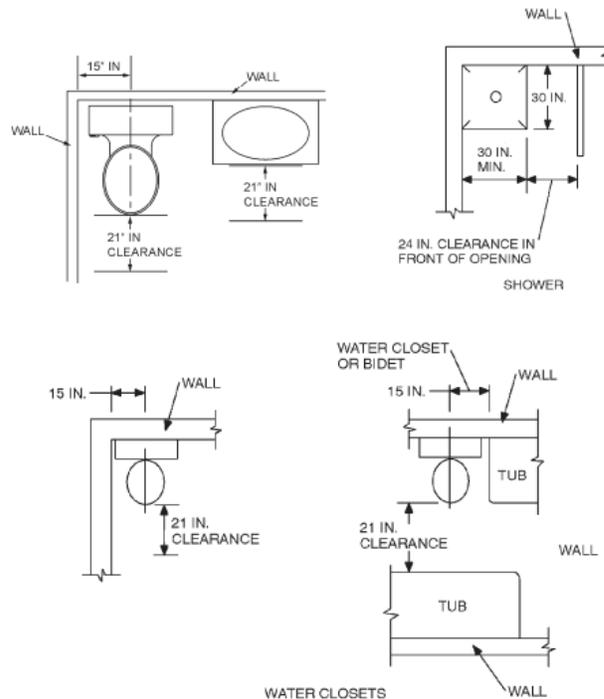
306.2 Kitchen. Each dwelling unit shall be provided with a kitchen area and every kitchen area shall be provided with a sink.

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

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

SECTION 307 TOILET, BATH AND SHOWER SPACES

307.1 Space required. Fixtures shall be spaced in accordance with Figure 307.1, and in accordance with the requirements of *the plumbing code*.



For SI: 1 inch = 25.4 mm.

**FIGURE 307.1
MINIMUM FIXTURE CLEARANCES**

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

SECTION 308 GLAZING

308.1 Identification. Except as indicated in Section 308.1.1 each pane of glazing installed in hazardous locations as defined in Section 308.4 shall be provided with a manufacturer's designation specifying who applied the designation, designating the type of glass and the safety glazing standard with which it complies, which is

visible in the final installation. The designation shall be acid etched, sandblasted, ceramic-fired, laser etched, embossed, or be of a type which once applied cannot be removed without being destroyed. A label shall be permitted in lieu of the manufacturer's designation.

Exceptions:

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

308.1.1 Identification of multiple assemblies. Multipane assemblies having individual panes not exceeding 1 square foot (0.09 m²) in exposed area shall have at least one pane in the assembly identified in accordance with Section 308.1. All other panes in the assembly shall be labeled "CPSC 16 CFR 1201" or "ANSI Z97.1" as appropriate.

308.2 Louvered windows or jalousies. Regular, float, wired or patterned glass in jalousies and louvered windows shall be no thinner than nominal ³/₁₆ inch (5 mm) and no longer than 48 inches (1219 mm). Exposed glass edges shall be smooth.

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

308.3 Human impact loads. Individual glazed areas, including glass mirrors in hazardous locations such as those indicated as defined in Section 308.4, shall pass the test requirements of Section 308.3.1.

Exceptions:

1. Louvered windows and jalousies shall comply with Section 308.2.
2. Mirrors and other glass panels mounted or hung on a surface that provides a continuous backing support.
3. Glass unit masonry complying with Section 610.

308.3.1 Impact test. Where required by other sections of the code, glazing shall be tested in accordance with CPSC 16 CFR 1201. Glazing shall comply with the test criteria for Category I or II as indicated in Table 308.3.1(1).

Exception: Glazing not in doors or enclosures for hot tubs, whirlpools, saunas, steam rooms, bathtubs and showers shall be permitted to be tested in accordance with ANSI Z97.1. Glazing shall comply with the test criteria for Class A or B as indicated in Table 308.3.1(2).

**TABLE 308.3.1(1)
MINIMUM CATEGORY CLASSIFICATION OF GLAZING USING CPSC 16 CFR 1201**

EXPOSED SURFACE AREA OF ONE SIDE OF ONE LITE	GLAZING IN STORM OR COMBINATION DOORS (Category Class)	GLAZING IN DOORS (Category Class)	GLAZED PANELS REGULATED BY ITEM 7 <u>3</u> OF SECTION 308.4 (Category Class)	GLAZED PANELS REGULATED BY ITEM 6 <u>2</u> OF SECTION 308.4 (Category Class)	GLAZING IN DOORS AND ENCLOSURES REGULATED BY ITEM 5 OF SECTION 308.4 (Category Class)	SLIDING GLASS DOORS PATIO TYPE (Category Class)
9 square feet or less	I	I	NR	I	II	II
More than 9 square feet	II	II	II	II	II	II

For SI: 1 square foot = 0.0929 m².
NR means "No Requirement."

**TABLE 308.3.1(2)
MINIMUM CATEGORY CLASSIFICATION OF GLAZING USING ANSI Z97.1**

EXPOSED SURFACE AREA OF ONE SIDE OF ONE LITE	GLAZED PANELS REGULATED BY ITEM 7 <u>3</u> OF SECTION 308.4 (Category Class)	GLAZED PANELS REGULATED BY ITEM 6 <u>2</u> OF SECTION 308.4 (Category Class)	DOORS AND ENCLOSURES REGULATED BY ITEM 5 OF SECTION 308.4* (Category Class)
9 square feet or less	No requirement	B	A
More than 9 square feet	A	A	A

For SI: 1 square foot = 0.0929 m².

a. Use is permitted only by the exception to Section 308.3.1.

308.4 Hazardous locations. The following shall be considered specific hazardous locations for the purposes of glazing:

1. Glazing in all fixed and operable panels of swinging, sliding and bifold doors.

Exceptions:

1. Glazed openings of a size through which a 3-inch diameter (76 mm) sphere is unable to pass.
2. Decorative glazing.

2. Glazing in an individual fixed or operable panel adjacent to a door where the nearest vertical edge is within a 24-inch (610 mm) arc of the door in a closed position and whose bottom edge is less than 60 inches (1524 mm) above the floor or walking surface.

Exceptions:

1. Decorative glazing.
 2. When there is an intervening wall or other permanent barrier between the door and the glazing.
 3. Glazing in walls on the latch side of and perpendicular to the plane of the door in a closed position.
 4. Glazing adjacent to a door where access through the door is to a closet or storage area 3 feet (914 mm) or less in depth.
 5. Glazing that is adjacent to the fixed panel of patio doors.
3. Glazing in an individual fixed or operable panel that meets all of the following conditions:
 - 3.1 The exposed area of an individual pane is larger than 9 square feet (0.836 m²); and
 - 3.2 The bottom edge of the glazing is less than 18 inches (457 mm) above the floor; and
 - 3.3 The top edge of the glazing is more than 36 inches (914 mm) above the floor; and
 - 3.4 One or more walking surfaces are within 36 inches (914 mm), measured horizontally and in a straight line, of the glazing.

Exceptions:

1. Decorative glazing.

2. When a horizontal rail is installed on the accessible side(s) of the glazing 34 to 38 inches (864 to 965) 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 be a minimum of 1½ inches (38 mm) in cross sectional height.
3. Outboard panes in insulating glass units and other multiple glazed panels when the bottom edge of the glass is 25 feet (7620 mm) or more above grade, a roof, walking surfaces or other horizontal [within 45 degrees (0.79 rad) of horizontal] surface adjacent to the glass exterior.
4. All glazing in railings regardless of area or height above a walking surface. Included are structural baluster panels and nonstructural infill panels.
5. Glazing in enclosures for or walls facing hot tubs, whirlpools, saunas, steam rooms, bathtubs and showers where the bottom exposed edge of the glazing is less than 60 inches (1524 mm) measured vertically above any standing or walking surface.

Exception: Glazing that is more than 60 inches (1524 mm), measured horizontally and in a straight line, from the waters edge of a hot tub, whirlpool or bathtub.

6. Glazing in walls and fences adjacent to indoor and outdoor swimming pools, hot tubs and spas where the bottom edge of the glazing is less than 60 inches (1524 mm) above a walking surface and within 60 inches (1524 mm), measured horizontally and in a straight line, of the water's edge. This shall apply to single glazing and all panes in multiple glazing.
7. Glazing adjacent to stairways, landings and ramps within 36 inches (914 mm) horizontally of a walking surface when the exposed surface of the glazing is less than 60 inches (1524 mm) above the plane of the adjacent walking surface.

Exceptions:

1. When a rail is installed on the accessible side(s) of the glazing 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 be a minimum of 1½ inches (38 mm) in cross sectional height.

2. The side of the stairway has a guardrail or handrail, including balusters or in-fill panels, complying with Sections ~~311.7.6~~ 311.7.7 and 312 and the plane of the glazing is more than 18 inches (457 mm) from the railing; or
 3. When a solid wall or panel extends from the plane of the adjacent walking surface to 34 inches (863 mm) to 36 inches (914 mm) above the walking surface and the construction at the top of that wall or panel is capable of withstanding the same horizontal load as a guard.
8. Glazing adjacent to stairways within 60 inches (1524 mm) horizontally of the bottom tread of a stairway in any direction when the exposed surface of the glazing is less than 60 inches (1524 mm) above the nose of the tread.

Exceptions:

1. The side of the stairway has a guardrail or handrail, including balusters or in-fill panels, complying with Sections ~~311.7.6~~ 311.7.7 and 312 and the plane of the glass is more than 18 inches (457 mm) from the railing; or
2. When a solid wall or panel extends from the plane of the adjacent walking surface to 34 inches (864 mm) to 36 inches (914 mm) above the walking surface and the construction at the top of that wall or panel is capable of withstanding the same horizontal load as a guard.

308.5 Site built windows. Site built windows shall comply with Section 2404 of the *Ohio* Building Code.

308.6 Skylights and sloped glazing. Skylights and sloped glazing shall comply with the following sections.

308.6.1 Definitions.

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

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

308.6.2 Permitted materials. The following types of glazing may be used:

1. Laminated glass with a minimum 0.015-inch (0.38 mm) polyvinyl butyral interlayer for glass panes 16 square feet (1.5 m²) or less in area located such that the highest point of the glass is not more than 12 feet (3658 mm) above a walking surface or other accessible area; for higher or larger sizes, the minimum interlayer thickness shall be 0.030 inch (0.76 mm).
2. Fully tempered glass.
3. Heat-strengthened glass.
4. Wired glass.
5. Approved rigid plastics.

308.6.3 Screens, general. For fully tempered or heat-strengthened glass, a retaining screen meeting the requirements of Section 308.6.7 shall be installed below the glass, except for fully tempered glass that meets either condition listed in Section 308.6.5.

308.6.4 Screens with multiple glazing. When the inboard pane is fully tempered, heat-strengthened or wired glass, a retaining screen meeting the requirements of Section 308.6.7 shall be installed below the glass, except for either condition listed in Section 308.6.5. All other panes in the multiple glazing may be of any type listed in Section 308.6.2.

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

1. Glass area 16 square feet (1.49 m²) or less. Highest point of glass not more than 12 feet (3658 mm) above a walking surface or other accessible area, nominal glass thickness not more than ³/₁₆ inch (4.8 mm), and (for multiple glazing only) the other pane or panes fully tempered, laminated or wired glass.
2. Glass area greater than 16 square feet (1.49 m²). Glass sloped 30 degrees (0.52 rad) or less from vertical, and highest point of glass not more than 10 feet (3048 mm) above a walking surface or other accessible area.

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

308.6.7 Screen characteristics. The screen and its fastenings shall be capable of supporting twice the weight of the glazing, be firmly and substantially fastened to the framing members, and have a mesh opening of no more than 1 inch by 1 inch (25 mm by 25 mm).

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

308.6.9 Testing and labeling. Unit skylights shall be tested by an approved independent laboratory, and bear a label identifying manufacturer, performance grade rating and approved inspection agency to indicate compliance with the requirements of AAMA/WDMA/CSA 101/I.S.2/A440.

SECTION 309 GARAGES AND CARPORTS

309.1 Floor surface. Garage floor surfaces shall be of approved noncombustible material.

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

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

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

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

309.3 Flood hazard areas. For buildings located in flood hazard areas as established by Table 301.2(1), garage floors shall be:

1. Elevated to or above the design flood elevation as determined in Section 322; or
2. Located below the design flood elevation provided they are at or above grade on at least one side, are used solely for parking, building access or storage, meet the requirements of Section 322 and are otherwise constructed in accordance with this code.

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

SECTION 310 EMERGENCY ESCAPE AND RESCUE OPENINGS

310.1 Emergency escape and rescue required. Every sleeping room shall have at least one operable emergency escape and rescue opening. Where emergency escape and rescue openings are provided they shall have a sill height of not more than 44 inches (1118 mm) above the floor. Where a door opening having a threshold below the adjacent ground elevation serves as an emergency escape and rescue opening and is provided with a bulkhead enclosure, the bulkhead enclosure shall comply with Section 310.3. The net clear opening dimensions required by this section shall be obtained by the normal operation of the emergency escape

and rescue opening from the inside. Emergency escape and rescue openings with a finished sill height below the adjacent ground elevation shall be provided with a window well in accordance with Section 310.2.

310.1.1 Minimum opening area. All emergency escape and rescue openings shall have a minimum net clear opening of 5.7 square feet (0.530 m²).

Exception: Grade floor openings shall have a minimum net clear opening of 5 square feet (0.465 m²).

310.1.2 Minimum opening height. The minimum net clear opening height shall be 24 inches (610 mm).

310.1.3 Minimum opening width. The minimum net clear opening width shall be 20 inches (508 mm).

310.1.4 Operational constraints. Emergency escape and rescue openings shall be operational from the inside of the room without the use of keys, tools or special knowledge.

310.1.5. Replacement windows. *Replacement windows installed in accordance with Section 113.6.1 shall not be required to comply with sections 310.1.1 through 310.1.3.*

310.2 Window wells. The minimum horizontal area of the window well shall be 9 square feet (0.9 m²), with a minimum horizontal projection and width of 36 inches (914 mm). The area of the window well shall allow the emergency escape and rescue opening to be fully opened.

Exception: The ladder or steps required by Section 310.2.1 shall be permitted to encroach a maximum of 6 inches (152 mm) into the required dimensions of the window well.

310.2.1 Ladder and steps. Window wells with a vertical depth greater than 44 inches (1118 mm) shall be equipped with a permanently affixed ladder or steps usable with the window in the fully open position. Ladders or steps required by this section shall not be required to comply with Sections 311.7 and 311.8. Ladders or rungs shall have an inside width of at least 12 inches (305 mm), shall project at least 3 inches (76 mm) from the wall and shall be spaced not more than 18 inches (457 mm) on center vertically for the full height of the window well.

310.3 Bulkhead enclosures. Bulkhead enclosures shall provide direct access to the basement. The bulkhead enclosure with the door panels in the fully open position shall provide the minimum net clear opening required by Section 310.1.1. Bulkhead enclosures shall also comply with Section ~~311.7.8.2~~ 311.7.9.2.

310.4 Bars, grilles, covers and screens. Bars, grilles, covers, screens or similar devices are permitted to be placed over emergency escape and rescue openings, bulkhead enclosures, or window wells that serve such openings, provided the minimum net clear opening size complies with Sections 310.1.1 to 310.1.3, and such devices shall be releasable or removable from the inside without the use of a key, tool, special knowledge or force greater than that which is required for normal operation of the escape and rescue opening.

310.5 Emergency escape windows under decks and porches. Emergency escape windows are allowed to be installed under decks and porches provided the location of the deck allows the emergency escape window to be fully opened and provides a path not less than 36 inches (914 mm) in height to a yard or court.

SECTION 311 MEANS OF EGRESS

311.1 Means of egress. All dwellings shall be provided with a means of egress as provided in 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 to the exterior of the dwelling at the required egress door without requiring travel through a garage.

311.2 Egress door. At least one egress door shall be provided for each dwelling unit. The egress door shall be side-hinged, and shall provide a minimum clear width of 32 inches (813 mm) when measured between the face of the door and the stop, with the door open 90 degrees (1.57 rad). The minimum clear height of the door opening shall not be 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 without the use of a key or special knowledge or effort.

311.2.1 Garage access doors. Garages shall be served by at least one side-hinged door not less than 2 feet 6 inches (760 mm) in width and 6 feet 8

inches (2032 mm) in height. Such door located between a dwelling and an attached garage shall be acceptable for meeting this requirement.

311.3 Floors and landings at exterior doors. There shall be a landing or floor on each side of each exterior door. The width of each landing shall not be less than the door served. Every landing shall have a minimum dimension of 36 inches (914 mm) measured in the direction of travel. Exterior landings shall be permitted to have a slope not to exceed $\frac{1}{4}$ unit vertical in 12 units horizontal (2-percent).

Exception: Exterior balconies less than 60 square feet (5.6 m²) and only accessible from a door are permitted to have a landing less than 36 inches (914 mm) measured in the direction of travel.

311.3.1 Floor elevations at the required egress doors. Landings or floors at the required egress door shall not be more than 1½ inches (38 mm) lower than the top of the threshold.

Exception: The exterior landing or floor shall not be more than 8 $\frac{1}{4}$ inches (196 mm) below the top of the threshold provided the door does not swing over the landing or floor.

When exterior landings or floors serving the required egress door are not at grade, they shall be provided with access to grade by means of a ramp in accordance with Section 311.8 or a stairway in accordance with Section 311.7.

311.3.2 Floor elevations for other exterior doors. Doors other than the required egress door shall be provided with landings or floors not more than 8 $\frac{1}{4}$ inches (196 mm) below the top of the threshold.

Exception: A landing is not required where a stairway of two or fewer risers is located on the exterior side of the door, provided the door does not swing over the stairway.

311.3.3 Storm and screen doors. Storm and screen doors shall be permitted to swing over all exterior stairs and landings.

311.4 Vertical egress. Egress from *finished* levels including attics and basements not provided with an egress door in accordance with Section 311.2 shall be by a ramp in accordance with Section 311.8 or a stairway in accordance with Section 311.7.

311.5 Construction.

311.5.1 Attachment. Exterior landings, decks, balconies, stairs and similar facilities shall be positively anchored to the primary structure to resist both vertical and lateral forces or shall be designed to be self-supporting. Attachment shall not be accomplished by use of toenails or nails subject to withdrawal.

311.6 Hallways. The minimum width of a hallway shall be not less than 3 feet (914 mm).

311.7 Stairways.

311.7.1 Width. Stairways shall not be less than 36 inches (914 mm) in clear width at all points above the permitted handrail height and below the required headroom height. Handrails shall not project more than 4.5 inches (114 mm) on either side of the stairway and the minimum clear width of the stairway at and below the handrail height, including treads and landings, shall not be less than 31½ inches (787 mm) where a handrail is installed on one side and 27 inches (698 mm) where handrails are provided on both sides.

Exception: The width of spiral stairways shall be in accordance with Section 311.7.9.1.

311.7.2 Headroom. The minimum headroom in all parts of the stairway shall not be less than 6 feet 8 inches (2032 mm) measured vertically from the sloped line adjoining the tread nosing or from the floor surface of the landing or platform on that portion of the stairway.

Exception: Where the nosings of treads at the side of a flight extend under the edge of a floor opening through which the stair passes, the floor opening shall be allowed to project horizontally into the required headroom a maximum of 4¾ inches (121 mm).

311.7.3 Walkline. 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.

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

311.7.4.1 Riser height. The maximum riser height shall be $8 \frac{1}{4}$ inches (196 mm). The riser shall be measured vertically between leading edges of the adjacent treads. The greatest riser height within any flight of stairs shall not exceed the smallest by more than $\frac{3}{8}$ inch (9.5 mm).

311.7.4.2 Tread depth. The minimum tread depth shall be 9 inches (254 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 $\frac{3}{8}$ inch (9.5 mm). Consistently shaped winders at the walkline shall be allowed within the same flight of stairs as rectangular treads and do not have to be within $\frac{3}{8}$ inch (9.5 mm) of the rectangular tread depth.

Winder treads shall have a minimum tread depth of $9 \frac{1}{4}$ inches (254 mm) measured between the vertical planes of the foremost projection of adjacent treads at the intersections with the walkline. Winder treads shall have a minimum tread depth of 6 inches (152 mm) at any point within the clear width of the stair. Within any flight of stairs, the largest winder tread depth at the walkline shall not exceed the smallest winder tread by more than $\frac{3}{8}$ inch (9.5 mm).

311.7.4.3 Profile. The radius of curvature at the nosing shall be no greater than $\frac{9}{16}$ inch (14 mm). A nosing not less than $\frac{3}{4}$ inch (19 mm) but not more than $1 \frac{1}{4}$ inches (32 mm) shall be provided on stairways with solid risers. The greatest nosing projection shall not exceed the smallest nosing projection by more than $\frac{3}{8}$ inch (9.5 mm) between two stories, including the nosing at the level of floors and landings. Beveling of nosings shall not exceed $\frac{1}{2}$ inch (12.7 mm). Risers shall be vertical or sloped under the tread above from the underside of the nosing above at an angle not more than 30 degrees (0.51 rad) from the vertical. Open risers are permitted, provided that the opening between treads does not permit the passage of a 4-inch diameter (102 mm) sphere.

Exceptions:

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

311.7.4.4 Exterior wood/plastic composite stair treads. Wood/plastic composite stair treads shall comply with the provisions of Section 317.4.

311.7.5 Landings for stairways. 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 (3658 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 a door does not swing over the stairs. ~~A flight of stairs shall not have a vertical rise larger than 12 feet (3658 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.~~

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

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

311.7.7.1 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 shall be allowed over the lowest tread.

2. When handrail fittings or bendings are used to provide continuous transition between flights, the transition from handrail to guardrail, or used at the start of a flight, the handrail height at the fittings or bendings shall be permitted to exceed the maximum height.

311.7.7.2 Continuity. Handrails for stairways shall be continuous for the full length of the flight, from a point directly above the top riser of the flight to a point directly above the lowest riser of the flight. Handrail ends shall be returned or shall terminate in newel posts or safety terminals. Handrails adjacent to a wall shall have a space of not less than 1½ inch (38 mm) between the wall and the handrails.

Exceptions:

1. Handrails shall be permitted to be interrupted by a newel post at the turn.
2. The use of a volute, turnout, starting easing or starting newel shall be allowed over the lowest tread.
3. *Two or more separate rails shall be considered continuous if the termination of the rails ~~occurs~~ occurs over a single tread and positioned within 4 inches of each other. If the transition occurs between a wall mounted handrail and handrail/guardrail combination, the wall mounted handrail shall return into the wall.*

311.7.7.3 Grip-size. All required handrails shall be of one of the following types or provide equivalent graspability.

1. Type I. Handrails with a circular cross section shall have an outside diameter of at least 1¼ inches (32 mm) and not greater than 2 inches (51 mm). If the handrail is not circular, it shall have a perimeter dimension of at least 4 inches (102 mm) and not greater than 6¼ inches (160 mm) with a maximum cross section of dimension of 2¼ inches (57 mm). Edges shall have a minimum radius of 0.01 inch (0.25 mm).
2. Type II. Handrails with a perimeter greater than 6¼ inches (160 mm) shall have a graspable finger recess area on both sides of the

profile. The finger recess shall begin within a distance of $\frac{3}{4}$ inch (19 mm) measured vertically from the tallest portion of the profile and achieve a depth of at least $\frac{5}{16}$ inch (8 mm) within $\frac{7}{8}$ inch (22 mm) below the widest portion of the profile. This required depth shall continue for at least $\frac{3}{8}$ inch (10 mm) to a level that is not less than $1\frac{3}{4}$ inches (45 mm) below the tallest portion of the profile. The minimum width of the handrail above the recess shall be $1\frac{1}{4}$ inches (32 mm) to a maximum of $2\frac{3}{4}$ inches (70 mm). Edges shall have a minimum radius of 0.01 inch (0.25 mm).

311.7.7.4 Exterior wood/plastic composite handrails. Wood/plastic composite handrails shall comply with the provisions of Section 317.4.

311.7.8 Illumination. All stairs shall be provided with illumination in accordance with Section 303.6.

311.7.9 Special stairways. Spiral stairways and bulkhead enclosure stairways shall comply with all requirements of Section 311.7 except as specified below.

311.7.9.1 Spiral stairways. Spiral stairways are permitted, provided the minimum clear width at and below the handrail shall be 26 inches (660 mm) with each tread having a $7\frac{1}{2}$ -inch (190 mm) minimum tread depth at 12 inches (914 mm) from the narrower edge. All treads shall be identical, and the rise shall be no more than $9\frac{1}{2}$ inches (241 mm). A minimum headroom of 6 feet 6 inches (1982 mm) shall be provided.

311.7.9.2 Bulkhead enclosure stairways. Stairways serving bulkhead enclosures, not part of the required building egress, providing access from the outside grade level to the basement shall be exempt from the requirements of Sections 311.3 and 311.7 where the maximum height from the basement finished floor level to grade adjacent to the stairway does not exceed 8 feet (2438 mm) and the grade level opening to the stairway is covered by a bulkhead enclosure with hinged doors or other approved means.

311.8 Ramps.

311.8.1 Maximum slope. Ramps shall have a maximum slope of 1 unit vertical in 8 units horizontal (*12.5 percent slope*).

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

1. At the top and bottom of ramps.
2. Where doors open onto ramps.
3. Where ramps change direction.

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

311.8.3.1 Height. Handrail height, measured above the finished surface of the ramp slope, shall be not less than 34 inches (864 mm) and not more than 38 inches (965 mm).

311.8.3.2 Grip size. Handrails on ramps shall comply with Section 311.7.7.3.

311.8.3.3 Continuity. Handrails where required on ramps shall be continuous for the full length of the ramp. Handrail ends shall be returned or shall terminate in newel posts or safety terminals. Handrails adjacent to a wall shall have a space of not less than 1½ inches (38 mm) between the wall and the handrails.

SECTION 312 GUARDS

312.1 Where required. Guards shall be located along open-sided walking surfaces, including stairs, ramps and landings, that are located more than 30 inches (762 mm) measured vertically to the floor or grade below at any point within 36 inches (914 mm) horizontally to the edge of the open side. Insect screening shall not be considered as a guard.

Exception: Guards are not required where a protective bar is installed 34 inches to 38 inches (864 mm to 965 mm) above the porch or deck on the interior side of the screening. The protective bar shall be capable of resisting a horizontal load of 50 pounds per lineal foot (730 N/m) without contacting the screen and be a minimum of 1½ inches (38 mm) in height.

312.2 Height. Required guards at open-sided walking surfaces, including stairs, porches, balconies or landings, shall be not less than 36 inches (914 mm) high measured vertically above the adjacent walking surface, adjacent fixed seating or the line connecting the leading edges of the treads.

Exceptions:

1. Guards on the open sides of stairs shall have a height not less than 34 inches (864 mm) measured vertically from a line connecting the leading edges of the treads.
2. Where the top of the guard also serves as a handrail on the open sides of stairs, the top of the guard shall not be not less than 34 inches (864 mm) and not more than 38 inches (965 mm) measured vertically from a line connecting the leading edges of the treads.

312.3 Opening limitations. Required guards shall not have openings from the walking surface to the required guard height which allow passage of a sphere 4 inches (102 mm) in diameter.

Exceptions:

1. The triangular openings at the open side of a stair, formed by the riser, tread and bottom rail of a guard, shall not allow passage of a sphere 6 inches (153 mm) in diameter.
2. Guards on the open sides of stairs shall not have openings which allow passage of a sphere $4\frac{3}{8}$ inches (111 mm) in diameter.

312.4 Exterior woodplastic composite guards. Woodplastic composite guards shall comply with the provisions of Section 317.4.

SECTION 313 AUTOMATIC FIRE SPRINKLER SYSTEMS

313.1 Townhouse automatic fire sprinkler systems. An automatic residential fire sprinkler system *is not required to be installed in townhouses or other R-3 occupancy designs using this code.*

313.1.1 Design and installation for non-required systems. *When a non-required automatic residential fire sprinkler system is intended to be installed*

within a townhouse or a dwelling in another R-3 occupancy using this code, the system shall be designed and installed in accordance with Section 2904, NFPA 13, NFPA 13R or NFPA 13D as referenced in Chapter 44 of this code.

313.2 One-, two- and three-family dwellings automatic fire systems. *An automatic residential fire sprinkler system is not required to be installed in one-, two-, or three-family dwellings.*

313.2.1 Design and installation for non-required systems. *When an automatic residential fire sprinkler systems is intended to be installed, it shall be designed and installed in accordance with Section 2904, NFPA 13, NFPA 13R or NFPA 13D as referenced in Chapter 44 of this code.*

313.3 Design and installation of non-required fire sprinkler systems. *Any full or partial fire sprinkler system not required by this code shall be permitted to be installed for partial or complete protection provided that such system meets the requirements of this code to the extent of the intended installation.*

SECTION 314 SMOKE ALARMS

314.1 Smoke detection and notification. All smoke alarms shall be listed in accordance with UL 217 and installed in accordance with the provisions of this code and the household fire warning equipment provisions of NFPA 72.

314.2 Smoke detection systems. Household fire alarm systems installed in accordance with NFPA 72 that include smoke alarms, or a combination of smoke detector and audible notification device installed as required by this section for smoke alarms, shall be permitted. The household fire alarm system shall provide the same level of smoke detection and alarm as required by this section for smoke alarms. Where a household fire warning system is installed using a combination of smoke detector and audible notification device(s), it shall become a permanent fixture of the occupancy and owned by the homeowner. The system shall be maintained in accordance with NFPA 72.

Exception: Where smoke alarms are provided meeting the requirements of Section 314.4.

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

1. In each sleeping room.
2. Outside each separate sleeping area, such as in the corridors in the immediate vicinity of the *sleeping rooms*.
3. On each additional story of the dwelling, including basements and habitable attics but not including crawl spaces and uninhabitable attics. In dwellings or dwelling units with split levels and without an intervening door between the adjacent levels, a smoke alarm installed on the upper level shall suffice for the adjacent lower level provided that the lower level is less than one full story below the upper level.

~~When more than one smoke alarm is required to be installed within an individual dwelling unit the alarm devices shall be interconnected in such a manner that the actuation of one alarm will activate all of the alarms in the individual unit.~~

~~**314.3.1 Alterations, repairs and additions.** When alterations, repairs or additions requiring *an approval* are made to the spaces described in items 1 and 2 of Section 314.3, smoke alarms shall be provided in those spaces as required for a new dwelling. When one or more sleeping rooms are added or created in existing dwellings, the *new sleeping rooms and the immediate vicinity outside each sleeping room* shall be equipped with smoke alarms 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 are exempt from the requirements of this section.~~
- ~~2. Installation or alteration of plumbing or mechanical systems are exempt from the requirements of this section.~~

314.3.1 New dwelling units. In new dwelling units, smoke alarms are required to be installed in the locations described in Section 314.3.

314.3.2 Existing dwelling units. Smoke alarms shall be provided in existing buildings as follows:

1. When alterations or repairs requiring an approval are made to the spaces described in item 1 or 2 of Section 314.3, smoke alarms shall be provided in those spaces as required for a new dwelling.

2. When one or more sleeping rooms are added or created in existing dwellings, the new sleeping rooms and the immediate vicinity outside each sleeping room shall be equipped with smoke alarms as required for new dwellings.

~~**314.4 Power source.** Smoke alarms shall receive their primary power from the building wiring when such wiring is served from a commercial source, and when primary power is interrupted, shall receive power from a battery. Wiring shall be permanent and without a disconnecting switch other than those required for overcurrent protection. Smoke alarms shall be interconnected.~~

314.4 Power source. Required smoke alarms shall receive their primary power from the building wiring when such wiring is served from a commercial source for the following conditions:

1. In new dwelling units.

2. In existing dwelling units where there is an attic, crawl space, or basement available which could provide access for hard-wiring.

3. In existing dwelling units where the existing interior finishes are removed, exposing the structure.

Exceptions:

1. Smoke alarms shall be permitted to be battery operated when installed in buildings without commercial power.

2. ~~Interconnection and hard~~ Hard-wiring of new smoke alarms installed in existing finished areas shall not be required where the alterations or repairs do not result in there is not access to an attic, crawl space, or basement, as described above, and where the removal of interior wall or ceiling finishes exposing the structure, unless there is an attic, crawl space or basement available which could provide access for hard wiring and interconnection without the removal of interior finishes is not otherwise proposed. Listed conventional battery operated smoke alarms or listed battery operated low-power radio (wireless) alarms are permitted to be installed in these existing finished areas.

314.5 Interconnection. Where more than one smoke alarm is required to be installed within an individual dwelling unit in accordance with Section 314.3, the

alarm devices shall be interconnected in such a manner that the actuation of one alarm will activate all of the alarms in the individual dwelling unit. Physical interconnection of smoke alarms shall not be required where listed low-power radio (wireless) alarms are installed and all alarms sound upon activation of one alarm.

Exception: Interconnection of smoke alarms in existing areas shall not be required where alterations or repairs do not result in removal of interior wall or ceiling finishes exposing the structure, unless there is an attic, crawl space or basement available which could provide access for interconnection without the removal of interior finishes.

SECTION 315 CARBON MONOXIDE ALARMS

~~**315.1 Carbon monoxide alarms.** For new construction, an approved carbon monoxide alarm shall be installed outside of each separate sleeping area in the immediate vicinity of the bedrooms in dwelling units within which fuel-fired appliances are installed and in dwelling units that have attached garages.~~

315.1 When required. Carbon monoxide alarms are required to be installed only in new and existing dwelling units having fuel-fired appliances or having attached garages and only when any of the conditions described in this section apply.

315.1.1 New dwelling units. In new dwelling units, carbon monoxide alarms are required to be installed in the locations described in Section 315.2.

315.1.2 Existing dwelling units. In existing dwelling units, where an application for approval is required for work involving any of the following areas or systems within that dwelling unit, carbon monoxide alarms are required to be installed in the locations described in Section 315.2.

1. The addition or creation of a new sleeping room;
2. An alteration of a sleeping room;
3. An alteration in the immediate vicinity outside of a sleeping room;
4. An addition of, or an alteration to, an attached garage;
5. An addition, alteration, repair or replacement of a fuel-fired appliance.

315.2 Where required. ~~Where work requiring a permit occurs in existing dwellings that have attached garages or in existing dwellings within which fuel-fired appliances exist, carbon monoxide alarms shall be provided in accordance with Section 315.1. In new dwelling units and in existing dwelling units meeting any of the conditions described in Section 315.1.2, an approved carbon monoxide alarm shall be installed outside of each separate sleeping area in the immediate vicinity of the sleeping rooms in those dwelling units.~~

315.3 Alarm requirements. Single station carbon monoxide alarms shall be listed as complying with UL 2034 and shall be installed in accordance with this code and the manufacturer's installation instructions.

SECTION 316 FOAM PLASTIC

316.1 General. The provisions of this section shall govern the materials, design, application, construction and installation of foam plastic materials.

316.2 Labeling and identification. Packages and containers of foam plastic insulation and foam plastic insulation components delivered to the job site shall bear the label of an approved agency showing the manufacturer's name, the product listing, product identification and information sufficient to determine that the end use will comply with the requirements.

316.3 Surface burning characteristics. Unless otherwise allowed in Section 316.5 or 316.6, all foam plastic or foam plastic cores used as a component in manufactured assemblies used in building construction shall have a flame spread index of not more than 75 and shall have a smoke-developed index of not more than 450 when tested in the maximum thickness intended for use in accordance with ASTM E 84 or UL 723. Loose-fill type foam plastic insulation shall be tested as board stock for the flame spread index and smoke-developed index.

Exception: Foam plastic insulation more than 4 inches (102 mm) thick shall have a maximum flame spread index of 75 and a smoke-developed index of 450 where tested at a minimum thickness of 4 inches (102 mm), provided the end use is approved in accordance with Section 316.6 using the thickness and density intended for use.

316.4 Thermal barrier. Unless otherwise allowed in Section 316.5 or Section 316.6, foam plastic shall be separated from the interior of a building by an approved thermal barrier of minimum ½ inch (12.7 mm) gypsum wallboard or an

approved finish material equivalent to a thermal barrier material that will limit the average temperature rise of the unexposed surface to no more than 250°F (139°C) after 15 minutes of fire exposure complying with the ASTM E 119 or UL 263 standard time temperature curve. The thermal barrier shall be installed in such a manner that it will remain in place for 15 minutes based on NFPA 286 with the acceptance criteria of Section 302.9.4, FM 4880, UL 1040 or UL 1715.

316.5 Specific requirements. The following requirements shall apply to these uses of foam plastic unless specifically approved in accordance with Section 316.6 or by other sections of the code or the requirements of Sections 316.2 through 316.4 have been met.

316.5.1 Masonry or concrete construction. The thermal barrier specified in Section 316.4 is not required in a masonry or concrete wall, floor or roof when the foam plastic insulation is separated from the interior of the building by a minimum 1-inch (25 mm) thickness of masonry or concrete.

316.5.2 Roofing. The thermal barrier specified in Section 316.4 is not required when the foam plastic in a roof assembly or under a roof covering is installed in accordance with the code and the manufacturer's installation instructions and is separated from the interior of the building by tongue-and-groove wood planks or wood structural panel sheathing in accordance with Section 803, not less than $1\frac{5}{32}$ inch (11.9 mm) thick bonded with exterior glue and identified as Exposure 1, 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.

316.5.3 Attics. The thermal barrier specified in Section 316.4 is not required where all of the following apply:

1. Attic access is required by Section 807.1.
2. The space is entered only for purposes of maintenance.
3. The foam plastic insulation is protected against ignition using one of the following ignition barrier materials:
 - 3.1. 1½-inch-thick (38 mm) mineral fiber insulation;
 - 3.2. ¼-inch-thick (6.4 mm) wood structural panels;

- 3.3. $\frac{3}{8}$ -inch (9.5 mm) particleboard;
- 3.4. $\frac{1}{4}$ -inch (6.4 mm) hardboard;
- 3.5. $\frac{3}{8}$ -inch (9.5 mm) gypsum board; or
- 3.6. Corrosion-resistant steel having a base metal thickness of 0.016 inch (0.406 mm).

The above ignition barrier is not required where the foam plastic insulation has been tested in accordance with Section 316.6.

316.5.4 Crawl spaces. The thermal barrier specified in Section 316.4 is not required where all of the following apply:

1. Crawlspace access is required by Section 408.4
2. Entry is made only for purposes of repairs or maintenance.
3. The foam plastic insulation is protected against ignition using one of the following ignition barrier materials:
 - 3.1. 1½-inch-thick (38 mm) mineral fiber insulation;
 - 3.2. $\frac{1}{4}$ -inch-thick (6.4 mm) wood structural panels;
 - 3.3. $\frac{3}{8}$ -inch (9.5 mm) particleboard;
 - 3.4. $\frac{1}{4}$ -inch (6.4 mm) hardboard;
 - 3.5. $\frac{3}{8}$ -inch (9.5 mm) gypsum board; or
 - 3.6. Corrosion-resistant steel having a base metal thickness of 0.016 inch (0.406 mm).

The above ignition barrier is not required where the foam plastic insulation has been tested in accordance with Section 316.6.

316.5.5 Foam-filled exterior doors. Foam-filled exterior doors are exempt from the requirements of Sections 316.3 and 316.4.

316.5.6 Foam-filled garage doors. Foam-filled garage doors in attached or detached garages are exempt from the requirements of Sections 316.3 and 316.4.

316.5.7 Foam backer board. The thermal barrier specified in Section 316.4 is not required where siding backer board foam plastic insulation has a maximum thickness of inch (12.7 mm) and a potential heat of not more than 2000 Btu per square foot (22 720 kJ/m²) when tested in accordance with NFPA 259 provided that:

1. The foam plastic insulation is separated from the interior of the building by not less than 2 inches (51 mm) of mineral fiber insulation or
2. The foam plastic insulation is installed over existing exterior wall finish in conjunction with re-siding or
3. The foam plastic insulation has been tested in accordance with Section 316.6.

316.5.8 Re-siding. The thermal barrier specified in Section 316.4 is not required where the foam plastic insulation is installed over existing exterior wall finish in conjunction with re-siding provided the foam plastic has a maximum thickness of 0.5 inch (12.7 mm) and a potential heat of not more than 2000 Btu per square foot (22 720 kJ/m²) when tested in accordance with NFPA 259.

316.5.9 Interior trim. The thermal barrier specified in Section 316.4 is not required for exposed foam plastic interior trim, provided all of the following are met:

1. The minimum density is 20 pounds per cubic foot (320 kg/m³).
2. The maximum thickness of the trim is 0.5 inch (12.7 mm) and the maximum width is 8 inches (204 mm).
3. The interior trim shall not constitute more than 10 percent of the aggregate wall and ceiling area of any room or space.
4. The flame spread index does not exceed 75 when tested per ASTM E 84. The smoke-developed index is not limited.

316.5.10 Interior finish. Foam plastics shall be permitted as interior finish where approved in accordance with Section 316.6. Foam plastics that are used as interior finish shall also meet the flame spread index and smoke-developed index requirements of Sections 302.9.1 and 302.9.2.

316.5.11 Sill plates and headers. Foam plastic shall be permitted to be spray applied to a sill plate and header without the thermal barrier specified in Section 316.4 subject to all of the following:

1. The maximum thickness of the foam plastic shall be 3¼ inches (83 mm).
2. The density of the foam plastic shall be in the range of 0.5 to 2.0 pounds per cubic foot (8 to 32 kg/m³).
3. The foam plastic shall have a flame spread index of 25 or less and an accompanying smoke developed index of 450 or less when tested in accordance with ASTM E 84.

316.5.12 Sheathing. Foam plastic insulation used as sheathing shall comply with Section 316.3 and Section 316.4. Where the foam plastic sheathing is exposed to the attic space at a gable or kneewall, the provisions of Section 316.5.3 shall apply.

316.6 Specific approval. Foam plastic not meeting the requirements of Sections 316.3 through 316.5 shall be specifically approved on the basis of one of the following approved tests: NFPA 286 with the acceptance criteria of Section 302.9.4, FM4880, ~~UL 723~~, UL 1040 or UL 1715, or fire tests related to actual end-use configurations. The specific approval shall be based on the actual end use configuration and shall be performed on the finished foam plastic assembly in the maximum thickness intended for use. Assemblies tested shall include seams, joints and other typical details used in the installation of the assembly and shall be tested in the manner intended for use.

316.7 Termite damage. The use of foam plastics in areas of “very heavy” termite infestation probability shall be in accordance with Section 318.4.

SECTION 317 PROTECTION OF WOOD AND WOOD BASED PRODUCTS AGAINST DECAY

317.1 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 for the species, product, preservative and end use. Preservatives shall be listed in Section 4 of AWPA U1.

1. Wood joists or the bottom of a wood structural floor when closer than 18 inches (457 mm) or wood girders when closer than 12 inches (305 mm) to the exposed ground in crawl spaces or unexcavated area located within the periphery of the building foundation.
2. All wood framing members that rest on concrete or masonry exterior foundation walls and are less than 8 inches (203 mm) from the exposed ground.
3. Sills and sleepers on a concrete or masonry slab 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 ½ 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.

317.1.1 Field treatment. *Deleted.*

317.1.2 Ground contact. All wood in contact with the ground, embedded in concrete in direct contact with the ground or embedded in concrete exposed to the weather that supports permanent structures intended for human occupancy

shall be approved pressure-preservative-treated wood suitable for ground contact use, except untreated wood may be used where entirely below groundwater level or continuously submerged in fresh water.

317.1.3 Geographical areas. In geographical areas where experience has demonstrated a specific need, approved naturally durable or pressure-preservative-treated wood shall be used for those portions of wood members that form the structural supports of buildings, balconies, porches or similar permanent building appurtenances when 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. Depending on local experience, such members may include:

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

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

Exceptions:

1. Columns exposed to the weather or in basements when supported by concrete 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.
2. 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 (203mm) from exposed earth and the earth is covered by an impervious moisture barrier.

317.1.5 Exposed glued-laminated timbers. The portions of glued-laminated timbers that form the structural supports of a building or other structure and are exposed to weather and not properly protected by a roof, eave or similar

covering shall be pressure treated with preservative, or be manufactured from naturally durable or preservative-treated wood.

317.2 Quality mark. Lumber and plywood required to be pressure-preservative-treated in accordance with Section 318.1 shall bear the quality mark of an approved inspection agency that maintains continuing supervision, testing and inspection over the quality of the product and that has been approved by an accreditation body that complies with the requirements of the American Lumber Standard Committee treated wood program.

317.2.1 Required information. The required quality mark on each piece of pressure-preservative-treated lumber or plywood shall contain the following information:

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

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

317.3 Fasteners and connectors in contact with preservative-treated and fire-retardant-treated wood. Fasteners and connectors in contact with preservative-treated wood and fire-retardant-treated wood shall be in accordance with this section. The coating weights for zinc-coated fasteners shall be in accordance with ASTM A 153.

317.3.1 Fasteners for preservative-treated wood. Fasteners for preservative-treated wood shall be of hot dipped zinc-coated galvanized steel, stainless steel, silicon bronze or copper. 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, a minimum of ASTM A 653 type G185 zinc-coated galvanized steel, or equivalent, shall be used.

Exceptions:

1. One-half-inch (12.7 mm) diameter or greater steel bolts.
2. Fasteners other than nails and timber rivets shall be permitted to be of mechanically deposited zinc coated steel with coating weights in accordance with ASTM B 695, Class 55 minimum.

317.3.2 Fastenings for wood foundations. Fastenings for wood foundations shall be as required in AF&PA ~~Technical Report No. 7PWF~~.

317.3.3 Fasteners for fire-retardant-treated wood used in exterior applications or wet or damp locations. Fasteners for fire-retardant-treated wood used in exterior applications or wet or damp locations shall be of hot-dipped zinc-coated galvanized steel, stainless steel, silicon bronze or copper. Fasteners other than nails and timber rivets shall be permitted to be of mechanically deposited zinc-coated steel with coating weights in accordance with ASTM B 695, Class 55 minimum.

317.3.4 Fasteners for fire-retardant-treated wood used in interior applications. Fasteners for fire-retardant-treated wood used in interior locations shall be in accordance with the manufacturer's recommendations. In the absence of the manufacturer's recommendations, Section 317.3.3 shall apply.

317.4 Wood/plastic composites. Wood/plastic composites used in exterior deck boards, stair treads, handrails and guardrail systems shall bear a label indicating the required performance levels and demonstrating compliance with the provisions of ASTM D 7032.

317.4.1 Wood/plastic composites shall be installed in accordance with the manufacturer's instructions.

SECTION 318 PROTECTION AGAINST SUBTERRANEAN TERMITES

318.1 Subterranean termite control methods. In areas subject to damage from termites as indicated by Table 301.2(1), methods of protection shall be one of the following methods or a combination of these methods:

1. Chemical termiticide treatment, as provided in Section 318.2.
2. Termite baiting system installed and maintained according to the label.
3. Pressure-preservative-treated wood in accordance with the provisions of Section 317.1.
4. Naturally durable termite-resistant wood and used in locations as specified in Section 318.1.
5. Physical barriers as provided in Section 318.3 ~~and used in locations as specified in Section 318.1.~~
6. Cold-formed steel framing in accordance with Sections 505.2.1 and 603.2.1.

318.1.1 Quality mark. Lumber and plywood required to be pressure-preservative-treated in accordance with Section 318.1 shall bear the quality mark of an approved inspection agency which maintains continuing supervision, testing and inspection over the quality of the product and which has been approved by an accreditation body which complies with the requirements of the American Lumber Standard Committee treated wood program.

318.1.2 Field treatment. *Deleted.*

318.2 Chemical termiticide treatment. Chemical termiticide treatment shall include soil treatment and/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.

318.3 Barriers. 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 are permitted to be used only if in combination with another method of protection.

318.4 Foam plastic protection. In areas where the probability of termite infestation is “very heavy” as indicated in Figure 301.2(6), 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 at least 6 inches (152 mm).

Exceptions:

1. Buildings where the structural members of walls, floors, ceilings and roofs are entirely of noncombustible materials or pressure-preservative-treated wood.
2. When in addition to the requirements of Section 318.1, an approved method of protecting the foam plastic and structure from subterranean termite damage is used.
3. On the interior side of basement walls.

**SECTION 319
SITE ADDRESS**

319.1 Address numbers. Buildings shall have approved address numbers, ~~7building~~ building numbers or approved building identification placed in a position that is plainly legible and visible from the street or road fronting the property.

**SECTION 320
ACCESSIBILITY**

320.1 Scope. *Where there are four or more dwelling units or sleeping units in a single structure, and the design qualifies for this code to apply, the provisions of section 320 shall apply.*

In structures with 1, 2 or 3 dwelling units, the accessibility provisions of this code are not required but when non-required accessibility components are intended to be installed inside the dwellings, they shall comply with the provisions for Type A,

Type B or Accessible units in ICC/ANSI A117.1 listed in Chapter 44 to the extent of the installation.

320.2 Applicability. *Where there are four or more dwelling units or sleeping units intended to be occupied as residences in a single structure, every dwelling unit shall be a Type B unit designed and constructed for accessibility in accordance with section 320 and the provisions for Type B units in Chapter 10 of the ICC/ANSI A117.1 listed in Chapter 44.*

Exception: *The number of Type B units is permitted to be reduced in accordance with Section 320.4.*

When this code applies to structures of four or more dwellings and Type B units are required, the common and public use areas serving the Type B dwellings and the accessible route connecting the common and public use areas to the Type B units shall comply with ICC/ANSI A117.1 listed in Chapter 44.

320.3 Accessible route. *At least one accessible route shall connect accessible building or facility entrances with the primary entrance of each Type B unit within the building or facility and with those exterior and interior spaces and facilities that serve the Type B units.*

Exception:

1. *If due to circumstances outside the control of the owner, either the slope of the finished ground level between accessible facilities and buildings exceeds one unit vertical in 12 units horizontal (1:12), or where physical barriers or legal restrictions prevent the installation of an accessible route, a vehicular route with parking that complies with ICC/ANSI A117.1 listed in Chapter 44 at each public or common use facility or building is permitted in place of the accessible route.*

320.4 General exceptions. *The required number of Type B units is permitted to be reduced in accordance with Sections 320.4.1 through 320.4.5.*

320.4.1 Structures without elevator service. *Where no elevator service is provided in a structure, only the dwelling units that are located on stories indicated in Sections 320.4.1.1 and 320.4.1.2 are required to be Type B units, respectively.*

320.4.1.1 One story with Type B units required. *At least one story containing dwelling units or sleeping units intended to be occupied as a residence shall be provided with an accessible entrance from the exterior of the structure and all units intended to be occupied as a residence on that story shall be Type B units.*

320.4.1.2 Additional stories with Type B units. *On all other stories that have a building entrance in proximity to arrival points intended to serve units on that story, as indicated in Items 1 and 2, all dwelling units intended to be occupied as a residence served by that entrance on that story shall be Type B units.*

1. *Where the slopes of the undisturbed site measured between the planned entrance and all vehicular or pedestrian arrival points within 50 feet (15 240 mm) of the planned entrance are 10 percent or less, and*
2. *Where the slopes of the planned finished grade measured between the entrance and all vehicular or pedestrian arrival points within 50 feet (15 240 mm) of the planned entrance are 10 percent or less.*

Where no such arrival points are within 50 feet (15 240 mm) of the entrance, the closest arrival point shall be used unless that arrival point serves the story required by Section 320.4.1.1.

320.4.2 Multistory units. *A multistory dwelling which is not provided with elevator service is not required to be a Type B unit. Where a multistory unit is provided with external elevator service to only one floor, the floor provided with elevator service shall be the primary entry to the unit, shall comply with the requirements for a Type B unit and a toilet facility shall be provided on that floor.*

For purposes of applying section 320, multistory units are dwellings with finished, habitable space on more than one level of the unit.

320.4.3 Elevator service to the lowest story with units. *Where elevator service in the building provides an accessible route only to the lowest story containing dwelling or sleeping units intended to be occupied as a residence, only the units on that story which are intended to be occupied as a residence are required to be Type B units.*

320.4.4 Site impracticality. *On a site with multiple non-elevator buildings, the number of units required by Section 320.4.1 to be Type B units is permitted to be reduced to a percentage which is equal to the percentage of the entire site having grades, prior to development, which are less than 10 percent, provided that all of the following conditions are met:*

1. *Not less than 20 percent of the units required by Section 320.4.1 on the site are Type B units;*
2. *Units required by Section 320.4.1, where the slope between the building entrance serving the units on that story and a pedestrian or vehicular arrival point is no greater than 8.33 percent, are Type B units;*
3. *Units required by Section 320.4.1, where an elevated walkway is planned between a building entrance serving the units on that story and a pedestrian or vehicular arrival point and the slope between them is 10 percent or less are Type B units; and*
4. *Units served by an elevator in accordance with Section 320.4.3 are Type B units.*

320.4.5 Design flood elevation. *The required number of Type B units shall not apply to a site where the required elevation of the lowest floor or the lowest horizontal structural building members of non-elevator buildings are at or above the design flood elevation resulting in:*

1. *A difference in elevation between the minimum required floor elevation at the primary entrances and vehicular and pedestrian arrival points within 50 feet (15 240 mm) exceeding 30 inches (762 mm), and*
2. *A slope exceeding 10 percent between the minimum required floor elevation at the primary entrances and vehicular and pedestrian arrival points within 50 feet (15.24 m).*

Where no such arrival points are within 50 feet (15.24 m) of the primary entrances, the closest arrival points shall be used.

SECTION 321 ELEVATORS AND PLATFORM LIFTS

321.1 Elevators. Where provided, passenger elevators, limited-use/limited-application elevators or private residence elevators shall comply with ASME A17.1.

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

321.3 Accessibility. Elevators or platform lifts that are part of an accessible route, shall *also* comply with *ICC/ANSI A117.1*.

SECTION 322 FLOOD-RESISTANT CONSTRUCTION

322.1 General. *Except where approved by the Flood Plain Administrator having jurisdiction or by variance granted, buildings and structures constructed in whole or in part in flood hazard areas (including A or V Zones) as established in Table 301.2(1) shall be designed and constructed in accordance with the provisions contained in this section.*

Exception: Buildings and structures located in whole or in part in identified floodways shall be designed and constructed in accordance with ASCE 24.

322.1.1 Alternative provisions. As an alternative to the requirements in Section 322.3 for buildings and structures located in whole or in part in coastal high-hazard areas (V Zones), ASCE 24 is permitted subject to the limitations of this code and the limitations therein.

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

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

322.1.4 Establishing the design flood elevation. The design flood elevation shall be used to define areas prone to flooding. At a minimum, the design flood elevation is the higher of:

1. The base flood elevation at the depth of peak elevation of flooding (including wave height) which has a 1 percent (100-year flood) or greater chance of being equaled or exceeded in any given year, or
2. The elevation of the design flood associated with the area designated on a flood hazard map adopted by the community, or otherwise legally designated.

322.1.4.1 Determination of design flood elevations. If design flood elevations are not specified, the building official is authorized to require the applicant to:

1. Obtain and reasonably use data available from a federal, state or other source; or
2. Determine the design flood elevation in accordance with accepted hydrologic and hydraulic engineering practices used to define special flood hazard areas. Determinations shall be undertaken by a registered design professional who shall document that the technical methods used reflect currently accepted engineering practice. Studies, analyses and computations shall be submitted in sufficient detail to allow thorough review and approval.

322.1.4.2 Determination of impacts. In riverine flood hazard areas where design flood elevations are specified but floodways have not been designated, the applicant shall demonstrate that the effect of the proposed buildings and structures on design flood elevations, including fill, when combined with all other existing and anticipated flood hazard area encroachments, will not increase the design flood elevation more than 1 foot (305 mm) at any point within the jurisdiction.

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

322.1.6 Protection of mechanical and electrical systems. Electrical systems, equipment and components; heating, ventilating, air conditioning; plumbing appliances and plumbing fixtures; duct systems; and other service equipment shall be located at or above the elevation required in Section 322.2 (flood

hazard areas including A Zones) or 322.3 (coastal high-hazard areas including V Zones). If replaced as part of a substantial improvement, electrical systems, equipment and components; heating, ventilating, air conditioning and plumbing appliances and plumbing fixtures; duct systems; and other service equipment shall meet the requirements of this section. Systems, fixtures, and equipment and components shall not be mounted on or penetrate through walls intended to break away under flood loads.

Exception: Locating electrical systems, equipment and components; heating, ventilating, air conditioning; plumbing appliances and plumbing fixtures; duct systems; and other service equipment is permitted below the elevation required in Section 322.2 (flood hazard areas including A Zones) or 322.3 (coastal high-hazard areas including V Zones) provided that they are designed and installed to prevent water from entering or accumulating within the components and to resist hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding to the design flood elevation in accordance with ASCE 24. Electrical wiring systems are permitted to be located below the required elevation provided they conform to the provisions of the electrical part of this code for wet locations.

322.1.7 Protection of water supply and sanitary sewage systems. New and replacement water supply systems shall be designed to minimize or eliminate infiltration of flood waters into the systems in accordance with the plumbing code. New and replacement sanitary sewage systems shall be designed to minimize or eliminate infiltration of floodwaters into systems and discharges from systems into floodwaters in accordance with the plumbing code.

322.1.8 Flood-resistant materials. Building materials used below the elevation required in Section 322.2 (flood hazard areas including A Zones) or 322.3 (coastal high-hazard areas including V Zones) shall comply with the following:

1. All wood, including floor sheathing, shall be pressure-preservative-treated in accordance with AWP A U1 for the species, product, preservative and end use or be the decay-resistant heartwood of redwood, black locust or cedars. Preservatives shall be listed in Section 4 of AWP A U1.

2. Materials and installation methods used for flooring and interior and exterior walls and wall coverings shall conform to the provisions of FEMA/FIA-TB-2.

322.1.9 Manufactured homes. *Deleted.*

322.1.10 As-built elevation documentation. A registered design professional shall prepare documentation of the elevations specified in Section 322.2 or 322.3.

322.2 Flood hazard areas (including A Zones). All areas that have been determined to be prone to flooding but not subject to high velocity wave action shall be designated as flood hazard areas. Flood hazard areas that have been delineated as subject to wave heights between 1½ feet (457 mm) and 3 feet (914 mm) shall be designated as Coastal A Zones. All building and structures constructed in whole or in part in flood hazard areas shall be designed and constructed in accordance with Sections 322.2.1 through 322.2.3.

322.2.1 Elevation requirements.

1. Buildings and structures in flood hazard areas not designated as Coastal A Zones shall have the lowest floors elevated to or above the design flood elevation.
2. Buildings and structures in flood hazard areas designated as Coastal A Zones shall have the lowest floors elevated to or above the base flood elevation plus 1 foot (305 mm), or to the design flood elevation, whichever is higher.
3. In areas of shallow flooding (AO Zones), buildings and structures shall have the lowest floor (including basement) elevated at least as high above the highest adjacent grade as the depth number specified in feet on the FIRM, or at least 2 feet (610 mm) if a depth number is not specified.
4. Basement floors that are below grade on all sides shall be elevated to or above the design flood elevation.

Exception: Enclosed areas below the design flood elevation, including basements whose floors are not below grade on all sides, shall meet the requirements of Section 322.2.2.

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

1. Be used solely for parking of vehicles, building access or storage.
2. Be provided with flood openings that meet the following criteria:

There shall be a minimum of two openings on different sides of each enclosed area; if a building has more than one enclosed area below the design flood elevation, each area shall have openings on exterior walls.

The total net area of all openings shall be at least 1 square inch (645 mm²) for each square foot (0.093 m²) of enclosed area, or the openings shall be designed and the construction documents shall include a statement by a registered design professional that the design of the openings will provide for equalization of hydrostatic flood forces on exterior walls by allowing for the automatic entry and exit of floodwaters as specified in Section 2.6.2.2 of ASCE 24.

The bottom of each opening shall be 1 foot (305 mm) or less above the adjacent ground level.

Openings shall be not less than 3 inches (76 mm) in any direction in the plane of the wall.

Any louvers, screens or other opening covers shall allow the automatic flow of floodwaters into and out of the enclosed area.

Openings installed in doors and windows, that meet requirements 2.1 through 2.5, are acceptable; however, doors and windows without installed openings do not meet the requirements of this section.

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

Exception: Unless designed in accordance with Section 404:

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

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

322.3 Coastal high-hazard areas (including V Zones). Areas that have been determined to be subject to wave heights in excess of 3 feet (914 mm) or subject to high-velocity wave action or wave-induced erosion shall be designated as coastal high-hazard areas. Buildings and structures constructed in whole or in part in coastal high-hazard areas shall be designed and constructed in accordance with Sections 322.3.1 through 322.3.6.

322.3.1 Location and site preparation.

1. New buildings and buildings that are determined to be substantially improved pursuant to Section 113.4, shall be located landward of the reach of mean high tide.
2. For any alteration of sand dunes and *other coastal features* the building official shall require submission of an engineering analysis which demonstrates that the proposed alteration will not increase the potential for flood damage.

322.3.2 Elevation requirements.

1. All buildings and structures erected within coastal high hazard areas shall be elevated so that the lowest portion of all structural members supporting the lowest floor, with the exception of mat or raft foundations, piling, pile caps, columns, grade beams and bracing, is:

- 1.1 Located at or above the design flood elevation, if the lowest horizontal structural member is oriented parallel to the direction of wave approach, where parallel shall mean less than or equal to 20 degrees (0.35 rad) from the direction of approach, or
 - 1.2 Located at the base flood elevation plus 1 foot (305 mm), or the design flood elevation, whichever is higher, if the lowest horizontal structural member is oriented perpendicular to the direction of wave approach, where perpendicular shall mean greater than 20 degrees (0.35 rad) from the direction of approach.
2. Basement floors that are below grade on all sides are prohibited.
 3. The use of fill for structural support is prohibited.
 4. 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.

Exception: Walls and partitions enclosing areas below the design flood elevation shall meet the requirements of Sections 322.3.4 and 322.3.5.

322.3.3 Foundations. Buildings and structures erected in coastal high-hazard areas shall be supported on pilings or columns and shall be adequately anchored to those pilings or columns. Pilings shall have adequate soil penetrations to resist the combined wave and wind loads (lateral and uplift). Water loading values used shall be those associated with the design flood. Wind loading values shall be those required by this code. Pile embedment shall include consideration of decreased resistance capacity caused by scour of soil strata surrounding the piling. Pile systems design and installation shall be certified in accordance with Section 322.3.6. Mat, raft or other foundations that support columns shall not be permitted where soil investigations that are required in accordance with Section 401.4 indicate that soil material under the mat, raft or other foundation is subject to scour or erosion from wave-velocity flow conditions. Slabs, pools, pool decks and walkways shall be located and constructed to be structurally independent of buildings and structures and their foundations to prevent transfer of flood loads to the buildings and structures during conditions of flooding, scour or erosion from wave-velocity flow

conditions, unless the buildings and structures and their foundation are designed to resist the additional flood load.

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

1. Electrical, mechanical, and plumbing system components are not to be mounted on or penetrate through walls that are designed to break away under flood loads; and
2. Are constructed with insect screening or open lattice; or
3. Are designed to break away or collapse without causing collapse, displacement or other structural damage to the elevated portion of the building or supporting foundation system. Such walls, framing and connections shall have a design safe loading resistance of not less than 10 (479 Pa) and no more than 20 pounds per square foot (958 Pa); or
4. Where wind loading values of this code exceed 20 pounds per square foot (958 Pa), the construction documents shall include documentation prepared by a registered design professional that:
 - 4.1. The walls and partitions below the design flood elevation have been designed to collapse from a water load less than that which would occur during the design flood.
 - 4.2. The elevated portion of the building and supporting foundation system have been designed to withstand the effects of wind and flood loads acting simultaneously on all building components (structural and nonstructural). Water loading values used shall be those associated with the design flood. Wind loading values shall be those required by this code.

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

322.3.6 Construction documents. The construction documents shall include documentation that is prepared by a registered design professional that the

design and methods of construction to be used meet the applicable criteria of this section.

SECTION 323 STORM SHELTERS

323.1 General. This section applies to the construction of storm shelters when constructed as separate detached buildings or when constructed as safe rooms within buildings for the purpose of providing safe refuge from storms that produce high winds, such as tornados and hurricanes. In addition to other applicable requirements in this code, storm shelters shall be constructed in accordance with ICC/NSSA-500.

SECTION 324 POST FRAME ACCESSORY STRUCTURES

324.1 Post frame accessory structures. *The following requirements serve as minimum standards for post and frame structures within all of the following structural limitations:*

1. *Residential accessory structures,*
2. *Single story,*
3. *Solid exterior structural sheathing or metal roof, and solid wall panels,*
4. *No attic storage (~~attic storage would require engineered design trusses~~),*
5. *Maximum building width of thirty six feet including the overhang,*
6. *Maximum wall height of sixteen feet,*
7. *Maximum mean roof height of twenty feet, and*
8. *Maximum post spacing of eight feet (~~unless truss sit directly on post~~).*

Post and frame structures and portions thereof outside the above structural limitations of this standard shall be accompanied by structural calculations as required by the residential building official or designed under the provisions of section ~~116.2~~ 106.5 of the Residential Code of Ohio (RCO). Post and

frame structures shall comply with the structural design requirements of section 301 of the RCO.

324.2 Definition. Post frame accessory structures consist of primary members (wood posts, beams & single span roof trusses or ceiling joist and rafters) and secondary members (wood roof purlins, wall girts, bracing & sheathing) where all loads are transmitted from the sheathing and the secondary members to the primary members which transfer all combined loads to the soil through vertical posts bearing on footings embedded in the ground. See Figure 324.

324.3 Footings and foundations. Footings and foundations shall comply with applicable provisions of 401. Post frame structures shall have poured in-place concrete footings installed below all posts. The top of the footing shall be a minimum of 48 inches below finished grade and have footing diameters complying with Table 324.3.

TABLE 324.3
POST FRAME PIER FOOTING DIAMETERS^{1,2,3,4}

	Building width (length of truss) including overhang (feet)			
	24	28	32	36
Diameter (inches) 20# roof snow load	18	20	22	22
Diameter (inches) 30# roof snow load	18	22	24	26

1. Pier footing thickness shall be a minimum one-half of the diameter of the footing.
2. Based upon 2000 PSF soil bearing capacity and truss loads of 20 or 30 PSF live or snow load top chord, 10 PSF dead load top chord, 5 PSF dead load on the bottom chord and no live load on the bottom chord
3. Fractional widths shall be rounded to the next higher pier footing diameter.
4. Table not to be used in Ohio case study areas.

324.4 ~~Column~~ Post and wall construction. ~~Columns-Posts~~ shall be three (3) ply un-spliced, reinforced spliced or solid wood and shall not be less than 4 inch by 6 inch nominal size. ~~Columns Posts~~ shall comply with the requirements of Section ~~319~~ 317 and shall be restrained to prevent lateral displacement.

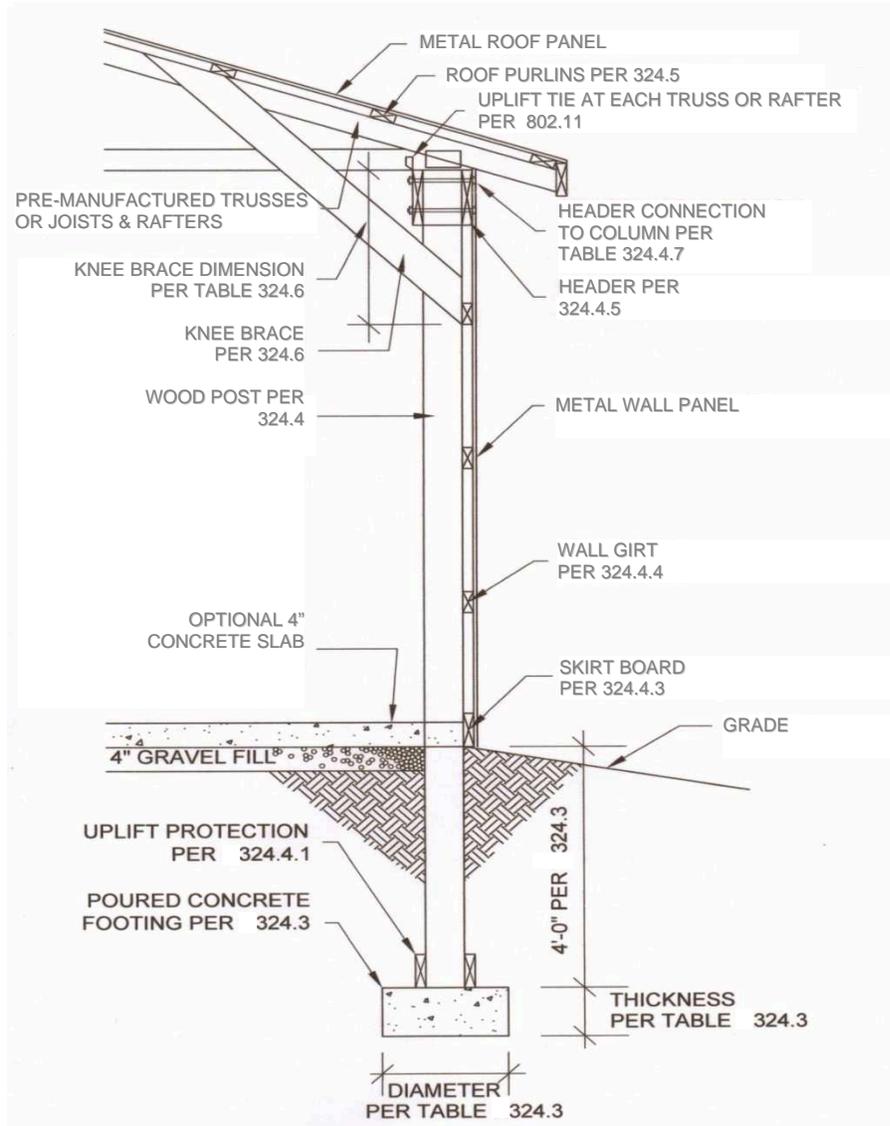
324.4.1 Uplift protection: ~~Columns-Posts~~ shall have uplift protection by one of the following methods:

1. Two 2x6x12 inch ~~column-post~~ uplift protection blocks attached to each side of the base of the ~~column-post~~. The ~~column-post~~ uplift blocks shall be placed horizontally, attached per Table 324.7 and comply with Section ~~319~~ 317;

2. 12 inch high, concrete collar poured on top of footing around the post, with 2-#5x9 inch rebar placed through the post at 3 inches and 9 inches from bottom of post in opposite directions. The rebar ends must be 1 ½ inches from the soil. See Figure 324.1; ~~or~~
3. ~~Each truss or rafter must have an uplift hanger as per Figure 324.~~

324.4.2 ~~Column~~Post Spacing. The maximum spacing for ~~e~~columns-posts shall be (eight) 8 feet on center (~~unless truss sit directly on post~~).

FIGURE 324
POST AND FRAME WALL SECTION.
(NO SCALE)



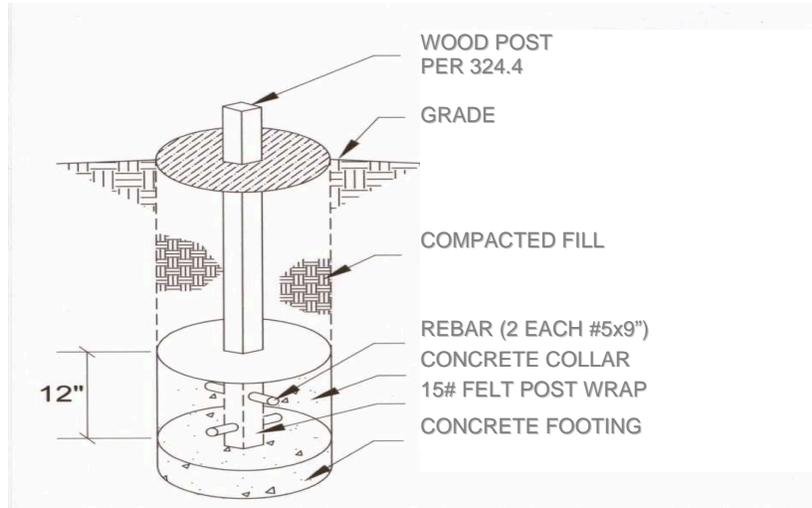


FIGURE 324.1
COLUMN POST UPLIFT PROTECTION EXCEPTION
 (NO SCALE)

324.4.3 Skirt Boards. Skirt boards shall be treated lumber meeting the requirements of Section ~~319~~317 and attached per Table 324.7.

324.4.4 Wall girts. Wall girts shall be not less than 2 x 4 inches nominal and spaced not more than twenty-four (24) inches on center.

324.4.5 Load bearing beams and headers: Load bearing beams and headers shall comply with Table 502.5(1).

Exceptions.

1. Bearing beams are not required if the trusses or ceiling joists and rafters bear directly on the ~~columns~~ posts.
2. ~~Openings on the gable end walls supporting a door or roof total load not exceeding 5 square feet per lineal foot of wall area that require beams or headers must~~ Headers in the gable-end wall which do not support more than five square feet of wall area per lineal foot of header shall be sized per Table 324.4.5.

TABLE 324.4.5
GABLE END HEADER SIZES.

Opening Width (feet)	10	12	16
Header Size (inches)	2-2x8	2-2x10	2-2x12

324.4.6 Bracing. Wall bracing shall be provided to resist all racking and shearing forces and must comply with the applicable provisions of section ~~R602.10~~ or by installing 2x6 diagonal cross braces in the bays between two adjoining columns at 8 feet on center or multiple spacing totaling a minimum 8 feet on center where the post spacing design is less than 8 feet on center adjacent posts as described in this section. The diagonal ~~brac~~ cross braces shall be placed from the top header or girt to the next ~~adjoining column~~ adjacent post at the skirt board. The cross bracing shall be placed or installed on ~~each side~~ all sides of the building and shall be spaced at a minimum maximum of 25 feet on center and within 12 feet of the ~~end corners~~ of the building and attached ~~to the wall girts and columns~~ per Table 324.7. Any splices of the diagonal brace required due to excessive length, must lap over two consecutive wall girts.

324.4.7 Beams supporting trusses or rafters and ceiling joists attachment to column. Bearing beams supporting roof trusses or rafters and ceiling joists shall be connected to the ~~columns~~ posts by one of the following methods:

1. Bolts that are 1/2 inch diameter through-bolted to the side of the ~~column~~ post;
2. Bolts that are 1/2 inch diameter, directly attached to a 3-ply ~~column~~ post notch, enclosing the truss or rafter at the top of ~~column~~ post; or
3. Other fasteners with minimum shear or withdraw values stated in Table 324.4.7

324.4.7.1 Number of fasteners. The minimum numbers of through bolts or other fasteners with minimum shears or withdraw values required per Table 324.4.7.

**TABLE 324.4.7
BEAM OR TRUSS CONNECTION AT ~~COLUMNS~~ POSTS MINIMUM FASTENERS OR
TOTAL SHEAR OR WITHDRAW VALUES ^{1,2,3 a,b,c}**

	Building Width (Length of Truss) including overhang (feet)			
	24	28	32	36
Shear or withdraw (pounds) 20# <u>lb</u> snow load	3360	3920	4480	5040
Number of Bolts, 20 # <u>lb</u> roof snow load	2	2	2	3
Shear or withdraw (pounds)	4320	5040	5760	6480

30# lb roof snow load				
Number of Bolts, 30 # lb roof snow load	2	3	3	3

~~1-a.~~ Based upon truss loads of 20 or 30 PSF live or snow load top chord, 10 PSF dead load top chord, 5 PSF live load on the bottom chord and no live load on the bottom chord.

~~2-b.~~ Based upon post spacing at intervals not exceeding 8 feet.

~~3-c.~~ When beams are attached at each side of the column and fasteners do not extend through both beams such as ~~through~~ through-bolts, the required values are one-half the amount shown above for each beam.

324.5 Roof purlins. Roof purlins shall be a minimum of 4x2 SPF#2 laid flat for spans up to 4 feet, and 4x2 SPF#2 laid on edge for spans up to 8 feet. Roof purlins shall be spaced not more than 24 inches on center.

324.6 Knee bracing: A 2x6 brace shall extend from the ~~column~~ post to the top chord of the truss or rafter adjacent to the post at a 45 degree angle. The vertical distance down from the bottom chord of the truss or ceiling joist to the point where the brace attaches to the ~~columns~~ posts shall be in compliance with Table ~~324.5~~ 324.6 as shown on Figure 324. Trusses or rafters must be spaced such that they align with the ~~column~~ post intervals. Attachment of knee brace shall be per Table 324.7.

**TABLE 324.6
KNEE BRACE VERTICAL DISTANCE.**

Wall Height	Vertical Dimension
8'-0" and 9'-0"	1'-6"
10'-0" and 11'-0"	2'-0"
12'-0" and 13'-0"	3'-0"
14'-0" through 16'-0"	4'-0"

324.7 Attachment details. Structural fastener details for post and frame buildings shall comply with Table 324.7.

**TABLE 324.7
STRUCTURAL FASTENES FASTENERS**

Fastener Schedule for Structural Members		
Description of Building Element	Number and Type of Fastener	Attachment type
Uplift blocking to column post	5-16d Hot Dipped Galvanized	Each block
Skirt board to column post	2-16d Hot Dipped Galvanized	Face nail
Wall girt to column post	2-16d Hot Dipped Galvanized	Face nail
Diagonal cross bracing to column post	2-16d Hot Dipped Galvanized	Face nail
Diagonal cross bracing to skirt board	2-10d Hot Dipped Galvanized	Face nail
Diagonal cross bracing to wall girts, beam, or header	2-10d	Face nail
Knee brace to column post	3-16d Hot Dipped Galvanized	Face nail
Knee brace to top chord of truss or rafter	3-10d	Face nail
Knee brace to bottom chord of truss or	3-10d	Face nail

<i>ceiling joist</i>		
<i>Roof purlin to truss or rafter with span of 2' or 4'</i>	<i>2-16d</i>	<i>Face nail</i>
<i>Roof purlin to truss or rafter with span of 8'</i>	<i>Mechanical fastener with uplift protection greater than 225 pounds.</i>	<i>Per manufacturer installation manual</i>

324.8 Roof trusses. *Engineered roof trusses, where used, shall be accompanied by drawings sealed by the registered design professional responsible for their preparation and shall be submitted to the residential building official for approval prior to the framing inspection. The truss design shall comply with Sections 802.10 and 802.11 and shall account for all loads imposed on the truss as a result of the prescriptive requirements of this section.*

Effective: 07/01/2014

R.C. 119.032 review dates: 01/01/2018

CERTIFIED ELECTRONICALLY

Certification

04/14/2014

Date

Promulgated Under: 119.03
Statutory Authority: 3781.10(A)
Rule Amplifies: 3781.01, 3781.06, 3781.10, 3781.11, 3791.04, 4740.14
Prior Effective Dates: 5/27/06, 1/1/13

4101:8-4-01 Foundations.

[Comment: When a reference is made within this rule to a federal statutory provision, an industry consensus standard, or any other technical publication, the specific date and title of the publication as well as the name and address of the promulgating agency are listed in rule 4101:8-44-01 of the Administrative Code. The application of the referenced standards shall be limited and as prescribed in section 102.5 of rule 4101:8-1-01 of the Administrative Code.]

**SECTION 401
GENERAL**

401.1 Application. The provisions of this chapter shall control the design and construction of the foundation and foundation spaces for all buildings. In addition to the provisions of this chapter, the design and construction of foundations in areas prone to flooding as established by Table 301.2(1) shall meet the provisions of Section 322. Wood foundations shall be designed and installed in accordance with AF&PA PWF.

Exception: The provisions of this chapter shall be permitted to be used for wood foundations only in the following situations:

1. In buildings that have no more than two floors and a roof.
2. When interior basement and foundation walls are constructed at intervals not exceeding 50 feet (15 240 mm).

Wood foundations in Seismic Design Category D₀, D₁ or D₂ shall be designed in accordance with accepted engineering practice.

401.2 Requirements. Foundation construction shall be capable of accommodating all loads according to Section 301 and of transmitting the resulting loads to the supporting soil. Fill soils that support footings and foundations shall be designed, installed and tested in accordance with accepted engineering practice. Gravel fill used as footings for wood and precast concrete foundations shall comply with Section 403.

401.3 Drainage. Surface drainage shall be diverted to a storm sewer conveyance or other approved point of collection that does not create a hazard. Lots shall be graded to drain surface water away from foundation walls. The grade shall fall a minimum of 6 inches (152 mm) within the first 10 feet (3048 mm).

Exception: Where lot lines, walls, slopes or other physical barriers prohibit 6 inches (152 mm) of fall within 10 feet (3048 mm), drains or swales shall be constructed to ensure drainage away from the structure. Impervious surfaces within 10 feet (3048 mm) of the building foundation shall be sloped a minimum of 2 percent away from the building.

401.4 Soil tests. Where quantifiable data created by accepted soil science methodologies indicate expansive, compressible, shifting or other questionable soil characteristics are likely to be present, the building official *may* determine whether to require a soil test to determine the soil's characteristics at a particular location. This test shall be done by an approved agency using an approved method.

401.4.1 Geotechnical evaluation. In lieu of a complete geotechnical evaluation, the load-bearing values in Table 401.4.1 shall be assumed.

**TABLE 401.4.1
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
Sandy gravel and/or gravel (GW and GP)	3,000
Sand, silty sand, clayey sand, silty gravel and clayey gravel (SW, SP, SM, SC, GM and GC)	2,000
Clay, sandy clay, silty clay, clayey silt, silt and sandy silt (CL, ML, MH and CH)	1,500 ^b

For SI: 1 pound per square foot = 0.0479 kPa.

- a. When soil tests are required by Section R401.4, the allowable bearing capacities of the soil shall be part of the recommendations.
- b. Where the building official determines that in-place soils with an allowable bearing capacity of less than 1,500 psf are likely to be present at the site, the allowable bearing capacity shall be determined by a soils investigation.

401.4.2 Controlled low-strength material (CLSM). *Where footings will bear on controlled low-strength material (CLSM), the CLSM shall comply with the provisions of an approved report. The report shall contain the following:*

1. *Specifications for the preparation of the site prior to placement of CLSM.*
2. *Specifications for the CLSM.*

3. *Laboratory or field test method(s) to be used to determine the compressive strength or bearing capacity of the CLSM.*
4. *Test methods for determining the acceptance of the CLSM in the field.*
5. *Number and frequency of field tests required to determine compliance with Item 4.*

401.5 Compressible or shifting soil. *Instead of a complete geotechnical evaluation, when top or subsoils are compressible or shifting, they shall be removed to a depth and width sufficient to assure stable moisture content in each active zone and shall not be used as fill or stabilized within each active zone by chemical, dewatering or presaturation.*

SECTION 402 MATERIALS

402.1 Wood foundations. Wood foundation systems shall be designed and installed in accordance with the provisions of this code.

402.1.1 Fasteners. Fasteners used below grade to attach plywood to the exterior side of exterior basement or crawl-space wall studs, or fasteners used in knee wall construction, shall be of Type 304 or 316 stainless steel. Fasteners used above grade to attach plywood and all lumber-to-lumber fasteners except those used in knee wall construction shall be of Type 304 or 316 stainless steel, silicon bronze, copper, hot-dipped galvanized (zinc coated) steel nails, or hot-tumbled galvanized (zinc coated) steel nails. Electrogalvanized steel nails and galvanized (zinc coated) steel staples shall not be permitted.

402.1.2 Wood treatment. All lumber and plywood shall be pressure-preservative treated and dried after treatment in accordance with AWPA U1 (Commodity Specification A, Use Category 4B and Section 5.2), and shall bear the label of an accredited agency. Where lumber and/or plywood is cut or drilled after treatment, the treated surface shall be field treated with copper naphthenate, the concentration of which shall contain a minimum of 2 percent copper metal, by repeated brushing, dipping or soaking until the wood absorbs no more preservative.

402.2 Concrete. Concrete shall have a minimum specified compressive strength of f'_c , as shown in Table 402.2. Concrete subject to moderate or severe weathering as indicated in Table 301.2(1) shall be air entrained as specified in Table 402.2. The maximum weight of fly ash, other pozzolans, silica fume, slag or blended cements that is included in concrete mixtures for garage floor slabs and for exterior porches, carport slabs and steps that will be exposed to deicing chemicals shall not exceed the percentages of the total weight of cementitious materials specified in Section 4.2.3 of ACI 318. Materials used to produce concrete and testing thereof shall comply with the applicable standards listed in Chapter 3 of ACI 318 or ACI 332.

**TABLE 402.2
MINIMUM SPECIFIED COMPRESSIVE STRENGTH OF CONCRETE**

TYPE OR LOCATION OF CONCRETE CONSTRUCTION	MINIMUM SPECIFIED COMPRESSIVE STRENGTH ^a (f'_c)		
	Weathering Potential ^b		
	Negligible	Moderate	Severe
Basement walls, foundations and other concrete not exposed to the weather	2,500	2,500	2,500 ^c
Basement slabs and interior slabs on grade, except garage floor slabs	2,500	2,500	2,500 ^c
Basement walls, foundation walls, exterior walls and other vertical concrete work exposed to the weather	2,500	3,000 ^d	3,000 ^d
Porches, carport slabs and steps exposed to the weather, and garage floor slabs	2,500	3,000 ^{d, e, f}	3,500 ^{d, e, f}

For SI: 1 pound per square inch = 6.895 kPa.

a. Strength at 28 days psi.

b. See Table 301.2(1) for weathering potential.

c. Concrete in these locations that may be subject to freezing and thawing during construction shall be air-entrained concrete in accordance with Footnote d.

d. Concrete shall be air-entrained. Total air content (percent by volume of concrete) shall be not less than 5 percent or more than 7 percent.

e. See Section 402.2 for maximum cementitious materials content.

f. For garage floors with a steel troweled finish, reduction of the total air content (percent by volume of concrete) to not less than 3 percent is permitted if the specified compressive strength of the concrete is increased to not less than 4,000 psi.

402.3 Precast concrete. Precast concrete foundations shall be designed in accordance with Section 404.5 and shall be installed in accordance with the provisions of this code and the manufacturer's installation instructions.

402.3.1 Precast concrete foundation materials. Materials used to produce precast concrete foundations shall meet the following requirements.

1. All concrete used in the manufacture of precast concrete foundations shall have a minimum compressive strength of 5,000 psi (34 470 kPa)

at 28 days. Concrete exposed to a freezing and thawing environment shall be air entrained with a minimum total air content of 5 percent.

2. Structural reinforcing steel shall meet the requirements of ASTM A 615, A 706 or A 996. The minimum yield strength of reinforcing steel shall be 40,000 psi (Grade 40) (276 MPa). Steel reinforcement for precast concrete foundation walls shall have a minimum concrete cover of $\frac{3}{4}$ inch (19.1 mm).
3. Panel-to-panel connections shall be made with Grade II steel fasteners.
4. The use of nonstructural fibers shall conform to ASTM C 1116.
5. Grout used for bedding precast foundations placed upon concrete footings shall meet ASTM C 1107.

SECTION 403 FOOTINGS

403.1 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 which shall be of sufficient design to accommodate all loads according to Section 301 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, *controlled low-strength material (CLSM)*, or engineered fill. Concrete footings shall be designed and constructed in accordance with the provisions of Section 403 or in accordance with ACI 332.

403.1.1 Minimum size. Minimum sizes for concrete and masonry footings shall be as set forth in Table 403.1 and Figure 403.1(1). The footing width, *W*, shall be based on the load-bearing value of the soil in accordance with Table 401.4.1. Spread footings shall be at least 6 inches (152 mm) in thickness, *T*. Footing projections, *P*, shall be at least 2 inches (51 mm) and shall not exceed the thickness of the footing. The size of footings supporting piers and columns shall be based on the tributary load and allowable soil pressure in accordance with Table 401.4.1. Footings for wood foundations shall be in accordance with the details set forth in Section 403.2, and Figures 403.1(2) and 403.1(3).

TABLE 403.1
MINIMUM WIDTH OF CONCRETE, PRECAST OR MASONRY FOOTINGS (inches)^a

	LOAD-BEARING VALUE OF SOIL (psf)			
	1,500	2,000	3,000	4,000
Conventional light-frame construction				
1-story	12	12	12	12
2-story	15	12	12	12
3-story	23	17	12	12
4-inch brick veneer over light frame or 8-inch hollow concrete masonry				
1-story	12	12	12	12
2-story	21	16	12	12
3-story	32	24	16	12
8-inch solid or fully grouted masonry				
1-story	16	12	12	12
2-story	29	21	14	12
3-story	42	32	21	16

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

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

403.1.2 Continuous footing in Seismic Design Categories D₀, D₁ and D₂.
Deleted.

403.1.3 Seismic reinforcing. *Deleted.*

403.1.3.1 Foundations with stemwalls. Foundations with stem walls shall have installed a minimum of one No. 4 bar within 12 inches (305 mm) of the top of the wall and one No. 4 bar located 3 inches (76 mm) to 4 inches (102 mm) from the bottom of the footing.

403.1.3.2 Slabs-on-ground with turned-down footings. Slabs on ground with turned down footings shall have a minimum of one No. 4 bar at the top and the bottom of the footing.

Exception: For slabs-on-ground cast monolithically with the footing, locating one No. 5 bar or two No. 4 bars in the middle third of the footing depth shall be permitted as an alternative to placement at the footing top and bottom.

Where the slab is not cast monolithically with the footing, No. 3 or larger vertical dowels with standard hooks on each end shall be provided in accordance with Figure 403.1.3.2. Standard hooks shall comply with Section 611.5.4.5.

403.1.4 Minimum depth. All exterior footings shall be placed at least 12 inches (305 mm) below the undisturbed ground surface. Where applicable, the depth of footings shall also conform to Sections 403.1.4.1 through 403.1.4.2.

403.1.4.1 Frost protection. 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:

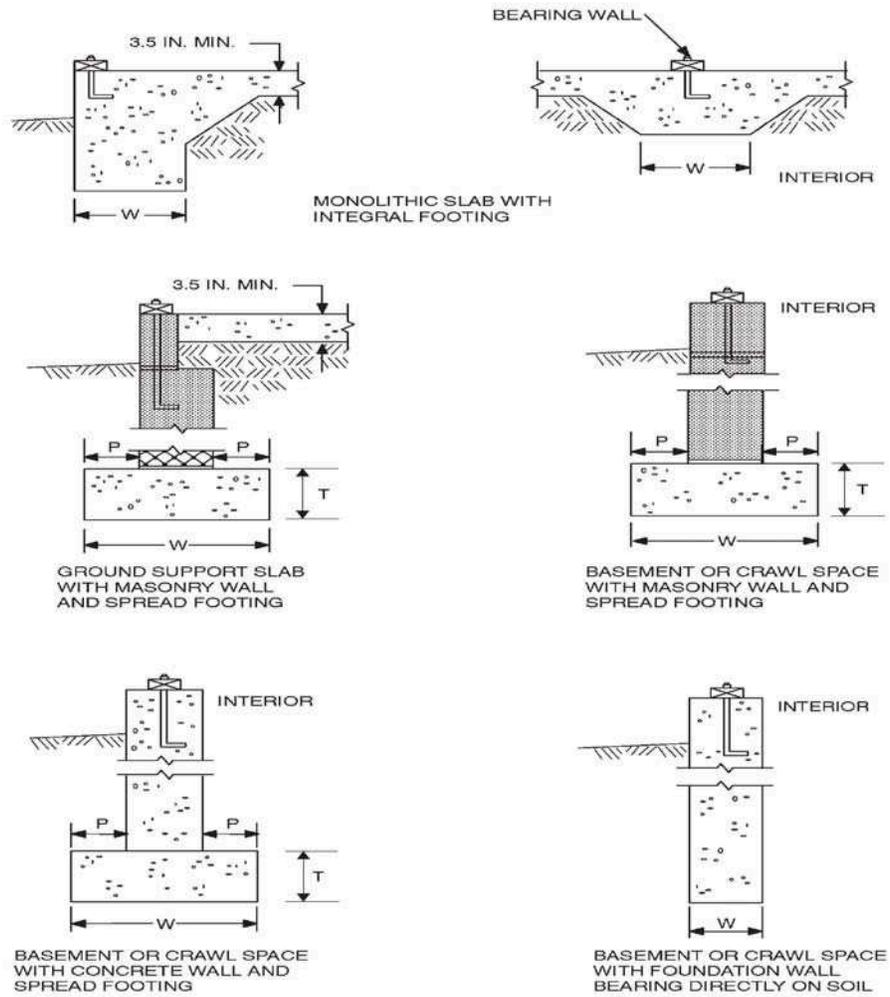
1. Extended below the frost line specified in Table 301.2.(1);
2. Constructing in accordance with Section 403.3;
3. Constructing in accordance with ASCE 32; or
4. Erected on solid rock.

Exceptions:

1. Protection of freestanding accessory structures with an area of 600 square feet (56 m²) or less, of light-frame construction, with an eave height of 10 feet (3048 mm) or less shall not be required.
2. Protection of freestanding accessory structures with an area of 400 square feet (37 m²) or less, of other than light-frame construction, with an eave height of 10 feet (3048 mm) or less shall not be required.
3. Decks not supported by a dwelling need not be provided with footings that extend below the frost line.

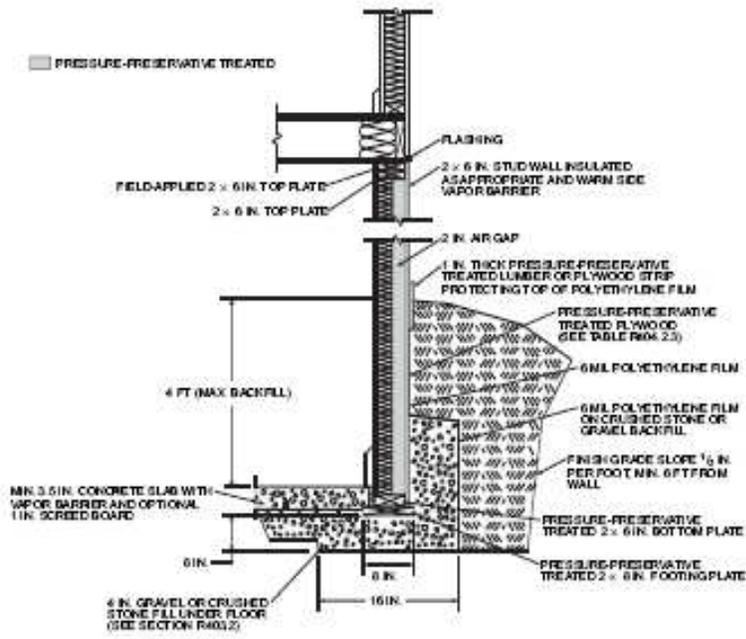
Footings shall not bear on frozen soil unless the frozen condition is permanent.

403.1.4.2 Seismic conditions. *Deleted.*



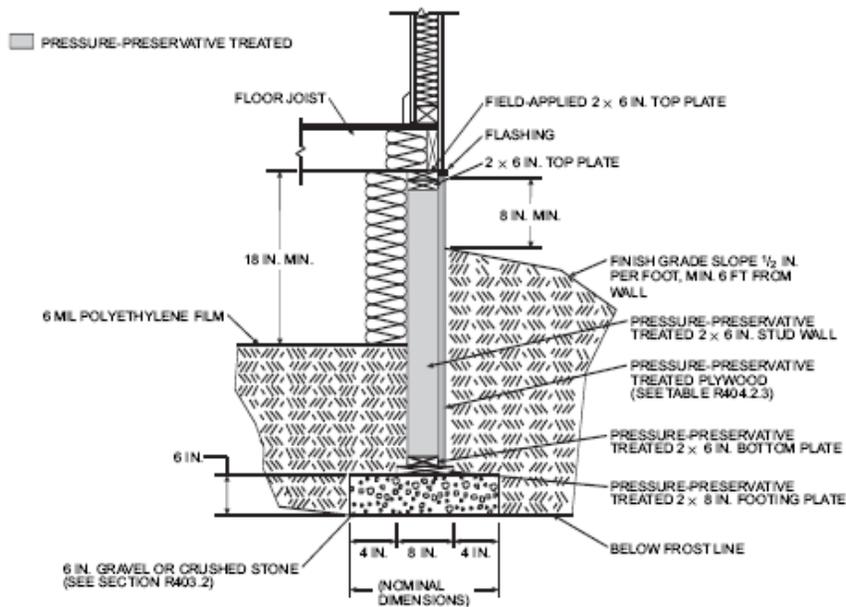
For SI: 1 inch = 25.4 mm.

FIGURE 403.1(1)
CONCRETE AND MASONRY FOUNDATION DETAILS



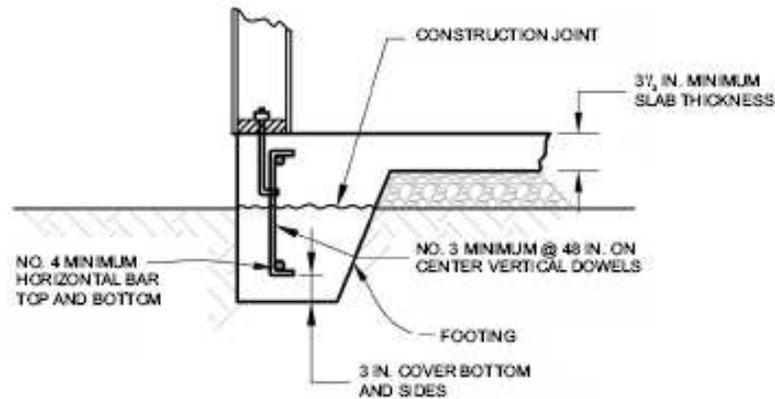
For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm.

FIGURE P403.1(3)
PERMANENT WOOD FOUNDATION BASEMENT WALL SECTION



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm.

FIGURE R403.1(3)
PERMANENT WOOD FOUNDATION CRAWL SPACE SECTION



For SI: 1 inch = 25.4 mm.

FIGURE R403.1.3.2
DOWELS FOR SLABS-ON-GROUND WITH TURNED-DOWN FOOTINGS

403.1.5 Slope. The top surface of footings shall be level. The bottom surface of footings shall not have a slope exceeding one unit vertical in 10 units horizontal (10-percent slope). Footings shall be stepped where it is necessary to change the elevation of the top surface of the footings or where the slope of the bottom surface of the footings will exceed one unit vertical in ten units horizontal (10-percent slope).

403.1.6 Foundation anchorage. Sill plates and walls supported directly on continuous foundations 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 anchor bolts spaced a maximum of 6 feet (1829 mm) on center. Bolts shall be at least 1/2 inch (12.7 mm) in diameter and shall extend a minimum of 7 inches (178 mm) into concrete or grouted cells of concrete masonry units. A nut and washer shall be tightened on each anchor bolt. There shall be a minimum of 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. 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 317 and 318. Cold-formed steel framing systems shall be fastened

to wood sill plates or anchored directly to the foundation as required in Section 505.3.1 or 603.3.1.

Exceptions:

1. Foundation anchorage, spaced as required to provide equivalent anchorage to ½-inch-diameter (12.7 mm) anchor bolts.
2. Walls 24 inches (610 mm) total length or shorter connecting offset braced wall panels shall be anchored to the foundation with a minimum of 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 Figure 602.10.4.4(1).~~
3. 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 Figure 602.10.4.4(1).~~

403.1.6.1 Foundation anchorage in Seismic Design Categories C, D₀, D₁ and D₂. *Deleted.*

403.1.7 Footings on or adjacent to slopes. The placement of buildings and structures on or adjacent to slopes steeper than one unit vertical in three units horizontal (33.3-percent slope) shall conform to Sections 403.1.7.1 through 403.1.7.4.

403.1.7.1 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 403.1.7.4 and Figure 403.1.7.1, the following criteria will be assumed to provide this protection. Where the existing slope is steeper than one unit vertical in one 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.

403.1.7.2 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 403.1.7.4 and Figure 403.1.7.1, the following setback is deemed adequate to meet the criteria. Where the slope is steeper than one unit vertical in one 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.

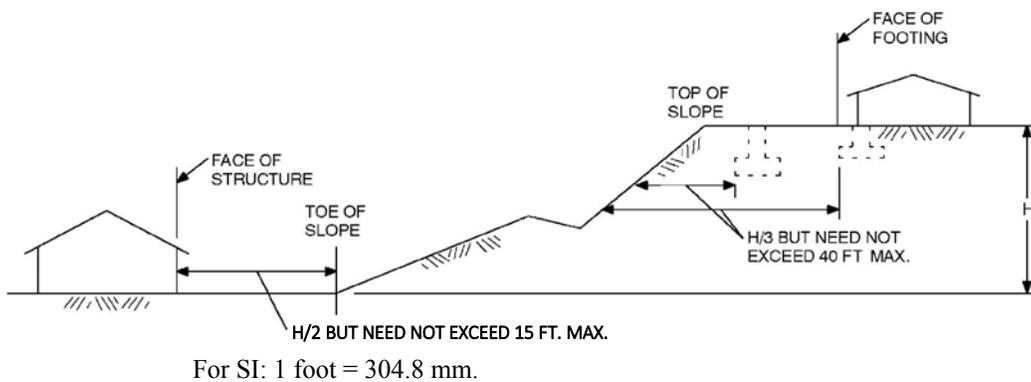


FIGURE 403.1.7.1
FOUNDATION CLEARANCE FROM SLOPES

403.1.7.3 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 a minimum of 12 inches (305 mm) plus 2 percent. Alternate elevations are permitted subject to the approval of the building official, provided 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.

403.1.7.4 Alternate setback 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.

403.1.8 Foundations on expansive soils. Foundation and floor slabs for buildings located on expansive soils shall be designed in accordance with Section 1808.6 of the *Ohio Building Code*.

Exception: Slab-on-ground and other foundation systems which have performed adequately in soil conditions similar to those encountered at the building site are permitted subject to the approval of the building official.

403.1.8.1 Expansive soils classifications. Soils meeting all four of the following provisions shall be considered 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 D 4318.
2. More than 10 percent of the soil particles pass a No. 200 sieve (75 μ m), determined in accordance with ASTM D 422.
3. More than 10 percent of the soil particles are less than 5 micrometers in size, determined in accordance with ASTM D 422.
4. Expansion Index greater than 20, determined in accordance with ASTM D 4829.

403.2 Footings for wood foundations. Footings for wood foundations shall be in accordance with Figures 403.1(2) and 403.1(3). Gravel shall be washed and well graded. The maximum size stone shall not exceed $\frac{3}{4}$ inch (19.1 mm). Gravel shall be free from organic, clayey or silty soils. Sand shall be coarse, not smaller than $\frac{1}{16}$ -inch (1.6 mm) grains and shall be free from organic, clayey or silty soils. Crushed stone shall have a maximum size of $\frac{1}{2}$ inch (12.7 mm).

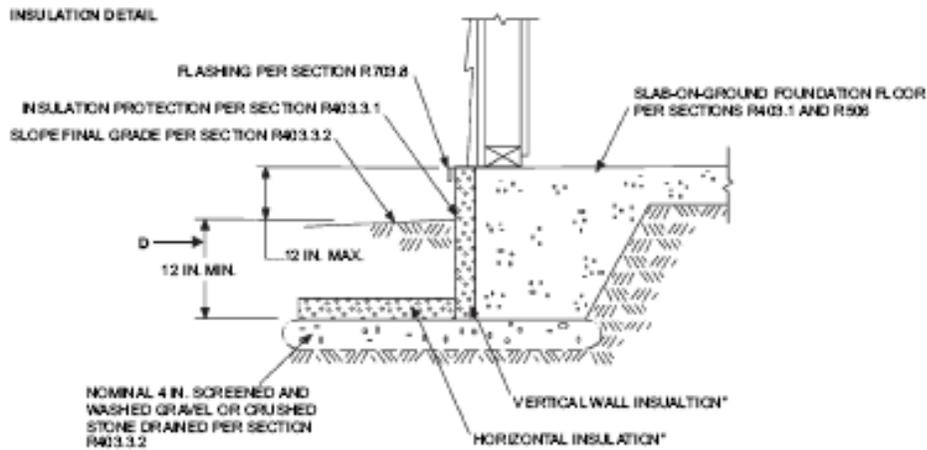
403.3 Frost protected shallow foundations. For buildings where the monthly mean temperature of the building is maintained at a minimum of 64°F (18°C), footings are not required to extend below the frost line when protected from frost by insulation in accordance with Figure 403.3(1) and Table 403.3(1). Foundations protected from frost in accordance with Figure 403.3(1) and Table 403.3(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 C 578.

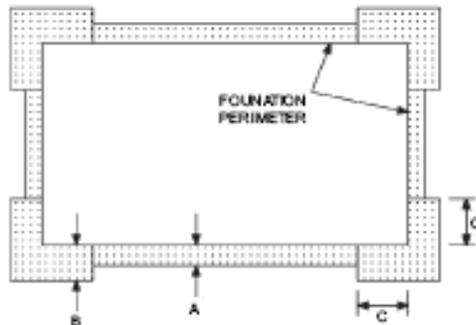
403.3.1 Foundations adjoining frost protected shallow foundations.

Foundations that adjoin frost protected shallow foundations shall be protected from frost in accordance with Section 403.1.4.

403.3.1.1 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 a minimum of 64°F (18°C) shall be in accordance with Figure 403.3(3) and Table 403.3(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 either be 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



HORIZONTAL INSULATION PLAN



For SI: 1 inch = 25.4 mm.

a. See Table 403.3(1) for required dimensions and R-values for vertical and horizontal insulation and minimum footing depth.

**FIGURE 403.3(1)
INSULATION PLACEMENT FOR FROST PROTECTED FOOTINGS IN
HEATED BUILDINGS**

**TABLE 403.3(1)
MINIMUM FOOTING DEPTH AND INSULATION REQUIREMENTS FOR FROST-
PROTECTED FOOTINGS IN HEATED BUILDINGS^a**

AIR FREEZING INDEX (°F-days) ^b	MINIMUM FOOTING DEPTH, <i>D</i> (inches)	VERTICAL INSULATION R-VALUE ^{c, d}	HORIZONTAL INSULATION R-VALUE ^{c, e}		HORIZONTAL INSULATION DIMENSIONS PER FIGURE 403.3(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

- a. Insulation requirements are for protection against frost damage in heated buildings. Greater values may be required to meet energy conservation standards.
- b. See Figure 403.3(2) or Table 403.3(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— $2.4R$ per inch; Type IV extruded polystyrene— $4.5R$ per inch; Type VI extruded polystyrene— $4.5R$ per inch; Type IX expanded polystyrene— $3.2R$ per inch; Type X extruded polystyrene— $4.5R$ per inch.
- d. Vertical insulation shall be expanded polystyrene insulation or extruded polystyrene insulation.
- e. Horizontal insulation shall be extruded polystyrene insulation.

**TABLE 403.3(2)
AIR-FREEZING INDEX FOR U.S. OHIO LOCATIONS BY COUNTY**

STATE	AIR-FREEZING INDEX					
	1500 or less	2000	2500	3000	3500	4000
Ohio	All counties not listed	Ashland, Crawford, Defiance, Holmes, Huron, Knox, Licking, Morrow, Paulding, Putnam, Richland, Seneca, Williams	—	—	—	—

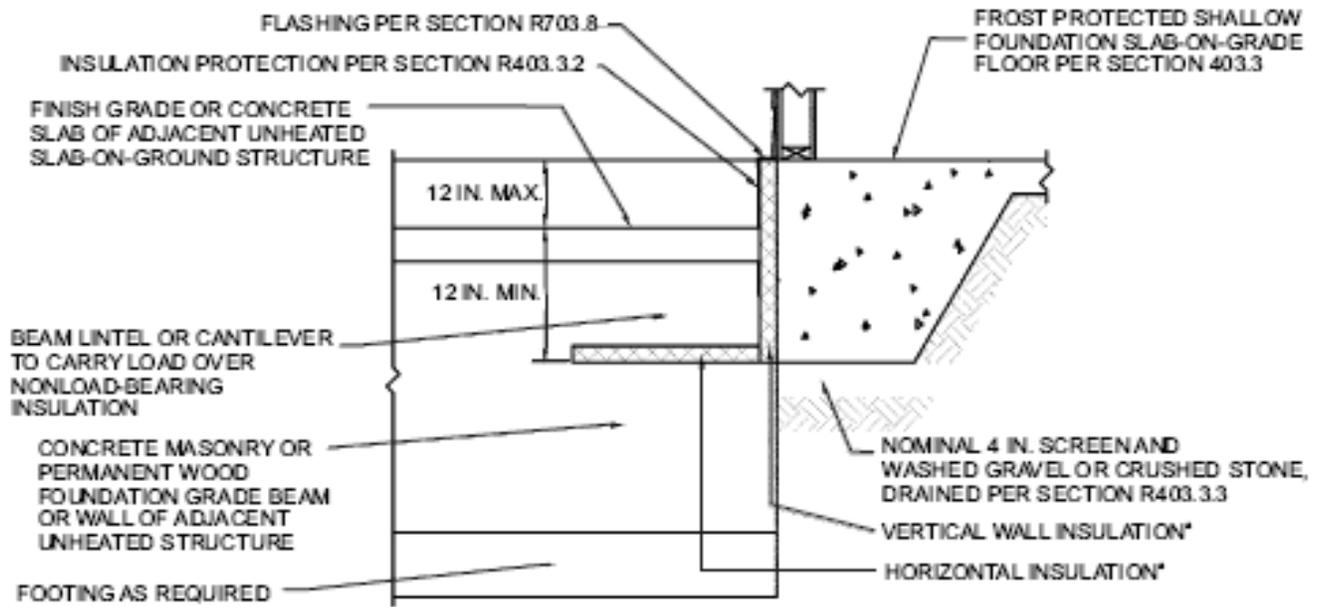


For SI: $C = [(F) - 32]/1.8$.

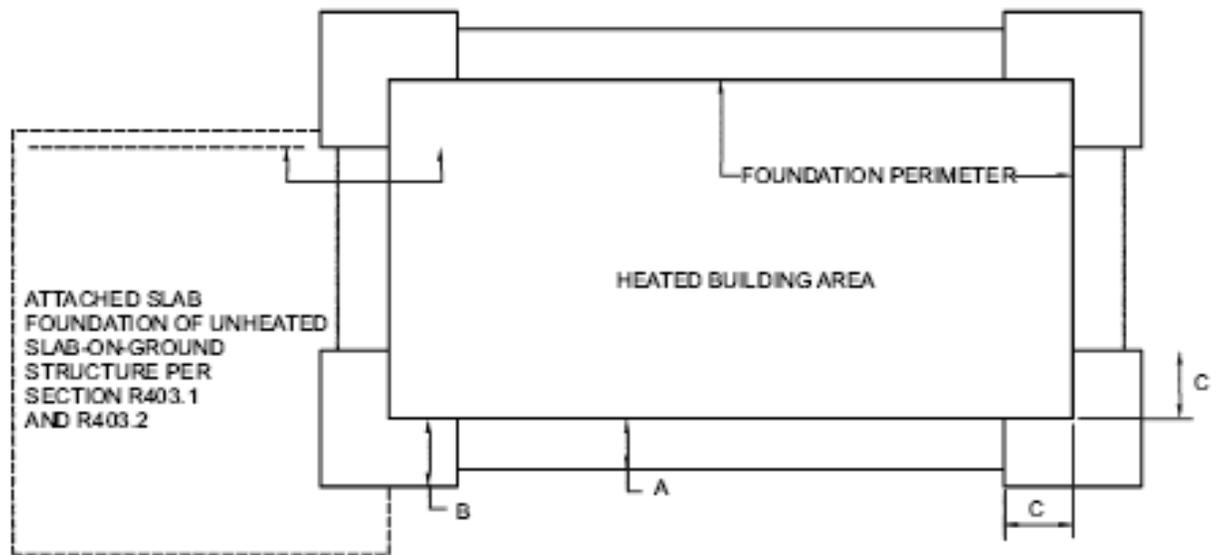
Note: The air-freezing index is defined as cumulative degree days below 32F. It is used as a measure of the combined magnitude and duration of air temperature below freezing. The index was computed over a 12-month period (July-June) for each of the 3,044 stations used in the above analysis. Data from the 1951-80 period were fitted to a Weibull probability distribution to produce an estimate of the 100-year return period.

FIGURE 403.3(2)
AIR-FREEZING INDEX
AN ESTIMATE OF THE 100-YEAR RETURN PERIOD

INSULATION DETAIL



HORIZONTAL INSULATION PLAN



For SI: 1 inch = 25.4 mm.

a. See Table R403.3(1) for required dimensions and R-values for vertical and horizontal insulation.

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

403.3.1.2 Attachment to heated structure. Where a frost protected shallow foundation abuts a structure that has a monthly mean temperature maintained at a minimum of 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 403.3(4) a distance of not less than Dimension A in Table 403.3(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.

403.3.2 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.

403.3.3 Drainage. Final grade shall be sloped in accordance with Section R401.3. In other than Group I Soils, as detailed in Table 405.1, gravel or crushed stone beneath horizontal insulation below ground shall drain *by gravity or mechanical means into an approved drainage system or other location that complies with the Ohio Plumbing Code.*

403.3.4 Termite damage. The use of foam plastic in areas of “very heavy” termite infestation probability shall be in accordance with Section R318.4.

403.4 Footings for precast concrete foundations. Footings for precast concrete foundations shall comply with Section 403.4.

403.4.1 Crushed stone footings. Clean crushed stone shall be free from organic, clayey or silty soils. Crushed stone shall be angular in nature and meet ASTM C 33, with the maximum size stone not to exceed ½ inch (12.7 mm) and the minimum stone size not to be smaller than 1/16-inch (1.6 mm). Crushed stone footings for precast foundations shall be installed in accordance with Figure 403.4(1) and Table 403.4. Crushed stone footings shall be

consolidated using a vibratory plate in a maximum of 8-inch lifts. Crushed stone footings shall be limited to Seismic Design Categories A, B and C.

403.4.2 Concrete footings. Concrete footings shall be installed in accordance with Section 403.1 and Figure 403.4(2).

403.5 Exterior deck footings. Exterior deck footings of poured-in-place concrete shall be a minimum of 8 inches (203 mm) thick and extend below the frost depth per Table 301.2(1). The diameter or width of the footing shall comply with Table 403.5.

TABLE 403.4
MINIMUM DEPTH OF CRUSHED STONE FOOTINGS (D), (inches)

		LOAD BEARING VALUE OF SOIL (psf)															
		1500				2000				3000				4000			
		MH, CH, CL, ML				SC, GC, SM, GM, SP, SW				GP, GW							
		Wall width (inches)				Wall width (inches)				Wall width (inches)				Wall width (inches)			
		6	8	10	12	6	8	10	12	6	8	10	12	6	8	10	12
Conventional light-frame construction																	
1-story	1100 plf	6	4	4	4	6	4	4	4	6	4	4	4	6	4	4	4
2-story	1800 plf	8	6	4	4	6	4	4	4	6	4	4	4	6	4	4	4
3-story	2000 2900 plf	16	14	12	10	10	8	6	6	6	4	4	4	6	4	4	4
4-inch brick veneer over light-frame or 8-inch hollow concrete masonry																	
1-story	1500 plf	6	4	4	4	6	4	4	4	6	4	4	4	6	4	4	4
2-story	2700 plf	14	12	10	8	10	8	6	4	6	4	4	4	6	4	4	4
3-story	4000 plf	22	22	20	18	16	14	12	10	10	8	6	4	6	4	4	4
8-inch solid or fully grouted masonry																	
1-story	2000 plf	10	8	6	4	6	4	4	4	6	4	4	4	6	4	4	4
2-story	3600 plf	20	18	16	16	14	12	10	8	8	6	4	4	6	4	4	4
3-story	5300 plf	32	30	28	26	22	22	20	18	14	12	10	8	10	8	6	4

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 6.89 kPa. 1 plf = 14.6 N/m. 1 pounds per square foot = 47.9 N/m²

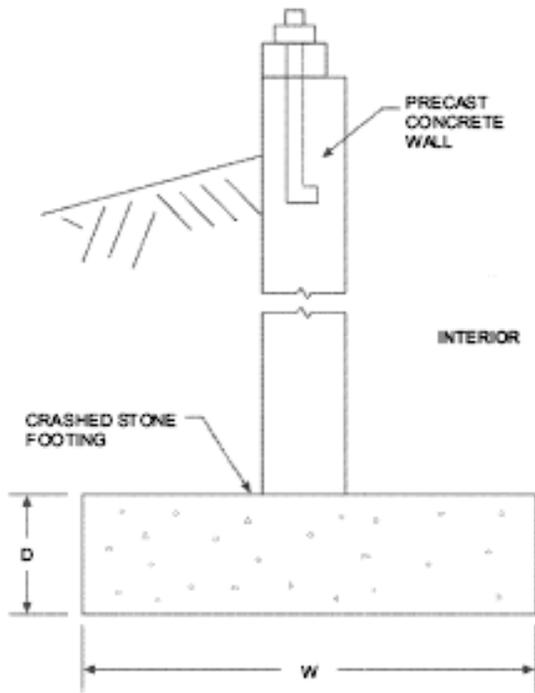


FIGURE R403.4(1)
BASEMENT OR CRAWL SPACE WITH PRECAST
FOUNDATION WALL BEARING ON CRUSHED STONE

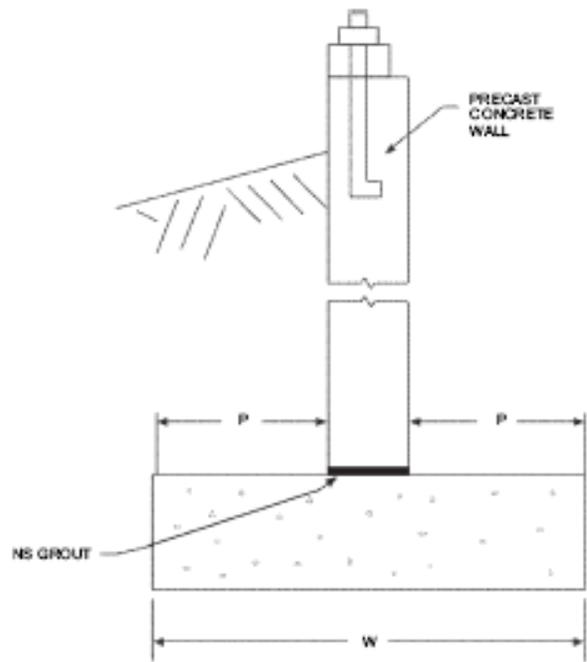


FIGURE R403.4(2)
BASEMENT OR CRAWL SPACE WITH PRECAST
FOUNDATION WALL ON SPREAD FOOTING

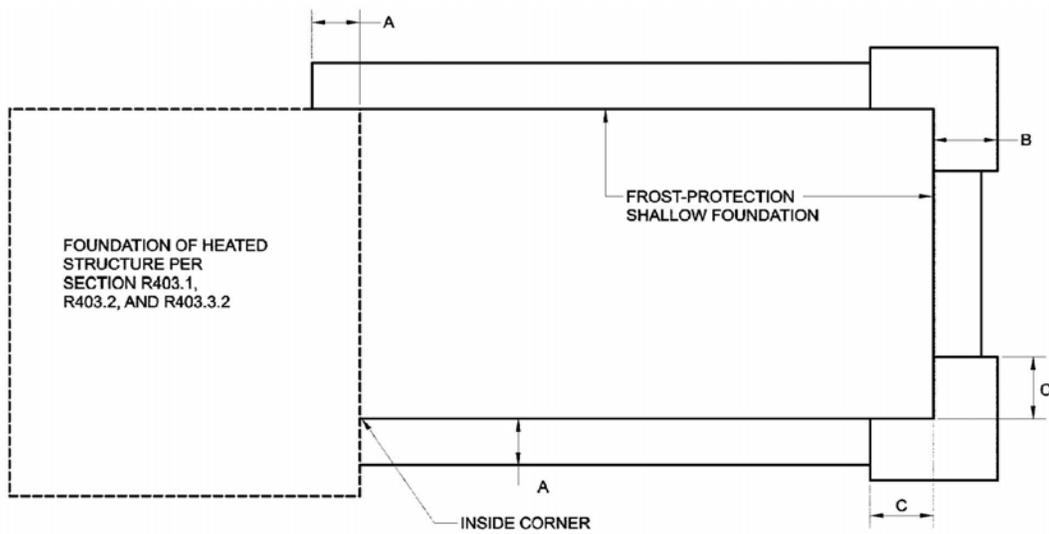


FIGURE 403.3(4)
INSULATION PLACEMENT FOR FROST-PROTECTED FOOTINGS
ADJACENT TO HEATED STRUCTURE

TABLE 403.5
MINIMUM FOOTING SIZE FOR DECK FOOTINGS WITHOUT ROOF LOADS
EXTERIOR DECK AND PORCH FOOTING SIZE IN INCHES^{a,b}

<i>Diameter</i>	<i>Square</i>	<i>Maximum Tributary Area Allowed Per Post (square feet)</i>
8	8 x 8	14
10	9 x 9	22
12	11 x 11	31.6
14	13 x 13	42.8
16	15 x 15	56
18	16 x 16	70.8
20	18 x 18	87.2

a. Based upon 2000 lbs. per square foot soil bearing capacity.

b. Based upon 40 lbs. per square foot live load and a 10 lbs. per square foot dead load.

SECTION 404 FOUNDATION AND RETAINING WALLS

404.1 Concrete and masonry foundation walls. Concrete foundation walls shall be selected and constructed in accordance with the provisions of Section 404.1.2. Masonry foundation walls shall be selected and constructed in accordance with the provisions of Section 404.1.1.

404.1.1 Design of masonry foundation walls. Masonry foundation walls shall be designed and constructed in accordance with the provisions of this section or in accordance with the provisions of TMS 402/ACI 530/ASCE 5 or NCMA TR68-A.

TABLE 404.1.1(1)
PLAIN MASONRY FOUNDATION WALLS

MAXIMUM WALL HEIGHT (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT ^c (feet)	PLAIN MASONRY ^a MINIMUM NOMINAL WALL THICKNESS (inches)		
		Soil classes ^b		
		GW, GP, SW and SP	GM, GC, SM, SM-SC and ML	SC, MH, ML-CL and inorganic CL
5	4	6 solid ^d or 8	6 solid ^d or 8	6 solid ^d or 8
	5	6 solid ^d or 8	8	10
6	4	6 solid ^d or 8	6 solid ^d or 8	6 solid ^d or 8
	5	6 solid ^d or 8	8	10
	6	8	10	12

7	4	6 solid ^d or 8	8	8
	5	6 solid ^d or 8	10	10
	6	10	12	10 solid ^d
	7	12	10 solid ^d	12 solid ^d
8	4	6 solid ^d or 8	6 solid ^d or 8	8
	5	6 solid ^d or 8	10	12
	6	10	12	12 solid ^d
	7	12	12 solid ^d	Footnote e
	8	10 solid ^d	12 solid ^d	Footnote e
9	4	6 solid ^d or 8	6 solid ^d or 8	8
	5	8	10	12
	6	10	12	12 solid ^d
	7	12	12 solid ^d	Footnote e
	8	12 solid ^d	Footnote e	Footnote e
	9	Footnote e	Footnote e	Footnote e

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square inch = 6.895 Pa.

- a. Mortar shall be Type M or S and masonry shall be laid in running bond. UngROUTED hollow masonry units are permitted except where otherwise indicated.
- b. Soil classes are in accordance with the Unified Soil Classification System. Refer to Table 405.1.
- c. Unbalanced backfill height is the difference in height between the exterior finish ground level and the lower of the top of the concrete footing that supports the foundation wall or the interior finish ground level. Where an interior concrete slab-on-grade is provided and is in contact with the interior surface of the foundation wall, measurement of the unbalanced backfill height from the exterior finish ground level to the top of the interior concrete slab is permitted.
- d. Solid grouted hollow units or solid masonry units.
- e. Wall construction shall be in accordance with either Table 404.1.1(2), Table 404.1.1(3), Table 404.1.1(4), or a design shall be provided.

TABLE 404.1.1(2)
8-INCH MASONRY FOUNDATION WALLS WITH REINFORCING
WHERE d > 5 INCHES^{a, c}

WALL HEIGHT	HEIGHT OF UNBALANCED BACKFILL ^c	MINIMUM VERTICAL REINFORCEMENT AND SPACING (INCHES) ^{b, c}		
		Soil classes and lateral soil load ^d (psf per foot below grade)		
		GW, GP, SW and SP soils 30	GM, GC, SM, SM-SC and ML soils 45	SC, ML-CL and inorganic CL soils 60
6 feet 8 inches	4 feet (or less)	#4 at 48	#4 at 48	#4 at 48
	5 feet	#4 at 48	#4 at 48	#4 at 48
	6 feet 8 inches	#4 at 48	#5 at 48	#6 at 48
7 feet 4 inches	4 feet (or less)	#4 at 48	#4 at 48	#4 at 48
	5 feet	#4 at 48	#4 at 48	#4 at 48
	6 feet	#4 at 48	#5 at 48	#5 at 48
	7 feet 4 inches	#5 at 48	#6 at 48	#6 at 40
8 feet	4 feet (or less)	#4 at 48	#4 at 48	#4 at 48
	5 feet	#4 at 48	#4 at 48	#4 at 48
	6 feet	#4 at 48	#5 at 48	#5 at 48
	7 feet 8 feet	#5 at 48	#6 at 48	#6 at 40
			#5 at 48	#6 at 32

8 feet 8 inches	4 feet (or less)	#4 at 48	#4 at 48	#4 at 48
	5 feet	#4 at 48	#4 at 48	#5 at 48
	6 feet	#4 at 48	#5 at 48	#6 at 48
	7 feet	#5 at 48	#6 at 48	#6 at 40
	8 feet 8 inches	#6 at 48	#6 at 32	#6 at 24
9 feet 4 inches	4 feet (or less)	#4 at 48	#4 at 48	#4 at 48
	5 feet	#4 at 48	#4 at 48	#5 at 48
	6 feet	#4 at 48	#5 at 48	#6 at 48
	7 feet	#5 at 48	#6 at 48	#6 at 40
	8 feet	#6 at 48	#6 at 40	#6 at 24
	9 feet 4 inches	#6 at 40	#6 at 24	#6 at 16
10 feet	4 feet (or less)	#4 at 48	#4 at 48	#4 at 48
	5 feet	#4 at 48	#4 at 48	#5 at 48
	6 feet	#4 at 48	#5 at 48	#6 at 48
	7 feet	#5 at 48	#6 at 48	#6 at 32
	8 feet	#6 at 48	#6 at 32	#6 at 24
	9 feet	#6 at 40	#6 at 24	#6 at 16
	10 feet	#6 at 32	#6 at 16	#6 at 16

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot per foot = 0.157 kPa/mm.

- a. Mortar shall be Type M or S and masonry shall be laid in running bond.
- b. Alternative reinforcing bar sizes and spacings having an equivalent cross-sectional area of reinforcement per lineal foot of wall shall be permitted provided the spacing of the reinforcement does not exceed 72 inches.
- c. Vertical reinforcement shall be Grade 60 minimum. The distance, *d*, from the face of the soil side of the wall to the center of vertical reinforcement shall be at least 5 inches.
- d. Soil classes are in accordance with the Unified Soil Classification System and design lateral soil loads are for moist conditions without hydrostatic pressure. Refer to Table 405.1.
- e. Unbalanced backfill height is the difference in height between the exterior finish ground level and the lower of the top of the concrete footing that supports the foundation wall or the interior finish ground level. Where an interior concrete slab-on-grade is provided and is in contact with the interior surface of the foundation wall, measurement of the unbalanced backfill height from the exterior finish ground level to the top of the interior concrete slab is permitted.

TABLE 404.1.1(3)
10-INCH MASONRY FOUNDATION WALLS WITH REINFORCING
WHERE *d* > 6.75 INCHES^{a, c}

WALL HEIGHT	HEIGHT OF UNBALANCED BACKFILL ^c	MINIMUM VERTICAL REINFORCEMENT AND SPACING (INCHES) ^{b, c}		
		Soil classes and later soil load ^d (psf per foot below grade)		
		GW, GP, SW and SP soils 30	GM, GC, SM, SM-SC and ML soils 45	SC, ML-CL and inorganic CL soils 60
6 feet 8 inches	4 feet (or less)	#4 at 56	#4 at 56	#4 at 56
	5 feet	#4 at 56	#4 at 56	#4 at 56
	6 feet 8 inches	#4 at 56	#5 at 56	#5 at 56
7 feet 4 inches	4 feet (or less)	#4 at 56	#4 at 56	#4 at 56
	5 feet	#4 at 56	#4 at 56	#4 at 56
	6 feet	#4 at 56	#4 at 56	#5 at 56
	7 feet 4 inches	#4 at 56	#5 at 56	#6 at 56

8 feet	4 feet (or less)	#4 at 56	#4 at 56	#4 at 56
	5 feet	#4 at 56	#4 at 56	#4 at 56
	6 feet	#4 at 56	#4 at 56	#5 at 56
	7 feet	#4 at 56	#5 at 56	#6 at 56
	8 feet	#5 at 56	#6 at 56	#6 at 48
8 feet 8 inches	4 feet (or less)	#4 at 56	#4 at 56	#4 at 56
	5 feet	#4 at 56	#4 at 56	#4 at 56
	6 feet	#4 at 56	#4 at 56	#5 at 56
	7 feet	#4 at 56	#5 at 56	#6 at 56
9 feet 4 inches	4 feet (or less)	#4 at 56	#4 at 56	#4 at 56
	5 feet	#4 at 56	#4 at 56	#4 at 56
	6 feet	#4 at 56	#5 at 56	#5 at 56
	7 feet	#4 at 56	#5 at 56	#6 at 56
	8 feet	#5 at 56	#6 at 56	#6 at 40
10 feet	4 feet (or less)	#4 at 56	#4 at 56	#4 at 56
	5 feet	#4 at 56	#4 at 56	#4 at 56
	6 feet	#4 at 56	#5 at 56	#5 at 56
	7 feet	#5 at 56	#6 at 56	#6 at 48
	8 feet	#5 at 56	#6 at 48	#6 at 40
	9 feet	#6 at 56	#6 at 40	#6 at 24
10 feet	#6 at 48	#6 at 32	#6 at 24	

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot per foot = 0.157 kPa/mm.

- a. Mortar shall be Type M or S and masonry shall be laid in running bond.
- b. Alternative reinforcing bar sizes and spacings having an equivalent cross-sectional area of reinforcement per lineal foot of wall shall be permitted provided the spacing of the reinforcement does not exceed 72 inches.
- c. Vertical reinforcement shall be Grade 60 minimum. The distance, *d*, from the face of the soil side of the wall to the center of vertical reinforcement shall be at least 6.75 inches.
- d. Soil classes are in accordance with the Unified Soil Classification System and design lateral soil loads are for moist conditions without hydrostatic pressure. Refer to Table 405.1.
- e. Unbalanced backfill height is the difference in height between the exterior finish ground level and the lower of the top of the concrete footing that supports the foundation wall or the interior finish ground level. Where an interior concrete slab-on-grade is provided and is in contact with the interior surface of the foundation wall, measurement of the unbalanced backfill height from the exterior finish ground level to the top of the interior concrete slab is permitted.

TABLE 404.1.1(4)
12-INCH MASONRY FOUNDATION WALLS WITH REINFORCING
WHERE *d* > 8.75 INCHES^{a, c}

WALL HEIGHT	HEIGHT OF UNBALANCED BACKFILL ^c	MINIMUM VERTICAL REINFORCEMENT AND SPACING (INCHES) ^{b, c}		
		Soil classes and lateral soil load ^d (psf per foot below grade)		
		GW, GP, SW and SP soils 30	GM, GC, SM, SM-SC and ML soils 45	SC, ML-CL and inorganic CL soils 60
6 feet 8 inches	4 feet (or less)	#4 at 72	#4 at 72	#4 at 72
	5 feet	#4 at 72	#4 at 72	#4 at 72
	6 feet 8 inches	#4 at 72	#4 at 72	#5 at 72

7 feet 4 inches	4 feet (or less)	#4 at 72	#4 at 72	#4 at 72
	5 feet	#4 at 72	#4 at 72	#4 at 72
	6 feet	#4 at 72	#4 at 72	#5 at 72
	7 feet 4 inches	#4 at 72	#5 at 72	#6 at 72
8 feet	4 feet (or less)	#4 at 72	#4 at 72	#4 at 72
	5 feet	#4 at 72	#4 at 72	#4 at 72
	6 feet	#4 at 72	#4 at 72	#5 at 72
	7 feet	#4 at 72	#5 at 72	#6 at 72
	8 feet	#5 at 72	#6 at 72	#6 at 64
8 feet 8 inches	4 feet (or less)	#4 at 72	#4 at 72	#4 at 72
	5 feet	#4 at 72	#4 at 72	#4 at 72
	6 feet	#4 at 72	#4 at 72	#5 at 72
	7 feet	#4 at 72	#5 at 72	#6 at 72
	8 feet 8 inches	#5 at 72	#7 at 72	#6 at 48
9 feet 4 inches	4 feet (or less)	#4 at 72	#4 at 72	#4 at 72
	5 feet	#4 at 72	#4 at 72	#4 at 72
	6 feet	#4 at 72	#5 at 72	#5 at 72
	7 feet	#4 at 72	#5 at 72	#6 at 72
	8 feet	#5 at 72	#6 at 72	#6 at 56
	9 feet 4 inches	#6 at 72	#6 at 48	#6 at 40
10 feet	4 feet (or less)	#4 at 72	#4 at 72	#4 at 72
	5 feet	#4 at 72	#4 at 72	#4 at 72
	6 feet	#4 at 72	#5 at 72	#5 at 72
	7 feet	#4 at 72	#6 at 72	#6 at 72
	8 feet	#5 at 72	#6 at 72	#6 at 48
	9 feet	#6 at 72	#6 at 56	#6 at 40
	10 feet	#6 at 64	#6 at 40	#6 at 32

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot per foot = 0.157 kPa/mm.

- a. Mortar shall be Type M or S and masonry shall be laid in running bond.
- b. Alternative reinforcing bar sizes and spacings having an equivalent cross-sectional area of reinforcement per lineal foot of wall shall be permitted provided the spacing of the reinforcement does not exceed 72 inches.
- c. Vertical reinforcement shall be Grade 60 minimum. The distance, d , from the face of the soil side of the wall to the center of vertical reinforcement shall be at least 8.75 inches.
- d. Soil classes are in accordance with the Unified Soil Classification System and design lateral soil loads are for moist conditions without hydrostatic pressure. Refer to Table 405.1.
- e. Unbalanced backfill height is the difference in height between the exterior finish ground level and the lower of the top of the concrete footing that supports the foundation wall or the interior finish ground levels. Where an interior concrete slab-on-grade is provided and in contact with the interior surface of the foundation wall, measurement of the unbalanced backfill height is permitted to be measured from the exterior finish ground level to the top of the interior concrete slab is permitted.

404.1.1.1 Masonry foundation walls. Concrete masonry and clay masonry foundation walls shall be constructed as set forth in Table 404.1.1(1), 404.1.1(2), 404.1.1(3) or 404.1.1(4) and shall also comply with applicable provisions of Sections 606, 607 and 608. 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 404.1.4.1. Rubble stone masonry foundation walls shall be constructed in accordance

with Sections 404.1.8 and 607.2.2. Rubble stone masonry walls shall not be used in Seismic Design Categories D₀, D₁ and D₂.

404.1.2 Concrete foundation walls. Concrete foundation walls that support light-frame walls shall be designed and constructed in accordance with the provisions of this section, ACI 318, ACI 332 or PCA 100. Concrete foundation walls that support above-grade concrete walls that are within the applicability limits of Section 611.2 shall be designed and constructed in accordance with the provisions of this section, ACI 318, ACI 332 or PCA 100. Concrete foundation walls that support above-grade concrete walls that are not within the applicability limits of Section 611.2 shall be designed and constructed in accordance with the provisions of ACI 318, ACI 332 or PCA 100.

404.1.2.1 Concrete cross-section. Concrete walls constructed in accordance with this code shall comply with the shapes and minimum concrete cross-sectional dimensions required by Table 611.3. Other types of forming systems resulting in concrete walls not in compliance with this section and Table 611.3 shall be designed in accordance with ACI 318.

404.1.2.2 Reinforcement for foundation walls. Concrete foundation walls shall be laterally supported at the top and bottom. Horizontal reinforcement shall be provided in accordance with Table 404.1.2(1). Vertical reinforcement shall be provided in accordance with Table 404.1.2(2), 404.1.2(3), 404.1.2(4), 404.1.2(5), 404.1.2(6), 404.1.2(7) or 404.1.2(8). Vertical reinforcement for flat basement walls retaining 4 feet (1219 mm) or more of unbalanced backfill is permitted to be determined in accordance with Table ~~404.1.2(9)~~ 404.1.2(8). For basement walls supporting above-grade concrete walls, vertical reinforcement shall be the greater of that required by Tables 404.1.2(2) through 404.1.2(8) or by Section 611.6 for the above-grade wall. In buildings assigned to Seismic Design Category D₀, D₁ or D₂, concrete foundation walls shall also comply with Section 404.1.4.2.

404.1.2.2.1 Concrete foundation stem walls supporting above-grade concrete walls. Foundation stem walls that support above-grade concrete walls shall be designed and constructed in accordance with this section.

1. Stem walls not laterally supported at top. Concrete stem walls that are not monolithic with slabs-on-ground or are not

otherwise laterally supported by slabs-on-ground shall comply with this section. Where unbalanced backfill retained by the stem wall is less than or equal to 18 inches (457 mm), the stem wall and above-grade wall it supports shall be provided with vertical reinforcement in accordance with Section 611.6 and Table 611.6(1), 611.6(2) or 611.6(3) for above-grade walls. Where unbalanced backfill retained by the stem wall is greater than 18 inches (457 mm), the stem wall and above-grade wall it supports shall be provided with vertical reinforcement in accordance with Section 611.6 and Table 611.6(4).

2. Stem walls laterally supported at top. Concrete stem walls that are monolithic with slabs-on ground or are otherwise laterally supported by slabs-on-ground shall be vertically reinforced in accordance with Section 611.6 and Table 611.6(1), 611.6(2) or 611.6(3) for above-grade walls. Where the unbalanced backfill retained by the stem wall is greater than 18 inches (457 mm), the connection between the stem wall and the slab-on-ground, and the portion of the slab-on-ground providing lateral support for the wall shall be designed in accordance with PCA 100 or in accordance with accepted engineering practice. Where the unbalanced backfill retained by the stem wall is greater than 18 inches (457 mm), the minimum nominal thickness of the wall shall be 6 inches (152 mm).

404.1.2.2.2 Concrete foundation stem walls supporting light-frame above-grade walls. Concrete foundation stem walls that support light-frame above-grade walls shall be designed and constructed in accordance with this section.

1. Stem walls not laterally supported at top. Concrete stem walls that are not monolithic with slabs-on-ground or are not otherwise laterally supported by slabs-on-ground and retain 48 inches (1219 mm) or less of unbalanced fill, measured from the top of the wall, shall be constructed in accordance with Section 404.1.2. Foundation stem walls that retain more than 48 inches (1219 mm) of unbalanced fill, measured from the top of the wall, shall be designed in accordance with Sections 404.1.3 and 404.4.

2. Stem walls laterally supported at top. Concrete stem walls that are monolithic with slabs-on ground or are otherwise laterally supported by slabs-on-ground shall be constructed in accordance with Section 404.1.2. Where the unbalanced backfill retained by the stem wall is greater than 48 inches (1219 mm), the connection between the stem wall and the slab-on-ground, and the portion of the slab-on-ground providing lateral support for the wall shall be designed in accordance with PCA 100 or in accordance with accepted engineering practice.

TABLE 404.1.2(1)
MINIMUM HORIZONTAL REINFORCEMENT FOR CONCRETE BASEMENT WALLS^{a, b}

MAXIMUM UNSUPPORTED HEIGHT OF BASEMENT WALL (feet)	LOCATION OF HORIZONTAL REINFORCEMENT
≤8	One No. 4 bar within 12 inches of the top of the wall story and one No. 4 bar near mid-height of the wall story
>8	One No. 4 bar within 12 inches of the top of the wall story and one No. 4 bar near third points in the wall story

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square inch = 6.895kPa.

- a. Horizontal reinforcement requirements are for reinforcing bars with a minimum yield strength of 40,000 psi and concrete with a minimum concrete compressive strength 2,500 psi.
- b. See Section 404.1.2.2 for minimum reinforcement required for foundation walls supporting above-grade concrete walls.

TABLE 404.1.2(2)
MINIMUM VERTICAL REINFORCEMENT FOR 6-INCH NOMINAL FLAT CONCRETE BASEMENT WALLS^{b, c, d, e, g, h, i, j}

MAXIMUM UNSUPPORTED WALL HEIGHT (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT ^f (feet)	MINIMUM VERTICAL REINFORCEMENT—BAR SIZE AND SPACING (inches)		
		Soil classes ^a and design lateral soil (psf per foot of depth)		
		GW, GP, SW, SP 30	GM, GC, SM, SM-SC and ML 45	SC, ML-CL and inorganic CL 60
8	4	NR	NR	NR
	5	NR	6 @ 39	6 @ 48
	6	5 @ 39	6 @ 48	6 @ 35
	7	6 @ 48	6 @ 34	6 @ 25
	8	6 @ 39	6 @ 25	6 @ 18
9	4	NR	NR	NR
	5	NR	5 @ 37	6 @ 48
	6	5 @ 36	6 @ 44	6 @ 32
	7	6 @ 47	6 @ 30	6 @ 22
	8	6 @ 34	6 @ 22	6 @ 16

	9	6 @ 27	6 @ 17	DR
10	4	NR	NR	NR
	5	NR	5 @ 35	6 @ 48
	6	6 @ 48	6 @ 41	6 @ 30
	7	6 @ 43	6 @ 28	6 @ 20
	8	6 @ 31	6 @ 20	DR
	9	6 @ 24	6 @ 15	DR
	10	6 @ 19	DR	DR

For SI: 1 foot = 304.8 mm; 1 inch = 25.4 mm; 1 pound per square foot per foot = 0.1571 kPa²/m, 1 pound per square inch = 6.895 kPa.

- a. Soil classes are in accordance with the Unified Soil Classification System. Refer to Table 405.1.
- b. Table values are based on reinforcing bars with a minimum yield strength of 60,000 psi concrete with a minimum specified compressive strength of 2,500 psi and vertical reinforcement being located at the centerline of the wall. See Section 404.1.2.3.7.2.
- c. Vertical reinforcement with a yield strength of less than 60,000 psi and/or bars of a different size than specified in the table are permitted in accordance with Section 404.1.2.3.7.6 and Table 404.1.2(9).
- d. Deflection criterion is $L/240$, where L is the height of the basement wall in inches.
- e. Interpolation is not permitted.
- f. Where walls will retain 4 feet or more of unbalanced backfill, they shall be laterally supported at the top and bottom before backfilling.
- g. NR indicates no vertical wall reinforcement is required, except for 6-inch nominal walls formed with stay-in-place forming systems in which case vertical reinforcement shall be No. 4 @ 48 inches on center.
- h. See Section 404.1.2.2 for minimum reinforcement required for basement walls supporting above-grade concrete walls.
- i. See Table 611.3 for tolerance from nominal thickness permitted for flat walls.
- j. DR means design is required in accordance with the applicable building code, or where there is no code, in accordance with ACI 318.

404.1.2.3 Concrete, materials for concrete, and forms. Materials used in concrete, the concrete itself and forms shall conform to requirements of this section or ACI 318.

404.1.2.3.1 Compressive strength. The minimum specified compressive strength of concrete, f'_c , shall comply with Section 402.2 and shall be not less than 2,500 psi (17.2 MPa) at 28 days in buildings assigned to Seismic Design Category A, B or C and 3000 psi (20.5 MPa) in buildings assigned to Seismic Design Category D₀, D₁ or D₂.

404.1.2.3.2 Concrete mixing and delivery. Mixing and delivery of concrete shall comply with ASTM C 94 or ASTM C 685.

404.1.2.3.3 Maximum aggregate size. The nominal maximum size of coarse aggregate shall not exceed one-fifth the narrowest distance

between sides of forms, or three-fourths the clear spacing between reinforcing bars or between a bar and the side of the form.

Exception: When approved, these limitations shall not apply where removable forms are used and workability and methods of consolidation permit concrete to be placed without honeycombs or voids.

TABLE 404.1.2(3)
MINIMUM VERTICAL REINFORCEMENT FOR 8-INCH (203 mm) NOMINAL FLAT CONCRETE
BASEMENT WALLS^{b, c, d, e, f, h, i}

MAXIMUM UNSUPPORTED WALL HEIGHT (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT ^g (feet)	MINIMUM VERTICAL REINFORCEMENT—BAR SIZE AND SPACING (inches)		
		Soil classes ^a and design lateral soil (psf per foot of depth)		
		GW, GP, SW, SP 30	GM, GC, SM, SM-SC and ML 45	SC, ML-CL and inorganic CL 60
8	4	NR	NR	NR
	5	NR	NR	NR
	6	NR	NR	6 @ 37
	7	NR	6 @ 36	6 @ 35
	8	6 @ 41	6 @ 35	6 @ 26
9	4	NR	NR	NR
	5	NR	NR	NR
	6	NR	NR	6 @ 35
	7	NR	6 @ 35	6 @ 32
	8	6 @ 36	6 @ 32	6 @ 23
	9	6 @ 35	6 @ 25	6 @ 18
10	4	NR	NR	NR
	5	NR	NR	NR
	6	NR	NR	6 @ 35
	7	NR	6 @ 35	6 @ 29
	8	6 @ 35	6 @ 29	6 @ 21
	9	6 @ 34	6 @ 22	6 @ 16
	10	6 @ 27	6 @ 17	6 @ 13

For SI: 1 foot = 304.8 mm; 1 inch = 25.4 mm; 1 pound per square foot per foot = 0.1571 kPa²/m, 1 pound per square inch = 6.895 kPa.

a. Soil classes are in accordance with the Unified Soil Classification System. Refer to Table 405.1.

b. Table values are based on reinforcing bars with a minimum yield strength of 60,000 psi (420 MPa), concrete with a minimum specified compressive strength of 2,500 psi and vertical reinforcement being located at the centerline of the wall. See Section 404.1.2.3.7.2.

- c. Vertical reinforcement with a yield strength of less than 60,000 psi and/or bars of a different size than specified in the table are permitted in accordance with Section 404.1.2.3.7.6 and Table 404.1.2(9).
- d. NR indicates no vertical reinforcement is required.
- e. Deflection criterion is $L/240$, where L is the height of the basement wall in inches.
- f. Interpolation is not permitted.
- g. Where walls will retain 4 feet or more of unbalanced backfill, they shall be laterally supported at the top and bottom before backfilling.
- h. See Section 404.1.2.2 for minimum reinforcement required for basement walls supporting above-grade concrete walls.
- i. See Table 611.3 for tolerance from nominal thickness permitted for flat walls.

404.1.2.3.4 Proportioning and slump of concrete. Proportions of materials for concrete shall be established to provide workability and consistency to permit concrete to be worked readily into forms and around reinforcement under conditions of placement to be employed, without segregation or excessive bleeding. Slump of concrete placed in removable forms shall not exceed 6 inches (152 mm).

Exception: When approved, the slump is permitted to exceed 6 inches (152 mm) for concrete mixtures that are resistant to segregation, and are in accordance with the form manufacturer’s recommendations.

Slump of concrete placed in stay-in-place forms shall exceed 6 inches (152 mm). Slump of concrete shall be determined in accordance with ASTM C 143.

404.1.2.3.5 Consolidation of concrete. Concrete shall be consolidated by suitable means during placement and shall be worked around embedded items and reinforcement and into corners of forms. Where stay-in-place forms are used, concrete shall be consolidated by internal vibration.

Exception: When approved for concrete to be placed in stay-in-place forms, self-consolidating concrete mixtures with slumps equal to or greater than 8 inches (203 mm) that are specifically designed for placement without internal vibration need not be internally vibrated.

TABLE 404.1.2(4)
MINIMUM VERTICAL REINFORCEMENT FOR 10-INCH NOMINAL FLAT CONCRETE BASEMENT WALLS^{b, c, d, e, f, h, i}

MAXIMUM UNSUPPORTED	MAXIMUM UNBALANCED	MINIMUM VERTICAL REINFORCEMENT—BAR SIZE AND SPACING (inches)
		Soil classes ^a and design lateral soil (psf per foot of depth)

WALL HEIGHT (feet)	BACKFILL HEIGHT ^g (feet)	GW, GP, SW, SP 30	GM, GC, SM, SM-SC and ML 45	SC, ML-CL and inorganic CL 60
8	4	NR	NR	NR
	5	NR	NR	NR
	6	NR	NR	NR
	7	NR	NR	NR
	8	6 @ 48	6 @ 35	6 @ 28
9	4	NR	NR	NR
	5	NR	NR	NR
	6	NR	NR	NR
	7	NR	NR	6 @ 31
	8	NR	6 @ 31	6 @ 28
	9	6 @ 37	6 @ 28	6 @ 24
10	4	NR	NR	NR
	5	NR	NR	NR
	6	NR	NR	NR
	7	NR	NR	6 @ 28
	8	NR	6 @ 28	6 @ 28
	9	6 @ 33	6 @ 28	6 @ 21
	10	6 @ 28	6 @ 23	6 @ 17

For SI: 1 foot = 304.8 mm; 1 inch = 25.4 mm; 1 pound per square foot per foot = 0.1571 kPa²/m, 1 pound per square inch = 6.895 kPa.

- a. Soil classes are in accordance with the Unified Soil Classification System. Refer to Table 405.1.
- b. Table values are based on reinforcing bars with a minimum yield strength of 60,000 psi concrete with a minimum specified compressive strength of 2,500 psi and vertical reinforcement being located at the centerline of the wall. See Section 404.1.2.3.7.2.
- c. Vertical reinforcement with a yield strength of less than 60,000 psi and/or bars of a different size than specified in the table are permitted in accordance with Section 404.1.2.3.7.6 and Table 404.1.2(9).
- d. NR indicates no vertical reinforcement is required.
- e. Deflection criterion is $L/240$, where L is the height of the basement wall in inches.
- f. Interpolation is not permitted.
- g. Where walls will retain 4 feet or more of unbalanced backfill, they shall be laterally supported at the top and bottom before backfilling.
- h. See Section 404.1.2.2 for minimum reinforcement required for basement walls supporting above-grade concrete walls.
- i. See Table 611.3 for tolerance from nominal thickness permitted for flat walls.

404.1.2.3.6 Form materials and form ties. Forms shall be made of wood, steel, aluminum, plastic, a composite of cement and foam insulation, a composite of cement and wood chips, or other approved material suitable for supporting and containing concrete. Forms shall provide sufficient strength to contain concrete during the concrete placement operation.

Form ties shall be steel, solid plastic, foam plastic, a composite of cement and wood chips, a composite of cement and foam plastic, or other suitable material capable of resisting the forces created by fluid pressure of fresh concrete.

404.1.2.3.6.1 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 302. The surface burning characteristics of foam plastic used in insulating concrete forms shall comply with Section 316.3.
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 316. 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 hazards. In areas where hazard of termite damage is very heavy in accordance with Figure 301.2(6), foam plastic insulation shall be permitted below grade on foundation walls in accordance with one of the following conditions:
 - 4.1. Where in addition to the requirements in Section 318.1, an approved method of protecting the foam plastic and structure from subterranean termite damage is provided.

4.2. The structural members of walls, floors, ceilings and roofs are entirely of noncombustible materials or pressure-preservative-treated wood.

4.3. On the interior side of basement walls.

TABLE 404.1.2(5)
MINIMUM VERTICAL WALL REINFORCEMENT FOR 6-INCH WAFFLE-GRID BASEMENT WALLS^{b, c, d, e, g, h, i}

MAXIMUM UNSUPPORTED WALL HEIGHT (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT ^f (feet)	MINIMUM VERTICAL REINFORCEMENT—BAR SIZE AND SPACING (inches)		
		Soil classes ^a and design lateral soil (psf per foot of depth)		
		GW, GP, SW, SP 30	GM, GC, SM, SM-SC and ML 45	SC, ML-CL and inorganic CL 60
8	4	4 @ 48	4 @ 46	6 @ 39
	5	4 @ 45	5 @ 46	6 @ 47
	6	5 @ 45	6 @ 40	DR
	7	6 @ 44	DR	DR
	8	6 @ 32	DR	DR
9	4	4 @ 48	4 @ 46	4 @ 37
	5	4 @ 42	5 @ 43	6 @ 44
	6	5 @ 41	6 @ 37	DR
	7	6 @ 39	DR	DR
	> 8	DR ⁱ	DR	DR
10	4	4 @ 48	4 @ 46	4 @ 35
	5	4 @ 40	5 @ 40	6 @ 41
	6	5 @ 38	6 @ 34	DR
	7	6 @ 36	DR	DR
	> 8	DR	DR	DR

For SI: 1 foot = 304.8 mm; 1 inch = 25.4 mm; 1 pound per square foot per foot = 0.1571 kPa²/m, 1 pound per square inch = 6.895 kPa.

a. Soil classes are in accordance with the Unified Soil Classification System. Refer to Table 405.1.

b. Table values are based on reinforcing bars with a minimum yield strength of 60,000 psi concrete with a minimum specified compressive strength of 2,500 psi and vertical reinforcement being located at the centerline of the wall. See Section 404.1.2.3.7.2.

c. Maximum spacings shown are the values calculated for the specified bar size. Where the bar used is Grade 60 and the size specified in the table, the actual spacing in the wall shall not exceed a whole-number multiple of 12 inches (i.e., 12, 24, 36 and 48) that is less than or equal to the tabulated spacing. Vertical reinforcement with a yield strength of less than 60,000 psi and/or bars of a different size than specified in the table are permitted in accordance with Section 404.1.2.3.7.6 and Table 404.1.2(9).

d. Deflection criterion is $L/240$, where L is the height of the basement wall in inches.

e. Interpolation is not permitted.

- f. Where walls will retain 4 feet or more of unbalanced backfill, they shall be laterally supported at the top and bottom before backfilling.
- g. See Section 404.1.2.2 for minimum reinforcement required for basement walls supporting above-grade concrete walls.
- h. See Table 611.3 for thicknesses and dimensions of waffle-grid walls.
- i. DR means design is required in accordance with the applicable building code, or where there is no code, in accordance with ACI 318.

TABLE 404.1.2(6)
MINIMUM VERTICAL REINFORCEMENT FOR 8-INCH WAFFLE-GRID BASEMENT
WALLS^{b, c, d, e, f, h, i, j}

MAXIMUM UNSUPPORTED WALL HEIGHT (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT ^g (feet)	MINIMUM VERTICAL REINFORCEMENT—BAR SIZE AND SPACING (inches)		
		Soil classes ^a and design lateral soil (psf per foot of depth)		
		GW, GP, SW, SP 30	GM, GC, SM, SM-SC and ML 45	SC, ML-CL and inorganic CL 60
8	4	NR	NR	NR
	5	NR	5 @ 48	5 @ 46
	6	5 @ 48	5 @ 43	6 @ 45
	7	5 @ 46	6 @ 43	6 @ 31
	8	6 @ 48	6 @ 32	6 @ 23
9	4	NR	NR	NR
	5	NR	5 @ 47	5 @ 46
	6	5 @ 46	5 @ 39	6 @ 41
	7	5 @ 42	6 @ 38	6 @ 28
	8	6 @ 44	6 @ 28	6 @ 20
	9	6 @ 34	6 @ 21	DR
10	4	NR	NR	NR
	5	NR	5 @ 46	5 @ 44
	6	5 @ 46	5 @ 37	6 @ 38
	7	5 @ 38	6 @ 35	6 @ 25
	8	6 @ 39	6 @ 25	DR
	9	6 @ 30	DR	DR
	10	6 @ 24	DR	DR

For SI: 1 foot = 304.8 mm; 1 inch = 25.4 mm; 1 pound per square foot per foot = 0.1571 kPa²/m, 1 pound per square inch = 6.895 kPa.

- a. Soil classes are in accordance with the Unified Soil Classification System. Refer to Table 405.1.
- b. Table values are based on reinforcing bars with a minimum yield strength of 60,000 psi concrete with a minimum specified compressive strength of 2,500 psi and vertical reinforcement being located at the centerline of the wall. See Section 404.1.2.3.7.2.
- c. Maximum spacings shown are the values calculated for the specified bar size. Where the bar used is Grade 60 (420 MPa) and the size specified in the table, the actual spacing in the wall shall not exceed a whole-number multiple of 12 inches (i.e., 12, 24, 36 and 48) that is less than or equal to the tabulated spacing. Vertical reinforcement with a yield strength of less than 60,000 psi and/or bars of a different size than specified in the table are permitted in accordance with Section 404.1.2.3.7.6 and Table 404.1.2(9).
- d. NR indicates no vertical reinforcement is required.

- e. Deflection criterion is $L/240$, where L is the height of the basement wall in inches.
 f. Interpolation shall not be permitted.
 g. Where walls will retain 4 feet or more of unbalanced backfill, they shall be laterally supported at the top and bottom before backfilling.
 h. See Section 404.1.2.2 for minimum reinforcement required for basement walls supporting above-grade concrete walls.
 i. See Table 611.3 for thicknesses and dimensions of waffle-grid walls.
 j. DR means design is required in accordance with the applicable building code, or where there is no code, in accordance with ACI 318.

TABLE 404.1.2(7)
MINIMUM VERTICAL REINFORCEMENT FOR 6-INCH (152 mm) SCREEN-GRID
BASEMENT WALLS^{b, c, d, e, g, h, i}

MAXIMUM UNSUPPORTED WALL HEIGHT (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT ^f (feet)	MINIMUM VERTICAL REINFORCEMENT—BAR SIZE AND SPACING (inches)		
		Soil classes ^a and design lateral soil (psf per foot of depth)		
		GW, GP, SW, SP 30	GM, GC, SM, SM-SC and ML 45	SC, ML-CL and inorganic CL 60
8	4	4 @ 48	4 @ 48	5 @ 43
	5	4 @ 48	5 @ 48	5 @ 37
	6	5 @ 48	6 @ 45	6 @ 32
	7	6 @ 48	DR	DR
	8	6 @ 36	DR	DR
9	4	4 @ 48	4 @ 48	4 @ 41
	5	4 @ 48	5 @ 48	6 @ 48
	6	5 @ 45	6 @ 41	DR
	7	6 @ 43	DR	DR
	> 8	DR	DR	DR
10	4	4 @ 48	4 @ 48	4 @ 39
	5	4 @ 44	5 @ 44	6 @ 46
	6	5 @ 42	6 @ 38	DR
	7	6 @ 40	DR	DR
	> 8	DR	DR	DR

For SI: 1 foot = 304.8 mm; 1 inch = 25.4 mm; 1 pound per square foot per foot = 0.1571 kPa²/m, 1 pound per square inch = 6.895 kPa.

- a. Soil classes are in accordance with the Unified Soil Classification System. Refer to Table 405.1.
 b. Table values are based on reinforcing bars with a minimum yield strength of 60,000 psi (420 MPa), concrete with a minimum specified compressive strength of 2,500 psi and vertical reinforcement being located at the centerline of the wall. See Section 404.1.2.3.7.2.
 c. Maximum spacings shown are the values calculated for the specified bar size. Where the bar used is Grade 60 and the size specified in the table, the actual spacing in the wall shall not exceed a whole-number multiple of 12 inches (i.e., 12, 24, 36 and 48) that is less than or equal to the tabulated spacing. Vertical reinforcement with a yield strength of less than 60,000 psi and/or bars of a different size than specified in the table are permitted in accordance with Section 404.1.2.3.7.6 and Table 404.1.2(9).
 d. Deflection criterion is $L/240$, where L is the height of the basement wall in inches.

- e. Interpolation is not permitted.
- f. Where walls will retain 4 feet or more of unbalanced backfill, they shall be laterally supported at the top and bottom before backfilling.
- g. See Sections 404.1.2.2 for minimum reinforcement required for basement walls supporting above-grade concrete walls.
- h. See Table 611.3 for thicknesses and dimensions of screen-grid walls.
- i. DR means design is required in accordance with the applicable building code, or where there is no code, in accordance with ACI 318.

404.1.2.3.7 Reinforcement.

404.1.2.3.7.1 Steel reinforcement. Steel reinforcement shall comply with the requirements of ASTM A 615, A 706, or A 996. ASTM A 996 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 D₀, D₁ or D₂, reinforcing steel shall comply with the requirements of ASTM A 706 for low-alloy steel with a minimum yield strength of 60,000 psi (Grade 60) (414 MPa).

404.1.2.3.7.2 Location of reinforcement in wall. The center of vertical reinforcement in basement walls determined from Tables 404.1.2(2) through 404.1.2(7) shall be located at the center-line of the wall. Vertical reinforcement in basement walls determined from ~~Tables 404.1.2(2) or 404.1.2(8)~~ Table 404.1.2(8) shall be located to provide a maximum cover of 1.25 inches (32 mm) measured from the inside face of the wall. Regardless of the table used to determine vertical wall reinforcement, the center of the steel shall not vary from the specified location by more than the greater of 10 percent of the wall thickness and ³/₈-inch (10 mm). Horizontal and vertical reinforcement shall be located in foundation walls to provide the minimum cover required by Section 404.1.2.3.7.4.

404.1.2.3.7.3 Wall openings. Vertical wall reinforcement required by Section 404.1.2.2 that is interrupted by wall openings shall have additional vertical reinforcement of the same size placed within 12 inches (305 mm) of each side of the opening.

TABLE 404.1.2(8)
MINIMUM VERTICAL REINFORCEMENT FOR 6-, 8-, 10-INCH AND 12-INCH
NOMINAL FLAT BASEMENT WALLS^{b, c, d, e, f, h, i, k, n}

MAXIMUM	MAXIMUM	MINIMUM VERTICAL REINFORCEMENT—BAR SIZE AND SPACING (inches)
---------	---------	--

WALL HEIGHT (feet)	UNBALANCED BACKFILL HEIGHT ^g (feet)	Soil classes ^a and design lateral soil (psf per foot of depth)											
		GW, GP, SW, SP 30				GM, GC, SM, SM-SC and ML 45				SC, ML-CL and inorganic CL 60			
		Minimum nominal wall thickness (inches)											
		6	8	10	12	6	8	10	12	6	8	10	12
5	4	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
	5	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
6	4	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
	5	NR	NR	NR	NR	NR	NR ¹	NR	NR	4 @ 35	NR ¹	NR	NR
	6	NR	NR	NR	NR	5 @ 48	NR	NR	NR	5 @ 36	NR	NR	NR
7	4	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
	5	NR	NR	NR	NR	NR	NR	NR	NR	5 @ 47	NR	NR	NR
	6	NR	NR	NR	NR	5 @ 42	NR	NR	NR	6 @ 43	5 @ 48	NR ¹	NR
	7	5 @ 46	NR	NR	NR	6 @ 42	5 @ 46	NR ¹	NR	6 @ 34	6 @ 48	NR	NR
8	4	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
	5	NR	NR	NR	NR	4 @ 38	NR ¹	NR	NR	5 @ 43	NR	NR	NR
	6	4 @ 37	NR ¹	NR	NR	5 @ 37	NR	NR	NR	6 @ 37	5 @ 43	NR ¹	NR
	7	5 @ 40	NR	NR	NR	6 @ 37	5 @ 41	NR ¹	NR	6 @ 34	6 @ 43	NR	NR
	8	6 @ 43	5 @ 47	NR ¹	NR	6 @ 34	6 @ 43	NR	NR	6 @ 27	6 @ 32	6 @ 44	NR
9	4	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
	5	NR	NR	NR	NR	4 @ 35	NR ¹	NR	NR	5 @ 40	NR	NR	NR
	6	4 @ 34	NR ¹	NR	NR	6 @ 48	NR	NR	NR	6 @ 36	6 @ 39	NR ¹	NR
	7	5 @ 36	NR	NR	NR	6 @ 34	5 @ 37	NR	NR	6 @ 33	6 @ 38	5 @ 37	NR ¹
	8	6 @ 38	5 @ 41	NR ¹	NR	6 @ 33	6 @ 38	5 @ 37	NR ¹	6 @ 24	6 @ 29	6 @ 39	4 @ 48m
	9	6 @ 34	6 @ 46	NR	NR	6 @ 26	6 @ 30	6 @ 41	NR	6 @ 19	6 @ 23	6 @ 30	6 @ 39
10	4	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
	5	NR	NR	NR	NR	4 @ 33	NR ¹	NR	NR	5 @ 38	NR	NR	NR
	6	5 @ 48	NR ¹	NR	NR	6 @ 45	NR	NR	NR	6 @ 34	5 @ 37	NR	NR
	7	6 @ 47	NR	NR	NR	6 @ 34	6 @ 48	NR	NR	6 @ 30	6 @ 35	6 @ 48	NR ¹
	8	6 @ 34	5 @ 38	NR	NR	6 @ 30	6 @ 34	6 @ 47	NR ¹	6 @ 22	6 @ 26	6 @ 35	6 @ 45m
	9	6 @ 34	6 @ 41	4 @ 48	NR ¹	6 @ 23	6 @ 27	6 @ 35	4 @ 48m	DR	6 @ 22	6 @ 27	6 @ 34
	10	6 @ 28	6 @ 33	6 @ 45	NR	DR ¹	6 @ 23	6 @ 29	6 @ 38	DR	6 @ 22	6 @ 22	6 @ 28

For SI: 1 foot = 304.8 mm; 1 inch = 25.4 mm; 1 pound per square foot per foot = 0.1571 kPa²/m, 1 pound per square inch = 6.895 kPa.

- a. Soil classes are in accordance with the Unified Soil Classification System. Refer to Table 405.1.
- b. Table values are based on reinforcing bars with a minimum yield strength of 60,000 psi.
- c. Vertical reinforcement with a yield strength of less than 60,000 psi and/or bars of a different size than specified in the table are permitted in accordance with Section 404.1.2.3.7.6 and Table 404.1.2(9).
- d. NR indicates no vertical wall reinforcement is required, except for 6-inch nominal walls formed with stay-in-place forming systems in which case vertical reinforcement shall be #4 @ 48 inches on center.
- e. Allowable deflection criterion is $L/240$, where L is the unsupported height of the basement wall in inches.
- f. Interpolation is not permitted.
- g. Where walls will retain 4 feet or more of unbalanced backfill, they shall be laterally supported at the top and bottom before backfilling.
- h. Vertical reinforcement shall be located to provide a cover of 1.25 inches measured from the inside face of the wall. The center of the steel

- shall not vary from the specified location by more than the greater of 10 percent of the wall thickness or $\frac{3}{8}$ -inch.
- i. Concrete cover for reinforcement measured from the inside face of the wall shall not be less than $\frac{3}{4}$ -inch. Concrete cover for reinforcement measured from the outside face of the wall shall not be less than $1\frac{1}{2}$ inches for No. 5 bars and smaller, and not less than 2 inches for larger bars.
- j. DR means design is required in accordance with the applicable building code, or where there is no code in accordance with ACI 318.
- k. Concrete shall have a specified compressive strength, f'_c , of not less than 2,500 psi at 28 days, unless a higher strength is required by footnote l or m.
- l. The minimum thickness is permitted to be reduced 2 inches, provided the minimum specified compressive strength of concrete, f'_c , is 4,000 psi.
- m. A plain concrete wall with a minimum nominal thickness of 12 inches is permitted, provided minimum specified compressive strength of concrete, f'_c , is 3,500 psi.
- n. See Table 611.3 for tolerance from nominal thickness permitted for flat walls.

TABLE 404.1.2(9)
MINIMUM SPACING FOR ALTERNATE BAR SIZE AND/OR ALTERNATE GRADE OF STEEL^{a, b, c}

BAR SPACING FROM APPLICABLE TABLE IN SECTION	BAR SIZE FROM APPLICABLE TABLE IN SECTION 404.1.2.2														
	#4					#5					#6				
	Alternate bar size and/or alternate grade of steel desired														
	Grade 60		Grade 40			Grade 60		Grade 40			Grade 60		Grade 40		
	#5	#6	#4	#5	#6	#4	#6	#4	#5	#6	#4	#5	#4	#5	#6
404.1.2.2 (inches)	Maximum spacing for alternate bar size and/or alternate grade of steel (inches)														
8	12	18	5	8	12	5	11	3	5	8	4	6	2	4	5
9	14	20	6	9	13	6	13	4	6	9	4	6	3	4	6
10	16	22	7	10	15	6	14	4	7	9	5	7	3	5	7
11	17	24	7	11	16	7	16	5	7	10	5	8	3	5	7
12	19	26	8	12	18	8	17	5	8	11	5	8	4	6	8
13	20	29	9	13	19	8	18	6	9	12	6	9	4	6	9
14	22	31	9	14	21	9	20	6	9	13	6	10	4	7	9
15	23	33	10	16	22	10	21	6	10	14	7	11	5	7	10
16	25	35	11	17	23	10	23	7	11	15	7	11	5	8	11
17	26	37	11	18	25	11	24	7	11	16	8	12	5	8	11
18	28	40	12	19	26	12	26	8	12	17	8	13	5	8	12
19	29	42	13	20	28	12	27	8	13	18	9	13	6	9	13
20	31	44	13	21	29	13	28	9	13	19	9	14	6	9	13
21	33	46	14	22	31	14	30	9	14	20	10	15	6	10	14
22	34	48	15	23	32	14	31	9	15	21	10	16	7	10	15
23	36	48	15	24	34	15	33	10	15	22	10	16	7	11	15
24	37	48	16	25	35	15	34	10	16	23	11	17	7	11	16
25	39	48	17	26	37	16	35	11	17	24	11	18	8	12	17
26	40	48	17	27	38	17	37	11	17	25	12	18	8	12	17
27	42	48	18	28	40	17	38	12	18	26	12	19	8	13	18
28	43	48	19	29	41	18	40	12	19	26	13	20	8	13	19
29	45	48	19	30	43	19	41	12	19	27	13	20	9	14	19
30	47	48	20	31	44	19	43	13	20	28	14	21	9	14	20

31	48	48	21	32	45	20	44	13	21	29	14	22	9	15	21
32	48	48	21	33	47	21	45	14	21	30	15	23	10	15	21
33	48	48	22	34	48	21	47	14	22	31	15	23	10	16	22
34	48	48	23	35	48	22	48	15	23	32	15	24	10	16	23
35	48	48	23	36	48	23	48	15	23	33	16	25	11	16	23
36	48	48	24	37	48	23	48	15	24	34	16	25	11	17	24
37	48	48	25	38	48	24	48	16	25	35	17	26	11	17	25
38	48	48	25	39	48	25	48	16	25	36	17	27	12	18	25
39	48	48	26	40	48	25	48	17	26	37	18	27	12	18	26
40	48	48	27	41	48	26	48	17	27	38	18	28	12	19	27
41	48	48	27	42	48	26	48	18	27	39	19	29	12	19	27
42	48	48	28	43	48	27	48	18	28	40	19	30	13	20	28
43	48	48	29	44	48	28	48	18	29	41	20	30	13	20	29
44	48	48	29	45	48	28	48	19	29	42	20	31	13	21	29
45	48	48	30	47	48	29	48	19	30	43	20	32	14	21	30
46	48	48	31	48	48	30	48	20	31	44	21	32	14	22	31
47	48	48	31	48	48	30	48	20	31	44	21	33	14	22	31
48	48	48	32	48	48	31	48	21	32	45	22	34	15	23	32

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 6.895 kPa.

- a. This table is for use with tables in Section 404.1.2.2 that specify the minimum bar size and maximum spacing of vertical wall reinforcement for foundation walls and above-grade walls. Reinforcement specified in tables in Sections 404.1.2.2 is based on Grade 60 steel reinforcement.
- b. Bar spacing shall not exceed 48 inches on center and shall not be less than one-half the nominal wall thickness.
- c. For Grade 50 steel bars (ASTM A 996, Type R), use spacing for Grade 40 bars or interpolate between Grades 40 and 60.

404.1.2.3.7.4 Support and cover. 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 1½ 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 ¾ inch (19 mm). The minus tolerance for cover shall not exceed the smaller of one-third the required cover or ⅜ inch (10 mm).

404.1.2.3.7.5 Lap splices. Vertical and horizontal wall reinforcement shall be the longest lengths practical. Where splices are necessary in reinforcement, the length of lap splice shall be in

accordance with Table 611.5.4.(1) and Figure 611.5.4(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 611.5.4(1).

404.1.2.3.7.6 Alternate grade of reinforcement and spacing. Where tables in Section 404.1.2.2 specify vertical wall reinforcement based on minimum bar size and maximum spacing, which are based on Grade 60 (414 MPa) steel reinforcement, different size bars and/or bars made from a different grade of steel are permitted provided an equivalent area of steel per linear foot of wall is provided. Use of Table 404.1.2(9) is permitted to determine the maximum bar spacing for different bar sizes than specified in the tables and/or bars made from a different grade of steel. Bars shall not be spaced less than one-half the wall thickness, or more than 48 inches (1219 mm) on center.

404.1.2.3.7.7 Standard hooks. Where reinforcement is required by this code to terminate with a standard hook, the hook shall comply with Section 611.5.4.5 and Figure 611.5.4(3).

404.1.2.3.7.8 Construction joint reinforcement. Construction joints in foundation walls shall be made and located to not impair the strength of the wall. Construction joints in plain concrete walls, including walls required to have not less than No. 4 bars at 48 inches (1219 mm) on center by Sections 404.1.2.2 and 404.1.4.2, shall be located at points of lateral support, and a minimum of one No. 4 bar shall extend across the construction joint at a spacing not to exceed 24 inches (610 mm) on center. Construction joint reinforcement shall have a minimum of 12 inches (305 mm) embedment on both sides of the joint. Construction joints in reinforced concrete walls shall be located in the middle third of the span between lateral supports, or located and constructed as required for joints in plain concrete walls.

Exception: Use of vertical wall reinforcement required by this code is permitted in lieu of construction joint reinforcement provided the spacing does not exceed 24 inches (610 mm), or the combination of wall reinforcement and No.4 bars described above does not exceed 24 inches (610 mm).

404.1.2.3.8 Exterior wall coverings. Requirements for installation of masonry veneer, stucco and other wall coverings on the exterior of concrete walls and other construction details not covered in this section shall comply with the requirements of this code.

404.1.2.4 Requirements for Seismic Design Category C. *Deleted.*

404.1.3 Design required. Concrete or masonry foundation walls shall be designed in accordance with accepted engineering practice when either of the following conditions exists:

1. Walls are subject to hydrostatic pressure from groundwater.
2. Walls supporting more than 48 inches (1219 mm) of unbalanced backfill that do not have permanent lateral support at the top or bottom.

404.1.4 Seismic Design Category D₀, D₁ or D₂. *Deleted.*

404.1.5 Foundation wall thickness based on walls supported. The thickness of masonry or concrete foundation walls shall not be less than that required by Section 404.1.5.1 or 404.1.5.2, respectively.

404.1.5.1 Masonry wall thickness. Masonry foundation walls shall not be less than the thickness of the wall supported, except that masonry foundation walls of at least 8-inch (203 mm) nominal thickness shall be permitted under brick veneered frame walls and under 10-inch-wide (254 mm) cavity walls where the total height of the wall supported, including gables, is not more than 20 feet (6096 mm), provided the requirements of Section 404.1.1 are met.

404.1.5.2 Concrete wall thickness. The thickness of concrete foundation walls shall be equal to or greater than the thickness of the wall in the story above. Concrete foundation walls with corbels, brackets or other projections built into the wall for support of masonry veneer or other purposes are not within the scope of the tables in this section.

Where a concrete foundation wall is reduced in thickness to provide a shelf for the support of masonry veneer, the reduced thickness shall be equal to or greater than the thickness of the wall in the story above. Vertical reinforcement for the foundation wall shall be based on Table

404.1.2(8) and located in the wall as required by Section 404.1.2.3.7.2 where that table is used. Vertical reinforcement shall be based on the thickness of the thinner portion of the wall.

Exception: Where the height of the reduced thickness portion measured to the underside of the floor assembly or sill plate above is less than or equal to 24 inches (610 mm) and the reduction in thickness does not exceed 4 inches (102 mm), the vertical reinforcement is permitted to be based on the thicker portion of the wall.

404.1.5.3 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 the following requirements are met:

1. All load-bearing walls shall be placed on continuous concrete footings placed integrally with the exterior wall footings.
2. The minimum actual thickness of a load-bearing masonry wall shall be not less than 4 inches (102 mm) nominal or $3 \frac{3}{8}$ inches (92 mm) actual thickness, and shall be bonded integrally with piers spaced in accordance with Section 606.9.
3. Piers shall be constructed in accordance with Section 606.6 and Section 606.6.1, and shall be bonded into the load-bearing masonry wall in accordance with Section 608.1.1 or Section 608.1.1.2.
4. The maximum height of a 4-inch (102 mm) load-bearing masonry foundation wall supporting wood-frame walls and floors shall not be more than 4 feet (1219 mm).
5. Anchorage shall be in accordance with Section 403.1.6, Figure 404.1.5(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) for hollow masonry.
7. *Deleted.*

404.1.6 Height above finished grade. Concrete and masonry foundation walls shall extend above the finished grade adjacent to the foundation at all points a minimum of 4 inches (102 mm) where masonry veneer is used and a minimum of 6 inches (152 mm) elsewhere.

404.1.7 Backfill placement. Backfill shall not be placed against the wall until the wall has sufficient strength and has been anchored to the floor above, or has been sufficiently braced to prevent damage by the backfill.

Exception: Bracing is not required for walls supporting less than 4 feet (1219 mm) of unbalanced backfill.

404.1.8 Rubble stone masonry. Rubble stone masonry foundation walls shall have a minimum thickness of 16 inches (406 mm), shall not support an unbalanced backfill exceeding 8 feet (2438 mm) in height, shall not support a soil pressure greater than 30 pounds per square foot per foot (4.71 kPa/m), and shall not be constructed in Seismic Design Categories D₀, D₁, D₂ or townhouses in Seismic Design Category C, as established in Figure 301.2(2).

404.2 Wood foundation walls. Wood foundation walls shall be constructed in accordance with the provisions of Sections 404.2.1 through 404.2.6 and with the details shown in Figures 403.1(2) and 403.1(3).

404.2.1 Identification. All load-bearing lumber shall be identified by the grade mark of a lumber grading or inspection agency which has been approved by an accreditation body that complies with DOC PS 20. In lieu of a grade mark, a certificate of inspection issued by a lumber grading or inspection agency meeting the requirements of this section shall be accepted. Wood structural panels shall conform to DOC PS 1 or DOC PS 2 and shall be identified by a grade mark or certificate of inspection issued by an approved agency.

404.2.2 Stud size. The studs used in foundation walls shall be 2-inch by 6-inch (51 mm by 152 mm) members. When spaced 16 inches (406 mm) on center, a wood species with an F_b value of not less than 1,250 pounds per square inch (8619 kPa) as listed in AF&PA/NDS shall be used. When spaced 12 inches (305 mm) on center, an F_b of not less than 875 psi (6033 kPa) shall be required.

404.2.3 Height of backfill. For wood foundations that are not designed and installed in accordance with AF&PA PWF, the height of backfill against a

foundation wall shall not exceed 4 feet (1219 mm). When the height of fill is more than 12 inches (305 mm) above the interior grade of a crawl space or floor of a basement, the thickness of the plywood sheathing shall meet the requirements of Table 404.2.3.

404.2.4 Backfilling. Wood foundation walls shall not be backfilled until the basement floor and first floor have been constructed or the walls have been braced. For crawl space construction, backfill or bracing shall be installed on the interior of the walls prior to placing backfill on the exterior.

404.2.5 Drainage and dampproofing. Wood foundation basements shall be drained and dampproofed in accordance with Sections 405 and 406, respectively.

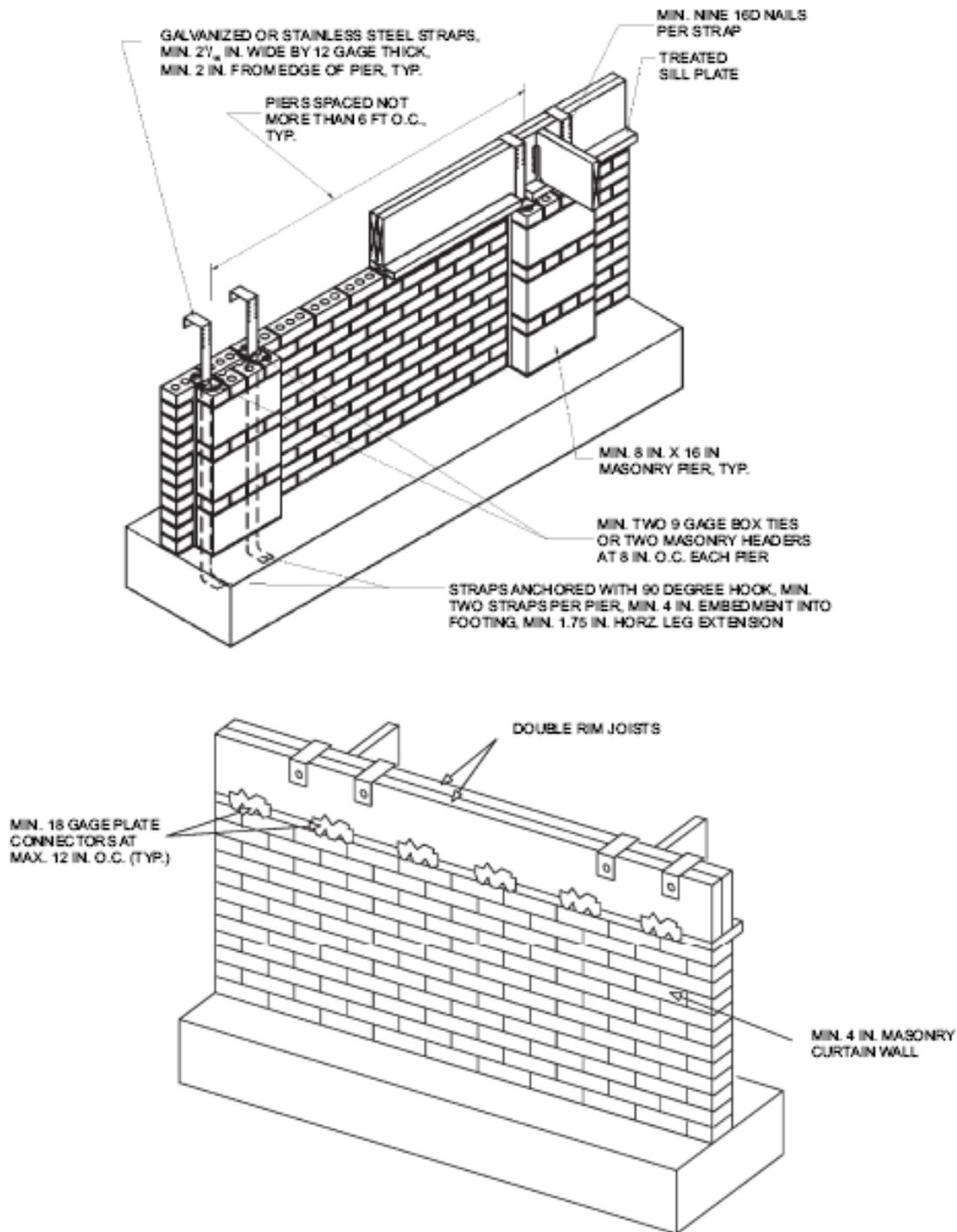
404.2.6 Fastening. Wood structural panel foundation wall sheathing shall be attached to framing in accordance with Table 602.3(1) and Section 402.1.1.

404.3 Wood sill plates. Wood sill plates shall be a minimum of 2-inch by 4-inch (51 mm by 102 mm) nominal lumber. Sill plate anchorage shall be in accordance with Sections 403.1.6 and 602.11.

404.4 Retaining walls. Retaining walls that are not laterally supported at the top and that retain in excess of 24 inches (610 mm) of unbalanced fill shall be designed 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.

404.5 Precast concrete foundation walls.

404.5.1 Design. Precast concrete foundation walls shall be designed in accordance with accepted engineering practice. The design and manufacture of precast concrete foundation wall panels shall comply with the materials requirements of Section 402.3 or ACI 318. The panel design drawings shall be in accordance with Section 106.5.



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 degree = 0.0175 rad.

FIGURE 404.1.5(1)
FOUNDATION WALL CLAY MASONRY CURTAIN WALL WITH CONCRETE MASONRY PIERS

**TABLE 404.2.3
PLYWOOD GRADE AND THICKNESS FOR WOOD FOUNDATION CONSTRUCTION
(30 pcf equivalent-fluid weight soil pressure)**

HEIGHT OF FILL (inches)	STUD SPACING (inches)	FACE GRAIN ACROSS STUDS			FACE GRAIN PARALLEL TO STUDS		
		Grade ^a	Minimum thickness (inches)	Span rating	Grade ^a	Minimum thickness (inches) ^{b, c}	Span rating
24	12	B	$15/32$	32/16	A	$15/32$	32/16
					B	$15/32^c$	32/16
	16	B	$15/32$	32/16	A	$15/32^c$	32/16
					B	$19/32^c$ (4, 5 ply)	40/20
36	12	B	$15/32$	32/16	A	$15/32$	32/16
					B	$15/32^c$ (4, 5 ply)	32/16
					B	$19/32$ (4, 5 ply)	40/20
	16	B	$15/32^c$	32/16	A	$19/32$	40/20
					B	$23/32$	48/24
48	12	B	$15/32$	32/16	A	$15/32^c$	32/16
					B	$19/32^c$ (4, 5 ply)	40/20
	16	B	$19/32$	40/20	A	$19/32^c$	40/20
					A	$23/32$	48/24

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per cubic foot = 0.1572kN/m³.

a. Plywood shall be of the following minimum grades in accordance with DOC PS 1 or DOC PS 2:

1. DOC PS 1 Plywood grades marked:

1.1. Structural I C-D (Exposure 1)

1.2. C-D (Exposure 1)

2. DOC PS 2 Plywood grades marked:

2.1. Structural I Sheathing (Exposure 1)

2.2. Sheathing (Exposure 1)

3. Where a major portion of the wall is exposed above ground and a better appearance is desired, the following plywood grades marked exterior are suitable:

3.1. Structural I A-C, Structural I B-C or Structural I C-C (Plugged) in accordance with DOC PS 1

3.2. A-C Group 1, B-C Group 1, C-C (Plugged) Group 1 or MDO Group 1 in accordance with DOC PS 1

3.3. Single Floor in accordance with DOC PS 1 or DOC PS 2

b. Minimum thickness $15/32$ inch, except crawl space sheathing may be $3/8$ inch for face grain across studs 16 inches on center and maximum 2-foot depth of unequal fill.

c. For this fill height, thickness and grade combination, panels that are continuous over less than three spans (across less than three stud spacings) require blocking 16 inches above the bottom plate. Offset adjacent blocks and fasten through studs with two 16d corrosion-resistant nails at each end.

404.5.2 Precast concrete foundation design drawings. Precast concrete foundation wall design drawings shall be submitted to the building official and approved prior to installation. Drawings shall include, at a minimum, the information specified below:

1. Design loading as applicable;
2. Footing design and material;
3. Concentrated loads and their points of application;
4. Soil bearing capacity;
5. Maximum allowable total uniform load;
6. Seismic design category; and
7. Basic wind speed.

404.5.3 Identification. Precast concrete foundation wall panels shall be identified by a certificate of inspection label issued by an approved inspection agency.

SECTION 405 FOUNDATION DRAINAGE

405.1 Concrete or masonry foundations. Drains shall be provided around all concrete or masonry foundations that retain earth and enclose habitable or usable spaces located below grade. Drainage tiles, gravel or crushed stone drains, perforated pipe or other approved systems or materials shall be installed at or below the area to be protected and shall discharge by gravity or mechanical means into an approved drainage system *or other location that complies with the Ohio Plumbing Code*. Gravel or crushed stone drains shall extend at least 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, and the drainage tiles or perforated pipe shall be placed on a minimum of 2 inches (51 mm) of washed gravel or crushed rock at least one sieve size larger than the tile joint opening or perforation and covered with not less than 6 inches (152 mm) of the same material.

Exception: A drainage system is not required when the foundation is installed on well-drained ground or sand-gravel mixture soils according to the Unified Soil Classification System, Group I Soils, as detailed in Table R405.1.

405.1.1 Precast concrete foundation. Precast concrete walls that retain earth and enclose habitable or use-able space located below-grade that rest on crushed stone footings shall have a perforated drainage pipe installed below the base of the wall on either the interior or exterior side of the wall, at least one foot (305 mm) beyond the edge of the wall. If the exterior drainage pipe is used, an approved filter membrane material shall cover the pipe. The drainage system shall discharge *by gravity or mechanical means into an approved drainage system or other location that complies with the Ohio Plumbing Code.*

405.2 Wood foundations. Wood foundations enclosing habitable or usable spaces located below grade shall be adequately drained in accordance with Sections 405.2.1 through 405.2.3.

405.2.1 Base. A porous layer of gravel, crushed stone or coarse sand shall be placed to a minimum thickness of 4 inches (102 mm) under the basement floor. Provision shall be made for automatic draining of this layer and the gravel or crushed stone wall footings.

405.2.2 Vapor retarder. A 6-mil-thick (0.15 mm) polyethylene vapor retarder shall be applied over the porous layer with the basement floor constructed over the polyethylene.

TABLE 405.1
PROPERTIES OF SOILS CLASSIFIED ACCORDING TO THE UNIFIED SOIL CLASSIFICATION SYSTEM

SOIL GROUP	UNIFIED SOIL CLASSIFICATION SYSTEM SYMBOL	SOIL DESCRIPTION	DRAINAGE CHARACTERISTICS ^a	FROST HEAVE POTENTIAL	VOLUME CHANGE POTENTIAL EXPANSION ^b
Group I	GW	Well-graded gravels, gravel sand mixtures, little or no fines	Good	Low	Low
	GP	Poorly graded gravels or gravel sand mixtures, little or no fines	Good	Low	Low
	SW	Well-graded sands, gravelly sands, little or no fines	Good	Low	Low
	SP	Poorly graded sands or gravelly sands, little or no fines	Good	Low	Low
	GM	Silty gravels, gravel-sand-silt mixtures	Good	Medium	Low
	SM	Silty sand, sand-silt mixtures	Good	Medium	Low
Group II	GC	Clayey gravels, gravel-sand-clay	Medium	Medium	Low

		mixtures			
	SC	Clayey sands, sand-clay mixture	Medium	Medium	Low
	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity	Medium	High	Low
	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	Medium	Medium	Medium to Low
Group III	CH	Inorganic clays of high plasticity, fat clays	Poor	Medium	High
	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	Poor	High	High
Group IV	OL	Organic silts and organic silty clays of low plasticity	Poor	Medium	Medium
	OH	Organic clays of medium to high plasticity, organic silts	Unsatisfactory	Medium	High
	Pt	Peat and other highly organic soils	Unsatisfactory	Medium	High

For SI: 1 inch = 25.4 mm.

- a. The percolation rate for good drainage is over 4 inches per hour, medium drainage is 2 inches to 4 inches per hour, and poor is less than 2 inches per hour.
- b. Soils with a low potential expansion typically have a plasticity index (PI) of 0 to 15, soils with a medium potential expansion have a PI of 10 to 35 and soils with a high potential expansion have a PI greater than 20.

405.2.3 Drainage system. In other than Group I soils, a sump shall be provided to drain the porous layer and footings. The sump shall be at least 24 inches (610 mm) in diameter or 20 inches square (0.0129 m²), shall extend at least 24 inches (610 mm) below the bottom of the basement floor and shall be capable of positive gravity or mechanical drainage to remove any accumulated water. The drainage system shall discharge *by gravity or mechanical means into an approved drainage system or other location that complies with the Ohio Plumbing Code.*

**SECTION 406
FOUNDATION WATERPROOFING AND DAMPPROOFING**

406.1 Concrete and masonry foundation dampproofing. Except where required by Section 406.2 to be waterproofed, foundation walls that retain earth and enclose interior spaces and floors below 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/m²) of acrylic modified cement.
3. One-eighth inch (3.2 mm) coat of surface-bonding cement complying with ASTM C 887.
4. Any material permitted for waterproofing in Section 406.2.
5. 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 above listed dampproofing materials or any one of the waterproofing materials listed in Section 406.2 to the exterior of the wall.

Exception: Existing foundations shall not be required to be dampproofed where a supplemental interior foundation drainage system is installed and connected to a sump pump.

406.2 Concrete and masonry foundation waterproofing. In areas where a high water table or other severe soil-water conditions are known to exist, exterior foundation walls that retain earth and enclose interior spaces and floors below grade shall be waterproofed from the top of the footing to the finished grade. 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. Six-mil (0.15 mm) polyvinyl chloride.
4. Six-mil (0.15 mm) polyethylene.
5. Forty-mil (1 mm) polymer-modified asphalt.
6. Sixty-mil (1.5 mm) flexible polymer cement.
7. One-eighth inch (3 mm) cement-based, fiber-reinforced, waterproof coating.

8. Sixty-mil (0.22 mm) solvent-free liquid-applied synthetic rubber.

Exceptions:

1. Organic-solvent-based products such as hydrocarbons, chlorinated hydrocarbons, ketones and esters shall not be used for ICF walls with expanded polystyrene form material. Use of plastic roofing cements, acrylic coatings, latex coatings, mortars and parings to seal ICF walls is permitted. Cold-setting asphalt or hot asphalt shall conform to type C of ASTM D 449. Hot asphalt shall be applied at a temperature of less than 200°F (93°C).
2. *Where existing exterior or interior dampproofing exists, no waterproofing shall be required.*
3. *Where an existing home has a supplemental interior foundation drainage system connected to a sump pump, no waterproofing shall be required.*

All joints in membrane waterproofing shall be lapped and sealed with an adhesive compatible with the membrane.

406.3 Dampproofing for wood foundations. Wood foundations enclosing habitable or usable spaces located below grade shall be dampproofed in accordance with Sections 406.3.1 through 406.3.4.

406.3.1 Panel joint sealed. Plywood panel joints in the foundation walls shall be sealed full length with a caulking compound capable of producing a moisture-proof seal under the conditions of temperature and moisture content at which it will be applied and used.

406.3.2 Below-grade moisture barrier. A 6-mil-thick (0.15 mm) polyethylene film shall be applied over the below-grade portion of exterior foundation walls prior to backfilling. Joints in the polyethylene film shall be lapped 6 inches (152 mm) and sealed with adhesive. The top edge of the polyethylene film shall be bonded to the sheathing to form a seal. Film areas at grade level shall be protected from mechanical damage and exposure by a pressure preservatively treated lumber or plywood strip attached to the wall several inches above finish grade level and extending approximately 9 inches (229 mm) below grade. The joint between the strip and the wall shall be caulked full length prior to fastening the strip to the wall. Other coverings

appropriate to the architectural treatment may also be used. The polyethylene film shall extend down to the bottom of the wood footing plate but shall not overlap or extend into the gravel or crushed stone footing.

406.3.3 Porous fill. The space between the excavation and the foundation wall shall be backfilled with the same material used for footings, up to a height of 1 foot (305 mm) above the footing for well-drained sites, or one-half the total back-fill height for poorly drained sites. The porous fill shall be covered with strips of 30-pound (13.6 kg) asphalt paper or 6-mil (0.15 mm) polyethylene to permit water seepage while avoiding infiltration of fine soils.

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

406.4 Precast concrete foundation system dampproofing. Except where required by Section 406.2 to be waterproofed, precast concrete foundation walls enclosing habitable or useable spaces located below grade shall be dampproofed in accordance with Section 406.1.

406.4.1 Panel joints sealed. Precast concrete foundation panel joints shall be sealed full height with a sealant meeting ASTM C 920, Type S or M, Grade NS, Class 25, Use NT, M or A. Joint sealant shall be installed in accordance with the manufacturer's installation instructions.

SECTION 407 COLUMNS

407.1 Wood column protection. Wood columns shall be protected against decay as set forth in Section 317.

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

407.3 Structural requirements. The columns shall be restrained to prevent lateral displacement at the bottom end. Wood columns shall not be less in nominal size than 4 inches by 4 inches (102 mm by 102 mm). Steel columns shall not be less than 3-inch-diameter (76 mm) Schedule 40 pipe manufactured in accordance with ASTM A 53 Grade B or approved equivalent.

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

SECTION 408 UNDER-FLOOR SPACE

408.1 Ventilation. The under-floor space between the bottom of the floor joists and the earth under any building (except space occupied by a basement) shall have ventilation openings through foundation walls or exterior walls. The minimum net area of ventilation openings shall not be less than 1 square foot (0.0929 m²) for each 150 square feet (14 m²) of under-floor space area, unless the ground surface is covered by a Class 1 vapor retarder material. When a Class 1 vapor retarder material is used, the minimum net area of ventilation openings shall not be less than 1 square foot (0.0929 m²) for each 1,500 square feet (140 m²) of under-floor space area. One such ventilating opening shall be within 3 feet (914 mm) of each corner of the building.

408.2 Openings for under-floor ventilation. The minimum net area of ventilation openings shall not be less than 1 square foot (0.0929 m²) for each 150 square feet (14 m²) of under-floor area. One ventilation opening shall be within 3 feet (915 mm) of each corner of the building. Ventilation openings shall be covered for their height and width with any of the following materials provided that the least dimension of the covering shall not exceed ¼ inch (6.4 mm):

1. Perforated sheet metal plates not less than 0.070 inch (1.8 mm) thick.
2. Expanded sheet metal plates not less than 0.047 inch (1.2 mm) thick.
3. Cast-iron 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.

Exception: 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 and the required openings are placed to provide cross ventilation of the space. The installation of operable louvers shall not be prohibited.

408.3 Unvented crawl space. Ventilation openings in under-floor spaces specified in Sections 408.1 and 408.2 shall not be required where:

1. Exposed earth is 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 at least 6 inches (152 mm) up the stem wall and shall be attached and sealed to the stem wall; and
2. One of the following is 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 (4.7m²) of crawlspace 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 1102.2.9;
 - 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 m²) 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 1102.2.9;
 - 2.3. Plenum in existing structures complying with Section 1601.5, if under-floor space is used as a plenum.

408.4 Access. Access shall be provided to all under-floor spaces. Access openings through the floor shall be a minimum of 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). When 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 1305.1.4 for access requirements where mechanical equipment is located under floors.

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

408.6 Finished grade. The finished grade of under-floor surface may be located at the bottom of the footings; however, where there is evidence that the groundwater table can rise to within 6 inches (152 mm) of the finished 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.

408.7 Flood resistance. For buildings located in areas prone to flooding as established in Table 301.2(1) *unless otherwise approved by the local flood plain administrator:*

1. Walls enclosing the under-floor space shall be provided with flood openings in accordance with Section 322.2.2.
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 409 FOUNDATION INSULATION

409.1 Protection of exposed foundation insulation. *Foundation walls and the edges of slab-on-grade floors with exterior applied insulation shall have a rigid, opaque and weather-resistant protective covering to prevent the degradation of thermal performance. The protective covering shall cover the exposed insulation and extend to a minimum of 6 inches (153 mm) below grade.*

Effective: 07/01/2014

R.C. 119.032 review dates: 01/01/2018

CERTIFIED ELECTRONICALLY

Certification

04/14/2014

Date

Promulgated Under: 119.03
Statutory Authority: 3781.10(A)
Rule Amplifies: 3781.01, 3781.06, 3781.10, 3781.11, 3791.04, 4740.14
Prior Effective Dates: 5/27/06, 1/1/13

4101:8-6-01 Wall construction.

[Comment: When a reference is made within this rule to a federal statutory provision, an industry consensus standard, or any other technical publication, the specific date and title of the publication as well as the name and address of the promulgating agency are listed in rule 4101:8-44-01 of the Administrative Code. The application of the referenced standards shall be limited and as prescribed in section 102.5 of rule 4101:8-1-01 of the Administrative Code.]

**SECTION 601
GENERAL**

601.1 Application. The provisions of this chapter shall control the design and construction of all walls and partitions for all buildings.

601.2 Requirements. Wall construction shall be capable of accommodating all loads imposed according to Section 301 and of transmitting the resulting loads to the supporting structural elements.

601.2.1 Compressible floor-covering materials. Compressible floor-covering materials that compress more than $\frac{1}{32}$ inch (0.8 mm) when subjected to 50 pounds (23 kg) applied over 1 inch square (645 mm) of material and are greater than $\frac{1}{8}$ inch (3 mm) in thickness in the uncompressed state shall not extend beneath walls, partitions or columns, which are fastened to the floor.

601.3 Vapor retarders. Class I or II vapor retarders are required on the interior side of frame walls in Zones 5, 6, 7, 8 and Marine 4.

Exceptions:

1. Basement walls.
2. Below grade portion of any wall.
3. Construction where moisture or its freezing will not damage the materials.
4. *Class III vapor retarders complying with Section 601.3.1.*

601.3.1 Class III vapor retarders. Class III vapor retarders shall be permitted where any one of the conditions in Table 601.3.1 is met.

601.3.2 Material vapor retarder class. The vapor retarder class shall be based on the manufacturer's certified testing or a tested assembly.

The following shall be deemed to meet the class specified:

Class I: Sheet polyethylene, unperforated aluminum foil.

Class II: Kraft-faced fiberglass batts.

Class III: Latex or enamel paint.

601.3.3 Minimum clear air spaces and vented openings for vented cladding. For the purposes of this section, vented cladding shall include the following minimum clear air spaces. Other openings with the equivalent vent area shall be permitted.

1. Vinyl lap or horizontal aluminum siding applied over a weather resistive barrier as specified in Table 703.4.
2. Brick veneer with a clear airspace as specified in Section 703.7.4.2.
3. Other approved vented claddings.

**TABLE 601.3.1
CLASS III VAPOR RETARDERS**

ZONE	CLASS III VAPOR RETARDERS PERMITTED FOR:^a
Marine 4	Vented cladding over OSB Vented cladding over plywood Vented cladding over fiberboard Vented cladding over gypsum Insulated sheathing with R -value ≥ 2.5 over 2 x 4 wall Insulated sheathing with R -value ≥ 3.75 over 2 x 6 wall
5	Vented cladding over OSB Vented cladding over plywood Vented cladding over fiberboard Vented cladding over gypsum Insulated sheathing with R -value ≥ 5 over 2 x 4 wall Insulated sheathing with R -value ≥ 7.5 over 2 x 6 wall
6	Vented cladding over fiberboard Vented cladding over gypsum Insulated sheathing with R -value ≥ 7.5 over 2 x 4 wall Insulated sheathing with R -value ≥ 11.25 over 2 x 6 wall
7 and 8	Insulated sheathing with R -value ≥ 10 over 2 x 4 wall Insulated sheathing with R -value ≥ 15 over 2 x 6 wall

For SI: 1 pound per cubic foot = 16.02 kg/m³.

- a. Spray foam with a minimum density of 2 lb/ft³ applied to the interior cavity side of OSB, plywood, fiberboard, insulating sheathing or gypsum is deemed to meet the insulating sheathing requirement where the spray foam R -value meets or exceeds the specified insulating sheathing R -value.

SECTION 602 WOOD WALL FRAMING

602.1 Identification. Load-bearing dimension lumber for studs, plates and headers shall be identified by a grade mark of a lumber grading or inspection agency that has been approved by an accreditation body that complies with DOC PS 20. In lieu of a grade mark, a certification of inspection issued by *an approved* lumber grading or inspection agency shall be accepted.

602.1.1 End-jointed lumber. Approved end-jointed lumber identified by a grade mark conforming to Section 602.1 may be used interchangeably with solid-sawn members of the same species and grade.

602.1.2 Structural glued laminated timbers. Glued laminated timbers shall be manufactured and identified as required in ANSI/AITC A190.1 and ASTM D 3737.

602.1.3 Structural log members. Stress grading of structural log members of nonrectangular shape, as typically used in log buildings, shall be in accordance with ASTM D 3957. Such structural log members shall be identified by the grade mark of an approved lumber grading or inspection agency. In lieu of a grade mark on the material, a certificate of inspection as to species and grade, issued by *an approved* lumber-grading or inspection agency, shall be permitted to be accepted.

602.2 Grade. Studs shall be a minimum No. 3, standard or stud grade lumber.

Exception: Bearing studs not supporting floors and nonbearing studs may be utility grade lumber, provided the studs are spaced in accordance with Table 602.3(5).

602.3 Exterior walls, design and construction. Exterior walls of wood-frame construction shall be designed and constructed in accordance with the provisions of this chapter and Figures 602.3(1) and 602.3(2) or in accordance with AF&PA's NDS. Components of exterior walls shall be fastened in accordance with Tables 602.3(1) through 602.3(4). Structural wall sheathing shall be fastened directly to structural framing members. Exterior wall coverings shall be capable of resisting the wind pressures listed in Table 301.2(2) adjusted for height and exposure using Table 301.2(3). Wood structural panel sheathing used for exterior walls shall conform to the requirements of Table 602.3(3). *Exterior walls shall be fireblocked in accordance with Section 602.8.*

Studs shall be continuous from support at the sole plate to a support at the top plate to resist loads perpendicular to the wall. The support shall be a foundation or floor, ceiling or roof diaphragm or shall be designed in accordance with accepted engineering practice.

Exception: Jack studs, trimmer studs and cripple studs at openings in walls that comply with Tables 502.5(1) and 502.5(2).

602.3.1 Stud size, height and spacing. The size, height and spacing of studs shall be in accordance with Table 602.3(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. Studs more than 10 feet (3048 mm) in height which are in accordance with Table 602.3.1.

602.3.2 Top plate. 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 at least 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 at least equal to the width of the studs.

Exception: A single top plate may be installed in stud walls, provided the plate is adequately tied at joints, corners and intersecting walls by a minimum 3-inch-by-6-inch by a 0.036-inch-thick (76 mm by 152 mm by 0.914 mm) galvanized steel plate that is nailed to each wall or segment of wall by six 8d nails on each side, provided the rafters or joists are centered over the studs with a tolerance of no more than 1 inch (25 mm). The top plate may be omitted over lintels that are adequately tied to adjacent wall sections with steel plates or equivalent as previously described.

602.3.3 Bearing studs. Where joists, trusses or rafters are spaced more than 16 inches (406 mm) on center and the bearing studs below are spaced 24 inches (610 mm) on center, such members shall bear within 5 inches (127 mm) of the studs beneath.

Exceptions:

1. The top plates are two 2-inch by 6-inch (38 mm by 140 mm) or two 3-inch by 4-inch (64 mm by 89 mm) members.
2. A third top plate is installed.
3. Solid blocking equal in size to the studs is installed to reinforce the double top plate.

602.3.4 Bottom (sole) plate. Studs shall have full bearing on a nominal 2-by (51 mm) or larger plate or sill having a width at least equal to the width of the studs.

602.4 Interior load-bearing walls. Interior load-bearing walls shall be constructed, framed and fireblocked as specified for exterior walls *in accordance with Section 602.8*.

602.5 Interior nonbearing walls. Interior nonbearing walls shall be permitted to be constructed with 2-inch-by-3-inch (51 mm by 76 mm) studs spaced 24 inches (610 mm) on center or, when not part of a braced wall line, 2-inch-by-4-inch (51 mm by 102 mm) flat studs spaced at 16 inches (406 mm) on center. Interior nonbearing walls shall be capped with at least a single top plate. Interior nonbearing walls shall be fireblocked in accordance with Section 602.8.

**TABLE 602.3(1)
FASTENER SCHEDULE FOR STRUCTURAL MEMBERS**

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER ^{a, b, c}	SPACING OF FASTENERS
------	----------------------------------	--	----------------------

Roof			
1	Blocking between joists or rafters to top plate, toe nail	3-8d (2½" x 0.113")	—
2	Ceiling joists to plate, toe nail	3-8d (2½" x 0.113")	—
3	Ceiling joists not attached to parallel rafter, laps over partitions, face nail	3-10d	—
4	Collar tie rafter, face nail or 1¼"x 20 gage ridge strap	3-10d (3" x 0.128")	—
5	Rafter to plate, toe nail	2-16d (3½" x 0.135")	—
6	Roof rafters to ridge, valley or hip rafters: toe nail face nail	4-16d (3½" x 0.135") 3-16d (3½" x 0.135")	— —
Wall			
7	Built-up corner studs	10d (3" x 0.128")	24"o.c.
8	Built-up header, two pieces with ½"spacer	16d (3½" x 0.135")	16"o.c. along each edge
9	Continued header, two pieces	16d (3½" x 0.135")	16"o.c. along each edge
10	Continuous header to stud, toe nail	4-8d (2½" x 0.113")	—
11	Double studs, face nail	10d (3" x 0.128")	24"o.c.
12	Double top plates, face nail	10d (3" x 0.128")	24"o.c.
13	Double top plates, minimum 24-inch offset of end joints, face nail in lapped area	8-16d (3½" x 0.135")	—
14	Sole plate to joist or blocking, face nail	16d (3½" x 0.135")	16"o.c.
15	Sole plate to joist or blocking at braced wall panels	3-16d (3½" x 0.135")	16"o.c.
16	Stud to sole plate, toe nail	3-8d (2½" x 0.113") or 2-16d (3½" x 0.135")	— —
17	Top or sole plate to stud, end nail	2-16d (3½" x 0.135")	—
18	Top plates, laps at corners and intersections, face nail	2-10d (3" x 0.128")	—
19	1" brace to each stud and plate, face nail	2-8d (2½" x 0.113") 2 staples 1¾"	— —
20	1"x 6"sheathing to each bearing, face nail	2-8d (2½" x 0.113") 2 staples 1¾"	— —
21	1"x 8"sheathing to each bearing, face nail	2-8d (2½" x 0.113") 3 staples 1¾"	— —
22	Wider than 1"x 8"sheathing to each bearing, face nail	3-8d (2½" x 0.113") 4 staples 1¾"	— —
Floor			
23	Joist to sill or girder, toe nail	3-8d (2½" x 0.113")	—
24	1"x 6"subfloor or less to each joist, face nail	2-8d (2½" x 0.113") 2 staples 1¾"	— —
25	2" subfloor to joist or girder, blind and face nail	2-16d (3½" x 0.135")	—
26	Rim joist to top plate, toe nail (roof applications also)	8d (2½" x 0.113")	6"o.c.
27	2" planks (plank & beam – floor & roof)	2-16d (3½" x 0.135")	at each bearing
28	Built-up girders and beams, 2-inch lumber layers	10d (3" x 0.128")	Nail each layer as follows: 32"o.c. at top and bottom and staggered. Two nails at ends and at each splice.
29	Ledger strip supporting joists or rafters	3-16d (3½" x 0.135")	At each joist or rafter

TABLE 602.3(1)—continued
FASTENER SCHEDULE FOR STRUCTURAL MEMBERS

ITEM	DESCRIPTION OF BUILDING MATERIALS	DESCRIPTION OF FASTENER ^{b, c, e}	SPACING OF FASTENERS	
			Edges (inches) ⁱ	Intermediate supports ^{c, e} (inches)
Wood structural panels, subfloor, roof and interior wall sheathing to framing and particleboard wall sheathing to framing				
30	$\frac{3}{8}$ "- $\frac{1}{2}$ "	6d common (2" x 0.113") nail (subfloor wall) ^f 8d common ($2\frac{1}{2}$ " x 0.131") nail (roof) ^f	6	12 ^g
31	$\frac{5}{16}$ "- $\frac{1}{2}$ "	6d common (2" x 0.113") nail (subfloor, wall) 8d common ($2\frac{1}{2}$ " x 0.131") nail (roof) ^f	6	12 ^g
32	$\frac{19}{32}$ "-1"	8d common nail ($2\frac{1}{2}$ " x 0.131")	6	12 ^g
33	$1\frac{1}{8}$ "- $1\frac{1}{4}$ "	10d common (3" x 0.148") nail or 8d ($2\frac{1}{2}$ " x 0.131") deformed nail	6	12
Other wall sheathing^h				
34	$\frac{1}{2}$ " structural cellulosic fiberboard sheathing	$1\frac{1}{2}$ " galvanized roofing nail, $\frac{7}{16}$ " crown or 1" crown staple 16 ga., $1\frac{1}{4}$ " long	3	6
35	$\frac{25}{32}$ " structural cellulosic fiberboard sheathing	$1\frac{3}{4}$ " galvanized roofing nail, $\frac{7}{16}$ " crown or 1" crown staple 16 ga., $1\frac{1}{2}$ " long	3	6
36	$\frac{1}{2}$ " gypsum sheathing ^d	$1\frac{1}{2}$ " galvanized roofing nail; staple galvanized, $1\frac{1}{2}$ " long; $1\frac{1}{4}$ " screws, Type W or S	7	7
37	$\frac{5}{8}$ " gypsum sheathing ^d	$1\frac{3}{4}$ " galvanized roofing nail; staple galvanized, $1\frac{5}{8}$ " long; $1\frac{5}{8}$ " screws, Type W or S	7	7
Wood structural panels, combination subfloor underlayment to framing				
38	$\frac{3}{4}$ " and less	6d deformed (2" x 0.120") nail or 8d common ($2\frac{1}{2}$ " x 0.131") nail	6	12
39	$\frac{7}{8}$ "-1"	8d common ($2\frac{1}{2}$ " x 0.131") nail or 8d deformed ($2\frac{1}{2}$ " x 0.120") nail	6	12
40	$1\frac{1}{8}$ "- $1\frac{1}{4}$ "	10d common (3" x 0.148") nail or 8d deformed ($2\frac{1}{2}$ " x 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; 1ksi = 6.895 MPa.

- All nails are smooth-common, box or deformed shanks except where otherwise stated. Nails used for framing and sheathing connections shall have minimum average bending yield strengths as shown: 80 ksi 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.
- Staples are 16 gage wire and have a minimum $\frac{7}{16}$ -inch on diameter crown width.
- Nails shall be spaced at not more than 6 inches on center at all supports where spans are 48 inches or greater.
- Four-foot-by-8-foot or 4-foot-by-9-foot panels shall be applied vertically.
- Spacing of fasteners not included in this table shall be based on Table 602.3(2).
- For regions having basic wind speed of 110 mph or greater, 8d deformed ($2\frac{1}{2}$ " x 0.120") nails shall be used for attaching plywood and wood structural panel roof sheathing to framing within minimum 48-inch distance from gable end walls, if mean roof height is more than 25 feet, up to 35 feet maximum.
- For regions having basic wind speed of 100 mph or less, nails for attaching wood structural panel roof sheathing to gable end wall framing shall be spaced 6 inches on center. When basic wind speed is greater than 100 mph, nails for attaching panel roof sheathing to intermediate supports shall be spaced 6 inches on center for minimum 48-inch distance from ridges, eaves and gable end walls; and 4 inches on center to gable end wall framing.
- Gypsum sheathing shall conform to ASTM C 1396 and shall be installed in accordance with GA 253. Fiberboard sheathing shall conform to ASTM C 208.
- Spacing of fasteners on floor sheathing panel edges applies to panel edges supported by framing members and required blocking and at all 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.

TABLE 602.3(2)
ALTERNATE ATTACHMENTS

NOMINAL MATERIAL THICKNESS (inches)	DESCRIPTION ^{a, b} OF FASTENER AND LENGTH (inches)	SPACING ^c OF FASTENERS	
		Edges (inches)	Intermediate supports (inches)
Wood structural panels subfloor, roof and wall sheathing to framing and particleboard wall sheathing to framing^f			
up to ½	Staple 15 ga. 1¾	4	8
	0.097 - 0.099 Nail 2¼	3	6
	Staple 16 ga. 1¾	3	6
19/32 and 5/8	0.113 Nail 2	3	6
	Staple 15 and 16 ga. 2	4	8
	0.097 - 0.099 Nail 2¼	4	8
23/32 and ¾	Staple 14 ga. 2	4	8
	Staple 15 ga. 1¾	3	6
	0.097 - 0.099 Nail 2¼	4	8
	Staple 16 ga. 2	4	8
1	Staple 14 ga. 2¼	4	8
	0.113 Nail 2¼	3	6
	Staple 15 ga. 2¼	4	8
	0.097 - 0.099 Nail 2½	4	8
NOMINAL MATERIAL THICKNESS (inches)	DESCRIPTION ^{a, b} OF FASTENER AND LENGTH (inches)	SPACING ^c OF FASTENERS	
		Edges (inches)	Body of panel ^d (inches)
Floor underlayment; plywood-hardboard-particleboard^f			
Plywood			
¼ and 5/16	1¼ ring or screw shank nail—minimum 12½ ga. (0.099") shank diameter	3	6
	Staple 18 ga., 7/8, 3/16 crown width	2	5
11/32, 3/8, 15/32, and ½	1¼ ring or screw shank nail—minimum 12½ ga. (0.099") shank diameter	6	8e
19/32, 5/8, 23/32 and ¾	1½ ring or screw shank nail—minimum 12½ ga. (0.099") shank diameter	6	8
	Staple 16 ga. 1½	6	8
Hardboard^f			
0.200	1½ long ring-grooved underlayment nail	6	6
	4d cement-coated sinker nail	6	6
	Staple 18 ga., 7/8 long (plastic coated)	3	6
Particleboard			
¼	4d ring-grooved underlayment nail	3	6
	Staple 18 ga., 7/8 long, 3/16 crown	3	6
3/8	6d ring-grooved underlayment nail	6	10
	Staple 16 ga., 1 1/8 long, 3/8 crown	3	6
½, 5/8	6d ring-grooved underlayment nail	6	10
	Staple 16 ga., 1 5/8 long, 3/8 crown	3	6

For SI: 1 inch = 25.4 mm.

a. Nail is a general description and may be T-head, modified round head or round head.

b. Staples shall have a minimum crown width of 5/8-inch on diameter except as noted.

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

Nails or staples shall be spaced at not more than 12 inches on center at intermediate supports for floors.

d. Fasteners shall be placed in a grid pattern throughout the body of the panel.

e. For 5-ply panels, intermediate nails shall be spaced not more than 12 inches on center each way.

f. Hardboard underlayment shall conform to ~~ANSI/AA~~ CPA/ANSI A135.4.

TABLE 602.3(3)
REQUIREMENTS FOR WOOD STRUCTURAL PANEL WALL SHEATHING USED TO RESIST WIND PRESSURES^{a,b,c}

MINIMUM NAIL		MINIMUM WOOD STRUCTURAL PANEL SPAN RATING	MINIMUM NOMINAL PANEL THICKNESS (inches)	MAXIMUM WALL STUD SPACING (inches)	PANEL NAIL SPACING		MAXIMUM WIND SPEED (mph)		
Size	Penetration (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	110	90	85
8d Common (2.5" × 0.131")	1.75	24/16	7/16	16	6	12	130	110	105
				24	6	12	110	90	85

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 per Section 301.2. Lateral bracing requirements shall be in accordance with Section 602.10.
- 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 oc or 24 oc shall be permitted as an alternate to panels with a 24/16 span rating. Wall-16 and Plywood siding 16 oc shall be used with studs spaced a maximum of 16 inches on center.

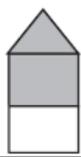
TABLE 602.3(4)
ALLOWABLE SPANS FOR PARTICLEBOARD WALL SHEATHING^a

THICKNESS (inch)	GRADE	STUD SPACING (inches)	
		When siding is nailed to studs	When siding is nailed to sheathing
3/8	M—1 Exterior glue	16	—
1/2	M—2 Exterior glue	16	16

For SI: 1 inch = 25.4 mm.

- a. Wall sheathing not exposed to the weather. If the panels are applied horizontally, the end joints of the panel shall be offset so that four panels corners will not meet. All panel edges must be supported. Leave a 1/16-inch gap between panels and nail no closer than 3/8 inch from panel edges.

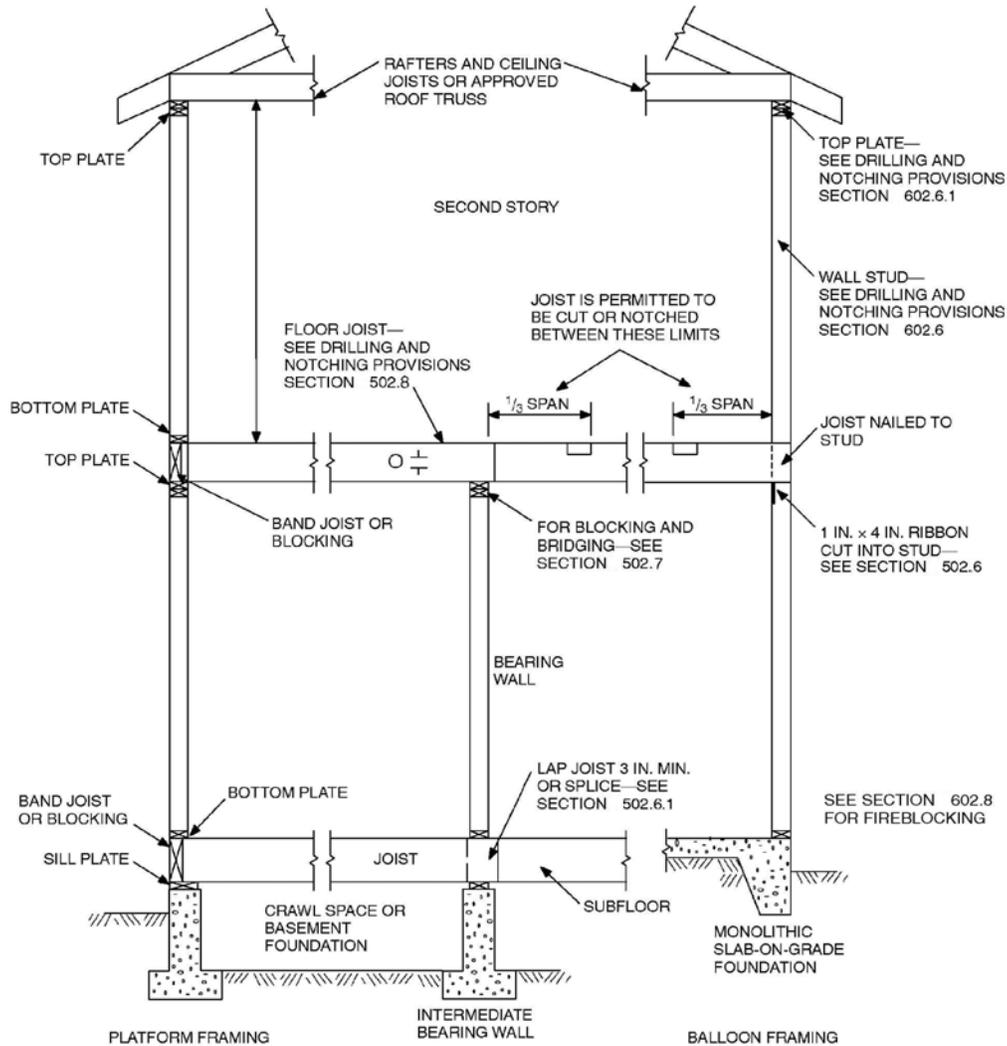
TABLE 602.3(5)

STUD SIZE (inches)	BEARING WALLS					NONBEARING WALLS	
	Laterally unsupported stud height ^a (feet)	Maximum spacing when supporting a roof-ceiling assembly or a habitable attic assembly, only (inches)	Maximum spacing when supporting one floor, plus a roof-ceiling assembly or a habitable attic assembly (inches)	Maximum spacing when supporting two floors, plus a roof-ceiling assembly or a habitable attic assembly (inches)	Maximum spacing when supporting one floor height ^a (feet)	Laterally unsupported stud height ^a (feet)	Maximum spacing (inches)
							
2 × 3 ^b	—	—	—	—	—	10	16
2 × 4	10	24 ^c	16 ^c	—	24	14	24
3 × 4	10	24	24	16	24	14	24
2 × 5	10	24	24	—	24	16	24
2 × 6	10	24	24	16	24	20	24

SIZE, HEIGHT AND SPACING OF WOOD STUDS^a

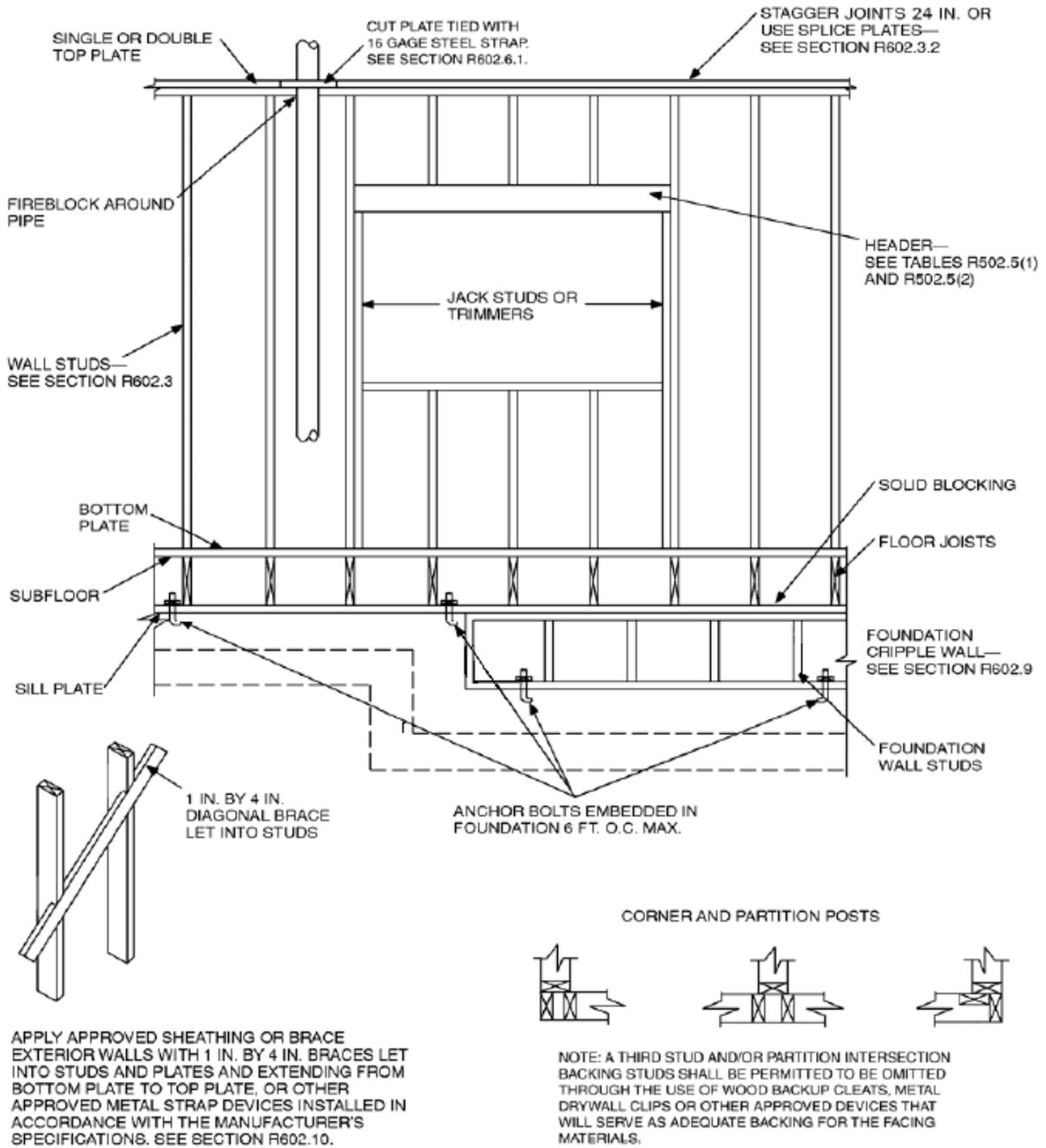
For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 square foot = 0.093m².

- a. Listed heights are distances between points of lateral support placed perpendicular to the plane of the wall. Increases in unsupported height are permitted where justified by analysis.
- b. Shall not be used in exterior walls.
- c. A habitable attic assembly supported by 2×4 studs is limited to a roof span of 32 feet. Where the roof span exceeds 32 feet, the wall studs shall be increased to 2×6 or the studs shall be designed in accordance with accepted engineering practice.



For SI: 1 inch = 25.4 mm.

FIGURE 602.3(1)
TYPICAL WALL, FLOOR AND ROOF FRAMING



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

FIGURE 602.3(2)
FRAMING DETAILS

TABLE 602.3.1
MAXIMUM ALLOWABLE LENGTH OF WOOD WALL STUDS EXPOSED TO WIND SPEEDS OF 100 mph
OR LESS IN SEISMIC DESIGN CATEGORIES A, B, C, D₀, D₁ and D₂^{b,c}

HEIGHT (feet)	ON-CENTER SPACING (inches)			
	24	16	12	8
Supporting a roof only				
>10	2 × 4	2 × 4	2 × 4	2 × 4
12	2 × 6	2 × 4	2 × 4	2 × 4
14	2 × 6	2 × 6	2 × 6	2 × 4
16	2 × 6	2 × 6	2 × 6	2 × 4
18	NA ^a	2 × 6	2 × 6	2 × 6
20	NA ^a	NA ^a	2 × 6	2 × 6
24	NA ^a	NA ^a	NA ^a	2 × 6
Supporting one floor and a roof				
>10	2 × 6	2 × 4	2 × 4	2 × 4
12	2 × 6	2 × 6	2 × 6	2 × 4
14	2 × 6	2 × 6	2 × 6	2 × 6
16	NA ^a	2 × 6	2 × 6	2 × 6
18	NA ^a	2 × 6	2 × 6	2 × 6
20	NA ^a	NA ^a	2 × 6	2 × 6
24	NA ^a	NA ^a	NA ^a	2 × 6
Supporting two floors and a roof				
>10	2 × 6	2 × 6	2 × 4	2 × 4
12	2 × 6	2 × 6	2 × 6	2 × 6
14	2 × 6	2 × 6	2 × 6	2 × 6
16	NA ^a	NA ^a	2 × 6	2 × 6
18	NA ^a	NA ^a	2 × 6	2 × 6
20	NA ^a	NA ^a	NA ^a	2 × 6
22	NA ^a	NA ^a	NA ^a	NA ^a
24	NA ^a	NA ^a	NA ^a	NA ^a

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kPa, 1 pound per square inch = 6.895 kPa, 1 mile per hour = 0.447 m/s.

a. Design required.

b. Applicability of this table assumes the following: Snow load not exceeding 25 psf, f_b not less than 1310 psi determined by multiplying the AF&PA NDS tabular base design value by the repetitive use factor, and by the size factor for all species except southern pine, E not less than 1.6×10^6 psi, tributary dimensions for floors and roofs not exceeding 6 feet, maximum span for floors and roof not exceeding 12 feet, eaves not over 2 feet in dimension and exterior sheathing. Where the conditions are not within these parameters, design is required.

c. Utility, standard, stud and No. 3 grade lumber of any species are not permitted.

(continued)

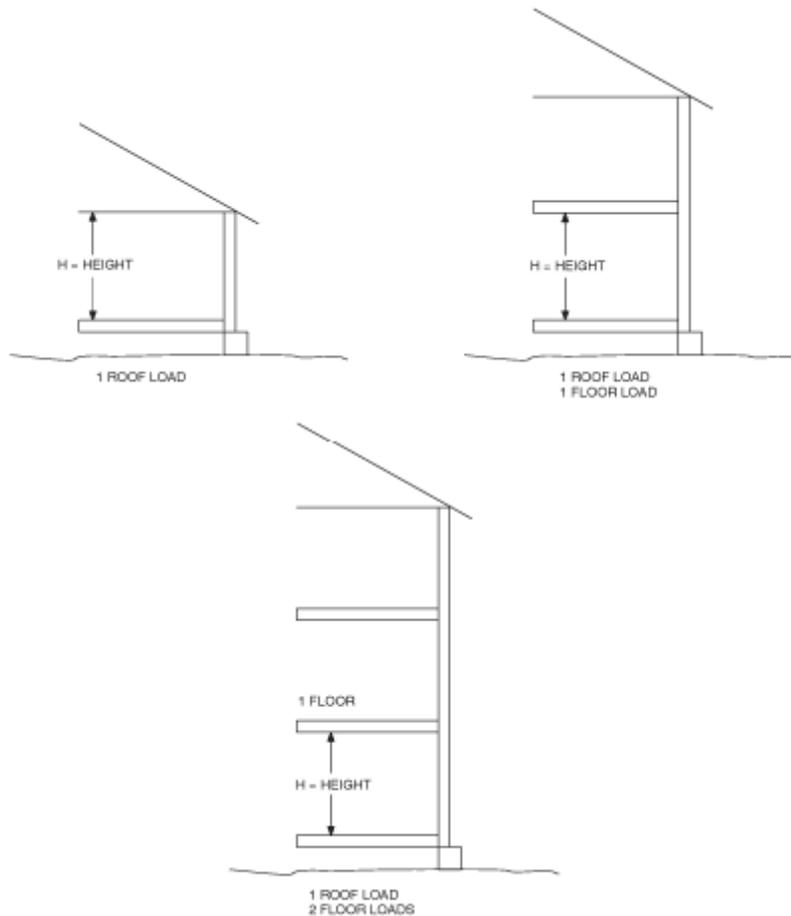


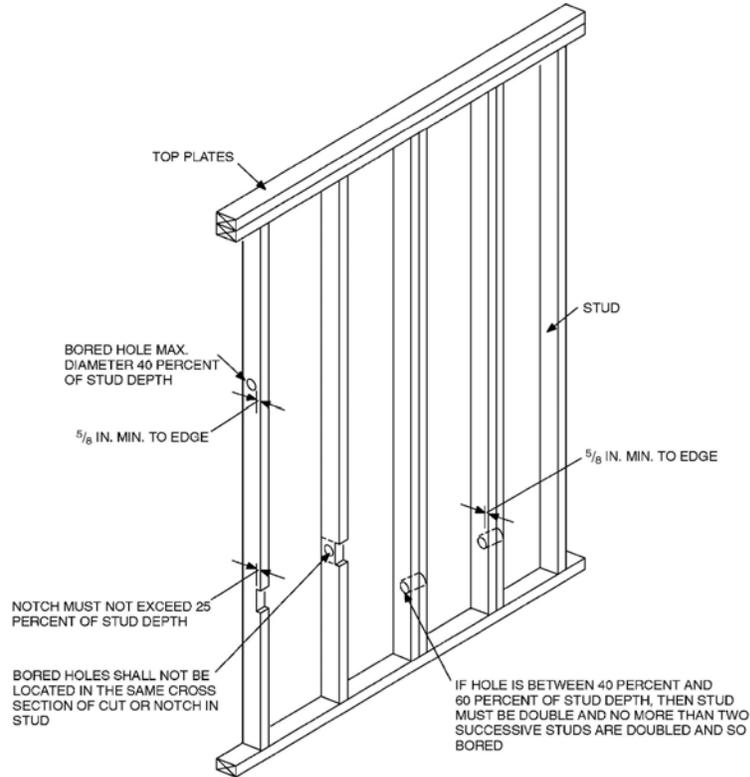
TABLE 602.3.1 - continued
MAXIMUM ALLOWABLE LENGTH OF WOOD WALL STUDS EXPOSED TO WIND SPEEDS OF 100 mph
OR LESS IN SEISMIC DESIGN CATEGORIES A, B, C, D₀, D₁ and D₂^{b,c}

602.6 Drilling and notching—studs. Drilling and notching of studs shall be in accordance with the following:

1. Notching. Any stud in an exterior wall or bearing partition may be cut or notched to a depth not exceeding 25 percent of its width. Studs in nonbearing partitions may be notched to a depth not to exceed 40 percent of a single stud width.
2. Drilling. Any stud may be bored or drilled, provided that the diameter of the resulting hole is no more than 60 percent of the stud width, the edge of the hole is no ~~more~~ *closer* than $\frac{5}{8}$ inch (16 mm) to the edge of the stud, and the hole is not located in the same section as a cut or notch. Studs located in exterior walls or bearing partitions drilled over

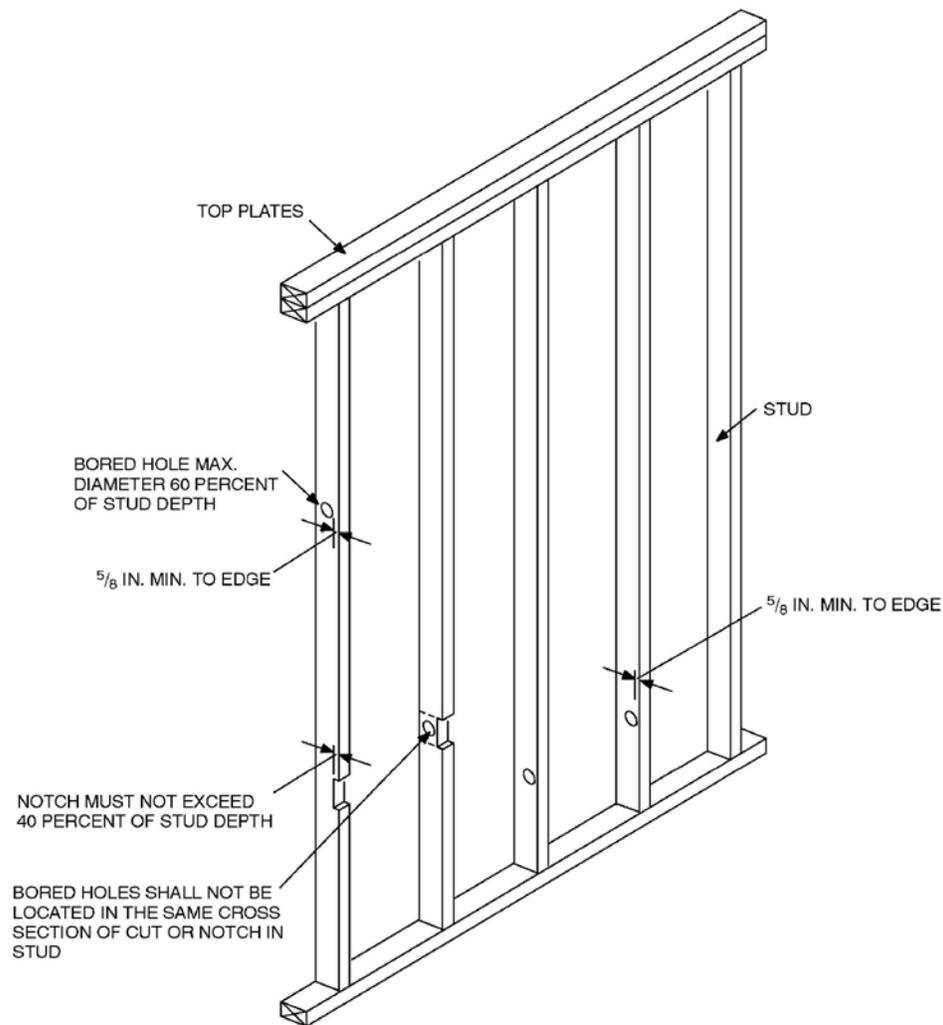
40 percent and up to 60 percent shall also be doubled with no more than two successive doubled studs bored. See Figures 602.6(1) and 602.6(2).

Exception: Use of approved stud shoes is permitted when they are installed in



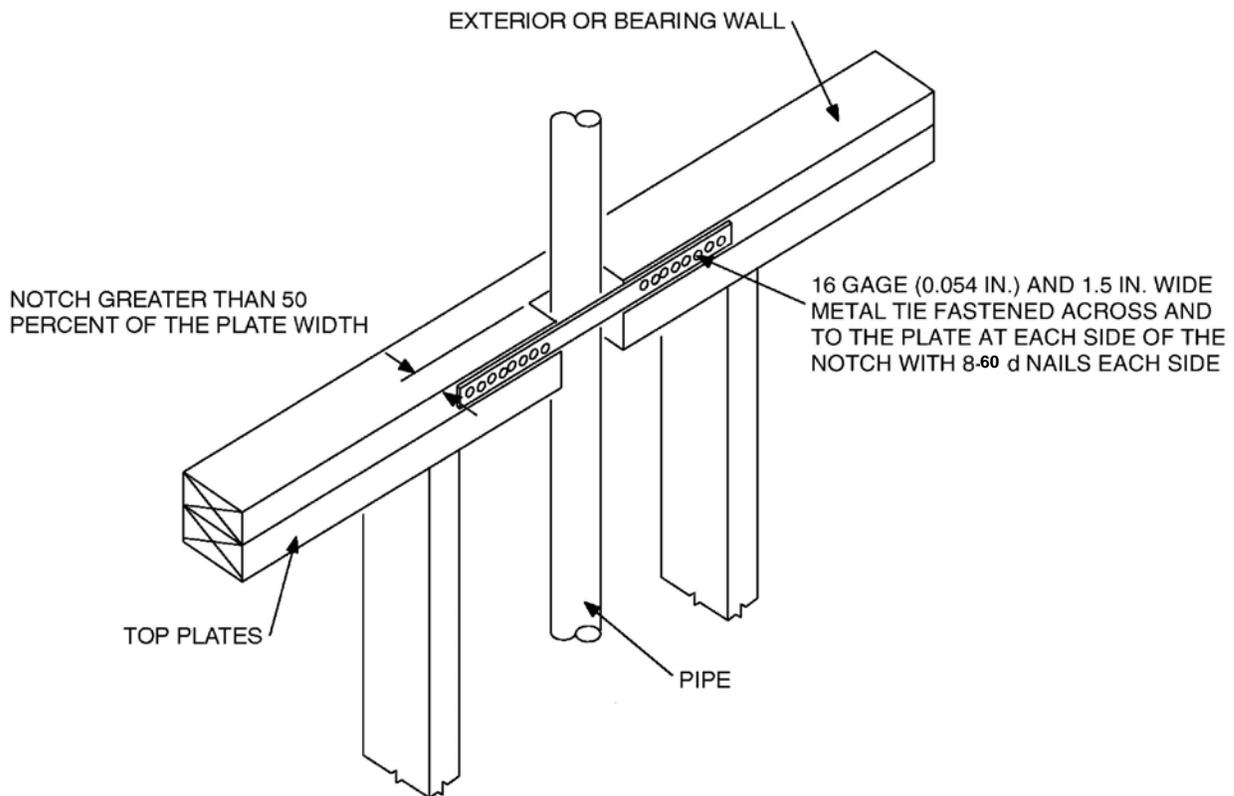
accordance with the manufacturer's recommendations.

FIGURE 602.6(1)
NOTCHING AND BORED HOLE LIMITATIONS FOR EXTERIOR WALLS AND BEARING WALLS



For SI: 1 inch = 25.4 mm.

FIGURE 602.6(2)
NOTCHING AND BORED HOLE LIMITATIONS FOR INTERIOR NONBEARING WALLS



For SI: 1 inch = 25.4 mm.

FIGURE 602.6.1
TOP PLATE FRAMING TO ACCOMMODATE PIPING

602.6.1 Drilling and notching of top plate. When piping or ductwork is placed in or partly in an exterior wall or interior load-bearing wall, necessitating cutting, drilling or notching of the top plate by more than 50 percent of its width, a galvanized metal tie not less than 0.054 inch thick (1.37 mm) (16 ga) and 1½ inches (38 mm) wide shall be fastened across and to the plate at each side of the opening with not less than eight 10d (0.148 inch diameter) having a minimum length of 1½ inches (38 mm) at each side or equivalent. The metal tie must extend a minimum of 6 inches past the opening. See Figure 602.6.1.

Exception: When the entire side of the wall with the notch or cut is covered by wood structural panel sheathing.

602.7 Headers. For header spans see Tables 502.5(1) and 502.5(2).

602.7.1 Wood structural panel box headers. Wood structural panel box headers shall be constructed in accordance with Figure 602.7.2 and Table 602.7.2.

602.7.2 Nonbearing walls. Load-bearing headers are not required in interior or exterior nonbearing walls. A single flat 2-inch-by-4-inch (51 mm by 102 mm) member may be used as a header in interior or exterior nonbearing walls for openings up to 8 feet (2438 mm) in width if the vertical distance to the parallel nailing surface above is not more than 24 inches

(610 mm). For such nonbearing headers, no cripples or blocking are required above the header.

602.8 Fireblocking required. Fireblocking shall be provided in accordance with Section 302.11.

602.9 Cripple walls. Foundation cripple walls shall be framed of studs not smaller than the studding above. When exceeding 4 feet (1219 mm) in height, such walls shall be framed of studs having the size required for an additional story.

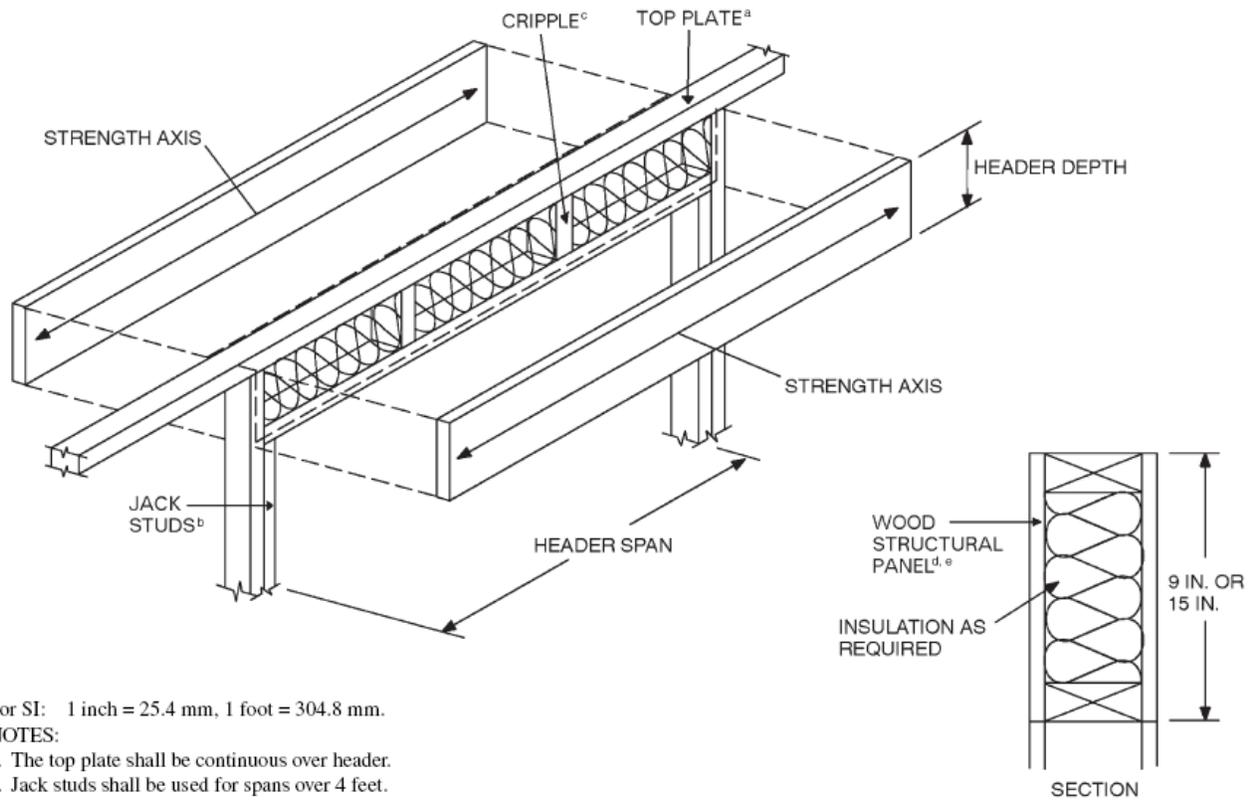
Cripple walls with a stud height less than 14 inches (356 mm) shall be sheathed on at least one side with a wood structural panel that is fastened to both the top and bottom plates in accordance with Table 602.3(1), or the cripple walls shall be constructed of solid blocking. Cripple walls shall be supported on continuous foundations.

TABLE 602.7.2
MAXIMUM SPANS FOR WOOD STRUCTURAL PANEL BOX HEADERS^a

HEADER CONSTRUCTION ^b	HEADER DEPTH (inches)	HOUSE DEPTH (feet)				
		24	26	28	30	32
Wood structural panel—one side	9	4	4	3	3	—
	15	5	5	4	3	3
Wood structural panel—both sides	9	7	5	5	4	3
	15	8	8	7	7	6

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

- a. Spans are based on single story with clear-span trussed roof or two-story with floor and roof supported by interior-bearing walls.
- b. See Figure 602.7.2 for construction details.



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

NOTES:

- a. The top plate shall be continuous over header.
- b. Jack studs shall be used for spans over 4 feet.
- c. Cripple spacing shall be the same as for studs.
- d. Wood structural panel faces shall be single pieces of $1\frac{1}{2}$ -inch-thick Exposure 1 (exterior glue) or thicker, installed on the interior or exterior or both sides of the header.
- e. Wood structural panel faces shall be nailed to framing and cripples with 8d common or galvanized box nails spaced 3 inches on center, staggering alternate nails $\frac{1}{2}$ inch. Galvanized nails shall be hot-dipped or tumbled.

FIGURE 602.7.2
TYPICAL WOOD STRUCTURAL PANEL BOX HEADER CONSTRUCTION

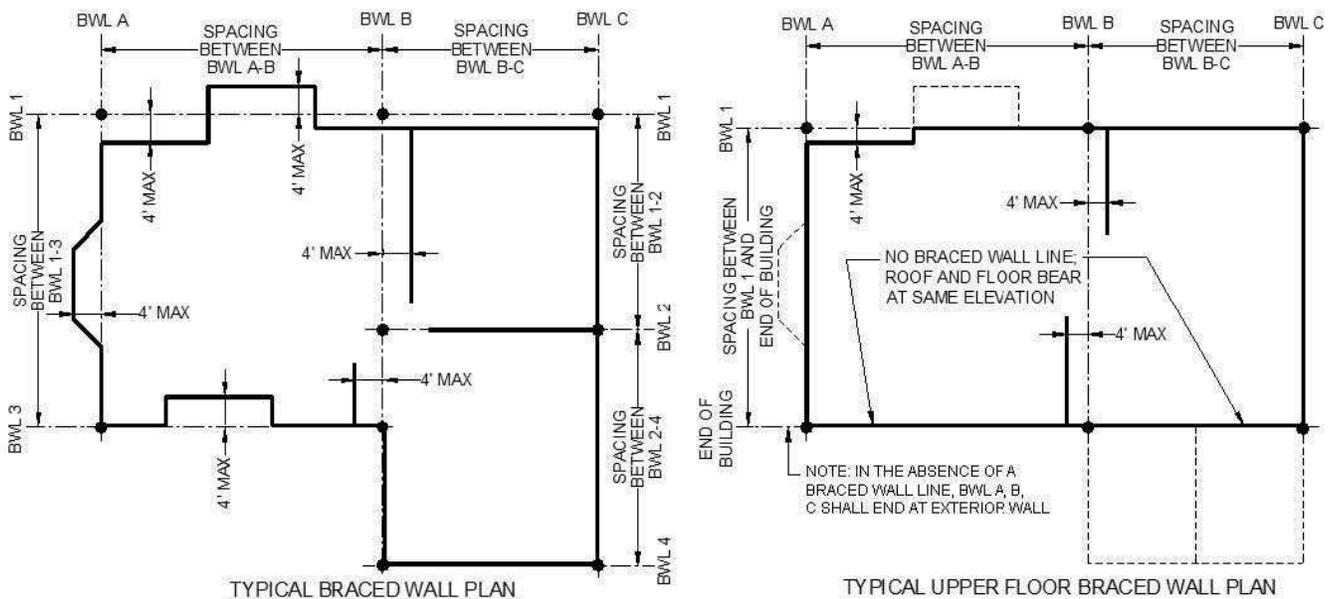
602.10 Wall bracing. Buildings shall be braced in accordance with this section. Where a building, or portion thereof, does not comply with one or more of the bracing requirements in this section, those portions shall be designed and constructed in accordance with Section ~~301.1~~ 301.1.1.

602.10.1 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.

602.10.1.1 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 602.10.1.4 or an exterior wall as shown in Figure 602.10.1.1.

602.10.1.2 Offsets along a braced wall line. All 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 602.10.1.1. 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 602.10.1.1.

602.10.1.3 Spacing of braced wall lines. The spacing between parallel braced wall lines shall be in accordance with Table 602.10.1.3. Intermediate braced wall lines through the interior of the building shall be permitted.



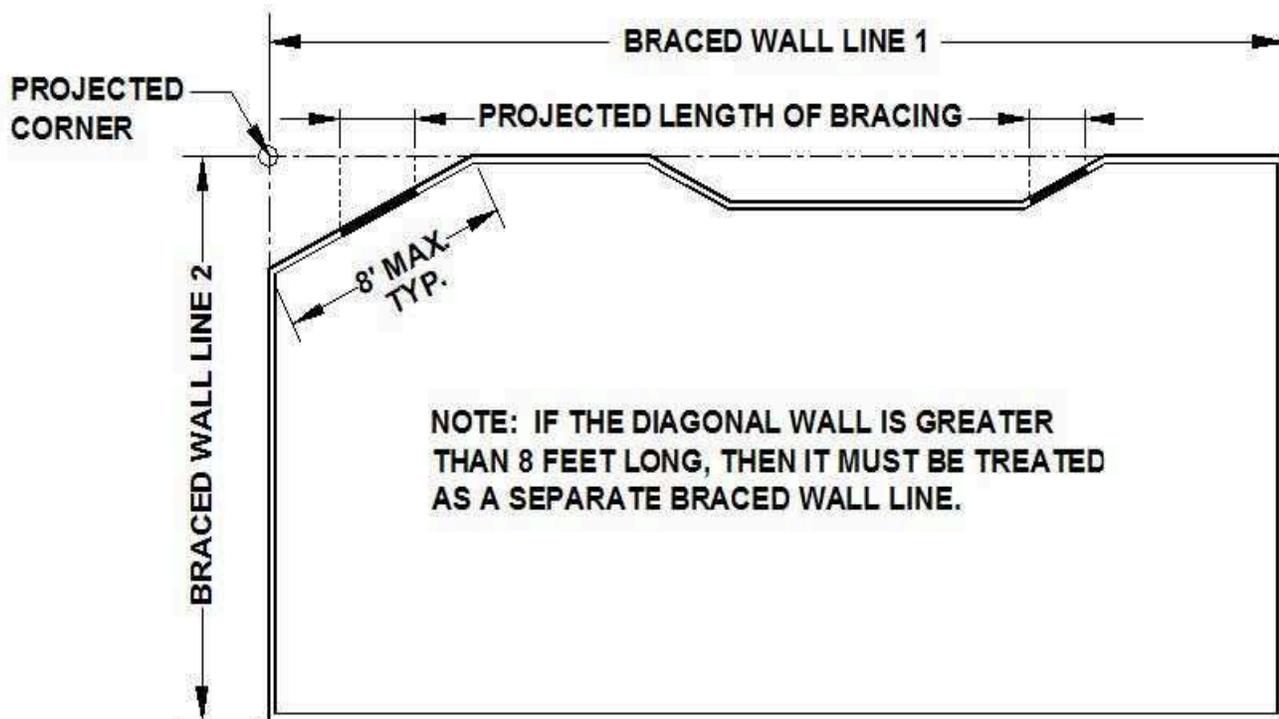
**FIGURE 602.10.1.1
BRACED WALL LINES**

**TABLE 602.10.1.3
BRACED WALL LINE SPACING**

APPLICATION	CONDITION	BUILDING TYPE	BRACED WALL LINE SPACING CRITERIA	
			Maximum Spacing	Exception to Maximum Spacing
Wind bracing	85 mph to <110 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 602.10.3(3) is adjusted in accordance with Table 602.10.3(4)
	SDC D0, D1, D2	Detached, townhouses, one-and two-story only	25 feet	Up to 35 feet to allow for a single room not to exceed 900 sq ft. Spacing of all other braced wall lines shall not exceed 25 feet.
	SDC D0, D1, D2	Detached, townhouse	25 feet	Up to 35 feet when length of required bracing per Table 602.10.3(3) is adjusted in accordance with Table 602.10.3(4).

For SI: 1 foot = 304.8 mm

602.10.1.4 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 602.10.1.4. Where the diagonal length is greater than 8 feet (2438 mm), it shall be considered a separate braced wall line and shall be braced in accordance with Section 602.10.1.



**FIGURE 602.10.1.4
ANGLED WALLS**

602.10.2 Braced wall panels. *Braced wall panels shall be full-height sections of wall that shall have no vertical or horizontal offsets. Braced wall panels shall be constructed and placed along a braced wall line in accordance with this section and the bracing methods specified in Section 602.10.4.*

602.10.2.1 Braced wall panel uplift load path. *The bracing lengths in Table 602.10.3(1) apply only when uplift loads are resisted in accordance with this section.*

Braced wall panels located at exterior walls that support roof rafters or trusses (including stories below top story) shall have the framing members connected in accordance with one of the following:

1. *Fastening in accordance with Table 602.3(1) where:*

1.1. *The basic wind speed does not exceed 90 mph (40 m/s), the wind exposure category is B, the roof pitch is 5:12 or greater, and the roof span is 32 feet (9754 mm) or less, or*

1.2. *The net uplift value at the top of a wall does not exceed 100 plf. The net uplift value shall be determined in accordance with Section 802.11 and shall be permitted to be reduced by 60 plf (86 N/mm) for each full wall above.*

2. *Where the net uplift value at the top of a wall exceeds 100 plf (146 N/mm), installing approved uplift framing connectors to provide a continuous load path from the top of the wall to the foundation. The net uplift value shall be as determined in Item 1.2 above.*

3. *Bracing and fasteners designed in accordance with accepted engineering practice to resist combined uplift and shear forces.*

602.10.2.2 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 602.10.1.1. The distance between adjacent edges of braced wall panels along a braced wall line shall be no greater than 20 feet (6096 mm) as shown in Figure 602.10.2.2.*

602.10.2.2.1 Location of braced wall panels in Seismic Design Categories D_0 , D_1 and D_2 . *Braced wall panels shall be located at each end of a braced wall line.*

Exception: *Braced wall panels constructed of Methods WSP or BV-WSP and continuous sheathing methods as specified in Section 602.10.4 shall be permitted to begin no more than 10 feet (3048 mm) from each end of a braced wall line provided each end complies with one of the following.*

1. *A minimum 24 inch wide (610 mm) panel for Methods WSP, BV-WSP, CS-WSP, CS-G, CS-PF and 32 inch (813 mm) wide panel for Method CS-SFB is applied to each side of the building corner as shown in Condition 4 of Figure 602.10.7.*

2. *The end of each braced wall panel closest to the end of the braced wall line shall have an 1,800 lb (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 Condition 5 of Figure 602.10.7.*
3. *For Method BV-WSP, hold-down devices shall be provided in accordance with Table 602.10.6.5 at the ends of each braced wall panel.*

602.10.2.3 Minimum number of braced wall panels. *Braced wall lines with a length of 16 feet (4877 mm) or less shall have a minimum of two braced wall panels 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 a minimum of two braced wall panels.*

602.10.3 Required length of bracing. *The required length of bracing along each braced wall line shall be determined as follows.*

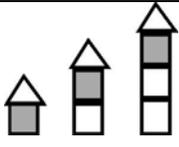
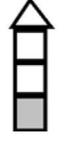
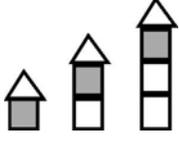
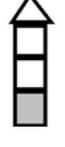
1. *All buildings in Seismic Design Categories A and B shall use Table 602.10.3(1) and the applicable adjustment factors in Table 602.10.3(2).*
2. *Detached buildings in Seismic Design Category C shall use Table 602.10.3(1) and the applicable adjustment factors in Table 602.10.3(2).*
3. *Townhouses in Seismic Design Category C shall use the greater value determined from Table 602.10.3(1) or 602.10.3(3) and the applicable adjustment factors in Table 602.10.3(2) or 602.10.3(4) respectively.*
4. *All buildings in Seismic Design Categories D_0 , D_1 and D_2 shall use the greater value determined from Table 602.10.3(1) or 602.10.3(3) and the applicable adjustment factors in Table 602.10.3(2) or 602.10.3(4) respectively.*

Only braced wall panels parallel to the braced wall line shall contribute towards the required length of bracing of that braced wall line. Braced wall panels along an angled wall meeting the minimum length requirements of Tables 602.10.5 and 602.10.5.2 shall be permitted to contribute its projected length towards the minimum required length of bracing for the braced wall line as shown in Figure 602.10.1.4. 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: *The length of wall bracing for dwellings in Seismic Design Categories D_0 , D_1 and D_2 with stone or masonry veneer installed per Section 703.7 and exceeding the first story height shall be in accordance with Section 602.10.6.5.*

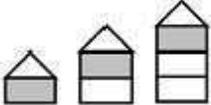
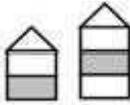
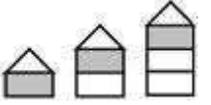
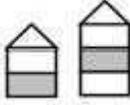
602.10.4 Construction methods for braced wall panels. *Intermittent and continuously sheathed braced wall panels shall be constructed in accordance with this section and the methods listed in Table 602.10.4.*

**TABLE 602.10.3(1)
BRACING REQUIREMENTS BASED ON WIND SPEED**

<ul style="list-style-type: none"> • EXPOSURE CATEGORY B • 30 FT MEAN ROOF HEIGHT • 10 FT EAVE TO RIDGE HEIGHT • 10 FT WALL HEIGHT 2 BRACED • WALL LINES 			MINIMUM TOTAL LENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE ^a			
Basic Wind Speed (mph)	Story Location	Braced Wall Line Spacing (feet)	Method LIB ^b	Method GB	Methods DWB, WSP, SFB, PBS, PCP, HPS, CS-SFB ^c	Methods CS-WSP, CS-G, CS-PF
≤ 85		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	15.0	13.0
		60	31.5	31.5	18.0	15.5
		10	NP	9.0	5.5	4.5
		20	NP	17.0	10.0	8.5
		30	NP	24.5	14.0	12.0
		40	NP	32.0	18.0	15.5
		50	NP	39.0	22.5	19.0
		60	NP	46.5	26.5	22.5
≤ 90		10	3.5	3.5	2.0	2.0
		20	7.0	7.0	4.0	3.5
		30	9.5	9.5	5.5	5.0
		40	12.5	12.5	7.5	6.0
		50	15.5	15.5	9.0	7.5
		60	18.5	18.5	10.5	9.0
		10	7.0	7.0	4.0	3.5
		20	13.0	13.0	7.5	6.5
		30	18.5	18.5	10.5	9.0
		40	24.0	24.0	14.0	12.0
		50	29.5	29.5	17.0	14.5
		60	35.0	35.0	20.0	17.0
		10	NP	10.5	6.0	5.0
		20	NP	19.0	11.0	9.5
		30	NP	27.5	15.5	13.5
		40	NP	35.5	20.5	17.5
		50	NP	44.0	25.0	21.5
		60	NP	52.0	30.0	25.5

(continued)

**TABLE 602.10.3(1)—continued
BRACING REQUIREMENTS BASED ON WIND SPEED**

<ul style="list-style-type: none"> • EXPOSURE CATEGORY B • 30 FT MEAN ROOF HEIGHT • 10 FT EAVE TO RIDGE HEIGHT • 10 FT WALL HEIGHT • 2 BRACED WALL LINES 			MINIMUM TOTAL LENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE ^a			
Basic Wind Speed (mph)	Story Location	Braced Wall Line Spacing (feet)	Method LIB ^b	Method GB	Methods DWB, WSP, SFB, PBS, PCP, HPS, CS-SFB ^c	Methods CS-WSP, CS-G, CS-PF
≤ 100		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	19.0	19.0	11.0	9.5
		60	22.5	22.5	13.0	11.0
		10	8.5	8.5	5.0	4.5
		20	16.0	16.0	9.0	8.0
		30	23.0	23.0	13.0	11.0
		40	29.5	29.5	17.0	14.5
		50	36.5	36.5	21.0	18.0
		60	43.5	43.5	25.0	21.0
		10	NP	12.5	7.5	6.0
		20	NP	23.5	13.5	11.5
		30	NP	34.0	19.5	16.5
		40	NP	44.0	25.0	21.5
		50	NP	54.0	31.0	26.5
		60	NP	64.0	36.5	31.0
< 110 _c		10	5.5	5.5	3.0	3.0
		20	10.0	10.0	6.0	5.0
		30	14.5	14.5	8.5	7.0
		40	18.5	18.5	11.0	9.0
		50	23.0	23.0	13.0	11.5
		60	27.5	27.5	15.5	13.5
		10	10.5	10.5	6.0	5.0
		20	19.0	19.0	11.0	9.5
		30	27.5	27.5	16.0	13.5
		40	36.0	36.0	20.5	17.5
		50	44.0	44.0	25.5	21.5
		60	52.5	52.5	30.0	25.5
		10	NP	15.5	9.0	7.5
		20	NP	28.5	16.5	14.0
		30	NP	41.0	23.5	20.0
		40	NP	53.0	30.5	26.0
		50	NP	65.5	37.5	32.0
		60	NP	77.5	44.5	37.5

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm.

a. Linear interpolation shall be permitted.

b. Method LIB shall have gypsum board fastened to at least one side with nails or screws in accordance with Table 602.3(1) for exterior sheathing or Table 702.3.5 for interior gypsum board. Spacing of fasteners at panel edges shall not exceed 8 inches (203 mm).

c. Method CS-SFB does not apply where the wind speed is greater than 100 mph.

TABLE 602.10.3(2)
WIND ADJUSTMENT FACTORS TO THE REQUIRED LENGTH OF WALL BRACING

ADJUSTMENT BASED ON	STORY/ SUPPORTING	CONDITION	ADJUSTMENT FACTOR ^{a,b} (multiply length from Table 602.10.3(1) by this factor)	APPLICABLE METHODS
Exposure category	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	
Roof eave-to-ridge height	Roof only	≤ 5 ft	0.70	
		10 ft	1.00	
		15 ft	1.30	
		20 ft	1.60	
	Roof + 1 floor	≤ 5 ft	0.85	
		10 ft	1.00	
		15 ft	1.15	
		20 ft	1.30	
	Roof + 2 floors	≤ 5 ft	0.90	
10 ft		1.00		
15 ft		1.10		
20 ft		Not permitted		
Wall height adjustment	Any story	8 ft	0.90	
		9 ft	0.95	
		10 ft 11 ft	1.00 1.05	
		12 ft	1.10	
Number of braced wall lines (per plan direction) ^c	Any story	2	1.00	
		3	1.30	
		4	1.45	
		≤ 5	1.60	
Additional 800 lb 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
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
Gypsum board fastening	Any story	4 in. o.c. at panel edges, including top and bottom plates, and all horizontal joints blocked	0.7	GB

For SI: 1 foot = 305 mm, 1 lb = 4.48 N.

a. Linear Interpolation shall be permitted.

b. The total adjustment factor is the product of all applicable adjustment factors.

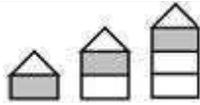
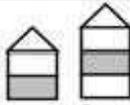
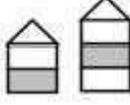
c. The adjustment factor is permitted to be 1.0 when determining bracing amounts for intermediate braced wall lines provided the bracing amounts on adjacent braced wall lines are based on a spacing and number that neglects the intermediate braced wall line.

**TABLE 602.10.3(3)
BRACING REQUIREMENTS BASED ON SEISMIC DESIGN CATEGORY**

<ul style="list-style-type: none"> • SOIL CLASS D^b • WALL HEIGHT = 10 FT • 10 PSF FLOOR DEAD LOAD • 15 PSF ROOF/CEILING DEAD LOAD • BRACED WALL LINE SPACING ≤ 25 FT 			MINIMUM TOTAL LENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE ^a				
Seismic Design Category	Story Location	Braced Wall Line Length (ft)	Method LIB ^c	Method GB	Methods DWB, SFB, PBS, PCP, HPS, CS-SFB ^d	Method WSP	Methods CS-WSP, CS-G
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
D ⁰		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 602.10.3(3)—continued
BRACING REQUIREMENTS BASED ON SEISMIC DESIGN CATEGORY

<i>D</i> ¹		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
		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
<i>D</i> ²		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
		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	

For SI: 1 foot 305 mm

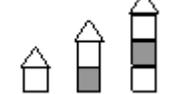
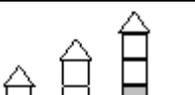
a. Linear interpolation shall be permitted.

b. Wall bracing lengths are based on a soil site class “D.” 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 1613.5 of the building code.

c. Method LIB shall have gypsum board fastened to at least one side with nails or screws per Table 602.3(1) for exterior sheathing or Table 702.3.5 for interior gypsum board. Spacing of fasteners at panel edges shall not exceed 8 inches (203 mm).

d. Method CS-SFB applies in SDC C only.

TABLE 602.10.3(4)
SEISMIC ADJUSTMENT FACTORS TO THE REQUIRED LENGTH OF WALL BRACING

ADJUSTMENT BASED ON:	STORY/SUPPORTING	Condition	ADJUSTMENT FACTOR^{a,b} <i>(Multiply length from Table 602.10.3(1) by this factor)</i>	APPLICABLE METHODS
<i>Story height (Section 301.3)</i>	<i>Any story</i>	≤ 10 ft	1.0	<i>All methods</i>
		> 10 ft and ≤ 12 ft	1.2	
<i>Braced wall line spacing, townhouses in SDC C</i>	<i>Any story</i>	≤ 35 ft	1.0	
		> 35 ft and ≤ 50 ft	1.43	
<i>Braced wall line spacing, in SDC D0, D1, D2^c</i>	<i>Any story</i>	> 25 ft and ≤ 30 ft	1.2	
		> 30 ft and ≤ 35 ft	1.4	
<i>Wall dead load</i>	<i>Any story</i>	> 8 psf and < 15 psf < 8 psf	1.0 0.85	
<i>Roof/ceiling dead load for wall supporting</i>	<i>Roof only or roof plus one or two stories</i>	≤ 15 psf	1.0	
	<i>Roof plus one or two stories</i>	> 15 psf and ≤ 25 psf	1.1	
		> 15 psf and ≤ 25 psf	1.2	
<i>Walls with stone or masonry veneer, town-houses in SDC^{d,e}</i>		1.0	<i>All intermittent & continuous methods</i>	
		1.5		
		1.5		
<i>Walls with stone or masonry veneer, detached one- and two- and three-family dwellings in SDC D0-D2^d</i>	<i>Any story</i>	<i>See Table R602.10.6.5</i>	<i>BV-WSP</i>	
<i>Interior gypsum board finish (or equivalent)</i>	<i>Any story</i>	<i>Omitted from inside face of braced wall panels</i>	1.5	<i>DWB, WSP, SFB, PBS, PCP, HPS, CS-WSP, CS-G, CS-SFB</i>

For SI: 1 psf = 47.8 N/m².

a. Linear interpolation shall be permitted.

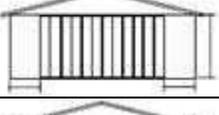
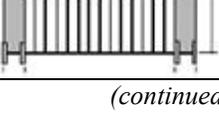
b. The total length of bracing required for a given wall line is the product of all applicable adjustment factors.

c. The length-to-width ratio for the floor/roof diaphragm shall not exceed 3:1. The top plate lap splice nailing shall be a minimum of 12-16d nails on each side of the splice.

d. Applies to stone or masonry veneer exceeding the first story height. See Section 602.10.6.5 for requirements when stone or masonry veneer does not exceed the first story height.

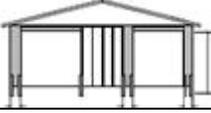
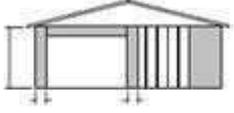
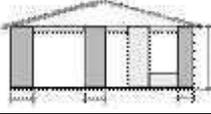
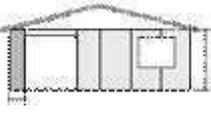
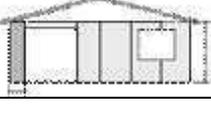
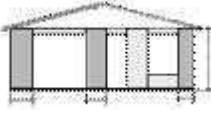
e. The adjustment factor for stone or masonry veneer shall be applied to all exterior braced wall lines and all braced wall lines on the interior of the building, backing or perpendicular to and laterally supported veneered walls.

**TABLE 602.10.4
BRACING METHODS**

METHODS, MATERIAL	MINIMUM THICKNESS	FIGURE	CONNECTION CRITERIA ^a		
			Fasteners	Spacing	
Intermittent Bracing Method	LIB <i>Let-in-bracing</i>	1 × 4 wood or approved metal straps at 45° to 60° angles for maximum 16" stud spacing		Wood: 2-8d common nails or 3-8d (2 1/2" long x 0.113" dia.) nails Metal strap: per manufacturer	Wood: per stud and top and bottom plates Metal: per manufacturer
	DWB <i>Diagonal wood boards</i>	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 <i>Wood structural panel (See Section 604)</i>	3/8 "		Exterior sheathing per Table 602.3(3)	6" edges 12" field
				Interior sheathing per Table 602.3(1) or 602.3(2)	Varies by fastener
	BV-WSP^e <i>Wood Structural Panels with Stone or Masonry Veneer (See Section 602.10.6.5)</i>	7/16 "	See Figure 602.10.6.5	8d common (2 1/2" × 0.131) nails	4" at panel edges 12" at intermediate supports 4" at braced wall panel end posts
	SFB <i>Structural fiberboard sheathing</i>	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 or 8d common (2 1/2" long × 0.131" dia.) nails	3" edges 6" field
	GB <i>Gypsum board</i>	1/2 "		Nails or screws per Table 602.3(1) for exterior locations	For all braced wall panel locations: 7" edges (including top and bottom plates) 7" field
				Nails or screws per Table 702.3.5 for interior locations	
	PBS <i>Particleboard sheathing (See Section 605)</i>	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 <i>Portland cement plaster</i>	See Section 703.6 for maximum 16" stud spacing		1 1/2" long, 11 gage, 7/16" dia. head nails or 7/8" long, 16 gage staples	6" o.c. on all framing members
HPS <i>Hardboard panel siding</i>	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 <i>Alternate braced wall</i>	3/8 "		See Section 602.10.6.1	See Section 602.10.6.1	

(continued)

**TABLE 602.10.4—continued
BRACING METHODS**

METHODS, MATERIAL		MINIMUM THICKNESS	FIGURE	CONNECTION CRITERIA ^a	
				Fasteners	Spacing
Intermittent Bracing Method	PFH Portal frame with hold-downs	3/8 "		See Section 602.10.6.2	See Section 602.10.6.2
	PFG Portal frame at garage	7/16 "		See Section 602.10.6.3	See Section 602.10.6.3
Continuous Sheathing Methods	CS-WSP Continuously sheathed wood structural panel	3/8 "		Exterior sheathing per Table 602.3(3)	6" edges 12" field
	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 602.10.6.4	See Section 602.10.6.4
	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 or 8d common (2 1/2" long × 0.131" dia.) nails	3" edges 6" field

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm.

- Adhesive attachment of wall sheathing, including Method GB, shall not be permitted in Seismic Design Categories C, D0, D1 and D2.
- Applies to panels next to garage door opening when supporting gable end wall or roof load only. May only be used on one wall of the garage. In Seismic Design Categories D0, D1, and D2, roof covering dead load may not exceed 3 psf (0.14 kN/m²).
- Garage openings adjacent to a Method CS-G panel shall be provided with a header in accordance with Table 502.5(1). A full height clear opening shall not be permitted adjacent to a Method CS-G panel.
- Method CS-SFB does not apply in Seismic Design Categories D0, D1 and D2 and in areas where the wind speed exceeds 100 mph.
- Method applies to detached one- and two-family dwellings in Seismic Design Categories D0-D2 only.

602.10.4.1 Mixing methods. Mixing of bracing methods shall be permitted as follows:

- Mixing intermittent bracing and continuous sheathing methods from story to story shall be permitted.
- Mixing intermittent bracing methods from braced wall line to braced wall line within a story shall be permitted. Within Seismic Design Categories A, B and C or in regions where the basic wind speed is less than or equal to 100 mph, 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 the length of required bracing in accordance with Table 602.10.3(1) or 602.10.3(3) is the highest value of all intermittent bracing methods used.*
4. *Mixing of continuous sheathing methods CSWSP, CS-G and CS-PF along a braced wall line shall be permitted.*
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 602.10.3(1) or 602.10.3(3) as adjusted by Tables 602.10.3(2) and 602.10.3(4), respectively. The requirements of Section 602.10.7 shall apply to each end of the continuously sheathed portion of the braced wall line.*

602.10.4.2 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 602.10.7.*

602.10.4.3 Braced wall panel interior finish material. *Braced wall panels shall have gypsum wall board installed on the side of the wall opposite the bracing material. Gypsum wall board shall be not less than ½ inch (12.7 mm) in thickness and be fastened with nails or screws in accordance with Table 602.3(1) for exterior sheathing or Table 702.3.5 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 D₀, D₁ and D₂.*

Exceptions:

1. *Interior finish material is not required opposite wall panels that are braced in accordance with Method GB, BV-WSP, ABW, PFH, PFG and CS-PF, unless otherwise required by Section 302.6.*
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 302.6.*
3. *Except for Method LIB, gypsum wall board is permitted to be omitted provided the required length of bracing in Tables 602.10.3(1) and 602.10.3(3) is multiplied by the appropriate adjustment factor in Tables 602.10.3(2) and 602.10.3(4) respectively, unless otherwise required by Section 302.6.*

602.10.5 Minimum length of a braced wall panel. The minimum length of a braced wall panel shall comply with Table 602.10.5. For Methods CS-WSP and CS-SFB, the minimum panel length shall be based on the adjacent clear opening height in accordance with Table 602.10.5 and Figure 602.10.5. When a panel has an opening on either side of differing heights, the taller opening height shall be used to determine the panel length.

**TABLE 602.10.5
MINIMUM LENGTH OF BRACED WALL PANELS**

METHOD (See Table 602.10.4)		MINIMUM LENGTH ^a (in)					CONTRIBUTING LENGTH (in)
		Wall Height					
		8 ft	9 ft	10 ft	11 ft	12 ft	
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, wind speed < 110 mph	28	32	34	38	42	48
	SDC D _o , D ₁ and D ₂ , wind speed < 110 mph	32	32	34	NP	NP	
PFH	Supporting roof only	16	16	16	18 ^c	20 ^c	48
	Supporting one story and roof	24	24	24	27 ^c	29 ^c	48
PFG		24	27	30	33 ^d	36 ^d	1.5 × Actual ^b
CS-G		24	27	30	33	36	Actual ^b
CS-PF		16	18	20	22 ^e	24 ^e	Actual ^b
CS-WSP, CS-SFB	Adjacent clear opening height (in)						Actual ^b
	≤ 64	24	27	30	33	36	
	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		

For SI: 1 inch = 25.4 mm NP = Not permitted

- a. Linear interpolation shall be permitted.
- b. Use the actual length when it is greater than or equal to the minimum length.
- c. Maximum header height for PFH is 10 feet per Figure 602.10.6.2, but wall height may be increased to 12 feet with pony wall.
- d. Maximum opening height for PFG is 10 feet per Figure 602.10.6.3, but wall height may be increased to 12 feet with pony wall.
- e. Maximum opening height for CS-PF is 10 feet per Figure 602.10.6.4, but wall height may be increased to 12 feet with pony wall

602.10.5.1 Contributing length. For purposes of computing the required length of bracing in Tables 602.10.3(1) and 602.10.3(3), the contributing length of each braced wall panel shall be as specified in Table 602.10.5.

602.10.5.2 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 in length shall be considered a braced wall panel and shall be permitted to partially contribute towards the required length of bracing in Tables 602.10.3(1) and 602.10.3(3), and the contributing length shall be determined from Table 602.10.5.2.

602.10.6 Construction of Methods ABW, PFH, PFG, CS-PF and BV-WSP . Methods ABW, PFH, PFG, CSPF and BV-WSP shall be constructed as specified in Sections 602.10.6.1 through 602.10.6.5.

602.10.6.1 Method ABW: Alternate braced wall panels. Method ABW braced wall panels shall be constructed in accordance with Figure 602.10.6.1. The hold-down force shall be in accordance with Table 602.10.6.1.

602.10.6.2 Method PFH: Portal frame with hold-downs. Method PFH braced wall panels shall be constructed in accordance with Figure 602.10.6.2.

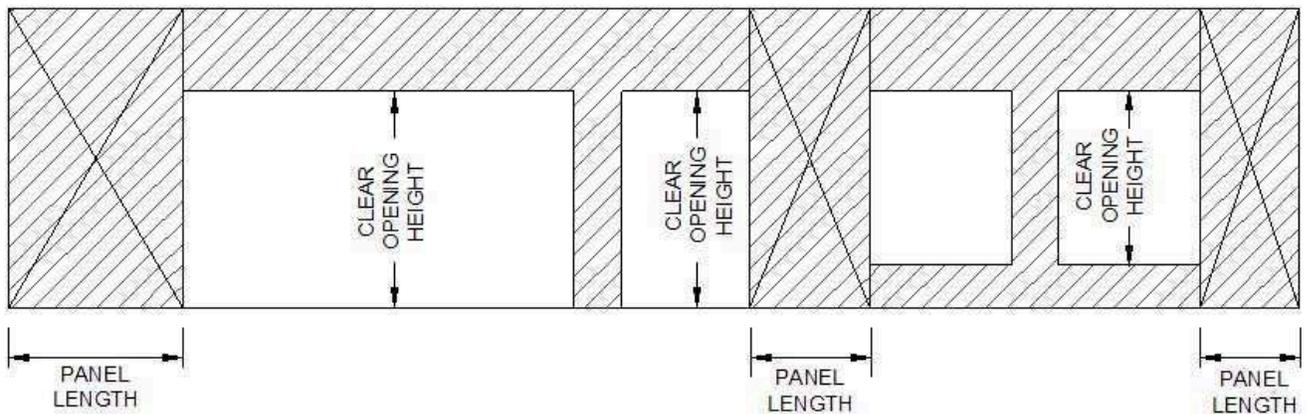


FIGURE 602.10.5
BRACED WALL PANELS WITH CONTINUOUS SHEATHING

TABLE 602.10.5.2
PARTIAL CREDIT FOR BRACED WALL PANELS LESS THAN 48 INCHES IN ACTUAL LENGTH

ACTUAL LENGTH OF BRACED WALL PANEL (in)	CONTRIBUTING LENGTH OF BRACED WALL PANEL (in) ^a	
	8 ft Wall Height	9 ft Wall Height
48	48	48
42	36	36
36	27	N/A

For SI: 1 inch = 25.4mm

a Linear interpolation shall be permitted.

TABLE 602.10.6.1
MINIMUM HOLD-DOWN FORCES FOR METHOD ABW BRACED WALL PANELS

SEISMIC DESIGN CATEGORY AND WIND SPEED	SUPPORTING/STORY	HOLD DOWN FORCE (lb)				
		Height of Braced Wall Panel				
		8 ft	9 ft	10 ft	11 ft	12 ft
SDC A, B and C Wind speed < 110 mph	One story	1800	1800	1800	2000	2200
	First of two story	3000	3000	3000	3300	3600
SDC D _o , D ₁ and D ₂ Wind speed < 110 mph	One story	1800	1800	1800	NP ^a	NP ^a
	First of two story	3000	3000	3000	NP ^a	NP ^a

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1lb = 4.45N

a. NP = Not Permitted.

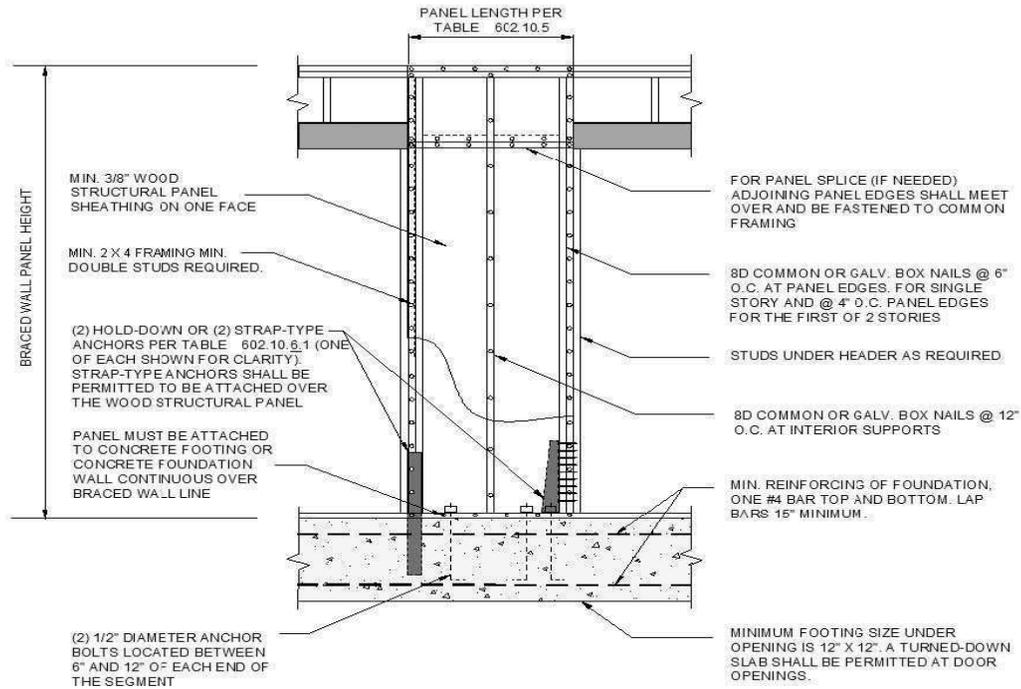


FIGURE 602.10.6.1

METHOD ABW: ALTERNATE BRACED WALL PANEL

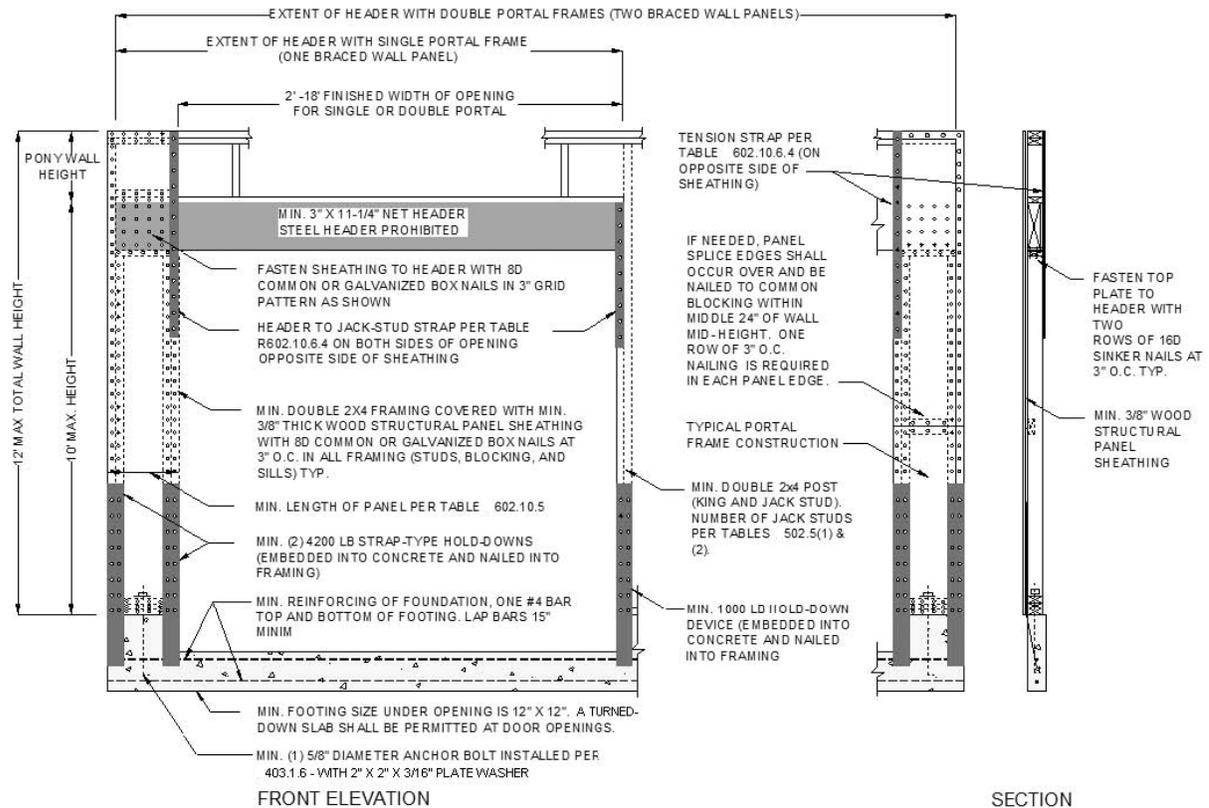


FIGURE 602.10.6.2
METHOD PFH: PORTAL FRAME WITH HOLD-DOWNS

602.10.6.3 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 602.10.6.3 shall be permitted on either side of garage door openings.

602.10.6.4 Method CS-PF: Continuously sheathed portal frame. Continuously sheathed portal frame braced wall panels shall be constructed in accordance with Figure 602.10.6.4 and Table 602.10.6.4. The number of continuously sheathed portal frame panels in a single braced wall line shall not exceed four.

602.10.6.5 Wall bracing for dwellings with stone and masonry veneer in Seismic Design Categories D_0 , D_1 and D_2 . Where stone and masonry veneer is installed in accordance with Section 703.7, 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.

Where dwellings in Seismic Design Categories D_0 , D_1 and D_2 have stone or masonry veneer installed in accordance with Section 703.7, and the veneer does not exceed the first story height, wall bracing shall be in accordance with Section 602.10.1.2.

Where detached one-, two-, or three-family dwellings in Seismic Design Categories D_0 , D_1 and D_2 have stone or masonry veneer installed in accordance with Section 703.7, 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 602.10.6.5. Cripple walls shall not be permitted, and required interior braced wall lines shall be supported on continuous foundations.

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.

602.10.6.5.1 Length of bracing. The length of bracing along each braced wall line shall be the greater of that required by the design wind speed and braced wall line spacing in accordance with Table ~~602.10.1.2(1)~~ 602.10.3(1) as adjusted by the factors in the footnotes or the Seismic Design Category and braced wall line length in accordance with Table 602.10.6.5. Angled walls shall be permitted to be counted in accordance with Section ~~602.10.1.3~~ 602.10.1.4, and braced wall panel location shall be in accordance with Section ~~602.10.1.4~~ 602.10.2.2. The seismic adjustment factors in Table ~~602.10.1.2(3)~~ 602.10.3(4) shall not be applied to the length of bracing determined using Table 602.10.6.5. In no case shall the minimum total length of bracing in a braced wall line, after all adjustments have been taken be less than 48 inches total.

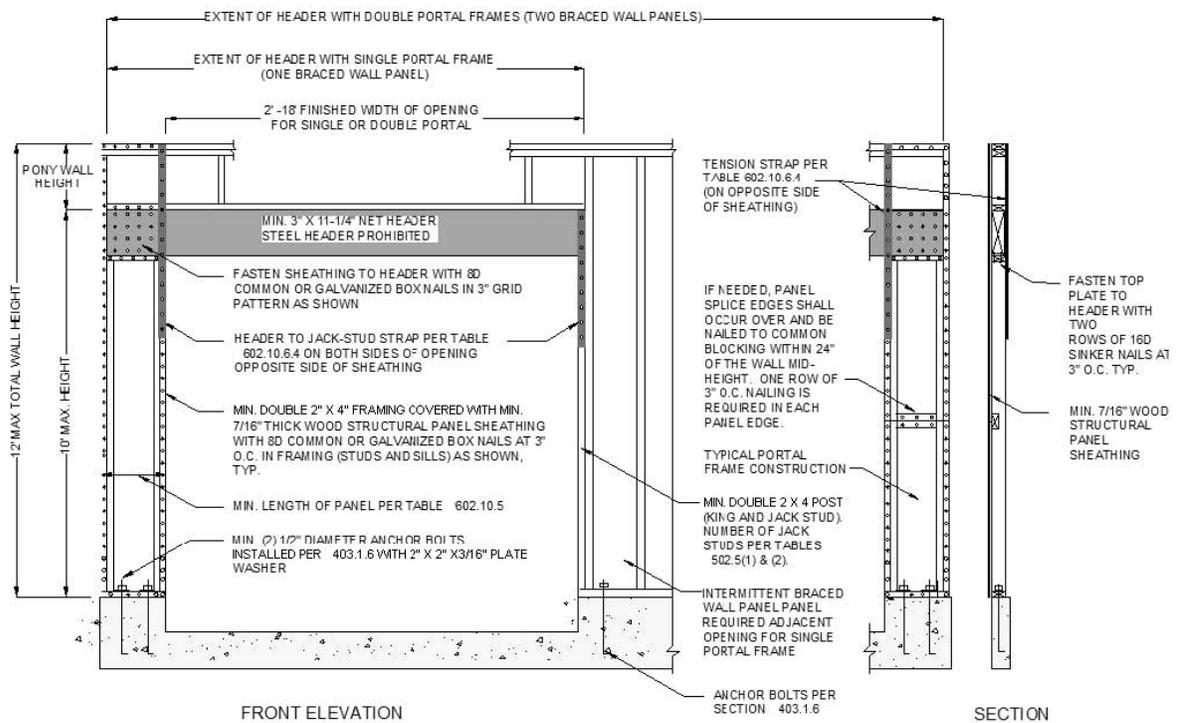


FIGURE 602.10.6.3
METHOD PFG: PORTAL FRAME AT GARAGE DOOR OPENINGS IN SEISMIC DESIGN CATEGORIES A, B, AND C

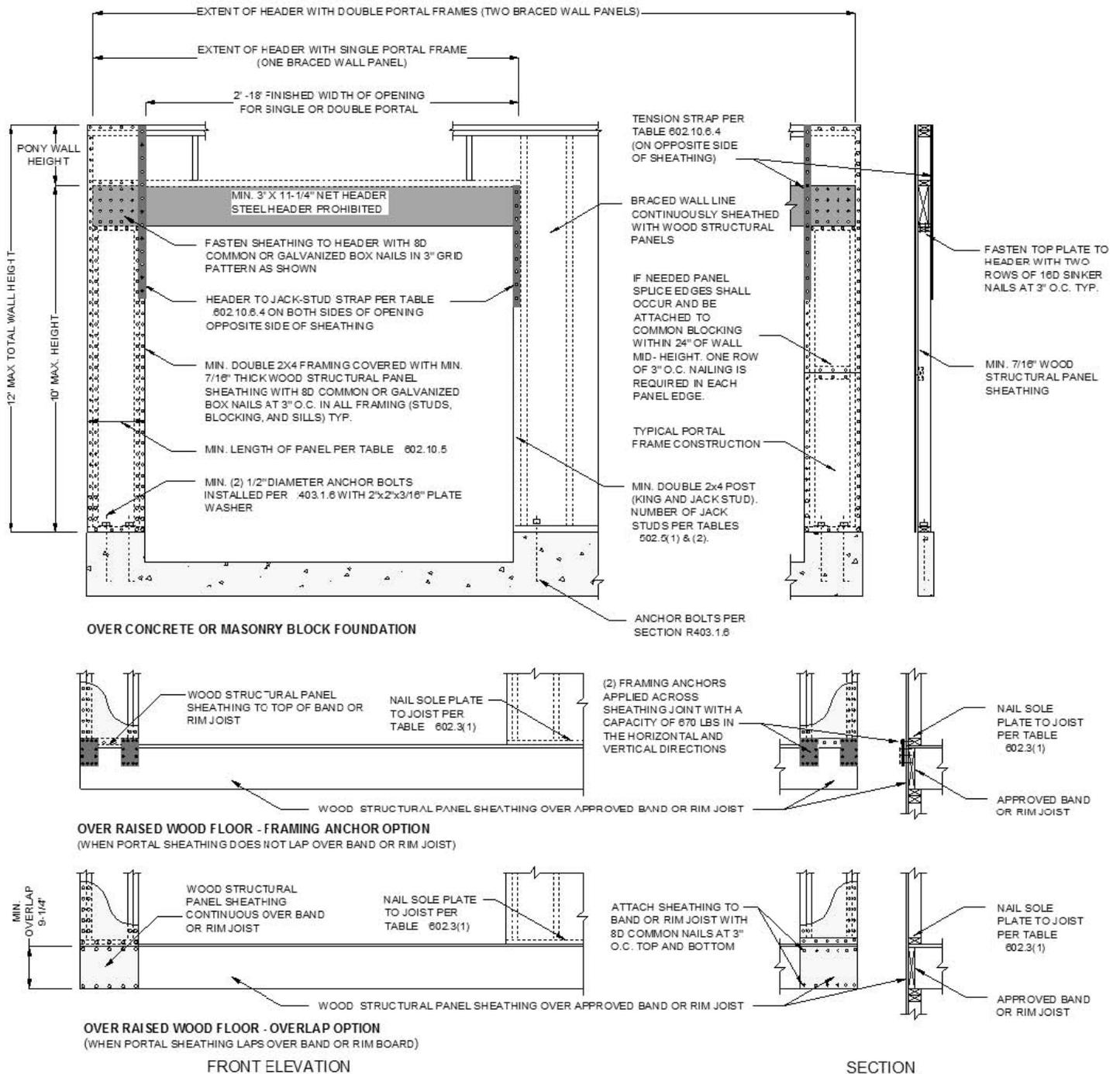


FIGURE 602.10.6.4
METHOD CS-PF: CONTINUOUSLY SHEATHED PORTAL FRAME PANEL CONSTRUCTION

**TABLE 602.10.6.4
TENSION STRAP CAPACITY REQUIRED FOR RESISTING WIND PRESSURES
PERPENDICULAR TO METHOD PFH, PFG AND CS-PF BRACED WALL PANELS**

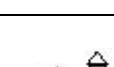
MINIMUM WALL STUD FRAMING NOMINAL SIZE AND GRADE	MAXIMUM PONY WALL HEIGHT (ft)	MAXIMUM TOTAL WALL HEIGHT (ft)	MAXIMUM OPENING WIDTH (ft)	TENSION STRAP CAPACITY REQUIRED (lb) ^{a, b}					
				Basic Wind Speed (mph)					
				85	90	100	85	90	100
				Exposure B			Exposure C		
2 x 4 No. 2 Grade	0	10	18	1000	1000	1000	1000	1000	1000
	1	10	9	1000	1000	1000	1000	1000	1275
			16	1000	1000	1750	1800	2325	3500
			18	1000	1200	2100	2175	2725	DR
	2	10	9	1000	1000	1025	1075	1550	2500
			16	1525	2025	3125	3200	3900	DR
			18	1875	2400	3575	3700	DR	DR
	2	12	9	1000	1200	2075	2125	2750	4000
			16	2600	3200	DR	DR	DR	DR
			18	3175	3850	DR	DR	DR	DR
	4	12	9	1775	2350	3500	3550	DR	DR
			16	4175	DR	DR	DR	DR	DR
2 x 6 Stud Grade	2	12	9	1000	1000	1325	1375	1750	2550
			16	1650	2050	2925	3000	3550	DR
			18	2025	2450	3425	3500	4100	DR
	4	12	9	1125	1500	2225	2275	2775	3800
			16	2650	3150	DR	DR	DR	DR
			18	3125	3675	DR	DR	DR	DR

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 lb = 4.45 N

a. DR = design required

b. Strap shall be installed in accordance with manufacturer's recommendations.

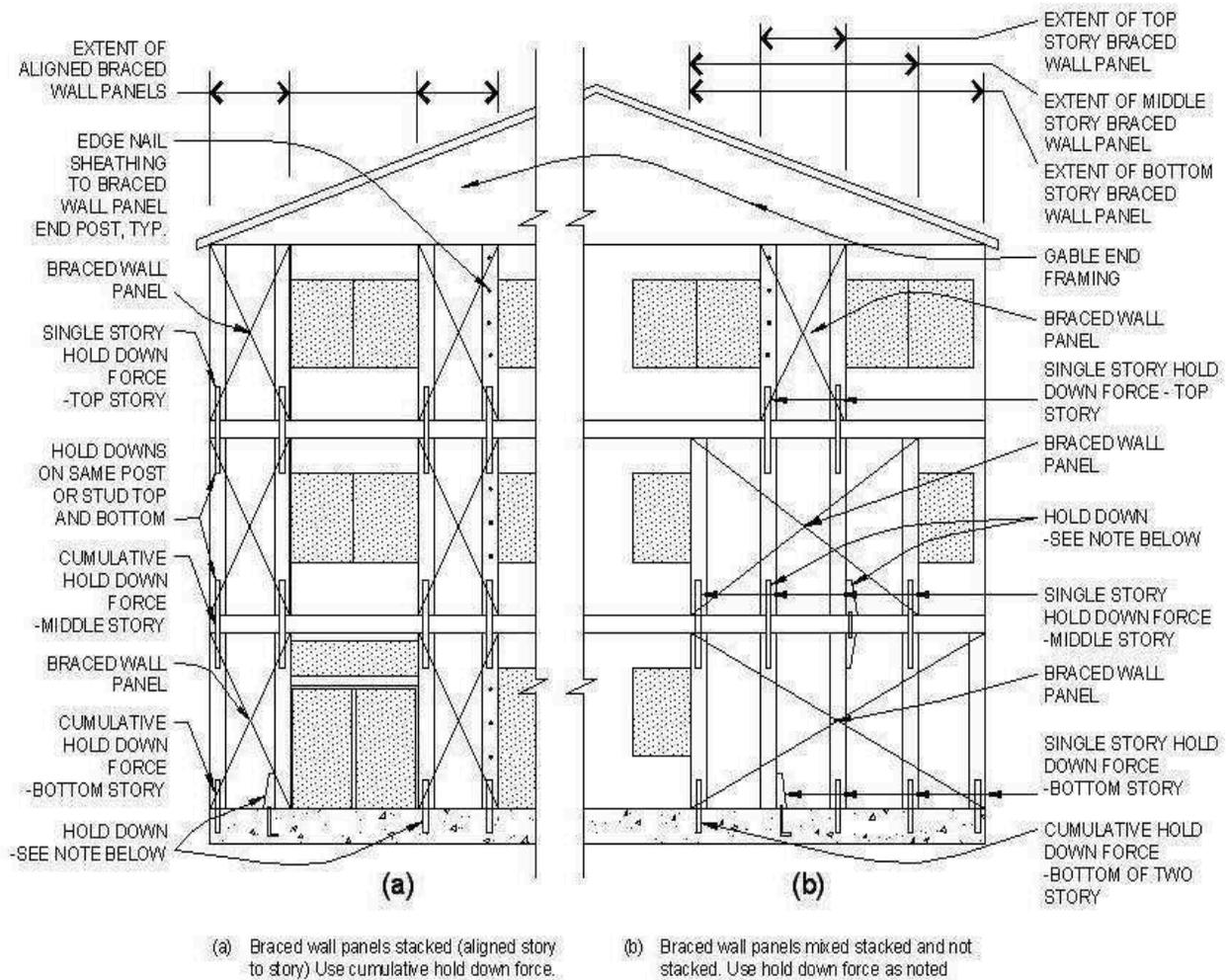
**TABLE 602.10.6.5
METHOD BV-WSP WALL BRACING REQUIREMENTS**

SEISMIC DESIGN CATEGORY	STORY	BRACED WALL LINE LENGTH (FT)					SINGLE STORY HOLD-DOWN FORCE (lb) ^a	CUMULATIVE HOLD DOWN FORCE (lb) ^b
		10	20	30	40	50		
		MINIMUM TOTAL LENGTH (FT) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE						
<i>D</i> ₀		4.0	7.0	10.5	14.0	17.5	N/A	—
		4.0	7.0	10.5	14.0	17.5	1900	—
		4.5	9.0	13.5	18.0	22.5	3500	5400
		6.0	12.0	18.0	24.0	30.0	3500	8900
<i>D</i> ₁		4.5	9.0	13.5	18.0	22.5	2100	—
		4.5	9.0	13.5	18.0	22.5	3700	5800
		6.0	12.0	18.0	24.0	30.0	3700	9500
<i>D</i> ₂		5.5	11.0	16.5	22.0	27.5	2300	—
		5.5	11.0	16.5	22.0	27.5	3900	6200
		NP	NP	NP	NP	NP	N/A	N/A

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. 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.

b. 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.



Note: Hold downs should be strap ties, tension ties, or other approved hold down devices and shall be installed in accordance with the manufacturer's instructions.

FIGURE 602.10.6.5

METHOD BV-WSP: WALL BRACING FOR DWELLINGS WITH STONE AND MASONRY VENEER IN SEISMIC CATEGORIES D_0 , D_1 , AND D_2

602.10.7 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 602.10.7.

602.10.8 Braced wall panel connections. Braced wall panels 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 602.10.8(1). Fastening of top and bottom wall plates to framing, rim joist, band joist and/or blocking shall be in accordance with Table 602.3(1).

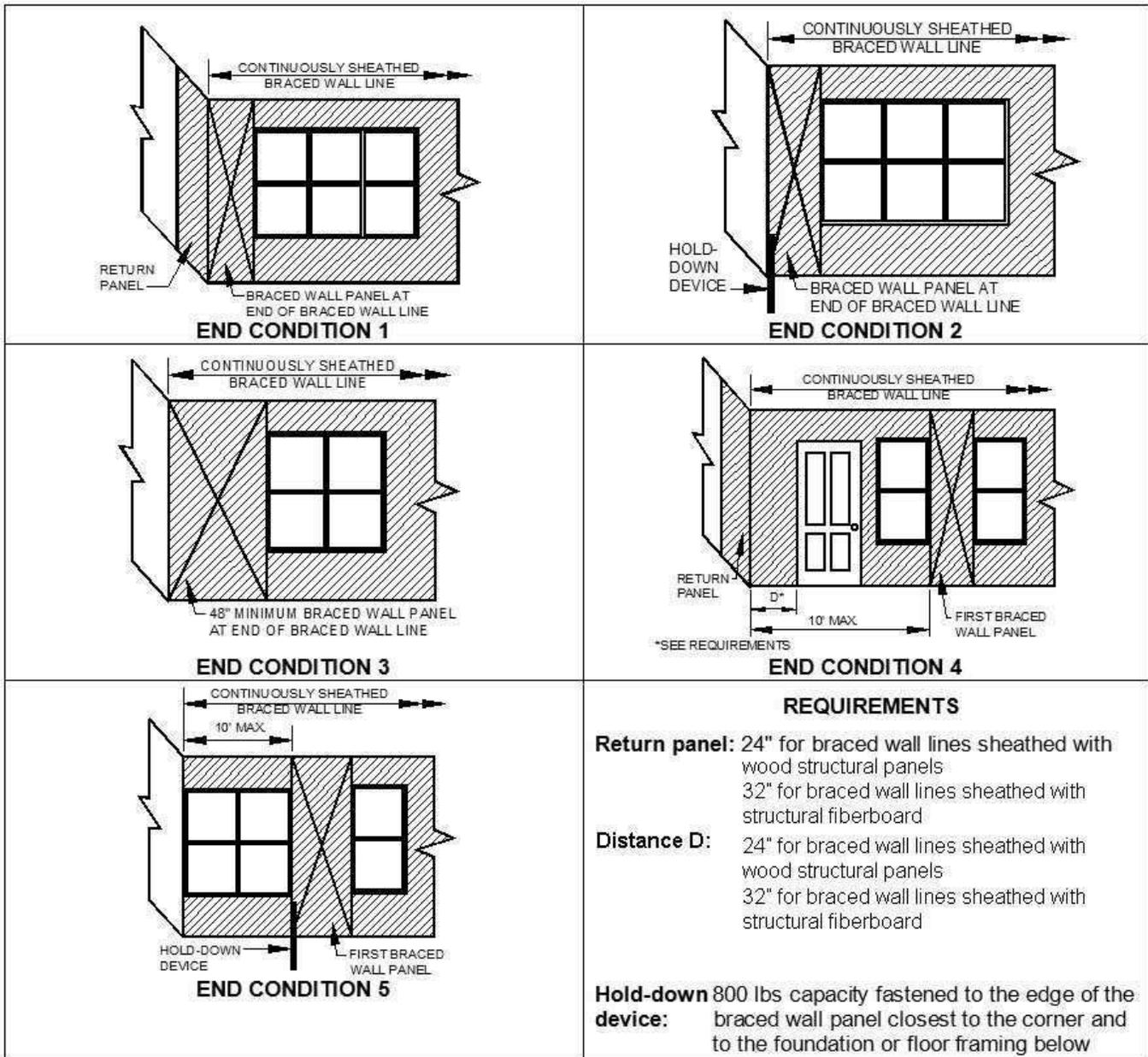


FIGURE 602.10.7
END CONDITIONS FOR BRACED WALL LINES WITH CONTINUOUS SHEATHING

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 602.10.8(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 602.10.8(2). Fastening of blocking and wall plates shall be in accordance with Table 602.3(1) and Figure 602.10.8(2).
3. Connections of braced wall panels to concrete or masonry shall be in accordance with Section 403.1.6.

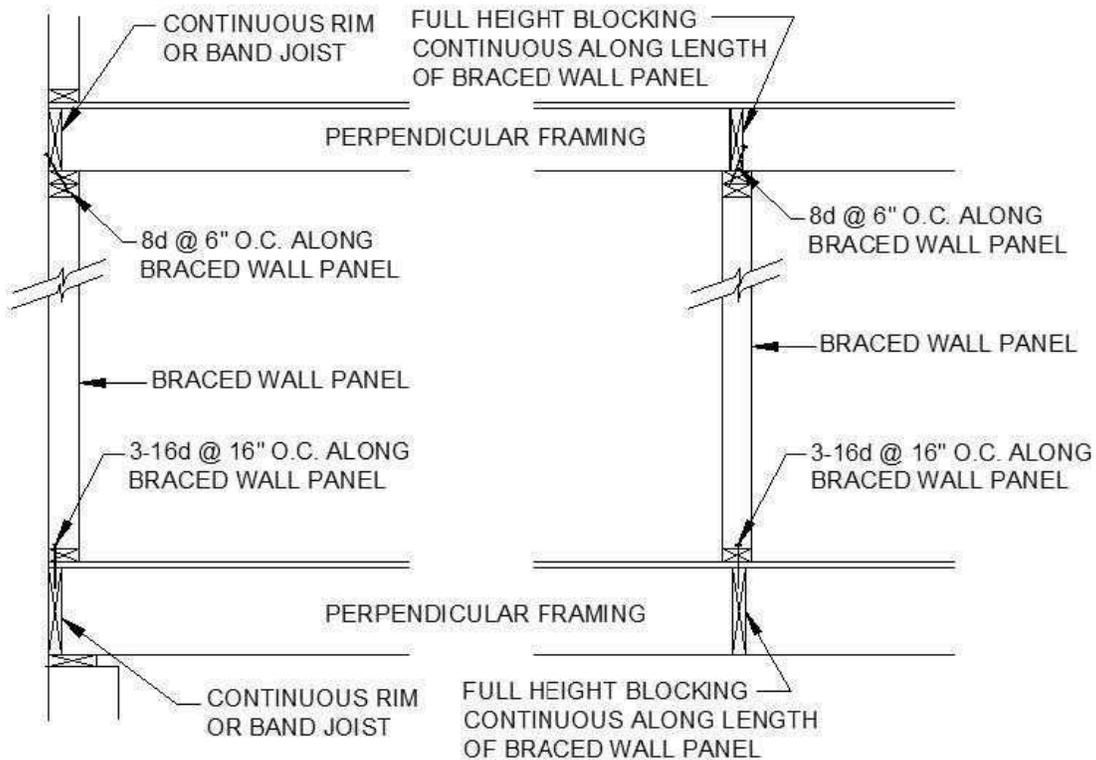


FIGURE 602.10.8(1)
BRACED WALL PANEL CONNECTION WHEN PERPENDICULAR TO FLOOR/CEILING FRAMING

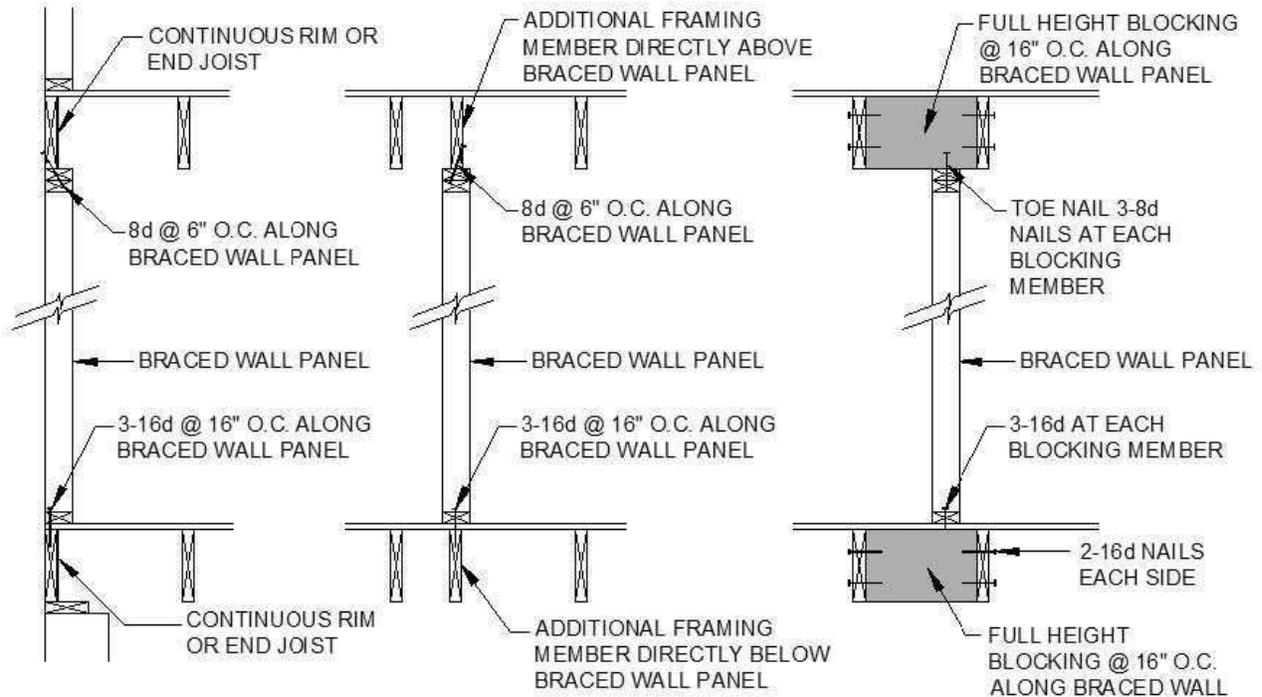


FIGURE 602.10.8(2)
BRACED WALL PANEL CONNECTION WHEN PARALLEL TO FLOOR/CEILING
FRAMING

602.10.8.1 Braced wall panel connections for Seismic Design Categories D_0 , D_1 and D_2 . Braced wall panels shall be fastened to required foundations in accordance with Section 602.11.1, and top plate lap splices shall be face-nailed with at least eight 16d nails on each side of the splice.

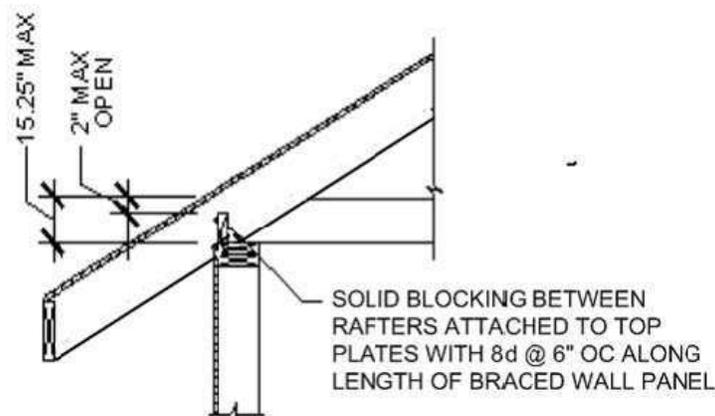
602.10.8.2 Connections to roof framing. Top plates of exterior braced wall panels shall be attached to rafters or roof trusses above in accordance with Table 602.3(1) and this section. Where required by this section, blocking between rafters or roof trusses shall be attached to top plates of braced wall panels and to rafters and roof trusses in accordance with Table 602.3(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 802.8 and for trusses in

accordance with Section 802.10.3. Roof ventilation shall be provided in accordance with Section 806.1.

1. For SDC A, B and C and wind speeds less than 100 mph (45 m/s) where the distance from the top of the braced wall panel to the top of the rafters or roof trusses above is 9 ¼ 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 ¼ inches (235 mm) and 15 ¼ inches (387 mm) blocking between rafters or roof trusses shall be provided above the braced wall panel in accordance with Figure 602.10.8.2(1).
2. For SDC D₀, D₁ and D₂ or wind speeds of 100 mph (45 m/s) or greater, where the distance from the top of the braced wall panel to the top of the rafters or roof trusses is 15 ¼ inches (387 mm) or less, blocking between rafters or roof trusses shall be provided above the braced wall panel in accordance with Figure 602.10.8.2(1).
3. Where the distance from the top of the braced wall panel to the top of rafters or roof trusses exceeds 15 ¼ 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 602.10.8.2(2),
 - 3.2. Vertical blocking panels constructed in accordance with Figure 602.10.8.2(3),
 - 3.3. Full-height engineered blocking panels designed in accordance with the AF&PA WFCM,
 - 3.4. Blocking, blocking panels, or other methods of lateral load transfer designed in accordance with accepted engineering practice.

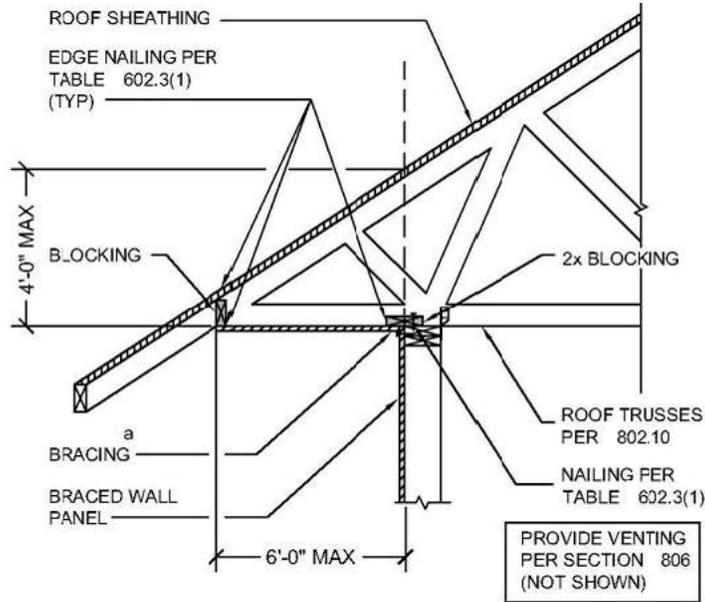
602.10.9 Braced wall panel support. Braced wall panel support shall be provided as follows:

1. *Cantilevered floor joists complying with Section 502.3.3 shall be permitted to support braced wall panels.*
2. *Elevated post or pier foundations supporting braced wall panels 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 panels shall be reinforced in accordance with Figure 602.10.9. Masonry stem walls with a length greater than 48 inches (1219 mm) supporting braced wall panels shall be constructed in accordance with Section 403.1 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 602.10.9.*



For SI: 1 inch = 25.4 mm

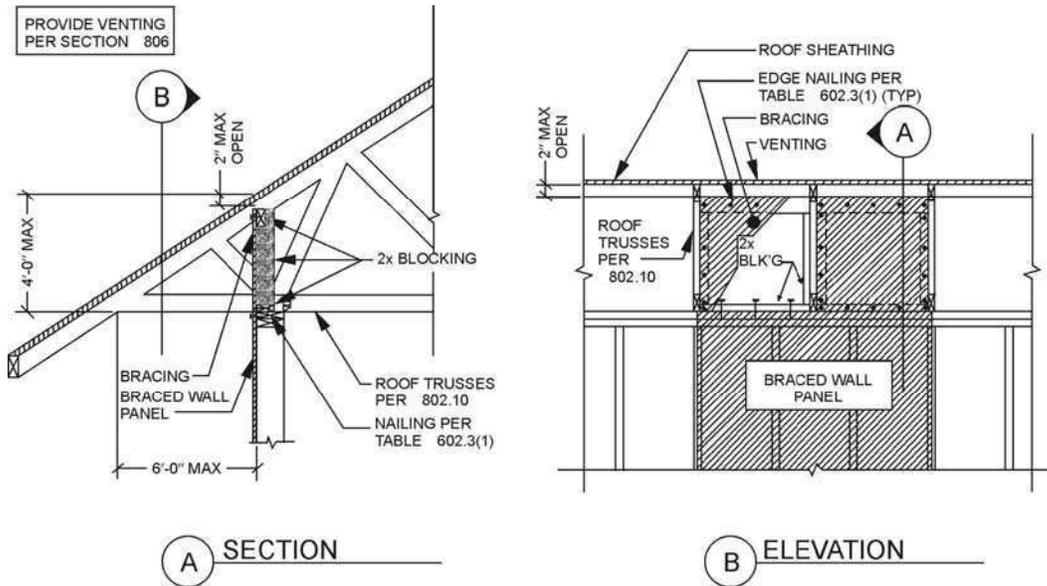
FIGURE 602.10.8.2(1)
BRACED WALL PANEL CONNECTION TO PERPENDICULAR RAFTERS



For SI: 1 inch = 25.4 mm

a. Methods of bracing shall be as described in Section 602.10.4

FIGURE 602.10.8.2(2)
BRACED WALL PANEL CONNECTION OPTION TO PERPENDICULAR RAFTERS OR ROOF TRUSSES



For SI: 1 inch = 25.4 mm

a. Methods of bracing shall be as described in Section 602.10.4

FIGURE 602.10.8.2(3)
BRACED WALL PANEL CONNECTION OPTION TO PERPENDICULAR RAFTERS OR ROOF TRUSSES

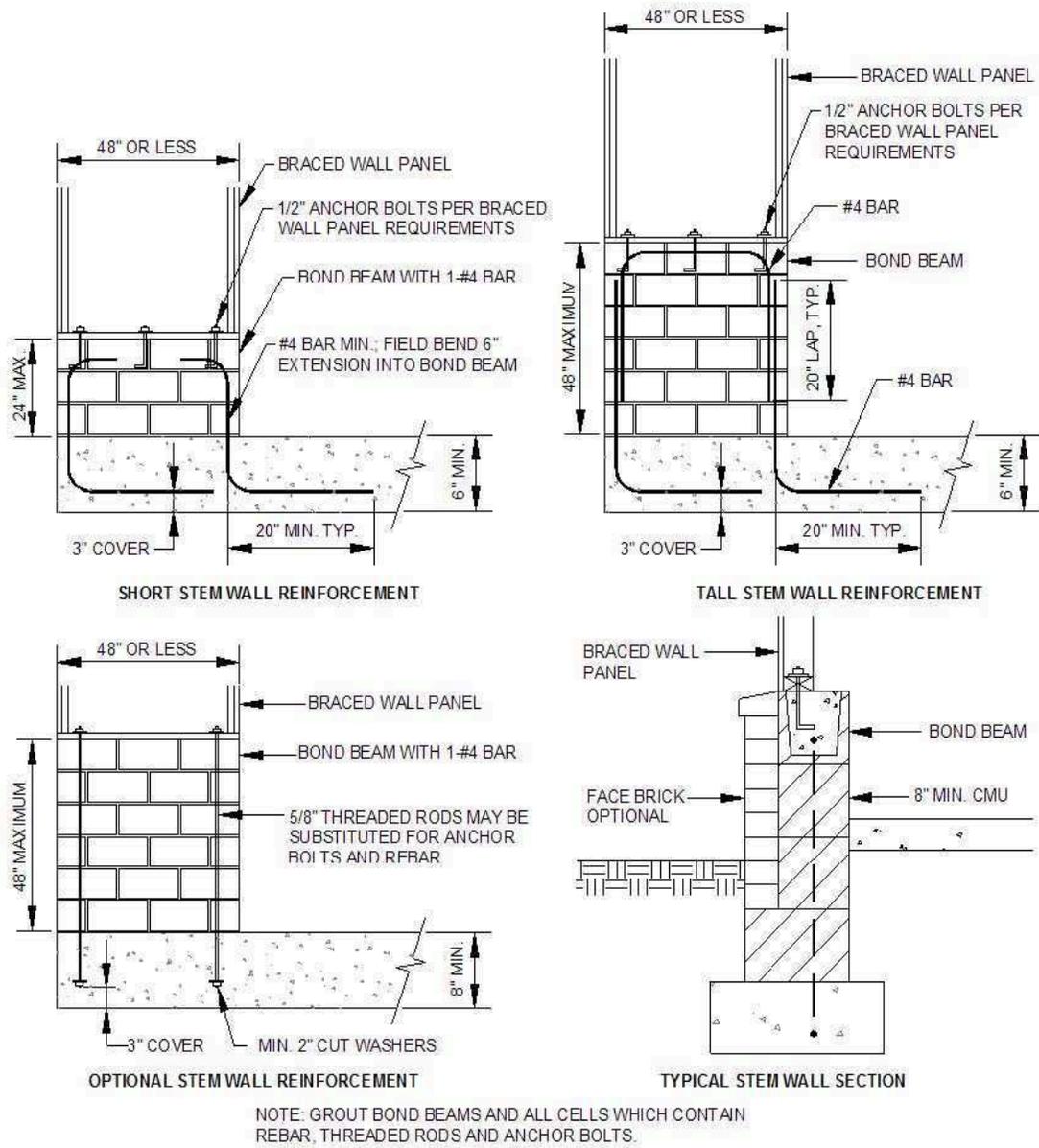


FIGURE 602.10.9
MASONRY STEM WALLS SUPPORTING BRACED WALL PANELS

602.10.9.1 Braced wall panel support for Seismic Design Category D₂. *In one-story buildings located in Seismic Design Category D₂, braced wall panels shall be supported on continuous foundations at intervals not exceeding 50 feet (15 240 mm). In two story buildings located in Seismic Design Category D₂, all braced wall panels 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.*

602.10.10 Panel joints. *All vertical joints of panel sheathing shall occur over, and be fastened to common studs. Horizontal joints in braced wall panels shall occur over, and be fastened to common blocking of a minimum 1 ½ inch (38 mm) thickness.*

Exceptions:

- 1. 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 2 rows of 10d box nails (3-inches by 0.128-inch) at 10 inch o.c.*
- 2. Blocking at horizontal joints shall not be required in wall segments that are not counted as braced wall panels.*
- 3. Where the bracing length provided is at least twice the minimum length required by Tables ~~602.10.1.2(1) and 602.10.1.2(2)~~ 602.10.3(1) and 602.10.3(2) blocking at horizontal joints shall not be required in braced wall panels constructed using Methods WSP, SFB, GB, PBS or HPS.*

4. *When Method GB panels are installed horizontally, blocking of horizontal joints is not required.*

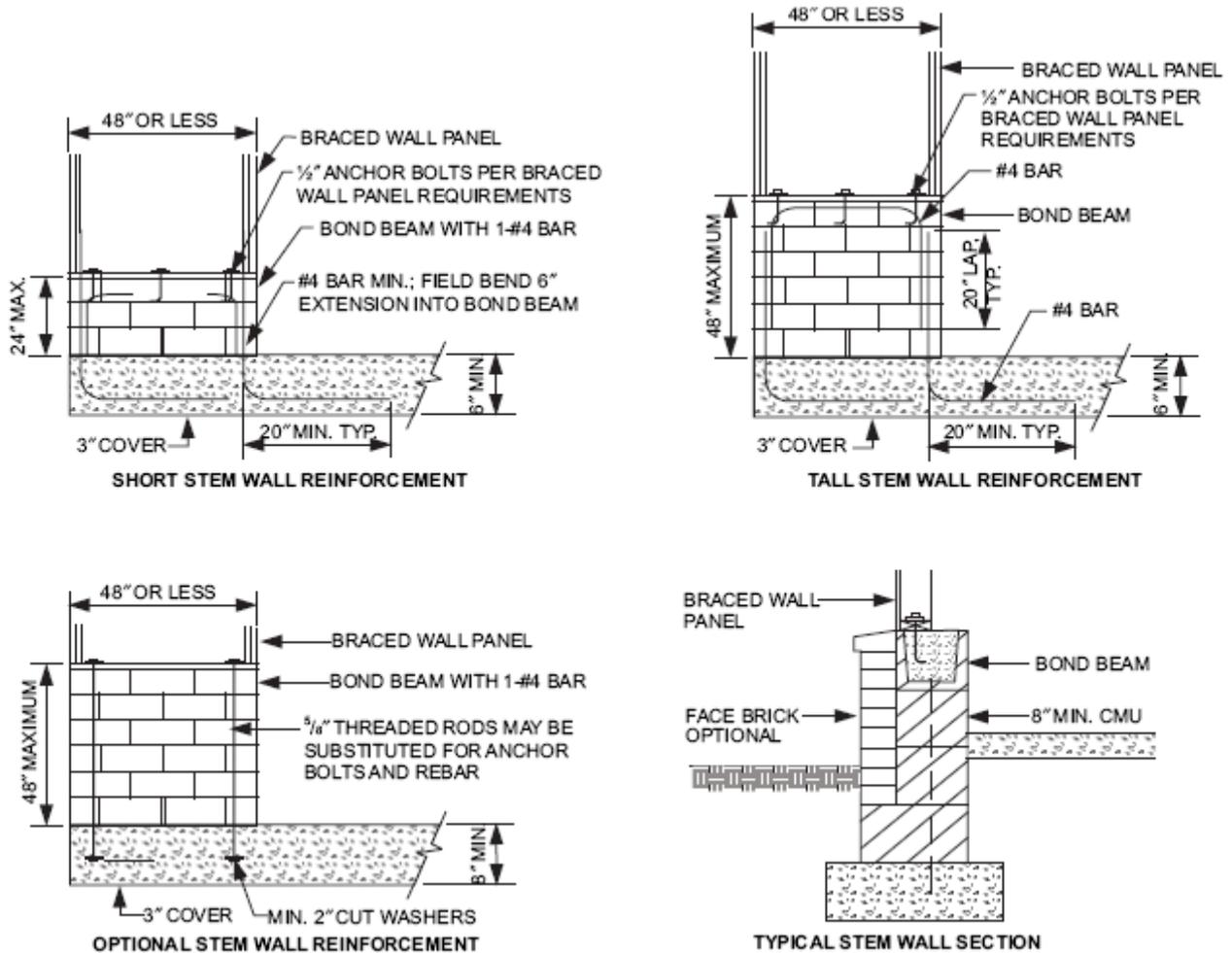
602.10.11 Cripple wall bracing. *Cripple walls shall be constructed in accordance with Section 602.9 and braced in accordance with this section. Cripple walls shall be braced with the length and method of bracing used for the wall above in accordance with Tables 602.10.1.3(1) and 602.10.1.3(3), except that the length of cripple wall bracing shall be multiplied by a factor of 1.15. The distance between adjacent edges of braced wall panels shall be reduced from 20 feet (6096 mm) to 14 feet (4267 mm).*

602.10.11.1 Cripple wall bracing for Seismic Design Categories D_0 , D_1 and townhouses in Seismic Design Category C. *In addition to the requirements in Section 602.10.11, the distance between adjacent edges of braced wall panels 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 per Section R602.10.2 or Method CS-WSP per Section 602.10.4. The length of bracing required per Table 602.10.1.3(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.

602.10.11.2 Cripple wall bracing for Seismic Design Category D_2 . *In Seismic Design Category D_2 , cripple walls shall be braced in accordance with Tables 602.10.3(3) and 602.10.3(4).*

602.10.11.3 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.*



NOTE: Grout bond beams and all cells which contain rebar, threaded rods and anchor bolts.
 For SI: 1 inch = 25.4 mm.

FIGURE 602.10.7
MASONRY STEM WALLS SUPPORTING BRACED WALL PANELS

602.11 Wall anchorage. Braced wall line sills shall be anchored to concrete or masonry foundations in accordance with Sections 403.1.6 and 602.11.1.

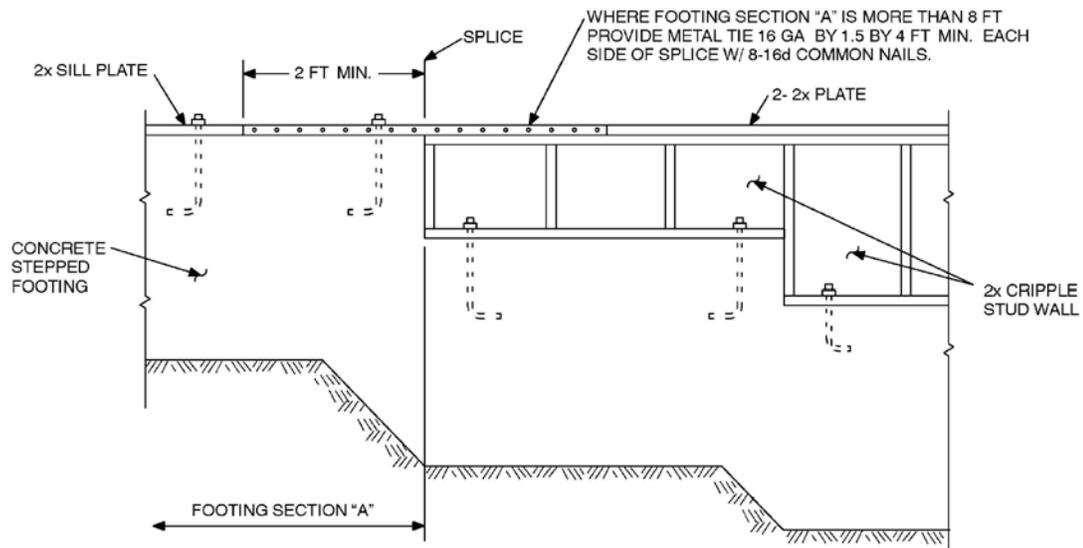
602.11.1 Wall anchorage for all buildings in Seismic Design Categories D₀, D₁ and D₂ and townhouses in Seismic Design Category C. Plate washers, a minimum of 0.229 inch by 3 inches by 3 inches (5.8 mm by 76 mm by 76 mm) in size, shall be provided between the foundation sill plate and the nut except where 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 $1\frac{3}{4}$ inches (44 mm), provided a standard cut washer is placed between the plate washer and the nut.

602.11.2 Stepped foundations in Seismic Design Categories D₀, D₁ and D₂.

In all buildings located in Seismic Design Categories D₀, D₁ or D₂, 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 a minimum of 4 feet (1219 mm) along the foundation. Anchor bolts shall be located a maximum of 1 foot and 3 feet (305 and 914 mm) from the step in the foundation. See Figure 602.11.2.
2. Where cripple walls occur between the top of the foundation and the lowest floor framing, the bracing requirements of Sections ~~602.10.9~~ and ~~602.10.9.1~~ 602.10.11, 602.10.11.1 and 602.10.11.2 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 403.1.6 and 602.11.1 shall apply.



For SI: 1 inch = 25.4 mm, 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 602.11.2
STEPPED FOUNDATION CONSTRUCTION

602.12 Simplified wall bracing. Buildings meeting all of the conditions listed in items 1-8 shall be permitted to be braced in accordance with this section as an alternative to the requirements of Section 602.10. The entire building shall be braced in accordance with this section; the use of other bracing provisions of R602.10, except as specified herein, shall not be permitted.

1. There shall be no more than two 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 (2743 mm).
4. The building shall have a roof eave-to-ridge height of 15 feet (4572 mm) or less.
5. All 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 702.3.5.
6. The structure shall be located where the basic wind speed is less than or equal to 90 mph (40 m/s), and the Exposure Category is A or B.

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 two-story buildings.

602.12.1 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 602.12.1. 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 have no side greater than 60 feet (18 288 mm), and the ratio between the long side and short side shall be a maximum of 3:1.*

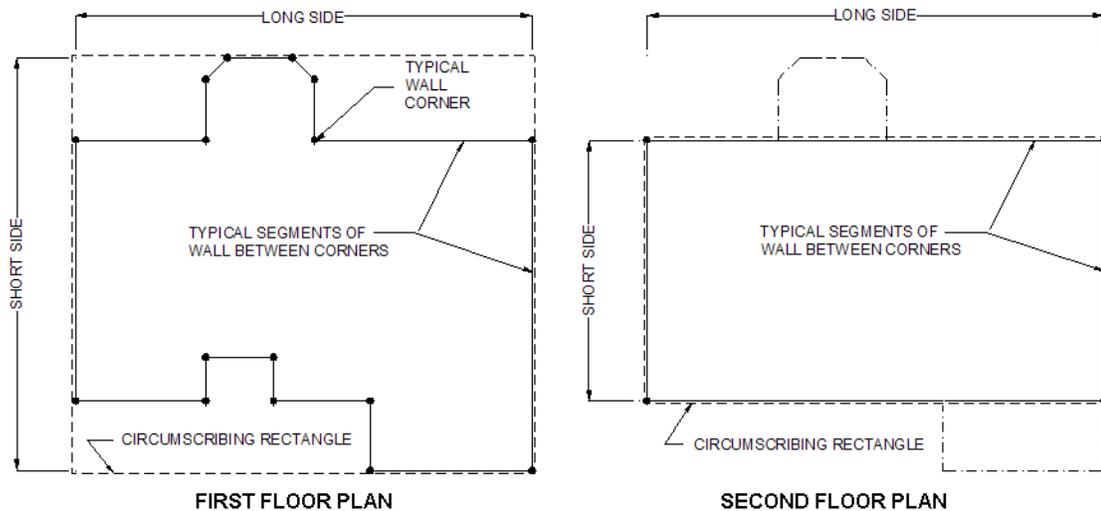


FIGURE R602.12.1
RECTANGLE CIRCUMSCRIBING AN ENCLOSED BUILDING

602.12.2 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 602.12.3. Mixing materials is prohibited.*

1. Wood structural panels with a minimum thickness of 3/8 inch (9.5 mm) fastened in accordance with Table 602.3(3).
2. Structural fiberboard sheathing with a minimum thickness of 1/2 inch (12.7 mm) fastened in accordance with Table 602.3(1).

602.12.3 Bracing unit. *A bracing unit shall be a fullheight sheathed segment of the exterior wall with no 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 602.12.2, 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 602.12.2 and areas between bracing units are covered with other materials, the minimum length of a bracing unit shall be 4 feet (1219 mm).

602.12.3.1 Multiple bracing units. Segments of wall compliant with Section 602.12.3 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 602.12.6.

602.12.4 Number of bracing units. Each side of the circumscribed rectangle, as shown in Figure 602.12.1, shall have, at a minimum, the number of bracing units in accordance with Table 602.12.4 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 602.12.5.

602.12.5 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 no more than 12 feet (3658 mm) from any wall corner.
2. The distance between adjacent edges of bracing units shall be no greater than 20 feet (6096 mm).
3. Segments of wall greater than 8 feet (2438 mm) in length shall have a minimum of one bracing unit.

602.12.6 Narrow panels. The bracing methods referenced in Section 602.10 and specified in Sections 602.12.6.1 through 602.12.6.3 shall be permitted when using simplified wall bracing.

602.12.6.1 Method CS-G. Braced wall panels constructed as Method CS-G in accordance with Tables 602.10.4 and 602.10.5 shall be permitted for one story garages when 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 which include a Method CS-G panel shall meet the requirements of Section R602.10.4.2.

602.12.6.2 Method CS-PF. *Braced wall panels constructed as Method CS-PF in accordance with Section 602.10.6.4 shall be permitted when all framed portions of all exterior walls are sheathed with wood structural panels. Each CS-PF panel shall equal 0.5 bracing units. A maximum of four CS-PF panels shall be permitted on all segments of walls parallel to each side of the circumscribed rectangle. Segments of wall which include a Method CS-PF panel shall meet the requirements of Section 602.10.4.2.*

**TABLE 602.12.4
MINIMUM NUMBER OF BRACING UNITS ON EACH SIDE OF THE CIRCUMSCRIBED
RECTANGLE**

STORY LEVEL	EAVE-TO-RIDGE HEIGHT (feet)	MINIMUM NUMBER OF BRACING UNITS ON EACH LONG SIDE ^{a, b}						MINIMUM NUMBER OF BRACING UNITS ON EACH SHORT SIDE ^{a, b}					
		Length of short side (feet) ^c						Length of long side (feet) ^c					
		10	20	30	40	50	60	10	20	30	40	50	60
	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
	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

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

a. Interpolation shall not be permitted.

b. Cripple walls or wood-framed basement walls in a walk-out condition of a one-story structure shall be designed as the first floor of a two-story house.

c. Actual lengths of the sides of the circumscribed rectangle shall be rounded to the next highest unit of 10 when using this table.

602.12.6.3 Methods PFH and PFG. *Braced wall panels constructed as Method PFH and PFG shall be permitted when bracing units are constructed using wood structural panels. Each PFH panel shall equal one bracing unit and each PFG panel shall be equal to 0.75 bracing units.*

602.12.7 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 602.10.8.2.*

602.12.8 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 602.10.9.*

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 602.10.9.

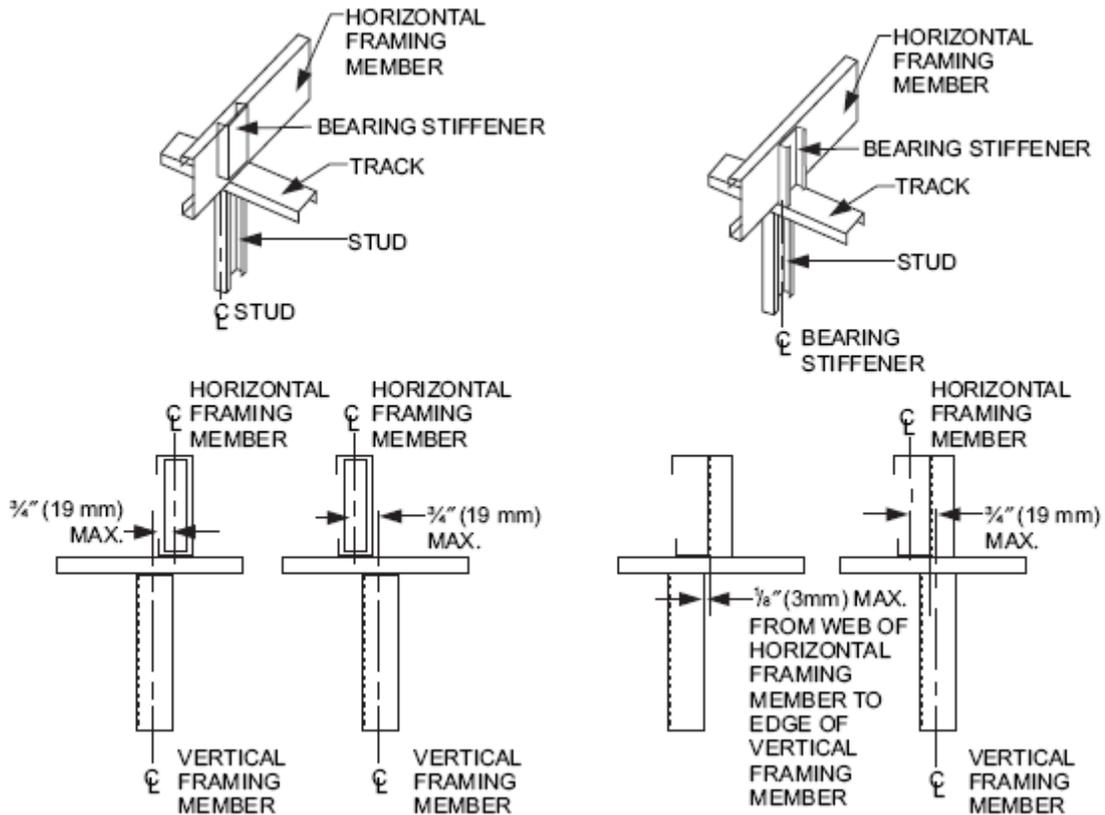
SECTION 603 STEEL WALL FRAMING

603.1 General. Elements shall be straight and free of any defects that would significantly affect structural performance. Cold-formed steel wall framing members shall comply with the requirements of this section.

603.1.1 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. All 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 subjected to a maximum design wind speed of 110 miles per hour (49 m/s) Exposure B or C and a maximum ground snow load of 70 pounds per square foot (3.35 kPa).

603.1.2 In-line framing. Load-bearing cold-formed steel studs constructed in accordance with Section 603 shall be located in-line with joists, trusses and rafters in accordance with Figure 603.1.2 and the tolerances specified as follows:

1. The maximum tolerance shall be $\frac{3}{4}$ inch (19 mm) between the centerline of the horizontal framing member and the centerline of the vertical framing member.
2. Where the centerline of the horizontal framing member and bearing stiffener are located to one side of the centerline of the vertical framing member, the maximum tolerance shall be $\frac{1}{8}$ inch (3 mm) between the web of the horizontal framing member and the edge of the vertical framing member.



**FIGURE 603.1.2
IN-LINE FRAMING**

For SI: 1 inch = 25.4 mm,

603.2 Structural framing. Load-bearing cold-formed steel wall framing members shall comply with Figure 603.2(1) and with the dimensional and minimum thickness requirements specified in Tables 603.2(1) and 603.2(2). Tracks shall comply with Figure 603.2(2) and shall have a minimum flange width of $1\frac{1}{4}$ inches (32 mm). The maximum inside bend radius for members shall be the greater of $\frac{3}{32}$ inch (2.4 mm) minus half the base steel thickness or 1.5 times the base steel thickness.

603.2.1 Material. Load-bearing cold-formed steel framing members shall be cold-formed to shape from structural quality sheet steel complying with the requirements of one of the following:

1. ASTM A 653: Grades 33, and 50 (Class 1 and 3).
2. ASTM A 792: Grades 33, and 50A.
3. ASTM A 1003: Structural Grades 33 Type H, and 50 Type H.

603.2.2 Identification. Load-bearing cold-formed steel framing members shall have a legible label, stencil, stamp or embossment with the following information as a minimum:

1. Manufacturer's identification.
2. Minimum base steel thickness in inches (mm).
3. Minimum coating designation.
4. Minimum yield strength, in kips per square inch (ksi) (MPa).

603.2.3 Corrosion protection. Load-bearing cold-formed steel framing shall have a metallic coating complying with ASTM A 1003 and one of the following:

1. A minimum of G 60 in accordance with ASTM A 653.
2. A minimum of AZ 50 in accordance with ASTM A 792.

603.2.4 Fastening requirements. Screws for steel-to-steel connections shall be installed with a minimum edge distance and center-to-center spacing of $\frac{1}{2}$ inch (12.7 mm), shall be self-drilling tapping and shall conform to ASTM C 1513. Structural sheathing shall be attached to cold-formed steel studs with minimum No. 8 self-drilling tapping screws that conform to ASTM C 1513. 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 $\frac{3}{8}$ inch (9.5 mm). Gypsum board shall be attached to cold-formed steel wall framing with minimum No. 6 screws conforming to ASTM C 954 or ASTM C 1513 with a bugle head style and shall be installed in accordance with Section 702. For all

connections, screws shall extend through the steel a minimum of three exposed threads. 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.

Where No. 8 screws are specified in a steel-to-steel connection, the required number of screws in the connection is permitted to be reduced in accordance with the reduction factors in Table 603.2.4, when larger screws are used or when one of the sheets of steel being connected is thicker than 33 mils (0.84 mm). When applying the reduction factor, the resulting number of screws shall be rounded up.

TABLE 603.2(1)
LOAD-BEARING COLD-FORMED STEEL STUD SIZES

MEMBER DESIGNATION^a	WEB DEPTH (inches)	MINIMUM FLANGE WIDTH (inches)	MAXIMUM FLANGE WIDTH (inches)	MINIMUM LIP SIZE (inches)
350S162-t	3.5	1.625	2	0.5
550S162-t	5.5	1.625	2	0.5

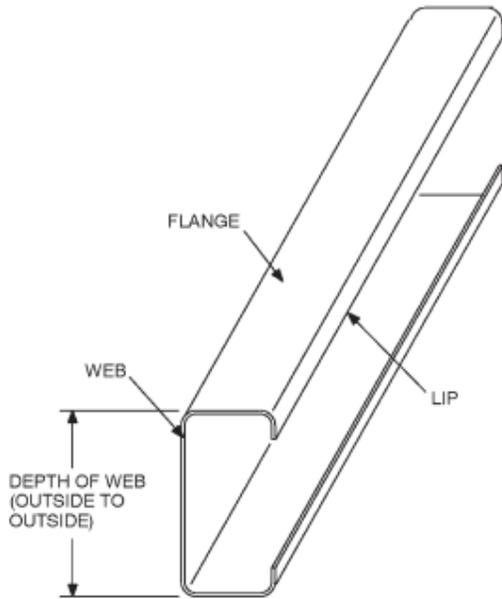
For SI: 1 inch = 25.4 mm; 1 mil = 0.0254 mm.

- a. The member designation is defined by the first number representing the member depth in hundredths of an inch “S” representing a stud or joist member, the second number representing the flange width in hundredths of an inch, and the letter “t” shall be a number representing the minimum base metal thickness in mils [See Table 603.2(2)].

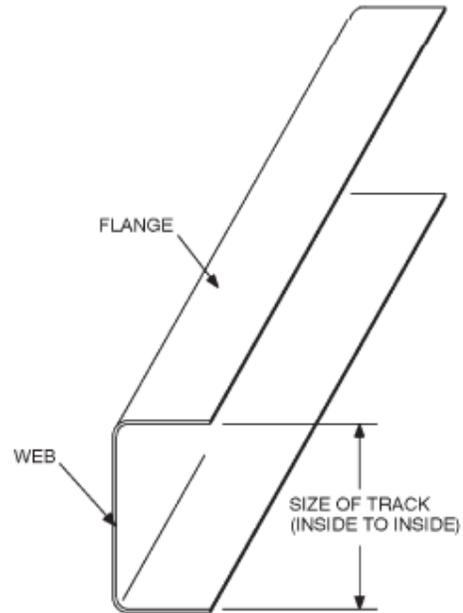
TABLE 603.2(2)
MINIMUM THICKNESS OF COLD-FORMED STEEL MEMBERS

DESIGNATION THICKNESS (mils)	MINIMUM BASE STEEL THICKNESS (inches)
33	0.0329
43	0.0428
54	0.0538
68	0.0677
97	0.0966

For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm.



**FIGURE 603.2(1)
C-SHAPED SECTION**



**FIGURE 603.2(2)
RACK SECTION**

**TABLE 603.2.4
SCREW SUBSTITUTION FACTOR**

SCREW SIZE	THINNEST CONNECTED STEEL SHEET (mils)	
	33	43
#8	1.0	0.67
#10	0.93	0.62
#12	0.86	0.56

For SI: 1 mil = 0.0254 mm.

603.2.5 Web holes, web hole reinforcing and web hole patching. Web holes, web hole reinforcing and web hole patching shall be in accordance with this section.

603.2.5.1 Web holes. Web holes in wall studs and other structural members shall comply with all of the following conditions:

1. Holes shall conform to Figure 603.2.5.1;
2. Holes shall be permitted only along the centerline of the web of the framing member;
3. Holes shall have a center-to-center spacing of not less than 24 inches (610 mm);

4. Holes shall have a web hole width not greater than 0.5 times the member depth, or 1½ inches (38 mm);
5. Holes shall have a web hole length not exceeding 4½ inches (114 mm); and
6. Holes shall have a minimum distance between the edge of the bearing surface and the edge of the web hole of not less than 10 inches (254 mm).

Framing members with web holes not conforming to the above requirements shall be reinforced in accordance with Section 603.2.5.2, patched in accordance with Section 603.2.5.3 or designed in accordance with accepted engineering practice.

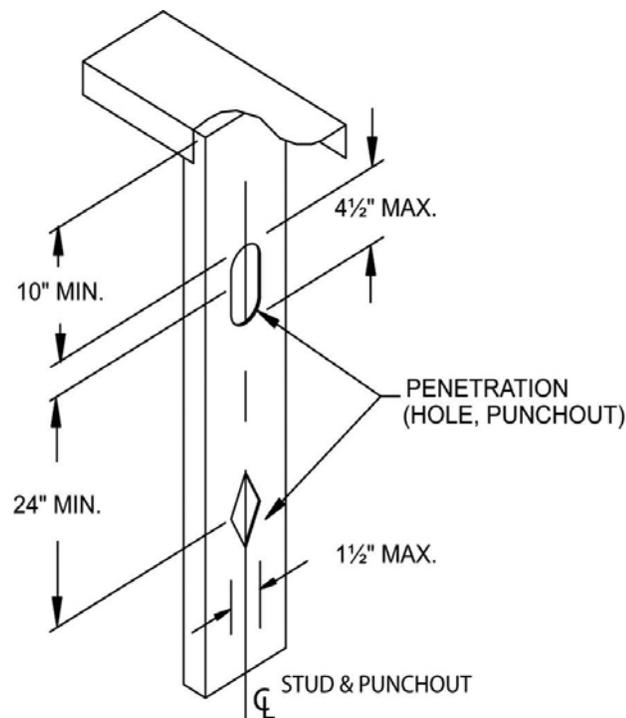
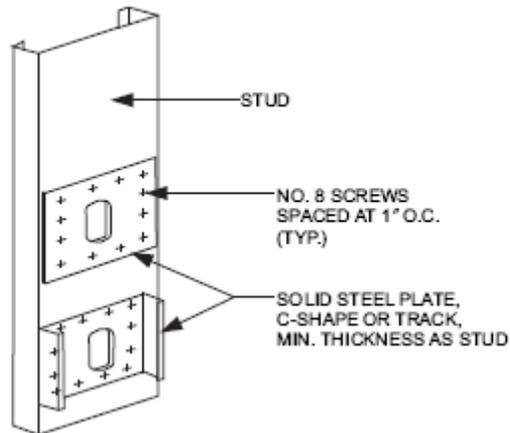


FIGURE 603.2.5.1
WEB HOLES

603.2.5.2 Web hole reinforcing. Web holes in gable endwall studs not conforming to the requirements of Section 603.2.5.1 shall be permitted to be reinforced if the hole is located fully within the center 40 percent of the span and the depth and length of the hole does not exceed 65 percent of the flat width of the web. The reinforcing shall be a steel plate or C-shape section with a hole that does not exceed the web hole size limitations of Section 603.2.5.1 for the member being reinforced. The steel reinforcing shall be the same thickness as the receiving member and shall extend at least 1 inch (25.4 mm) beyond all edges of the hole. The steel reinforcing shall be fastened to the web of the receiving member with No.8 screws spaced no more than 1 inch (25.4 mm) center-to-center along the edges of the patch with minimum edge distance of ½ inch (12.7 mm).

603.2.5.3 Hole patching. Web holes in wall studs and other structural members not conforming to the requirements in Section 603.2.5.1 shall be permitted to be patched in accordance with either of the following methods:

1. Framing members shall be replaced or designed in accordance with accepted engineering practice when web holes exceed the following size limits:
 - 1.1 The depth of the hole, measured across the web, exceeds 70 percent of the flat width of the web; or
 - 1.2 The length of the hole measured along the web exceeds 10 inches (254 mm) or the depth of the web, whichever is greater.
2. Web holes not exceeding the dimensional requirements in Section 603.2.5.3, Item 1 shall be patched with a solid steel plate, stud section or track section in accordance with Figure 603.2.5.3. The steel patch shall, as a minimum, be the same thickness as the receiving member and shall extend at least 1 inch (25.4 mm) beyond all edges of the hole. The steel patch shall be fastened to the web of the receiving member with No. 8 screws spaced no more than 1 inch (25.4 mm) center-to-center along the edges of the patch with a minimum edge distance of ½ inch (12.7 mm).



For SI: 1 inch = 25.4 mm.

**FIGURE 603.2.5.3
STUD WEB HOLE PATCH**

603.3 Wall construction. All 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.

603.3.1 Wall to foundation or floor connection. Cold-formed steel framed walls shall be anchored to foundations or floors in accordance with Table 603.3.1 and Figure 603.3.1(1), 603.3.1(2) or 603.3.1(3). Anchor bolts shall be located not more than 12 inches (305 mm) from corners or the termination of bottom tracks. Anchor bolts shall extend a minimum of 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.

603.3.1.1 Gable endwalls. Gable endwalls with heights greater than 10 feet (3048 mm) shall be anchored to foundations or floors in accordance with Tables 603.3.1.1(1) or 603.3.1.1(2).

603.3.2 Minimum stud sizes. Cold-formed steel walls shall be constructed in accordance with Figures 603.3.1(1), 603.3.1(2), or 603.3.1(3), as applicable. Exterior wall stud size and thickness shall be determined in accordance with the limits set forth in Tables 603.3.2(2) through 603.3.2(31). Interior load-bearing wall stud size and thickness shall be determined in accordance with the limits set forth in Tables 603.3.2(2) through 603.3.2(31) based upon an 85 miles per hour (38 m/s) Exposure A/B wind value and the building width, stud spacing and snow load, as appropriate. Fastening requirements shall be in

accordance with Section 603.2.4 and Table 603.3.2(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 603.3.2(2) through 603.3.2(31), but not less than 33 mils (0.84 mm), where both of the following conditions exist:

1. Minimum of $\frac{1}{2}$ inch (12.7 mm) gypsum board is installed and fastened in accordance with Section 702 on the interior surface.
2. Wood structural sheathing panels of minimum $\frac{7}{16}$ inch (11 mm) thick oriented strand board or $\frac{15}{32}$ inch (12 mm) thick plywood is installed and fastened in accordance with Section 603.9.1 and Table 603.3.2(1) on the outside surface.

Interior load-bearing walls shall be permitted to be reduced to the next thinner size, as shown in Tables 603.3.2(2) through 603.3.2(31), but not less than 33 mils (0.84 mm), where a minimum of $\frac{1}{2}$ inch (12.7 mm) gypsum board is installed and fastened in accordance with Section 702 on both sides of the wall. The tabulated stud thickness for load-bearing walls shall be used when the attic load is 10 pounds per square feet (480 Pa) or less. A limited attic storage load of 20 pounds per square feet (960 Pa) shall be permitted provided that the next higher snow load column is used to select the stud size from Tables 603.3.2(2) through 603.3.2(31).

For two-story buildings, the tabulated stud thickness for walls supporting one floor, roof and ceiling shall be used when second floor live load is 30 pounds per square feet (1440 Pa). Second floor live loads of 40 psf (1920 pounds per square feet) shall be permitted provided that the next higher snow load column is used to select the stud size from Tables 603.3.2(2) through 603.3.2(21).

For three-story buildings, the tabulated stud thickness for walls supporting one or two floors, roof and ceiling shall be used when the third floor live load is 30 pounds per square feet (1440 Pa). Third floor live loads of 40 pounds per square feet (1920 Pa) shall be permitted provided that the next higher snow load column is used to select the stud size from Tables 603.3.2(22) through 603.3.2(31).

603.3.2.1 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 Tables 603.3.2.1(1) or 603.3.2.1(2). 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 Tables 603.3.2.1(3) or 603.3.2.1(4).

603.3.3 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 702 and structural sheathing installed in accordance with Section 603.9.1 and Table 603.3.2(1).
2. Horizontal steel straps fastened in accordance with Figure 603.3.3(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 at least 1.5 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 all 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 603.3.3(2). Sheathing shall be installed in accordance with Item 1. Steel straps shall be installed in accordance with Item 2.

**TABLE 603.3.1
WALL TO FOUNDATION OR FLOOR CONNECTION REQUIREMENTS^{a,b}**

FRAMING CONDITION	WIND SPEED (mph) AND EXPOSURE					
	85 B	90 B	100 B 85 C	110 B 90 C	100 C	< 110 C
Wall bottom track to floor per Figure 603.3.1(1)	1-No. 8 screw at 12" o.c.	2-No. 8 screws at 12" o.c.	2 No. 8 screws at 12" o.c.			
Wall bottom track to foundation per Figure 603.3.1(2) ^d	½" minimum diameter anchor bolt at 6' o.c.	½" minimum diameter anchor bolt at 6' o.c.	½" minimum diameter anchor bolt at 4' o.c.	½" minimum diameter anchor bolt at 4' o.c.	½" minimum diameter anchor bolt at 4' o.c.	½" minimum diameter anchor bolt at 4' o.c.
Wall bottom track to wood sill per Figure 603.3.1(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 2' o.c., with 4-No. 8 screws and 4-10d or 6-8d common nails

Wind uplift connector strength to 16" stud spacing ^c	NR	NR	NR	NR	NR	65 lb per foot of wall length
Wind uplift connector strength for 24" stud spacing ^c	NR	NR	NR	NR	NR	100 lb per foot of wall length

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s, 1 foot = 304.8 mm, 1 lb = 4.45 N.

- a. Anchor bolts are to be located not more than 12 inches from corners or the termination of bottom tracks (e.g., at door openings or corners). Bolts are to extend a minimum of 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.

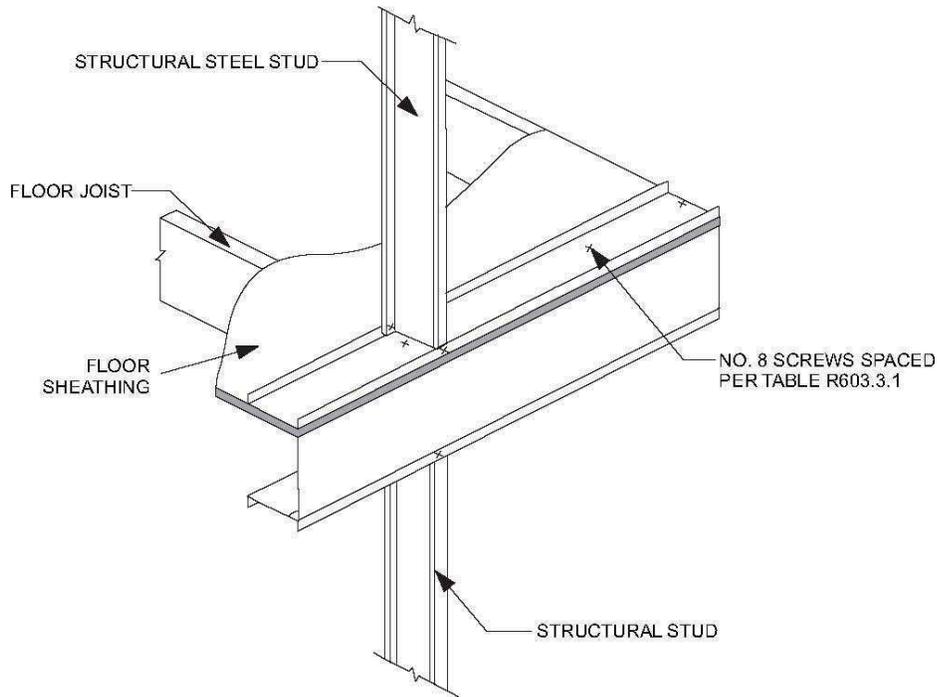
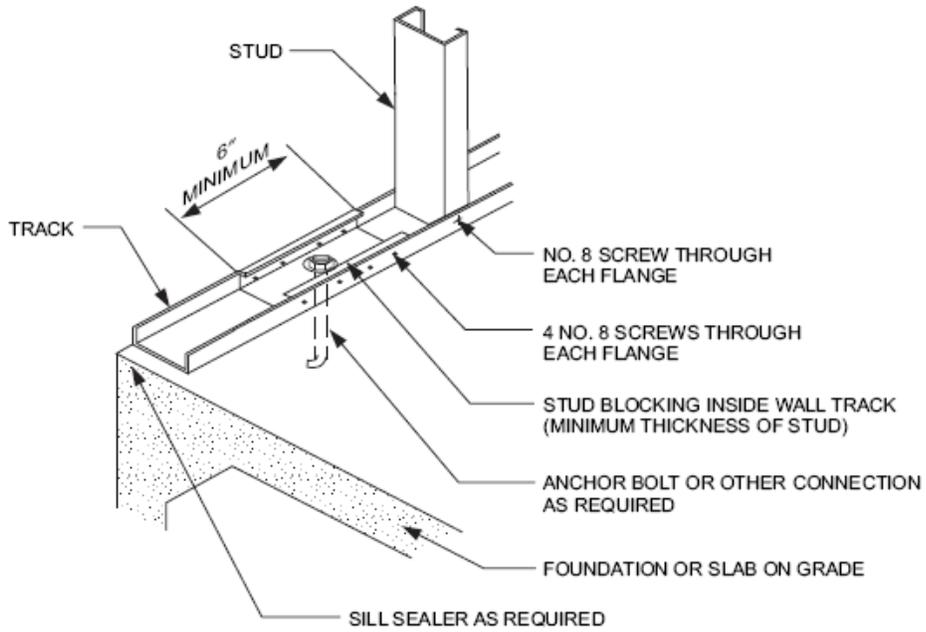


FIGURE 603.3.1(1)
WALL TO FLOOR CONNECTION



For SI: 1 inch = 25.4 mm.

FIGURE 603.3.1(2)
WALL TO FOUNDATION CONNECTION

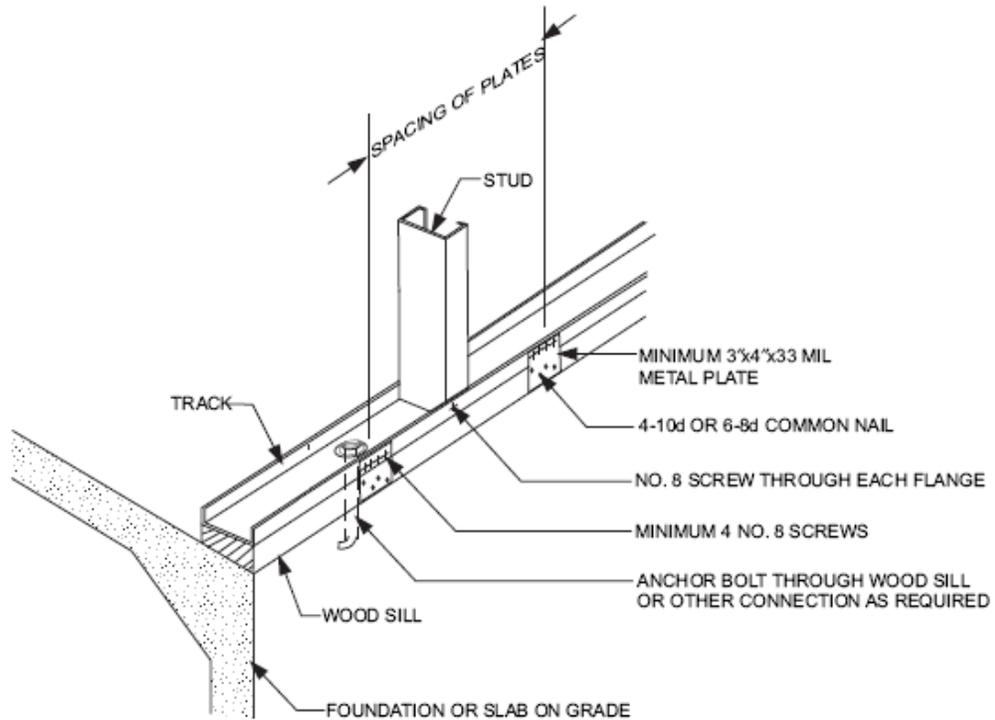


FIGURE 603.3.1(3)
WALL TO WOOD SILL CONNECTION

TABLE 603.3.1.1(1)
GABLE ENDWALL TO FLOOR CONNECTION REQUIREMENTS^{a,b,c}

BASIC WIND SPEED (mph)		WALL BOTTOM TRACK TO FLOOR JOIST OR TRACK CONNECTION		
Exposure		Stud height, h (ft)		
B	C	10 < h ≤ 14	14 < h ≤ 18	18 < h ≤ 22
85	—	1-No. 8 screw @ 12" o.c.	1-No. 8 screw @ 12" o.c.	1-No. 8 screw @ 12" o.c.
90	—	1-No. 8 screw @ 12" o.c.	1-No. 8 screw @ 12" o.c.	1-No. 8 screw @ 12" o.c.
100	85	1-No. 8 screw @ 12" o.c.	1-No. 8 screw @ 12" o.c.	1-No. 8 screw @ 12" o.c.
110	90	1-No. 8 screw @ 12" o.c.	1-No. 8 screw @ 12" o.c.	2-No. 8 screws @ 12" o.c.
—	100	1-No. 8 screw @ 12" o.c.	2-No. 8 screws @ 12" o.c.	1-No. 8 screw @ 8" o.c.
—	110	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.

- Refer to Table 603.3.1.1(2) for gable endwall bottom track to foundation connections.
- Where attachment is not given, special design is required.
- Stud height, h , is measured from wall bottom track to wall top track or brace connection height.

TABLE 603.3.1.1(2)
GABLE ENDWALL BOTTOM TRACK TO FOUNDATION CONNECTION REQUIREMENTS^{a,b,c}

BASIC WIND SPEED (mph)		MINIMUM SPACING FOR ½ IN. DIAMETER ANCHOR BOLTS ^d		
Exposure		Stud height, h (ft)		
B	C	10 < h ≤ 14	14 < h ≤ 18	18 < h ≤ 22
85	—	6' - 0" o.c.	6' - 0" o.c.	6' - 0" o.c.
90	—	6' - 0" o.c.	5' - 7" o.c.	6' - 0" o.c.
100	85	5' - 10" o.c.	6' - 0" o.c.	6' - 0" o.c.
110	90	4' - 10" o.c.	5' - 6" o.c.	6' - 0" o.c.
—	100	4' - 1" o.c.	6' - 0" o.c.	6' - 0" o.c.
—	110	5' - 1" o.c.	6' - 0" o.c.	5' - 2" o.c.

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

- Refer to Table 603.3.1.1(1) for gable endwall bottom track to floor joist or track connection connections.
- Where attachment is not given, special design is required.
- Stud height, h , is measured from wall bottom track to wall top track or brace connection height.
- 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.

603.3.4 Cutting and notching. Flanges and lips of cold-formed steel studs and headers shall not be cut or notched.

603.3.5 Splicing. Steel studs and other structural members shall not be spliced. Tracks shall be spliced in accordance with Figure 603.3.5.

603.4 Corner framing. In exterior walls, corner studs and the top tracks shall be installed in accordance with Figure 603.4.

603.5 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.

603.6 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 603.6(1) and 603.6(2), respectively, and Tables 603.6(1) through 603.6(24). 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 S100, Section D4.

603.6.1 Headers in gable endwalls. Box beam and back-to-back headers in gable endwalls shall be permitted to be constructed in accordance with Section 603.6 or with the header directly above the opening in accordance with Figures 603.6.1(1) and 603.6.1(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 (1830 mm).
3. Two 800S162-54 for openings greater than 6 feet (1829 mm) but less than or equal to 9 feet (2743 mm).

603.7 Jack and king studs. The number of jack and king studs installed on each side of a header shall comply with Table 603.7(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 603.7(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 603.6(1). The track or C-shape sections shall extend the depth of the header minus $\frac{1}{2}$ 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 × 51 mm) clip angle in accordance with Figure 603.6(2). The clip angle shall extend the depth of the header minus ½ 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 603.6(1) and 603.6(2).

603.8 Head and sill track. Head track spans above door and window openings and sill track spans beneath window openings shall comply with Table 603.8. 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 603.8. 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 603.8 by 1.50 shall be permitted.

603.9 Structural sheathing. Structural sheathing shall be installed in accordance with Figure 603.9 and this section on all sheathable exterior wall surfaces, including areas above and below openings.

603.9.1 Sheathing materials. Structural sheathing panels shall consist of minimum $\frac{7}{16}$ -inch (11 mm) thick oriented strand board or $\frac{15}{32}$ -inch (12 mm) thick plywood.

603.9.2 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 603.9.2(1) and by the plan aspect-ratio adjustment factors obtained from Table 603.9.2(2). The minimum length of full height sheathing shall not be 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 a minimum of 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 (i.e. vertical orientation) 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 below.

2. Be blocked when the long dimension is installed perpendicular to the stud framing (i.e. horizontal orientation). Blocking shall be a minimum of 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 (1219 mm) wide panel.

603.9.2.1 The minimum percentage of full-height structural sheathing shall be multiplied by 1.10 for 9 foot (2743 mm) high walls and multiplied by 1.20 for 10 foot (3048 mm) high walls.

603.9.2.2 For hip roofed homes, the minimum percentages of full height sheathing in Table 603.9.2(1), based upon wind, shall be 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.

603.9.2.3 In the lowest story of a dwelling, multiplying the percentage of full height sheathing required in Table 603.9.2(1) by 0.6, shall be permitted provided hold down anchors are provided in accordance with Section 603.9.4.2.

603.9.3 Structural sheathing fastening. All edges and interior areas of structural sheathing panels shall be fastened to framing members and tracks in accordance with Figure 603.9 and Table 603.3.2(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 603.9.2(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 Table 505.3.1(1) and Table 603.3.1 shall be multiplied by 2/3.

603.9.4 Uplift connection requirements. Uplift connections shall be provided in accordance with this section.

603.9.4.1 Where wind speeds are in excess of 100 miles per hour (45 m/s), Exposure C, walls shall be provided wind direct uplift connections in accordance with AISI S230, Section E13.3, and AISI S230, Section F7.2, as required for 110 miles per hour (49 m/s), Exposure C.

603.9.4.2 Where the percentage of full height sheathing is adjusted in accordance with Section 603.9.2.3, 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 603.9.2. 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 603.9.3 and AISI S230, Table E11-1.

A single hold down anchor, installed in accordance with Figure 603.9.2, shall be permitted at the corners of buildings.

603.9.5 Structural sheathing for stone and masonry veneer. In Seismic Design Category C, where stone and masonry veneer is installed in accordance with Section 703.7, the length of structural sheathing for walls supporting one story, roof and ceiling shall be the greater of the amount required by Section 603.9.2 or 36 percent, modified by Section 603.9.2 except Section 603.9.2.2 shall not be permitted.

**TABLE 603.3.2(1)
WALL FASTENING SCHEDULE^a**

DESCRIPTION OF BUILDING ELEMENT	NUMBER AND SIZE OF FASTENERS ^a	SPACING OF FASTENERS
Floor joist to track of load-bearing wall	2-No. 8 screws	Each joist
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
Roof framing to wall	Approved design or tie down in accordance with Section 802.11	

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 603.3.2(2)
24-FOOT-WIDE BUILDING SUPPORTING ROOF AND CEILING ONLY^{a, b, c}
33 ksi STEEL



WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)													
				8-Foot Studs				9-Foot Studs				10-Foot Studs					
Exp. B	Exp. C			Ground Snow Load (psf)													
		20	30	50	70	20	30	50	70	20	30	50	70				
85 mph	—	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	
			24	33	33	33	43	33	33	33	43	33	33	43	33	43	43
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33	33	33
90 mph	—	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	
			24	33	33	33	43	33	33	33	43	33	33	43	33	43	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33	33	33
100 mph	85 mph	350S162	16	33	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	43	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	33	33	33	33	33	33	43
110 mph	90 mph	350S162	16	33	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	54	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	33	43	43	43	43	43	43
—	100 mph	350S162	16	33	33	33	33	33	33	33	33	43	43	43	43	43	
			24	43	43	43	43	43	43	43	43	54	54	54	54		
		550S162	16	33	33	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	43	43
—	110 mph	350S162	16	33	33	33	33	43	43	43	43	43	43	43	43	43	
			24	43	43	43	43	54	54	54	54	68	68	68	68		
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	43	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 = 1000 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.

TABLE 603.3.2(3)
24-FOOT-WIDE BUILDING SUPPORTING ROOF AND CEILING ONLY^{a,b,c}
50 ksi STEEL

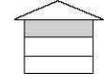


WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-Foot Studs				9-Foot Studs				10-Foot Studs			
Exp. B	Exp. C			Ground Snow Load (psf)											
		20	30	50	70	20	30	50	70	20	30	50	70		
85 mph	—	350S162	16	33	33	33	33	33	33	33	33	33	33	33	
			24	33	33	33	43	33	33	33	33	33	33	33	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	33
90 mph	—	350S162	16	33	33	33	33	33	33	33	33	33	33	33	
			24	33	33	33	43	33	33	33	33	33	33	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	33
100 mph	85 mph	350S162	16	33	33	33	33	33	33	33	33	33	33	33	
			24	33	33	33	43	33	33	33	33	33	33	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	33
110 mph	90 mph	350S162	16	33	33	33	33	33	33	33	33	33	33	33	
			24	33	33	33	43	33	33	33	43	43	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	33
—	100 mph	350S162	16	33	33	33	33	33	33	33	33	33	33	33	
			24	33	33	33	43	43	43	43	43	43	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	33
—	110 mph	350S162	16	33	33	33	33	33	33	33	33	33	33	33	
			24	33	33	33	43	43	43	43	43	54	54	54	
		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	33

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 = 0.0479kPa, 1 ksi = 1000 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.

TABLE 603.3.2(4)
28-FOOT-WIDE BUILDING SUPPORTING ROOF AND CEILING ONLY^{a,b,c}
33 ksi STEEL



WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)													
Exp. B	Exp. C			8-Foot Studs				9-Foot Studs				10-Foot Studs					
				Ground Snow Load (psf)													
				20	30	50	70	20	30	50	70	20	30	50	70		
85 mph	—	350S162	16	33	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	33	33
			24	33	33	33	43	33	33	33	43	33	33	33	43		
90 mph	—	350S162	16	33	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	33	
			24	33	33	33	43	33	33	33	43	33	33	33	43		
100 mph	85 mph	350S162	16	33	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	33	
			24	33	33	33	43	33	33	33	43	33	33	33	43		
110 mph	90 mph	350S162	16	33	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	33	
			24	33	33	33	43	33	33	33	43	33	33	33	43		
—	100 mph	350S162	16	33	33	33	33	33	33	33	33	33	43	43	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	33	
			24	33	33	33	43	33	33	33	43	33	33	33	43		
—	110 mph	350S162	16	33	33	33	33	43	43	43	43	43	43	43	43		
			24	43	43	43	54	54	54	54	54	68	68	68	68		
		550S162	16	33	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		

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 = 0.0479kPa, 1 ksi = 1000 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.

TABLE 603.3.2(5)
28-FOOT-WIDE BUILDING SUPPORTING ROOF AND CEILING ONLY^{a,b,c}
50 ksi STEEL



WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)													
				8-Foot Studs				9-Foot Studs				10-Foot Studs					
Exp. B	Exp. C			Ground Snow Load (psf)													
				20	30	50	70	20	30	50	70	20	30	50	70		
85 mph	—	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	
			24	33	33	33	43	33	33	33	43	33	33	33	33	43	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33	33	33
90 mph	—	350S162	16	33	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		
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33	33	33
100 mph	85 mph	350S162	16	33	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	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33	33	33
110 mph	90 mph	350S162	16	33	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	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33	33	33
—	100 mph	350S162	16	33	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		
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	33	33	33	33	33	33	
—	110 mph	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	
			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	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33	33	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 = 0.0479kPa, 1 ksi = 1000 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.

TABLE 603.3.2(6)
32-FOOT-WIDE BUILDING SUPPORTING ROOF AND CEILING ONLY^{a,b,c}
33 ksi STEEL

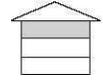


WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)													
Exp. B	Exp. C			8-Foot Studs				9-Foot Studs				10-Foot Studs					
				Ground Snow Load (psf)													
				20	30	50	70	20	30	50	70	20	30	50	70		
85 mph	—	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33	43	
			24	33	33	43	54	33	33	43	43	33	33	43	54		
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	33	33	33	43
90 mph	—	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33	43	
			24	33	33	43	54	33	33	43	43	33	33	43	54		
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	
			24	33	33	33	43	33	33	33	43	33	33	33	33	43	
100 mph	85 mph	350S162	16	33	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	33	
			24	33	33	33	43	33	33	33	43	33	33	33	33	43	
110 mph	90 mph	350S162	16	33	33	33	43	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	33	
			24	33	33	33	43	33	33	33	43	33	33	33	43	43	
—	100 mph	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			
		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		
—	110 mph	350S162	16	33	33	33	43	43	43	43	43	43	43	43	43		
			24	43	43	43	54	54	54	54	54	68	68	68			
		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		

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 = 0.0479kPa, 1 ksi = 1000 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.

TABLE 603.3.2(7)
32-FOOT-WIDE BUILDING SUPPORTING ROOF AND CEILING ONLY^{a,b,c}
50 ksi STEEL



WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)												
				8-Foot Studs				9-Foot Studs				10-Foot Studs				
Exp. B	Exp. C			Ground Snow Load (psf)												
		20	30	50	70	20	30	50	70	20	30	50	70			
85 mph	—	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	33
			24	33	33	33	43	33	33	33	33	33	33	33	33	43
90 mph	—	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	33
			24	33	33	33	43	33	33	33	33	33	33	33	33	43
100 mph	85 mph	350S162	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	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	33	33	33	33	33	43
110 mph	90 mph	350S162	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	54	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	33	33	33	33	33	43
—	100 mph	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	33
			24	33	33	33	43	33	33	33	43	33	33	33	33	43
—	110 mph	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	33
			24	33	33	33	43	33	33	33	43	33	33	33	33	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 = 0.0479kPa, 1 ksi = 1000 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.

TABLE 603.3.2(8)
36-FOOT-WIDE BUILDING SUPPORTING ROOF AND CEILING ONLY^{a,b,c}
33 ksi STEEL

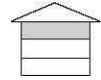


WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)												
				8-Foot Studs				9-Foot Studs				10-Foot Studs				
Exp. B	Exp. C			Ground Snow Load (psf)												
		20	30	50	70	20	30	50	70	20	30	50	70			
85 mph	—	350S162	16	33	33	33	43	33	33	33	43	33	33	33	43	
			24	33	33	43	54	33	33	43	54	33	43	43	54	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	43	43	33	33	43	43	
90 mph	—	350S162	16	33	33	33	43	33	33	33	43	33	33	33	43	
			24	33	33	43	54	33	33	43	54	33	43	43	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	
100 mph	85 mph	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	
110 mph	90 mph	350S162	16	33	33	33	43	33	33	33	33	33	33	33	43	
			24	33	33	43	54	43	43	43	43	43	43	54	68	
		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	
—	100 mph	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	68	
		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	
—	110 mph	350S162	16	33	33	33	43	43	43	43	43	43	43	43		
			24	43	43	54	54	54	54	54	54	68	68	68	68	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33		
			24	33	33	43	54	33	33	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 = 1000 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.

TABLE 603.3.2(9)
36-FOOT-WIDE BUILDING SUPPORTING ROOF AND CEILING ONLY^{a,b,c}
50 ksi STEEL

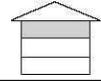


WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)												
Exp. B	Exp. C			8-Foot Studs				9-Foot Studs				10-Foot Studs				
				Ground Snow Load (psf)												
				20	30	50	70	20	30	50	70	20	30	50	70	
85 mph	—	350S162	16	33	33	3	33	33	33	33	33	33	33	33	33	3
			24	33	33	43	43	33	33	43	43	33	33	43	54	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	33	33	43
90 mph	—	350S162	16	33	33	33	3	33	33	3	3	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	
100 mph	85 mph	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	
110 mph	90 mph	350S162	16	33	33	33	33	33	33	33	33	33	33	33	43	
			24	33	33	43	54	33	33	33	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	
—	100 mph	350S162	16	33	33	33	33	33	33	33	33	33	33	33	43	
			24	33	33	33	54	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	
—	110 mph	350S162	16	33	33	33	43	33	33	33	33	33	33	33	43	
			24	33	33	43	54	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	33	33	33	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 = 0.0479kPa, 1 ksi = 1000 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.

TABLE 603.3.2(10)
40-FOOT-WIDE BUILDING SUPPORTING ROOF AND CEILING ONLY^{a,b,c}
33 ksi STEEL



WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)												
				8-Foot Studs				9-Foot Studs				10-Foot Studs				
Exp. B	Exp. C			Ground Snow Load (psf)												
				20	30	50	70	20	30	50	70	20	30	50	70	
85 mph	—	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	68	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	54	33	33	43	43	33	33	43	54	
90 mph	—	350S162	16	33	33	33	43	33	33	33	43	33	3	33	4	
			24	33	33	43	54	33	33	43	54	43	43	54	68	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	
			24	33	33	43	54	33	33	43	43	33	33	43	54	
100 mph	85 mph	350S162	16	33	33	33	43	33	33	33	43	33	33	33	43	
			24	33	43	43	54	33	43	43	54	43	43	54	68	
		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	
110 mph	90 mph	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	68	
		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	
—	100 mph	350S162	16	33	33	33	43	33	33	33	43	43	43	43	43	
			24	43	43	54	68	43	43	54	54	54	54	68		
		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	
—	110 mph	350S162	16	33	33	43	43	43	43	43	43	43	43	43	54	
			24	43	43	54	68	54	54	54	68	68	68	68		
		550S162	16	33	33	33	43	33	33	33	43	33	33	33	43	
			24	33	33	43	54	33	33	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 = 1000 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.

TABLE 603.3.2(11)
40-FOOT-WIDE BUILDING SUPPORTING ROOF AND CEILING ONLY^{a,b,c}
50 ksi STEEL



WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)												
				8-Foot Studs				9-Foot Studs				10-Foot Studs				
Exp. B	Exp. C			Ground Snow Load (psf)												
		20	30	50	70	20	30	50	70	20	30	50	70			
85 mph	—	350S162	16	33	33	33	33	33	33	33	33	33	33	33	43	
			24	33	33	43	54	33	33	43	43	33	33	43	54	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	33	33	43
90 mph	—	350S162	16	33	33	33	33	33	33	33	33	33	33	33	43	
			24	33	33	43	54	33	33	43	43	33	33	43	54	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	33	33	43
100 mph	85 mph	350S162	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	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	33	33	43
110 mph	90 mph	350S162	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	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	33	33	43
—	100 mph	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	33
			24	33	33	43	43	33	33	33	43	33	33	43	43	
—	110 mph	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	68	
		550S162	16	33	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	

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 = 0.0479kPa, 1 ksi = 1000 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.

TABLE 603.3.2(12)
24-FOOT-WIDE BUILDING SUPPORTING ONE FLOOR, ROOF AND
CEILING^{a,b,c} 33 ksi STEEL



WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)													
Exp. B	Exp. C			8-Foot Studs				9-Foot Studs				10-Foot Studs					
				Ground Snow Load (psf)													
				20	30	50	70	20	30	50	70	20	30	50	70		
85 mph	—	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33	43	
			24	33	33	43	43	33	43	43	43	43	43	43	43	43	54
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	33	43	33	33	33	33	43
90 mph	—	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33	43	
			24	33	33	43	43	33	43	43	43	43	43	43	43	54	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	33	43	33	33	33	33	43
100 mph	85 mph	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33	43	
			24	33	43	43	43	43	43	43	43	43	43	43	43	54	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	33	43	33	33	33	33	43
110 mph	90 mph	350S162	16	33	33	33	43	33	33	33	33	33	33	33	43	43	
			24	43	43	43	43	43	43	43	43	54	54	54	54		
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	33	43	43	43	43	43	43
—	100 mph	350S162	16	33	33	33	43	33	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	33	33
			24	33	33	33	43	43	43	43	43	43	43	43	43	43	43
—	110 mph	350S162	16	33	33	33	43	43	43	43	43	43	43	43	43	43	
			24	43	43	43	54	54	54	54	54	68	68	68	68		
		550S162	16	33	33	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	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 = 0.0479kPa, 1 ksi = 1000 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.

TABLE 603.3.2(13)
24-FOOT-WIDE BUILDING SUPPORTING ONE FLOOR, ROOF AND CEILING^{a,b,c}
50 ksi STEEL



WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)													
Exp. B	Exp. C			8-Foot Studs				9-Foot Studs				10-Foot Studs					
				Ground Snow Load (psf)													
				20	30	50	70	20	30	50	70	20	30	50	70		
85 mph	—	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	
			24	33	33	33	43	33	33	33	43	33	33	43	33	43	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33	33	33
90 mph	—	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	
			24	33	33	33	43	33	33	33	43	33	33	43	33	43	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33	33	33
100 mph	85 mph	350S162	16	33	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	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33	33	33
110 mph	90 mph	350S162	16	33	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		
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33	33	33
—	100 mph	350S162	16	33	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	54	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	33	33	33	33	33	33	43
—	110 mph	350S162	16	33	33	33	33	33	33	33	33	33	33	33	43	43	
			24	43	43	43	43	43	43	43	43	54	54	54	54		
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	
			24	33	33	33	43	33	33	33	33	33	33	33	33	33	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 = 1000 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.

TABLE 603.3.2(14)
28-FOOT-WIDE BUILDING SUPPORTING ONE FLOOR, ROOF AND CEILING^{a,b,c}
33 ksi STEEL



WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
Exp. B	Exp. C			8-Foot Studs				9-Foot Studs				10-Foot Studs			
				Ground Snow Load (psf)											
				20	30	50	70	20	30	50	70	20	30	50	70
85 mph	—	350S162	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
		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
90 mph	—	350S162	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
		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
100 mph	85 mph	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
110 mph	90 mph	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	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	43	43	43	43	43	43
—	100 mph	350S162	16	33	33	33	43	33	33	43	43	43	43	43	43
			24	43	43	43	54	54	54	54	54	54	54	54	68
		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
—	110 mph	350S162	16	33	33	43	43	43	43	43	43	43	43	43	54
			24	43	43	54	54	54	54	54	54	68	68	68	68
		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 = 1000 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.

TABLE 603.3.2(15)
28-FOOT-WIDE BUILDING SUPPORTING ONE FLOOR, ROOF AND CEILING^{a,b,c}
50 ksi STEEL



WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)													
Exp. B	Exp. C			8-Foot Studs				9-Foot Studs				10-Foot Studs					
				Ground Snow Load (psf)													
				20	30	50	70	20	30	50	70	20	30	50	70		
85 mph	—	350S162	16	33	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	54	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	33	33	33	43
90 mph	—	350S162	16	33	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	33	33
			24	33	33	33	43	33	33	33	43	33	33	33	33	33	43
100 mph	85 mph	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33	43	
			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	33	33
			24	33	33	33	43	33	33	33	43	33	33	33	33	33	43
110 mph	90 mph	350S162	16	33	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	33	33
			24	33	33	33	43	33	33	33	43	33	33	33	33	33	43
—	100 mph	350S162	16	33	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	54	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	33	33	33	43
—	110 mph	350S162	16	33	33	33	43	33	33	33	33	43	43	43	43	43	
			24	43	43	43	54	43	43	43	43	54	54	54	54		
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	33	33	33	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 = 0.0479kPa, 1 ksi = 1000 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.

TABLE 603.3.2(16)
32-FOOT-WIDE BUILDING SUPPORTING ONE FLOOR, ROOF AND CEILING^{a,b,c}
33 ksi STEEL



WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)												
Exp. B	Exp. C			8-Foot Studs				9-Foot Studs				10-Foot Studs				
				Ground Snow Load (psf)												
				20	30	50	70	20	30	50	70	20	30	50	70	
85 mph	—	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	43	33	33	33	33	33	33	33	33	43
			24	33	43	43	54	33	33	43	43	33	33	43	43	
90 mph	—	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	43	33	33	33	33	33	33	33	33	43
			24	33	43	43	54	33	33	43	43	33	33	43	43	
100 mph	85 mph	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	68	
		550S162	16	33	33	33	43	33	33	33	33	33	33	33	33	43
			24	33	43	43	54	33	33	43	43	33	33	43	43	
110 mph	90 mph	350S162	16	33	33	43	43	33	33	33	43	43	43	43	43	
			24	43	43	54	54	43	43	54	54	54	54	68		
		550S162	16	33	33	33	43	33	33	33	33	33	33	33	33	43
			24	33	43	43	54	33	33	43	43	43	43	43	43	
—	100 mph	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	33	43
			24	33	43	43	54	43	43	43	43	43	43	43	43	
—	110 mph	350S162	16	43	43	43	43	43	43	43	43	43	43	43	54	
			24	54	54	54	68	54	54	54	68	68	68	68		
		550S162	16	33	33	33	43	33	33	33	43	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 = 0.0479kPa, 1 ksi = 1000 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.

TABLE 603.3.2(17)
32-FOOT-WIDE BUILDING SUPPORTING ONE FLOOR, ROOF AND CEILING^{a,b,c}
50 ksi STEEL



WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)													
Exp. B	Exp. C			8-Foot Studs				9-Foot Studs				10-Foot Studs					
				Ground Snow Load (psf)													
				20	30	50	70	20	30	50	70	20	30	50	70		
85 mph	—	350S162	16	33	33	33	43	33	33	33	33	33	33	33	33	43	
			24	33	33	43	54	33	33	43	43	43	43	43	43	54	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	33	43	33	33	33	33	33	43
90 mph	—	350S162	16	33	33	33	43	33	33	33	33	33	33	33	33	43	
			24	33	33	43	54	33	33	43	43	43	43	43	54		
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	
			24	33	33	43	43	33	33	33	43	33	33	33	33	43	
100 mph	85 mph	350S162	16	33	33	33	43	33	33	33	33	33	33	33	33	43	
			24	33	33	43	54	33	33	43	43	43	43	43	54		
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	
			24	33	33	43	43	33	33	33	43	33	33	33	33	43	
110 mph	90 mph	350S162	16	33	33	33	43	33	33	33	33	33	33	33	33	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	33	
			24	33	33	43	43	33	33	33	43	33	33	33	33	43	
—	100 mph	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			
		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		
—	110 mph	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			
		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		

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 = 1000 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.

TABLE 603.3.2(18)
36-FOOT-WIDE BUILDING SUPPORTING ONE FLOOR, ROOF AND CEILING^{a,b,c}
33 ksi STEEL



WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)												
Exp. B	Exp. C			8-Foot Studs				9-Foot Studs				10-Foot Studs				
				Ground Snow Load (psf)												
				20	30	50	70	20	30	50	70	20	30	50	70	
85 mph	—	350S162	16	33	33	43	43	33	33	43	43	33	33	43	43	
			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	33	43
			24	43	43	43	54	43	43	43	54	43	43	43	43	54
90 mph	—	350S162	16	33	33	43	43	33	33	43	43	33	33	43	43	
			24	43	43	54	54	43	43	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	
100 mph	85 mph	350S162	16	33	33	43	43	33	33	43	43	43	43	43	43	
			24	43	43	54	68	43	43	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	
110 mph	90 mph	350S162	16	33	33	43	43	33	33	43	43	43	43	43	54	
			24	43	43	54	68	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	
—	100 mph	350S162	16	33	33	43	43	43	43	43	43	43	43	43	54	
			24	54	54	54	68	54	54	54	68	54	68	68	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	
—	110 mph	350S162	16	43	43	43	43	43	43	43	43	43	54	54	54	
			24	54	54	54	68	54	54	54	68	68	68	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 = 0.0479kPa, 1 ksi = 1000 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.

TABLE 603.3.2(19)
36-FOOT-WIDE BUILDING SUPPORTING ONE FLOOR, ROOF AND CEILING^{a,b,c}
50 ksi STEEL



WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)												
Exp. B	Exp. C			8-Foot Studs				9-Foot Studs				10-Foot Studs				
				Ground Snow Load (psf)												
				20	30	50	70	20	30	50	70	20	30	50	70	
85 mph	—	350S162	16	33	33	33	43	33	33	33	43	33	33	33	43	
			24	43	43	43	54	33	33	43	54	43	43	43	54	
		550S162	16	33	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	
90 mph	—	350S162	16	33	33	33	43	33	33	33	43	33	33	33	43	
			24	43	43	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	43	43	33	33	43	43	33	33	43	43	
100 mph	85 mph	350S162	16	33	33	33	43	33	33	33	43	33	33	33	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	
110 mph	90 mph	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	
—	100 mph	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	68	
		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	
—	110 mph	350S162	16	33	33	43	43	33	33	33	43	43	43	43	43	
			24	43	43	54	54	43	43	54	54	54	54	54	68	
		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	

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 = 0.0479kPa, 1 ksi = 1000 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.

TABLE 603.3.2(20)
40-FOOT-WIDE BUILDING SUPPORTING ONE FLOOR, ROOF AND CEILING^{a,b,c}
33 ksi STEEL



WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)													
Exp. B	Exp. C			8-Foot Studs				9-Foot Studs				10-Foot Studs					
				Ground Snow Load (psf)													
				20	30	50	70	20	30	50	70	20	30	50	70		
85 mph	—	350S162	16	33	33	43	43	33	33	43	43	43	43	43	43	54	
			24	43	43	54	68	43	43	54	68	54	54	54	54	68	
		550S162	16	33	33	33	43	33	33	33	43	33	33	33	33	33	43
			24	43	43	54	54	43	43	43	54	43	43	43	43	43	54
90 mph	—	350S162	16	33	33	43	43	33	33	43	43	43	43	43	43	54	
			24	43	43	54	68	43	43	54	68	54	54	54	68		
		550S162	16	33	33	33	43	33	33	33	43	33	33	33	33	43	
			24	43	43	54	54	43	43	43	54	43	43	43	43	54	
100 mph	85 mph	350S162	16	33	33	43	43	33	33	43	43	43	43	43	43	54	
			24	43	43	54	68	43	43	54	68	54	54	54	68		
		550S162	16	33	33	33	43	33	33	33	43	33	33	33	33	43	
			24	43	43	54	54	43	43	43	54	43	43	43	43	54	
110 mph	90 mph	350S162	16	33	33	43	43	43	43	43	43	43	43	43	43	54	
			24	43	43	54	68	54	54	54	68	54	54	68	68		
		550S162	16	33	33	43	43	33	33	33	43	33	33	33	33	43	
			24	43	43	54	54	43	43	43	54	43	43	43	43	54	
—	100 mph	350S162	16	43	43	43	54	43	43	43	54	43	43	54	54		
			24	54	54	54	68	54	54	54	68	68	68	68	97		
		550S162	16	33	33	43	43	33	33	33	43	33	33	33	43	43	
			24	43	43	54	54	43	43	43	54	43	43	43	54	54	
—	110 mph	350S162	16	43	43	43	54	43	43	43	54	54	54	54	54		
			24	54	54	54	68	54	54	68	68	68	68	68	97		
		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	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 = 0.0479kPa, 1 ksi = 1000 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.

TABLE 603.3.2(21)
40-FOOT-WIDE BUILDING SUPPORTING ONE FLOOR, ROOF AND CEILING^{a,b,c}
50 ksi STEEL



WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
Exp. B	Exp. C			8-Foot Studs				9-Foot Studs				10-Foot Studs			
				Ground Snow Load (psf)											
				20	30	50	70	20	30	50	70	20	30	50	70
85 mph	—	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	43	33	33	33	33	33	33	33	33
			24	33	43	43	54	33	33	43	43	33	33	43	43
90 mph	—	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	43	33	33	33	33	33	33	33	33
			24	33	43	43	54	33	33	43	43	33	33	43	43
100 mph	85 mph	350S162	16	33	33	33	43	33	33	33	43	33	33	43	43
			24	43	43	54	54	43	43	43	54	43	43	54	68
		550S162	16	33	33	33	43	33	33	33	33	33	33	33	33
			24	33	43	43	54	33	33	43	43	33	33	43	43
110 mph	90 mph	350S162	16	33	33	43	43	33	33	33	43	33	33	43	43
			24	43	43	54	54	43	43	43	54	54	54	54	68
		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
—	100 mph	350S162	16	33	33	43	43	33	33	33	43	43	43	43	43
			24	43	43	54	54	43	43	54	54	54	54	54	68
		550S162	16	33	33	33	43	33	33	33	33	33	33	33	43
			24	33	43	43	54	33	33	43	43	33	43	43	43
—	110 mph	350S162	16	33	33	43	43	33	33	43	43	43	43	43	54
			24	43	43	54	68	54	54	54	54	54	54	54	68
		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

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 = 1000 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.

TABLE 603.3.2(22)
24-FOOT-WIDE BUILDING SUPPORTING TWO FLOORS, ROOF AND CEILING^{a,b,c}
33 ksi STEEL



WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)													
				8-Foot Studs				9-Foot Studs				10-Foot Studs					
Exp. B	Exp. C			Ground Snow Load (psf)													
				20	30	50	70	20	30	50	70	20	30	50	70		
85 mph	—	350S162	16	43	43	43	43	33	33	33	43	43	43	43	43	43	
			24	54	54	54	54	43	43	54	54	54	54	54	54	54	
		550S162	16	33	33	43	43	33	33	33	33	33	33	33	33	33	43
			24	43	43	54	54	43	43	43	43	43	43	43	43	43	54
90 mph	—	350S162	16	43	43	43	43	33	33	33	43	43	43	43	43	43	
			24	54	54	54	54	43	54	54	54	54	54	54	54		
		550S162	16	33	33	43	43	33	33	33	33	33	33	33	33	43	
			24	43	43	54	54	43	43	43	43	43	43	43	43	43	54
100 mph	85 mph	350S162	16	43	43	43	43	33	33	33	43	43	43	43	43	43	
			24	54	54	54	54	54	54	54	54	54	54	54	54	68	
		550S162	16	33	33	43	43	33	33	33	33	33	33	33	33	43	
			24	43	43	54	54	43	43	43	43	43	43	43	43	43	54
110 mph	90 mph	350S162	16	43	43	43	43	43	43	43	43	43	43	43	43	43	
			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	33	43	
			24	43	43	54	54	43	43	43	43	43	43	43	43	43	54
—	100 mph	350S162	16	33	43	43	43	43	43	43	43	43	43	43	43	54	
			24	54	54	54	54	54	54	54	54	68	68	68	68		
		550S162	16	33	33	43	43	33	33	33	33	33	33	33	33	43	
			24	43	43	54	54	43	43	43	43	43	43	43	43	43	54
—	110 mph	350S162	16	43	43	43	43	43	43	43	43	43	54	54	54	54	
			24	54	54	54	68	54	54	68	68	68	68	68	97		
		550S162	16	33	33	43	43	33	33	33	33	33	33	33	33	43	
			24	43	43	54	54	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 = 0.0479kPa, 1 ksi = 1000 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.

TABLE 603.3.2(23)
24-FOOT-WIDE BUILDING SUPPORTING TWO FLOORS, ROOF AND CEILING^{a,b,c}
50 ksi STEEL



WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-Foot Studs				9-Foot Studs				10-Foot Studs			
Exp. B	Exp. C			Ground Snow Load (psf)											
		20	30	50	70	20	30	50	70	20	30	50	70		
85 mph	—	350S162	16	33	33	33	43	33	33	33	33	33	33	33	
			24	43	43	54	54	43	43	43	43	43	43	43	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
90 mph	—	350S162	16	33	33	33	43	33	33	33	33	33	33	33	
			24	43	43	54	54	43	43	43	43	43	43	54	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	
			24	43	43	43	43	43	43	43	43	43	43	43	
100 mph	85 mph	350S162	16	33	33	33	43	33	33	33	33	33	33	33	
			24	43	43	54	54	43	43	43	43	43	43	54	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	
			24	43	43	43	43	43	43	43	43	43	43	43	
110 mph	90 mph	350S162	16	33	33	33	43	33	33	33	33	33	33	43	
			24	43	43	54	54	43	43	43	43	54	54	54	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	
			24	43	43	43	43	43	43	43	43	43	43	43	
—	100 mph	350S162	16	33	33	33	43	33	33	33	33	43	43	43	
			24	43	43	54	54	43	43	54	54	54	54	54	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	
			24	43	43	43	43	43	43	43	43	43	43	43	
—	110 mph	350S162	16	33	33	33	43	33	33	33	43	43	43	43	
			24	54	54	54	54	54	54	54	54	54	54	68	
	550S162	16	33	33	33	33	33	33	33	33	33	33	33		
		24	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 = 0.0479kPa, 1 ksi = 1000 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. Attic live load is 10 psf.
- c. Building width is in the direction of horizontal framing members supported by the wall studs.

TABLE 603.3.2(24)
28-FOOT-WIDE BUILDING SUPPORTING TWO FLOORS,
ROOF AND CEILING^{a,b,c} 33 ksi STEEL



WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)												
Exp. B	Exp. C			8-Foot Studs				9-Foot Studs				10-Foot Studs				
				Ground Snow Load (psf)												
				20	30	50	70	20	30	50	70	20	30	50	70	
85 mph	—	350S162	16	43	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	68	54	54	54	54	54	54	54	54	68
		550S162	16	43	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	54
90 mph	—	350S162	16	43	43	43	43	43	43	43	43	43	43	43	43	
			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	
100 mph	85 mph	350S162	16	43	43	43	43	43	43	43	43	43	43	43	43	
			24	54	54	54	68	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	
110 mph	90 mph	350S162	16	43	43	43	43	43	43	43	43	43	43	43	43	
			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	
—	100 mph	350S162	16	43	43	43	43	43	43	43	43	43	43	54	54	
			24	54	54	54	68	54	54	68	68	68	68	68	97	
		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	
—	110 mph	350S162	16	43	43	43	43	43	43	43	43	43	54	54	54	
			24	54	68	68	68	68	68	68	68	68	68	97	97	
		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 = 0.0479kPa, 1 ksi = 1000 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.

TABLE 603.3.2(25)
28-FOOT-WIDE BUILDING SUPPORTING TWO FLOORS,
ROOF AND CEILING^{a,b,c} 50 ksi STEEL



WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)												
				8-Foot Studs				9-Foot Studs				10-Foot Studs				
Exp. B	Exp. C			Ground Snow Load (psf)												
		20	30	50	70	20	30	50	70	20	30	50	70			
85 mph	—	350S162	16	43	43	43	43	33	33	33	43	43	43	43	43	
			24	54	54	54	54	43	43	54	54	54	54	54	54	
		550S162	16	33	33	33	43	33	33	33	33	33	33	33	33	33
			24	43	43	43	54	43	43	43	43	43	43	43	43	43
90 mph	—	350S162	16	43	43	43	43	33	33	33	43	43	43	43	43	
			24	54	54	54	54	43	43	54	54	54	54	54		
		550S162	16	33	33	33	43	33	33	33	33	33	33	33	33	
			24	43	43	43	54	43	43	43	43	43	43	43	43	
100 mph	85 mph	350S162	16	43	43	43	43	33	33	33	43	43	43	43	43	
			24	54	54	54	54	43	43	54	54	54	54	54		
		550S162	16	33	33	33	43	33	33	33	33	33	33	33	33	
			24	43	43	43	54	43	43	43	43	43	43	43	43	
110 mph	90 mph	350S162	16	43	43	43	43	33	33	33	43	43	43	43	43	
			24	54	54	54	54	43	43	54	54	54	54	54		
		550S162	16	33	33	33	43	33	33	33	33	33	33	33	33	
			24	43	43	43	54	43	43	43	43	43	43	43	43	
—	100 mph	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	68	
		550S162	16	33	33	33	43	33	33	33	33	33	33	33	33	
			24	43	43	43	54	43	43	43	43	43	43	43	43	
—	110 mph	350S162	16	43	43	43	43	43	43	43	43	43	43	43	43	
			24	54	54	54	54	54	54	54	54	68	68	68	68	
		550S162	16	33	33	33	43	33	33	33	33	33	33	33	33	
			24	43	43	43	54	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 = 0.0479kPa, 1 ksi = 1000 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.

TABLE 603.3.2(26)
32-FOOT-WIDE BUILDING SUPPORTING TWO FLOORS,
ROOF AND CEILING^{a,b,c} 33 ksi STEEL



WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)													
Exp. B	Exp. C			8-Foot Studs				9-Foot Studs				10-Foot Studs					
				Ground Snow Load (psf)													
				20	30	50	70	20	30	50	70	20	30	50	70		
85 mph	—	350S162	16	43	43	43	54	43	43	43	43	43	43	43	43	54	
			24	68	68	68	68	54	54	68	68	68	68	68	68	68	68
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	68	54	54	54	54	54	54	54	54	54	54
90 mph	—	350S162	16	43	43	43	54	43	43	43	43	43	43	43	43	54	
			24	68	68	68	68	54	54	68	68	68	68	68	68	68	
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	68	54	54	54	54	54	54	54	54	54	54
100 mph	85 mph	350S162	16	43	43	43	54	43	43	43	43	43	43	43	43	54	
			24	68	68	68	68	54	54	68	68	68	68	68	68	68	
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	68	54	54	54	54	54	54	54	54	54	54
110 mph	90 mph	350S162	16	43	43	43	54	43	43	43	43	43	43	43	54	54	
			24	68	68	68	68	54	54	68	68	68	68	68	68	68	
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	68	54	54	54	54	54	54	54	54	54	54
—	100 mph	350S162	16	43	43	43	54	43	43	43	43	54	54	54	54		
			24	68	68	68	68	68	68	68	68	68	68	97	97		
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43	43	
			24	54	54	54	68	54	54	54	54	54	54	54	54	54	
—	110 mph	350S162	16	43	43	43	54	43	43	54	54	54	54	54	54		
			24	68	68	68	68	68	68	68	68	97	97	97	97		
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43		
			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 = 0.0479kPa, 1 ksi = 1000 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.

TABLE 603.3.2(27)
32-FOOT-WIDE BUILDING SUPPORTING TWO FLOORS,
ROOF AND CEILING^{a,b,c} 50 ksi STEEL



WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-Foot Studs				9-Foot Studs				10-Foot Studs			
Exp. B	Exp. C			Ground Snow Load (psf)											
		20	30	50	70	20	30	50	70	20	30	50	70		
85 mph	—	350S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	68	54	54	54	54	54	54	54	68
		550S162	16	43	43	43	43	33	33	33	43	33	33	43	43
			24	54	54	54	54	43	43	43	54	43	43	54	54
90 mph	—	350S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	68	54	54	54	54	54	54	68	
		550S162	16	43	43	43	43	33	33	33	43	33	33	43	43
			24	54	54	54	54	43	43	43	54	43	43	54	54
100 mph	85 mph	350S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	68	54	54	54	54	54	54	68	
		550S162	16	43	43	43	43	33	33	33	43	33	33	43	43
			24	54	54	54	54	43	43	43	54	43	43	54	54
110 mph	90 mph	350S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	68	54	54	54	54	54	54	68	
		550S162	16	43	43	43	43	33	33	33	43	33	33	43	43
			24	54	54	54	54	43	43	43	54	43	43	54	54
—	100 mph	350S162	16	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	68	54	54	54	54	68	68	68	
		550S162	16	43	43	43	43	33	33	33	43	33	33	43	43
			24	54	54	54	54	43	43	43	54	43	43	54	54
—	110 mph	350S162	16	43	43	43	43	43	43	43	43	43	43	43	54
			24	54	54	54	68	54	54	54	54	68	68	68	
		550S162	16	43	43	43	43	33	33	33	43	33	33	43	43
			24	54	54	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 = 1000 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.

TABLE 603.3.2(28)
36-FOOT-WIDE BUILDING SUPPORTING TWO FLOORS,
ROOF AND CEILING^{a,b,c} 33 ksi STEEL



WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-Foot Studs				9-Foot Studs				10-Foot Studs			
Exp. B	Exp. C			Ground Snow Load (psf)											
		20	30	50	70	20	30	50	70	20	30	50	70		
85 mph	—	350S162	16	54	54	54	54	43	43	43	54	54	54	54	
			24	68	68	68	97	68	68	68	68	68	68	68	97
		550S162	16	43	43	43	54	43	43	43	43	43	43	43	43
			24	68	68	68	68	54	54	54	68	54	54	68	68
90 mph	—	350S162	16	54	54	54	54	43	43	43	54	54	54	54	
			24	68	68	68	97	68	68	68	68	68	68	97	
		550S162	16	43	43	43	54	43	43	43	43	43	43	43	43
			24	68	68	68	68	54	54	54	68	54	54	68	68
100 mph	85 mph	350S162	16	54	54	54	54	43	43	43	54	54	54	54	
			24	68	68	68	97	68	68	68	68	68	68	97	
		550S162	16	43	43	43	54	43	43	43	43	43	43	43	43
			24	68	68	68	68	54	54	54	68	54	54	68	68
110 mph	90 mph	350S162	16	54	54	54	54	43	43	43	54	54	54	54	
			24	68	68	68	97	68	68	68	68	68	68	97	
		550S162	16	43	43	43	54	43	43	43	43	43	43	43	43
			24	68	68	68	68	54	54	54	68	54	54	68	68
—	100 mph	350S162	16	54	54	54	54	43	43	54	54	54	54	54	
			24	68	68	68	97	68	68	68	68	97	97	97	
		550S162	16	43	43	43	54	43	43	43	43	43	43	43	43
			24	68	68	68	68	54	54	54	68	54	54	68	68
—	110 mph	350S162	16	54	54	54	54	54	54	54	54	54	54	68	
			24	68	68	68	97	68	68	68	97	97	97	97	
		550S162	16	43	43	43	54	43	43	43	43	43	43	43	43
			24	68	68	68	68	54	54	54	68	54	54	68	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 = 1000 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.

TABLE 603.3.2(29)
36-FOOT-WIDE BUILDING SUPPORTING TWO FLOORS,
ROOF AND CEILING^{a,b,c} 50 ksi STEEL



WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)													
Exp. B	Exp. C			8-Foot Studs				9-Foot Studs				10-Foot Studs					
				Ground Snow Load (psf)													
				20	30	50	70	20	30	50	70	20	30	50	70		
85 mph	—	350S162	16	43	43	43	54	43	43	43	43	43	43	43	43	43	
			24	68	68	68	68	54	54	54	68	68	68	68	68	68	
		550S162	16	43	43	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	54	54
90 mph	—	350S162	16	43	43	43	54	43	43	43	43	43	43	43	43	43	
			24	68	68	68	68	54	54	54	68	68	68	68	68		
		550S162	16	43	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	54	
100 mph	85 mph	350S162	16	43	43	43	54	43	43	43	43	43	43	43	43	43	
			24	68	68	68	68	54	54	54	68	68	68	68	68		
		550S162	16	43	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	54	
110 mph	90 mph	350S162	16	43	43	43	54	43	43	43	43	43	43	43	43	43	
			24	68	68	68	68	54	54	54	68	68	68	68	68		
		550S162	16	43	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	54	
—	100 mph	350S162	16	43	43	43	54	43	43	43	43	43	43	43	43	54	
			24	68	68	68	68	54	54	54	68	68	68	68	68		
		550S162	16	43	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	54	
—	110 mph	350S162	16	43	43	43	54	43	43	43	43	43	43	54	54	54	
			24	68	68	68	68	54	54	68	68	68	68	68	68		
		550S162	16	43	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	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 = 0.0479kPa, 1 ksi = 1000 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.

TABLE 603.3.2(30)
40-FOOT-WIDE BUILDING SUPPORTING TWO FLOORS, R
OOF AND CEILING^{a,b,c} 33 ksi STEEL



WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-Foot Studs				9-Foot Studs				10-Foot Studs			
Exp. B	Exp. C			Ground Snow Load (psf)											
		20	30	50	70	20	30	50	70	20	30	50	70		
85 mph	—	350S162	16	54	54	54	54	54	54	54	54	54	54	54	54
			24	97	97	97	97	68	68	68	97	97	97	97	97
		550S162	16	54	54	54	54	43	43	54	54	43	43	54	54
			24	68	68	68	68	68	68	68	68	68	68	68	68
90 mph	—	350S162	16	54	54	54	54	54	54	54	54	54	54	54	
			24	97	97	97	97	68	68	68	97	97	97	97	
		550S162	16	54	54	54	54	43	43	54	54	43	43	54	54
			24	68	68	68	68	68	68	68	68	68	68	68	68
100 mph	85 mph	350S162	16	54	54	54	54	54	54	54	54	54	54	54	
			24	97	97	97	97	68	68	68	97	97	97	97	
		550S162	16	54	54	54	54	43	43	54	54	43	43	54	54
			24	68	68	68	68	68	68	68	68	68	68	68	68
110 mph	90 mph	350S162	16	54	54	54	54	54	54	54	54	54	54	54	
			24	97	97	97	97	68	68	68	97	97	97	97	
		550S162	16	54	54	54	54	43	43	54	54	43	43	54	54
			24	68	68	68	68	68	68	68	68	68	68	68	68
—	100 mph	350S162	16	54	54	54	54	54	54	54	54	54	54	54	
			24	97	97	97	97	68	68	68	97	97	97	97	
		550S162	16	54	54	54	54	43	43	54	54	43	43	54	54
			24	68	68	68	68	68	68	68	68	68	68	68	68
—	110 mph	350S162	16	54	54	54	54	54	54	54	54	54	68	68	
			24	97	97	97	97	68	68	97	97	97	97	97	
		550S162	16	54	54	54	54	43	43	54	54	43	43	54	54
			24	68	68	68	68	68	68	68	68	68	68	68	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 = 0.0479kPa, 1 ksi = 1000 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.

TABLE 603.3.2(31)
40-FOOT-WIDE BUILDING SUPPORTING TWO FLOORS,
ROOF AND CEILING^{a,b,c} 50 ksi STEEL



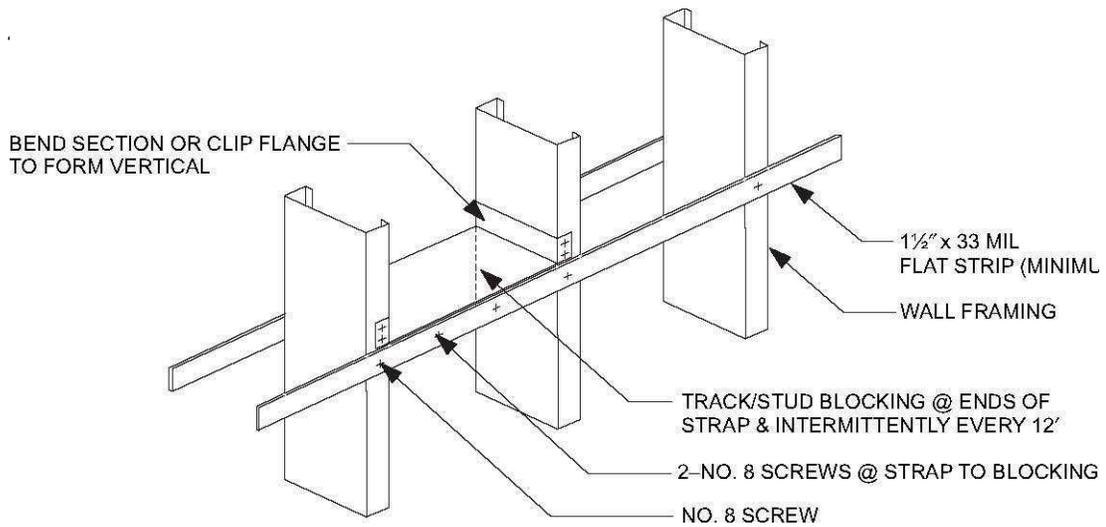
WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)												
Exp. B	Exp. C			8-Foot Studs				9-Foot Studs				10-Foot Studs				
				Ground Snow Load (psf)												
				20	30	50	70	20	30	50	70	20	30	50	70	
85 mph	—	350S162	16	54	54	54	54	43	43	43	43	43	54	54	54	
			24	68	68	68	68	68	68	68	68	68	68	68	68	
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	68	54	54	54	54	54	54	54	54	54
90 mph	—	350S162	16	54	54	54	54	43	43	43	43	43	54	54	54	
			24	68	68	68	68	68	68	68	68	68	68	68	68	
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	68	54	54	54	54	54	54	54	54	54
100 mph	85 mph	350S162	16	54	54	54	54	43	43	43	43	43	54	54	54	
			24	68	68	68	68	68	68	68	68	68	68	68	68	
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	68	54	54	54	54	54	54	54	54	54
110 mph	90 mph	350S162	16	54	54	54	54	43	43	43	43	43	54	54	54	
			24	68	68	68	68	68	68	68	68	68	68	68	68	
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	68	54	54	54	54	54	54	54	54	54
—	100 mph	350S162	16	54	54	54	54	43	43	43	43	43	54	54	54	
			24	68	68	68	68	68	68	68	68	68	68	68	68	
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	68	54	54	54	54	54	54	54	54	54
—	110 mph	350S162	16	54	54	54	54	43	43	43	43	54	54	54	54	
			24	68	68	68	68	68	68	68	68	68	68	68	97	
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	68	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 = 0.0479kPa, 1 ksi = 1000 psi = 6.895 MPa.

a. Deflection criterion: $L/240$.

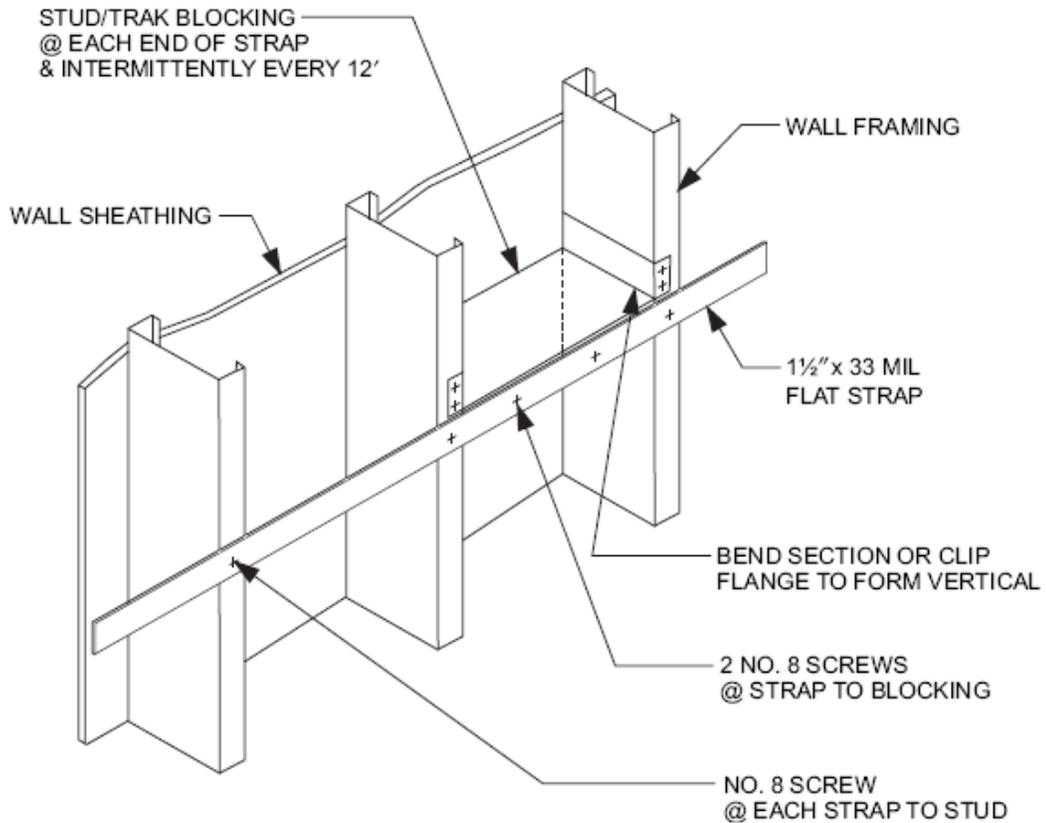
b. Design load assumptions: Top and middle floor dead load is 10 psf. Top floor live load is 30 psf. Middle floor live load is 40 psf. Roof/ceiling dead load is 12 psf. Attic live load is 10 psf.

c. Building width is in the direction of horizontal framing members supported by the wall studs.



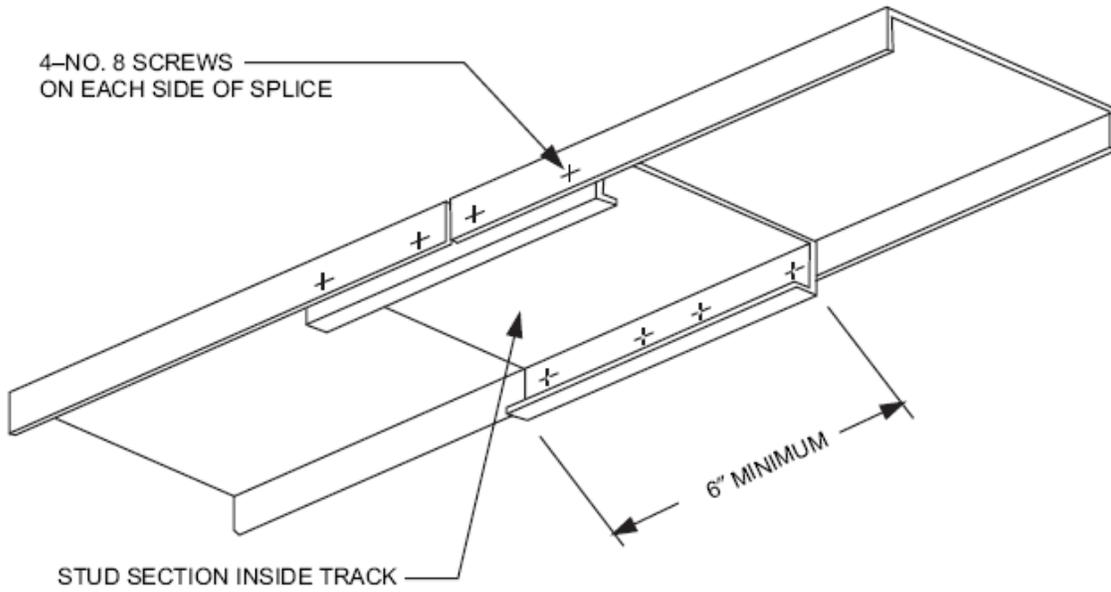
For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm.

FIGURE 603.3.3(1)
STUD BRACING WITH STRAPPING ONLY



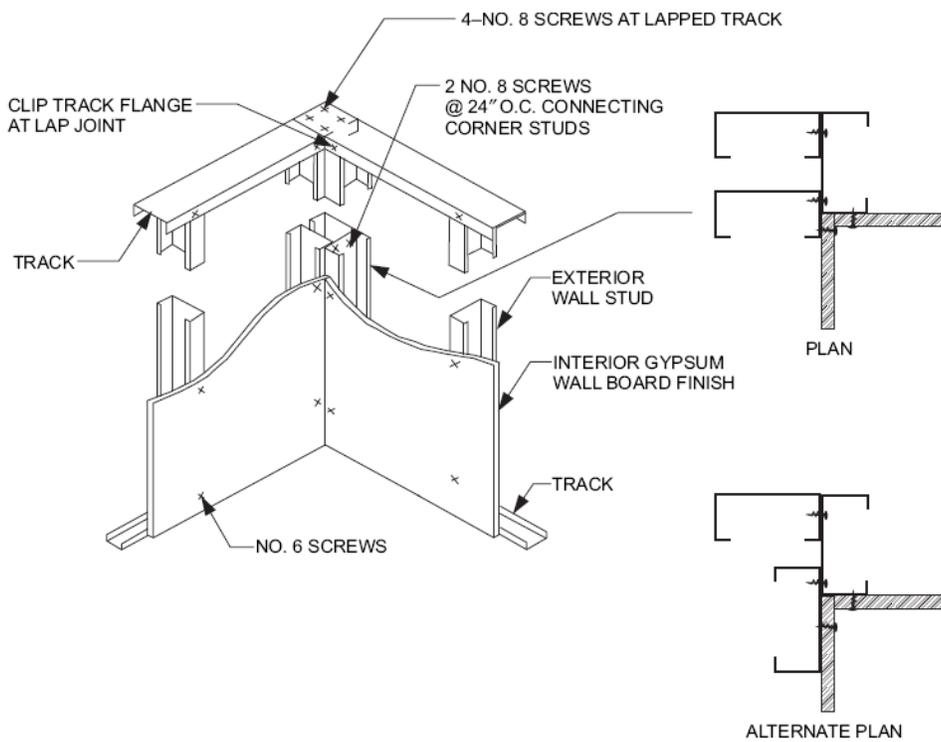
For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm.

FIGURE 603.3.3(2)
STUD BRACING WITH STRAPPING AND SHEATHING MATERIAL



For SI: 1 inch = 25.4 mm.

**FIGURE 603.3.5
TRACK SPLICE**



For SI: 1 inch = 25.4 mm.

**FIGURE 603.4
CORNER FRAMING**

TABLE 603.3.2.1(1)
ALL BUILDING WIDTHS GABLE ENDWALLS 8, 9 OR 10 FEET IN HEIGHT^{a,b,c}
33 ksi STEEL

WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (Mils)		
Exp. B	Exp. C			8-foot studs	9-foot studs	10-foot studs
85 mph	—	350S162	16	33	33	33
			24	33	33	33
		550S162	16	33	33	33
			24	33	33	33
90 mph	—	350S162	16	33	33	33
			24	33	33	33
		550S162	16	33	33	33
			24	33	33	33
100 mph	85 mph	350S162	16	33	33	33
			24	33	33	43
		550S162	16	33	33	33
			24	33	33	33
110 mph	90 mph	350S162	16	33	33	33
			24	33	33	43
		550S162	16	33	33	33
			24	33	33	33
—	100 mph	350S162	16	33	33	43
			24	43	43	54
		550S162	16	33	33	33
			24	33	33	33
—	110 mph	350S162	16	33	43	43
			24	43	54	54
		550S162	16	33	33	33
			24	33	33	43

For SI: 1 inch = 25.4, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479kPa, 1 ksi = 6.895 MPa.

a. Deflection criterion $L/240$.

b. Design load assumptions: Ground snow load is 70 psf. Roof and 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.

TABLE 603.3.2.1(2)
ALL BUILDING WIDTHS GABLE ENDWALLS 8, 9 OR 10 FEET IN HEIGHT^{a,b,c}
50 ksi STEEL

WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (Mils)		
Exp. B	Exp. C			8-foot studs	9-foot studs	10-foot studs
85 mph	—	350S162	16	33	33	33
			24	33	33	33
		550S162	16	33	33	33
			24	33	33	33
90 mph	—	350S162	16	33	33	33
			24	33	33	33
		550S162	16	33	33	33
			24	33	33	33
100 mph	85 mph	350S162	16	33	33	33
			24	33	33	33
		550S162	16	33	33	33
			24	33	33	33
110 mph	90 mph	350S162	16	33	33	33
			24	33	33	43
		550S162	16	33	33	33
			24	33	33	33
—	100 mph	350S162	16	33	33	33
			24	33	33	43
		550S162	16	33	33	33
			24	33	33	33
—	110 mph	350S162	16	33	33	33
			24	33	43	54
		550S162	16	33	33	33
			24	33	33	33

For SI: 1 inch = 25.4, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479kPa, 1 ksi = 6.895 MPa.

a. Deflection criterion $L/240$.

b. Design load assumptions: Ground snow load is 70 psf. Roof and 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.

TABLE 603.3.2.1(3)
ALL BUILDING WIDTHS GABLE ENDWALLS OVER 10 FEET IN HEIGHT^{a,b,c}
33 ksi STEEL

WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (Mils)					
Exp. B	Exp. C			Stud Height, h (feet)					
				10 < h ≤ 12	12 < h ≤ 14	14 < h ≤ 16	16 < h ≤ 18	18 < h ≤ 20	20 < h ≤ 22
85 mph	—	350S162	16	33	43	54	97	—	—
			24	43	54	97	—	—	—
		550S162	16	33	33	33	43	43	54
			24	33	33	43	54	68	97
90 mph	—	350S162	16	33	43	68	97	—	—
			24	43	68	97	—	—	—
		550S162	16	33	33	33	43	54	54
			24	33	33	43	54	68	97
100 mph	85 mph	350S162	16	43	54	97	—	—	—
			24	54	97	—	—	—	—
		550S162	16	33	33	43	54	54	68
			24	33	43	54	68	97	97
110 mph	90 mph	350S162	16	43	68	—	—	—	—
			24	68	—	—	—	—	—
		550S162	16	33	43	43	54	68	97
			24	43	54	68	97	97	—
—	100 mph	350S162	16	54	97	—	—	—	—
			24	97	—	—	—	—	—
		550S162	16	33	43	54	68	97	—
			24	43	68	97	97	—	—
—	110 mph	350S162	16	68	97	—	—	—	—
			24	97	—	—	—	—	—
		550S162	16	43	54	68	97	97	—
			24	54	68	97	—	—	—

For SI: 1 inch = 25.4, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479kPa, 1 ksi = 6.895 MPa.

a. Deflection criterion $L/240$.

b. Design load assumptions: Ground snow load is 70 psf. Roof and 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.

TABLE 603.3.2.1(4)
ALL BUILDING WIDTHS GABLE ENDWALLS OVER 10 FEET IN HEIGHT^{a,b,c}
50 ksi STEEL

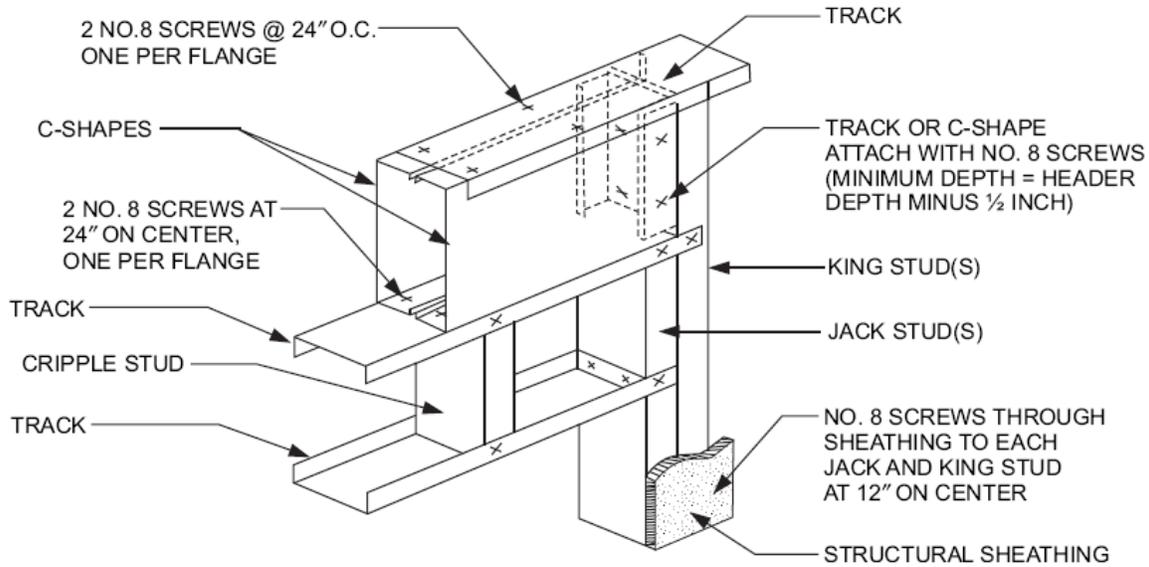
WIND SPEED		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (Mils)					
Exp. B	Exp. C			Stud Height, h (feet)					
				10 < h ≤ 12	12 < h ≤ 14	14 < h ≤ 16	16 < h ≤ 18	18 < h ≤ 20	20 < h ≤ 22
85 mph	—	350S162	16	33	43	54	97	—	—
			24	33	54	97	—	—	—
		550S162	16	33	33	33	33	43	54
			24	33	33	33	43	54	97
90 mph	—	350S162	16	33	43	68	97	—	—
			24	43	68	97	—	—	—
		550S162	16	33	33	33	33	43	54
			24	33	33	43	43	68	97
100 mph	85 mph	350S162	16	33	54	97	—	—	—
			24	54	97	—	—	—	—
		550S162	16	33	33	33	43	54	68
			24	33	33	43	54	97	97
110 mph	90 mph	350S162	16	43	68	—	—	—	—
			24	68	—	—	—	—	—
		550S162	16	33	33	43	43	68	97
			24	33	43	54	68	97	—
—	100 mph	350S162	16	54	97	—	—	—	—
			24	97	—	—	—	—	—
		550S162	16	33	33	43	54	97	—
			24	43	54	54	97	—	—
—	110 mph	350S162	16	54	97	—	—	—	—
			24	97	—	—	—	—	—
		550S162	16	33	43	54	68	97	—
			24	43	54	68	97	—	—

For SI: 1 inch = 25.4, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479kPa, 1 ksi = 6.895 MPa.

a. Deflection criterion $L/240$.

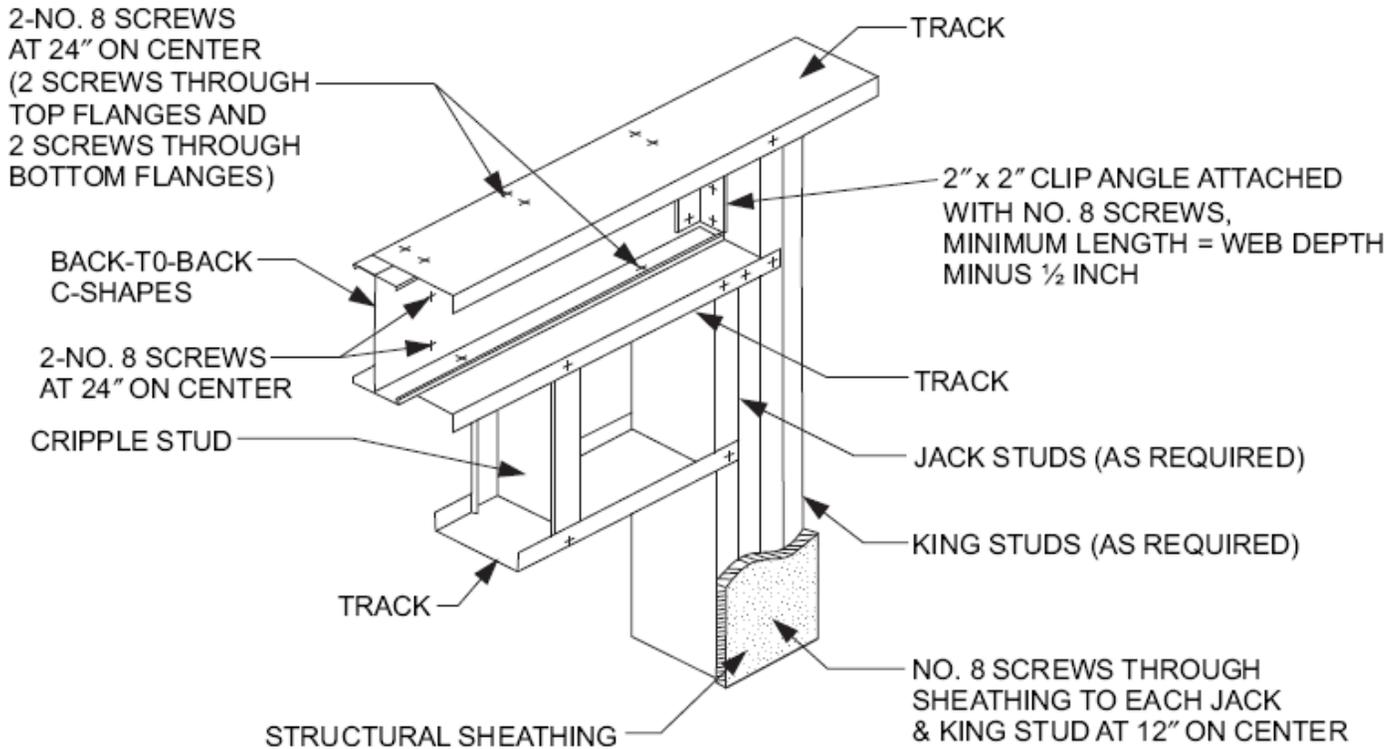
b. Design load assumptions: Ground snow load is 70 psf. Roof and ceiling dead load is 12 psf. Floor dead load is 10 psf. Floor live load is 40 psf. Attic dead load is 10 psf.

c. Building width is in the direction of horizontal framing members supported by the wall studs.



For SI: 1 inch = 25.4 mm.

**FIGURE 603.6(1)
BOX BEAM HEADER**



For SI: 1 inch = 25.4 mm.

**FIGURE 603.6(2)
BACK-TO-BACK HEADER**

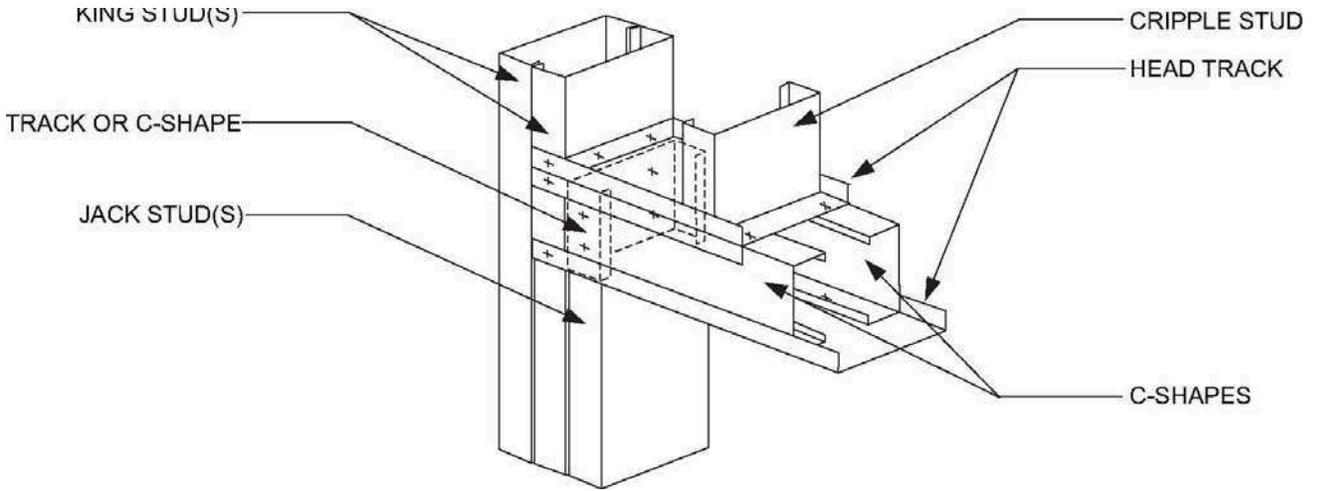
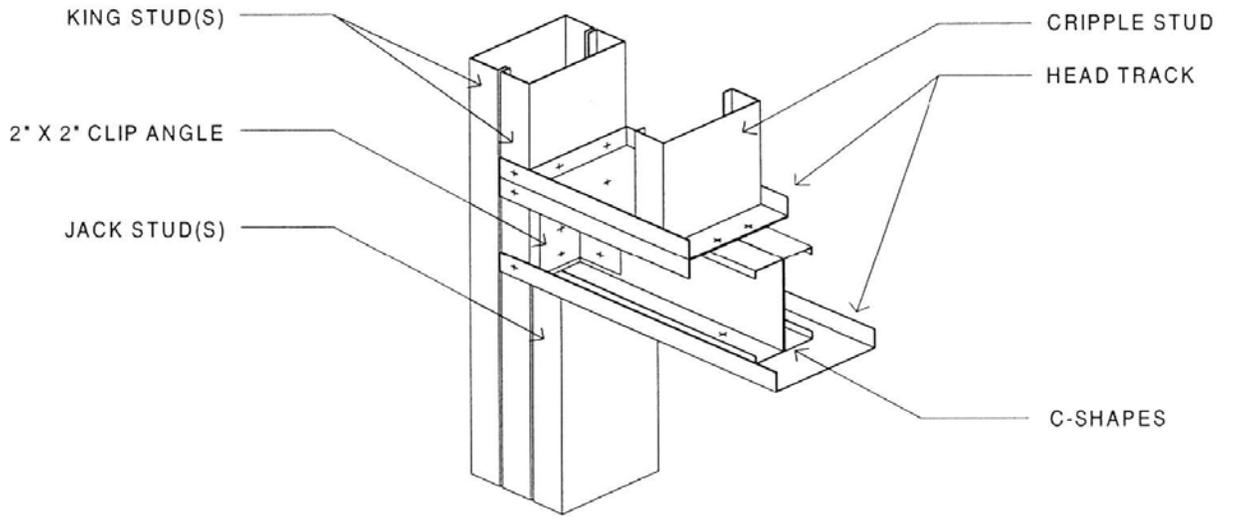


FIGURE 603.6.1(1)
BOX BEAM HEADER IN GABLE ENDWALL



For SI: 1 inch = 25.4 mm.

FIGURE 603.6.1(2)
BACK-TO-BACK HEADER IN GABLE ENDWALL

TABLE 603.6(1)
BOX-BEAM HEADER SPANS
Headers Supporting Roof and Ceiling Only (33 ksi steel)^{a, b}

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	5'-0"	4'-6"	4'-1"	3'-8"	3'-4"	4'-6"	4'-1"	3'-8"	3'-3"	3'-0"
2-350S162-68	5'-7"	5'-1"	4'-7"	4'-3"	3'-10"	5'-1"	4'-7"	4'-2"	3'-10"	3'-5"
2-350S162-97	7'-1"	6'-6"	6'-1"	5'-8"	5'-3"	6'-7"	6'-1"	5'-7"	5'-3"	4'-11"
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	7'-0"	6'-4"	5'-9"	5'-4"	4'-10"	6'-5"	5'-9"	5'-3"	4'-10"	4'-5"
2-550S162-68	8'-0"	7'-4"	6'-9"	6'-3"	5'-10"	7'-5"	6'-9"	6'-3"	5'-9"	5'-4"
2-550S162-97	9'-11"	9'-2"	8'-6"	8'-0"	7'-6"	9'-3"	8'-6"	8'-0"	7'-5"	7'-0"
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	8'-10"	8'-0"	7'-4"	6'-9"	6'-2"	8'-1"	7'-4"	6'-8"	6'-1"	5'-7"
2-800S162-68	10'-5"	9'-7"	8'-10"	8'-2"	7'-7"	9'-8"	8'-10"	8'-1"	7'-6"	7'-0"
2-800S162-97	13'-1"	12'-1"	11'-3"	10'-7"	10'-0"	12'-2"	11'-4"	10'-6"	10'-0"	9'-4"
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	10'-0"	9'-1"	8'-3"	7'-7"	7'-0"	9'-2"	8'-4"	7'-7"	6'-11"	6'-4"
2-1000S162-68	11'-11"	10'-11"	10'-1"	9'-4"	8'-8"	11'-0"	10'-1"	9'-3"	8'-7"	8'-0"
2-1000S162-97	15'-3"	14'-3"	13'-5"	12'-6"	11'-10"	14'-4"	13'-5"	12'-6"	11'-9"	11'-0"
2-1200S162-54	11'-1"	10'-0"	9'-2"	8'-5"	7'-9"	10'-1"	9'-2"	8'-4"	7'-7"	7'-0"
2-1200S162-68	13'-3"	12'-1"	11'-2"	10'-4"	9'-7"	12'-3"	11'-2"	10'-3"	9'-6"	8'-10"
2-1200S162-97	16'-8"	15'-7"	14'-8"	13'-11"	13'-3"	15'-8"	14'-8"	13'-11"	13'-2"	12'-6"

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kPa, 1 pound per square inch = 6.895kPa.

a. Deflection criterion: $L/360$ 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.

TABLE 603.6(2)
BOX-BEAM HEADER SPANS
Headers Supporting Roof and Ceiling Only (50 ksi steel)^{a, b}

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	4'-4"	3'-11"	3'-6"	3'-2"	2'-10"	3'-11"	3'-6"	3'-1"	2'-9"	2'-5"
2-350S162-43	5'-6"	5'-0"	4'-7"	4'-2"	3'-10"	5'-0"	4'-7"	4'-2"	3'-10"	3'-6"
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"
2-350S162-97	7'-3"	6'-11"	6'-8"	6'-5"	6'-3"	7'-0"	6'-8"	6'-5"	6'-3"	6'-0"
2-550S162-33	6'-2"	5'-6"	5'-0"	4'-7"	4'-2"	5'-7"	5'-0"	4'-6"	4'-1"	3'-8"
2-550S162-43	7'-9"	7'-2"	6'-7"	6'-1"	5'-8"	7'-3"	6'-7"	6'-1"	5'-7"	5'-2"
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"
2-550S162-97	10'-5"	10'-0"	9'-7"	9'-3"	9'-0"	10'-0"	9'-7"	9'-3"	8'-11"	8'-8"
2-800S162-33	4'-5"	3'-11"	3'-5"	3'-1"	2'-10"	3'-11"	3'-6"	3'-1"	2'-9"	2'-6"
2-800S162-43	9'-1"	8'-5"	7'-8"	6'-11"	6'-3"	8'-6"	7'-8"	6'-10"	6'-2"	5'-8"
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"
2-800S162-97	14'-2"	13'-6"	13'-0"	12'-7"	12'-2"	13'-8"	13'-1"	12'-7"	12'-2"	11'-9"
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"
2-1000S162-97	17'-1"	16'-4"	15'-8"	14'-11"	14'-3"	16'-5"	15'-9"	14'-10"	14'-1"	13'-6"
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"
2-1200S162-97	19'-11"	18'-7"	17'-6"	16'-8"	15'-10"	18'-9"	17'-7"	16'-7"	15'-9"	15'-0"

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kPa, 1 pound per square inch = 6.895kPa.

a. Deflection criterion: $L/360$ 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.

TABLE 603.6(3)
BOX-BEAM HEADER SPANS
Headers Supporting Roof and Ceiling Only (33 ksi steel)^{a, b}

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	3'-1"	2'-8"	2'-3"	—	—	2'-1"	—	—	—	—
2-350S162-68	3'-7"	3'-2"	2'-8"	2'-3"	—	2'-6"	—	—	—	—
2-350S162-97	5'-1"	4'-7"	4'-3"	3'-11"	3'-7"	4'-1"	3'-8"	3'-4"	3'-0"	2'-8"
2-550S162-33	2'-2"	—	—	—	—	—	—	—	—	—
2-550S162-43	3'-8"	3'-1"	2'-6"	—	—	2'-3"	—	—	—	—
2-550S162-54	4'-7"	4'-0"	3'-6"	3'-0"	2'-6"	3'-3"	2'-8"	2'-1"	—	—
2-550S162-68	5'-6"	4'-11"	4'-5"	3'-11"	3'-6"	4'-3"	3'-8"	3'-1"	2'-7"	2'-1"
2-550S162-97	7'-3"	6'-7"	6'-1"	5'-8"	5'-3"	5'-11"	5'-4"	4'-11"	4'-6"	4'-1"
2-800S162-33	2'-7"	—	—	—	—	—	—	—	—	—
2-800S162-43	4'-6"	3'-9"	3'-1"	2'-5"	—	2'-10"	—	—	—	—
2-800S162-54	5'-10"	5'-1"	4'-6"	3'-11"	3'-4"	4'-3"	3'-6"	2'-9"	—	—
2-800S162-68	7'-2"	6'-6"	5'-10"	5'-3"	4'-8"	5'-7"	4'-10"	4'-2"	3'-7"	2'-11"
2-800S162-97	9'-7"	8'-9"	8'-2"	7'-7"	7'-0"	7'-11"	7'-2"	6'-7"	6'-0"	5'-7"
2-1000S162-43	4'-8"	4'-1"	3'-6"	2'-9"	—	3'-3"	2'-2"	—	—	—
2-1000S162-54	6'-7"	5'-10"	5'-1"	4'-5"	3'-9"	4'-10"	4'-0"	3'-2"	2'-3"	—
2-1000S162-68	8'-3"	7'-5"	6'-8"	6'-0"	5'-5"	6'-5"	5'-7"	4'-9"	4'-1"	3'-5"
2-1000S162-97	11'-4"	10'-5"	9'-8"	9'-0"	8'-5"	9'-5"	8'-6"	7'-10"	7'-2"	6'-7"
2-1200S162-54	7'-3"	6'-5"	5'-7"	4'-10"	4'-2"	5'-4"	4'-4"	3'-5"	2'-5"	—
2-1200S162-68	9'-2"	8'-2"	7'-5"	6'-8"	6'-0"	7'-1"	6'-2"	5'-4"	4'-6"	3'-9"
2-1200S162-97	12'-10"	11'-9"	10'-11"	10'-2"	9'-6"	10'-7"	9'-8"	8'-10"	8'-2"	7'-6"

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kPa, 1 pound per square inch = 6.895kPa.

a. Deflection criterion: $L/360$ 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.

TABLE 603.6(4)
BOX-BEAM HEADER SPANS
Headers Supporting Roof and Ceiling Only (50 ksi steel)^{a, b}

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'-7"	2'-2"	—	—	—	—	—	—	—	—
2-350S162-43	3'-8"	3'-3"	2'-10"	2'-6"	2'-1"	2'-8"	2'-3"	—	—	—
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"
2-350S162-97	6'-2"	5'-11"	5'-8"	5'-6"	5'-4"	5'-8"	5'-5"	5'-3"	4'-11"	4'-7"
2-550S162-33	3'-11"	3'-4"	2'-10"	2'-4"	—	2'-7"	—	—	—	—
2-550S162-43	5'-4"	4'-10"	4'-4"	3'-10"	3'-5"	4'-2"	3'-7"	3'-1"	2'-7"	2'-1"
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"
2-550S162-97	8'-11"	8'-6"	8'-2"	7'-11"	7'-8"	8'-1"	7'-9"	7'-6"	7'-1"	6'-7"
2-800S162-33	2'-8"	2'-4"	2'-1"	1'-11"	1'-9"	2'-0"	1'-9"	—	—	—
2-800S162-43	5'-10"	5'-2"	4'-7"	4'-2"	3'-10"	4'-5"	3'-11"	3'-6"	3'-0"	2'-6"
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"
2-800S162-97	12'-1"	11'-7"	11'-2"	10'-8"	10'-2"	11'-0"	10'-4"	9'-9"	9'-2"	8'-7"
2-1000S162-43	4'-8"	4'-1"	3'-8"	3'-4"	3'-0"	3'-6"	3'-1"	2'-9"	2'-6"	2'-3"
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"
2-1000S162-97	13'-9"	12'-11"	12'-2"	11'-7"	11'-1"	11'-11"	11'-3"	10'-7"	9'-11"	9'-4"
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"
2-1200S162-97	15'-4"	14'-5"	13'-7"	12'-11"	12'-4"	13'-4"	12'-6"	11'-10"	11'-1"	10'-5"

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kPa, 1 pound per square inch = 6.895kPa.

a. Deflection criterion: $L/360$ 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.

TABLE 603.6(5)
BOX-BEAM HEADER SPANS
Headers Supporting One Floor, Roof and Ceiling (33 ksi steel)^{a, b}

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	2'-11"	2'-5"	—	—	—	2'-10"	2'-4"	—	—	—
2-350S162-68	3'-8"	3'-2"	2'-9"	2'-4"	—	3'-7"	3'-1"	2'-8"	2'-3"	—
2-350S162-97	4'-11"	4'-5"	4'-2"	3'-8"	3'-5"	4'-10"	4'-5"	4'-0"	3'-8"	3'-4"
2-550S162-33	—	—	—	—	—	—	—	—	—	—
2-550S162-43	3'-5"	2'-9"	2'-1"	—	—	3'-3"	2'-7"	—	—	—
2-550S162-54	4'-4"	3'-9"	3'-2"	2'-7"	2'-1"	4'-3"	3'-7"	3'-1"	2'-6"	—
2-550S162-68	5'-3"	4'-8"	4'-1"	3'-7"	3'-2"	5'-2"	4'-7"	4'-0"	3'-6"	3'-1"
2-550S162-97	7'-0"	6'-5"	5'-10"	5'-5"	5'-0"	6'-11"	6'-4"	5'-9"	5'-4"	4'-11"
2-800S162-33	2'-1"	—	—	—	—	—	—	—	—	—
2-800S162-43	4'-2"	3'-4"	2'-7"	—	—	4'-0"	3'-3"	2'-5"	—	—
2-800S162-54	5'-6"	4'-9"	4'-1"	3'-5"	2'-9"	5'-5"	4'-8"	3'-11"	3'-3"	2'-8"
2-800S162-68	6'-11"	6'-2"	5'-5"	4'-10"	4'-3"	6'-9"	6'-0"	5'-4"	4'-8"	4'-1"
2-800S162-97	9'-4"	8'-6"	7'-10"	7'-3"	6'-8"	9'-2"	8'-4"	7'-8"	7'-1"	6'-7"
2-1000S162-43	4'-4"	3'-9"	2'-11"	—	—	4'-3"	3'-8"	2'-9"	—	—
2-1000S162-54	6'-3"	5'-5"	4'-7"	3'-11"	3'-2"	6'-1"	5'-3"	4'-6"	3'-9"	3'-0"
2-1000S162-68	7'-11"	7'-0"	6'-3"	5'-6"	4'-10"	7'-9"	6'-10"	6'-1"	5'-4"	4'-9"
2-1000S162-97	11'-0"	10'-1"	9'-3"	8'-7"	8'-0"	10'-11"	9'-11"	9'-2"	8'-5"	7'-10"
2-1200S162-54	6'-11"	5'-11"	5'-1"	4'-3"	3'-5"	6'-9"	5'-9"	4'-11"	4'-1"	3'-3"
2-1200S162-68	8'-9"	7'-9"	6'-11"	6'-1"	5'-4"	8'-7"	7'-7"	6'-9"	5'-11"	5'-3"
2-1200S162-97	12'-4"	11'-5"	10'-6"	9'-8"	9'-0"	12'-3"	11'-3"	10'-4"	9'-6"	8'-10"

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kPa, 1 pound per square inch = 6.895kPa.

a. Deflection criterion: $L/360$ 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.

TABLE 603.6(6)
BOX-BEAM HEADER SPANS
Headers Supporting One Floor, Roof and Ceiling (50 ksi steel)^{a, b}

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'-4"	—	—	—	—	2'-3"	—	—	—	—
2-350S162-43	3'-4"	2'-11"	2'-6"	2'-1"	—	3'-3"	2'-10"	2'-5"	2'-0"	—
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"
2-350S162-97	5'-6"	5'-3"	5'-1"	4'-11"	2'-9"	5'-5"	5'-2"	5'-0"	4'-10"	4'-8"
2-550S162-33	3'-6"	2'-11"	2'-4"	—	—	3'-5"	2'-10"	2'-3"	—	—
2-550S162-43	5'-0"	4'-5"	3'-11"	3'-5"	3'-0"	4'-11"	4'-4"	3'-10"	3'-4"	2'-11"
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"
2-550S162-97	7'-11"	7'-7"	7'-3"	7'-0"	6'-10"	7'-9"	7'-5"	7'-2"	6'-11"	6'-9"
2-800S162-33	2'-5"	2'-2"	1'-11"	1'-9"	—	2'-5"	2'-1"	1'-10"	1'-8"	—
2-800S162-43	5'-5"	4'-9"	4'-3"	3'-9"	3'-5"	5'-3"	4'-8"	4'-1"	3'-9"	3'-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"
2-800S162-97	10'-9"	10'-3"	9'-11"	9'-7"	9'-3"	10'-7"	10'-1"	9'-9"	9'-5"	9'-1"
2-1000S162-43	4'-4"	3'-9"	3'-4"	3'-0"	2'-9"	4'-3"	3'-8"	3'-3"	2'-11"	2'-8"
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"
2-1000S162-97	12'-11"	12'-4"	11'-8"	11'-1"	10'-6"	12'-9"	12'-2"	11'-6"	10'-11"	10'-5"
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"
2-1200S162-97	14'-9"	13'-9"	13'-0"	12'-4"	11'-9"	14'-7"	13'-8"	12'-10"	12'-3"	11'-8"

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kPa, 1 pound per square inch = 6.895kPa.

a. Deflection criterion: $L/360$ 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 live load is 10 psf.

c. Building width is in the direction of horizontal framing members supported by the header.

TABLE 603.6(7)
BOX-BEAM HEADER SPANS
Headers Supporting One Floor, Roof and Ceiling (33 ksi steel)^{a, b}

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	—	—	—	—	—	—	—	—	—	—
2-350S162-68	2'-8"	2'-3"	—	—	—	—	—	—	—	—
2-350S162-97	4'-0"	3'-7"	3'-3"	2'-11"	2'-7"	3'-4"	2'-11"	2'-6"	2'-2"	—
2-550S162-33	—	—	—	—	—	—	—	—	—	—
2-550S162-43	2'-0"	—	—	—	—	—	—	—	—	—
2-550S162-54	3'-1"	2'-6"	—	—	—	—	—	—	—	—
2-550S162-68	4'-1"	3'-6"	2'-11"	2'-5"	—	3'-1"	2'-5"	—	—	—
2-550S162-97	5'-10"	5'-3"	4'-10"	4'-5"	4'-0"	4'-11"	4'-5"	3'-11"	3'-6"	3'-2"
2-800S162-33	—	—	—	—	—	—	—	—	—	—
2-800S162-43	2'-6"	—	—	—	—	—	—	—	—	—
2-800S162-54	4'-0"	3'-3"	2'-6"	—	—	2'-8"	—	—	—	—
2-800S162-68	5'-5"	4'-8"	4'-0"	3'-4"	2'-8"	4'-2"	3'-4"	2'-6"	—	—
2-800S162-97	7'-9"	7'-1"	6'-6"	5'-11"	5'-5"	6'-7"	5'-11"	5'-4"	4'-10"	4'-4"
2-1000S162-43	2'-10"	—	—	—	—	—	—	—	—	—
2-1000S162-54	4'-7"	3'-8"	2'-9"	—	—	3'-0"	—	—	—	—
2-1000S162-68	6'-2"	5'-4"	4'-7"	3'-10"	3'-1"	4'-9"	3'-10"	2'-11"	—	—
2-1000S162-97	9'-3"	8'-5"	7'-8"	7'-1"	6'-6"	7'-10"	7'-1"	6'-5"	5'-9"	5'-2"
2-1200S162-54	5'-0"	4'-0"	3'-1"	—	—	3'-4"	—	—	—	—
2-1200S162-68	6'-10"	5'-11"	5'-0"	4'-3"	3'-5"	5'-3"	4'-3"	3'-2"	—	—
2-1200S162-97	10'-5"	9'-6"	8'-8"	8'-0"	7'-4"	8'-10"	8'-0"	7'-3"	6'-6"	5'-10"

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kPa, 1 pound per square inch = 6.895kPa.

a. Deflection criterion: $L/360$ 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 live load is 10 psf.

c. Building width is in the direction of horizontal framing members supported by the header.

TABLE 603.6(8)
BOX-BEAM HEADER SPANS
Headers Supporting One Floor, Roof and Ceiling (50 ksi steel)^{a, b}

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'-8"	—	—	—	—	—	—	—	—	—
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"
2-350S162-97	5'-1"	4'-10"	4'-8"	4'-6"	4'-5"	4'-10"	4'-7"	4'-4"	4'-0"	3'-8"
2-550S162-33	2'-4"	—	—	—	—	—	—	—	—	—
2-550S162-43	3'-10"	3'-4"	2'-9"	2'-3"	—	2'-11"	2'-3"	—	—	—
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"
2-550S162-97	7'-4"	7'-0"	6'-9"	6'-6"	6'-4"	6'-11"	6'-8"	6'-3"	5'-10"	5'-5"
2-800S162-33	1'-11"	1'-8"	—	—	—	—	—	—	—	—
2-800S162-43	4'-2"	3'-8"	3'-4"	2'-9"	2'-2"	3'-5"	2'-9"	—	—	—
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"
2-800S162-97	9'-11"	9'-6"	9'-2"	8'-10"	8'-3"	9'-5"	8'-10"	8'-2"	7'-7"	7'-0"
2-1000S162-43	3'-4"	2'-11"	2'-7"	2'-5"	2'-2"	2'-8"	2'-5"	2'-2"	—	—
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"
2-1000S162-97	11'-7"	10'-11"	10'-3"	9'-7"	9'-0"	10'-5"	9'-7"	8'-10"	8'-2"	7'-8"
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"
2-1200S162-97	12'-11"	12'-2"	11'-6"	10'-8"	10'-0"	11'-8"	10'-9"	9'-11"	9'-2"	8'-6"

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kPa, 1 pound per square inch = 6.895kPa.

a. Deflection criterion: $L/360$ 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 live load is 10 psf.

c. Building width is in the direction of horizontal framing members supported by the header.

TABLE 603.6(9)
BOX-BEAM HEADER SPANS
Headers Supporting Two Floors, Roof and Ceiling (33 ksi steel)^a

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	—	—	—	—	—	—	—	—	—	—
2-350S162-68	—	—	—	—	—	—	—	—	—	—
2-350S162-97	3'-1"	2'-8"	2'-3"	—	—	3'-1"	2'-7"	2'-2"	—	—
2-550S162-33	—	—	—	—	—	—	—	—	—	—
2-550S162-43	—	—	—	—	—	—	—	—	—	—
2-550S162-54	—	—	—	—	—	—	—	—	—	—
2-550S162-68	2'-9"	—	—	—	—	2'-8"	—	—	—	—
2-550S162-97	4'-8"	4'-1"	3'-7"	3'-2"	2'-9"	4'-7"	4'-0"	3'-6"	3'-1"	2'-8"
2-800S162-33	—	—	—	—	—	—	—	—	—	—
2-800S162-43	—	—	—	—	—	—	—	—	—	—
2-800S162-54	2'-1"	—	—	—	—	—	—	—	—	—
2-800S162-68	3'-8"	2'-9"	—	—	—	3'-7"	2'-8"	—	—	—
2-800S162-97	6'-3"	5'-6"	4'-11"	4'-4"	3'-9"	6'-2"	5'-5"	4'-10"	4'-3"	3'-9"
2-1000S162-43	—	—	—	—	—	—	—	—	—	—
2-1000S162-54	2'-5"	—	—	—	—	2'-3"	—	—	—	—
2-1000S162-68	4'-3"	3'-2"	2'-0"	—	—	4'-2"	3'-1"	—	—	—
2-1000S162-97	7'-5"	6'-7"	5'-10"	5'-2"	4'-7"	7'-4"	6'-6"	5'-9"	5'-1"	4'-6"
2-1200S162-54	2'-7"	—	—	—	—	2'-6"	—	—	—	—
2-1200S162-68	4'-8"	3'-6"	2'-2"	—	—	4'-7"	3'-5"	2'-0"	—	—
2-1200S162-97	8'-5"	7'-5"	6'-7"	5'-10"	5'-2"	8'-3"	7'-4"	6'-6"	5'-9"	5'-1"

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kPa, 1 pound per square inch = 6.895kPa.

a. Deflection criterion: $L/360$ 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.

TABLE 603.6(10)
BOX-BEAM HEADER SPANS
Headers Supporting Two Floors, Roof and Ceiling (50 ksi steel)^{a, b}

MEMBER DESIGNATION	GROUND SNOW LOAD (20 psf)					GROUND SNOW LOAD (30 psf)				
	Building widthc (feet)					Building widthc (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"	—
2-350S162-97	4'-9"	4'-6"	4'-1"	3'-8"	3'-4"	4'-8"	4'-5"	4'-0"	3'-8"	3'-4"
2-550S162-33	—	—	—	—	—	—	—	—	—	—
2-550S162-43	2'-7"	—	—	—	—	2'-6"	—	—	—	—
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"
2-550S162-97	6'-10"	6'-5"	5'-10"	5'-5"	4'-11"	6'-9"	6'-4"	5'-10"	5'-4"	4'-11"
2-800S162-33	—	—	—	—	—	—	—	—	—	—
2-800S162-43	3'-1"	2'-3"	—	—	—	3'-0"	2'-2"	—	—	—
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"
2-800S162-97	9'-2"	8'-4"	7'-8"	7'-0"	6'-6"	9'-1"	8'-3"	7'-7"	7'-0"	6'-5"
2-1000S162-43	2'-6"	2'-2"	—	—	—	2'-6"	2'-2"	—	—	—
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"
2-1000S162-97	10'-0"	9'-1"	8'-3"	7'-8"	7'-0"	9'-10"	9'-0"	8'-3"	7'-7"	7'-0"
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"
2-1200S162-97	11'-2"	10'-1"	9'-3"	8'-6"	7'-10"	11'-0"	10'-0"	9'-2"	9'-2"	7'-9"

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kPa, 1 pound per square inch = 6.895kPa.

a. Deflection criterion: $L/360$ 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.

TABLE 603.6(11)
BOX-BEAM HEADER SPANS
Headers Supporting Two Floors, Roof and Ceiling (33 ksi steel)^{a, b}

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	—	—	—	—	—	—	—	—	—	—
2-350S162-68	—	—	—	—	—	—	—	—	—	—
2-350S162-97	2'-11"	2'-5"	2'-0"	—	—	2'-7"	2'-2"	—	—	—
2-550S162-33	—	—	—	—	—	—	—	—	—	—
2-550S162-43	—	—	—	—	—	—	—	—	—	—
2-550S162-54	—	—	—	—	—	—	—	—	—	—
2-550S162-68	2'-5"	—	—	—	—	—	—	—	—	—
2-550S162-97	4'-4"	3'-10"	3'-4"	2'-10"	2'-5"	4'-0"	3'-6"	3'-1"	2'-7"	2'-2"
2-800S162-33	—	—	—	—	—	—	—	—	—	—
2-800S162-43	—	—	—	—	—	—	—	—	—	—
2-800S162-54	—	—	—	—	—	—	—	—	—	—
2-800S162-68	3'-3"	2'-3"	—	—	—	2'-8"	—	—	—	—
2-800S162-97	5'-11"	5'-2"	4'-6"	4'-0"	3'-5"	5'-6"	4'-10"	4'-3"	3'-8"	3'-2"
2-1000S162-43	—	—	—	—	—	—	—	—	—	—
2-1000S162-54	—	—	—	—	—	—	—	—	—	—
2-1000S162-68	3'-9"	2'-7"	—	—	—	3'-1"	—	—	—	—
2-1000S162-97	7'-0"	6'-2"	5'-5"	4'-9"	4'-2"	6'-6"	5'-9"	5'-1"	4'-5"	3'-10"
2-1200S162-54	—	—	—	—	—	—	—	—	—	—
2-1200S162-68	4'-2"	2'-10"	—	—	—	3'-5"	2'-0"	—	—	—
2-1200S162-97	7'-11"	7'-0"	6'-2"	5'-5"	4'-8"	7'-4"	6'-6"	5'-9"	5'-0"	4'-4"

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kPa, 1 pound per square inch = 6.895kPa.

a. Deflection criterion: $L/360$ 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.

TABLE 603.6(12)
BOX-BEAM HEADER SPANS^{a,b,c}
Headers Supporting Two Floors, Roof and Ceiling (50 ksi steel)^{a,b}

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"	—	—	—
2-350S162-97	4'-6"	4'-3"	3'-10"	3'-6"	3'-2"	4'-3"	4'-0"	3'-7"	3'-3"	3'-0"
2-550S162-33	—	—	—	—	—	—	—	—	—	—
2-550S162-43	2'-3"	—	—	—	—	—	—	—	—	—
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"
2-550S162-97	6'-5"	6'-1"	5'-7"	5'-1"	4'-8"	6'-3"	5'-10"	5'-4"	4'-10"	4'-5"
2-800S162-33	—	—	—	—	—	—	—	—	—	—
2-800S162-43	2'-8"	—	—	—	—	2'-2"	—	—	—	—
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"
2-800S162-97	8'-9"	8'-0"	7'-3"	6'-8"	6'-2"	8'-4"	7'-7"	6'-11"	6'-4"	5'-10"
2-1000S162-43	2'-4"	2'-0"	—	—	—	2'-2"	—	—	—	—
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"
2-1000S162-97	9'-6"	8'-8"	7'-11"	7'-3"	6'-8"	9'-0"	8'-3"	7'-6"	6'-11"	6'-4"
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"
2-1200S162-97	10'-8"	9'-8"	8'-10"	8'-1"	7'-5"	10'-1"	9'-2"	8'-5"	7'-9"	7'-1"

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kPa, 1 pound per square inch = 6.895kPa.

a. Deflection criterion: $L/360$ 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.

TABLE 603.6(13)
BACK-TO-BACK HEADER SPANS
Headers Supporting Roof and Ceiling Only (33 ksi steel)^{a,b}

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'-11"	2'-4"	—	—	—	2'-5"	—	—	—	—
2-350S162-43	4'-8"	3'-10"	3'-5"	3'-1"	2'-9"	3'-11"	3'-5"	3'-0"	2'-8"	2'-4"
2-350S162-54	5'-3"	4'-9"	4'-4"	4'-1"	3'-8"	4'-10"	4'-4"	4'-0"	3'-8"	3'-4"
2-350S162-68	6'-1"	5'-7"	5'-2"	4'-10"	4'-6"	5'-8"	5'-3"	4'-10"	4'-6"	4'-2"
2-350S162-97	7'-3"	6'-10"	6'-5"	6'-0"	5'-8"	6'-11"	6'-5"	6'-0"	5'-8"	5'-4"
2-550S162-33	4'-5"	3'-9"	3'-1"	2'-6"	—	3'-9"	3'-2"	2'-6"	—	—
2-550S162-43	6'-2"	5'-7"	5'-0"	4'-7"	4'-2"	5'-7"	5'-0"	4'-6"	4'-1"	3'-8"
2-550S162-54	7'-5"	6'-9"	6'-3"	5'-9"	5'-4"	6'-10"	6'-3"	5'-9"	5'-4"	4'-11"
2-550S162-68	6'-7"	7'-11"	7'-4"	6'-10"	6'-5"	8'-0"	7'-4"	6'-10"	6'-5"	6'-0"
2-550S162-97	10'-5"	9'-8"	9'-0"	8'-6"	8'-0"	9'-9"	9'-0"	8'-6"	8'-0"	7'-7"
2-800S162-33	4'-5"	3'-11"	3'-5"	3'-1"	2'-4"	3'-11"	3'-6"	3'-0"	2'-3"	—
2-800S162-43	7'-7"	6'-10"	6'-2"	5'-8"	5'-2"	6'-11"	6'-2"	5'-7"	5'-1"	4'-7"
2-800S162-54	9'-3"	8'-7"	7'-11"	7'-4"	6'-10"	8'-8"	7'-11"	7'-4"	6'-9"	6'-3"
2-800S162-68	10'-7"	9'-10"	9'-4"	8'-10"	8'-5"	9'-11"	9'-4"	8'-10"	8'-4"	7'-11"
2-800S162-97	13'-9"	12'-9"	12'-0"	11'-3"	10'-8"	12'-10"	12'-0"	11'-3"	10'-7"	10'-0"
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	10'-5"	9'-9"	9'-0"	8'-4"	7'-9"	9'-10"	9'-0"	8'-4"	7'-9"	7'-2"
2-1000S162-68	12'-1"	11'-3"	10'-8"	10'-1"	9'-7"	11'-4"	10'-8"	10'-1"	9'-7"	9'-1"
2-1000S162-97	15'-3"	14'-3"	13'-5"	12'-9"	12'-2"	14'-4"	13'-5"	12'-8"	12'-1"	11'-6"
2-1200S162-54	11'-6"	10'-9"	10'-0"	9'-0"	8'-2"	10'-10"	10'-0"	9'-0"	8'-1"	7'-4"
2-1200S162-68	13'-4"	12'-6"	11'-9"	11'-2"	10'-8"	12'-7"	11'-10"	11'-2"	10'-7"	10'-1"
2-1200S162-97	16'-8"	15'-7"	14'-8"	13'-11"	13'-3"	15'-8"	14'-8"	13'-11"	13'-2"	12'-7"

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kPa, 1 pound per square inch = 6.895kPa.

a. Deflection criterion: $L/360$ for live loads, $L/240$ for total loads.

b. Design load assumptions:

Second floor dead load is 12 psf.

Attic live load is 10 psf.

c. Building width is in the direction of horizontal framing members supported by header.

TABLE 603.6(14)
BACK-TO-BACK HEADER SPANS
Headers Supporting Roof and Ceiling Only (50 ksi steel)^{a,b}

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	4'-2"	3'-8"	3'-3"	2'-10"	2'-6"	3'-8"	3'-3"	2'-10"	2'-5"	2'-1"
2-350S162-43	5'-5"	5'-0"	4'-6"	4'-2"	3'-10"	5'-0"	4'-7"	4'-2"	3'-10"	3'-6"
2-350S162-54	6'-2"	5'-10"	5'-8"	5'-4"	5'-0"	5'-11"	5'-8"	5'-4"	5'-0"	4'-8"
2-350S162-68	6'-7"	6'-3"	6'-0"	5'-10"	5'-8"	6'-4"	6'-1"	5'-10"	5'-8"	5'-6"
2-350S162-97	7'-3"	6'-11"	6'-8"	6'-5"	6'-3"	7'-0"	6'-8"	6'-5"	6'-3"	6'-0"
2-550S162-33	5'-10"	5'-3"	4'-8"	4'-3"	3'-9"	5'-3"	4'-9"	4'-2"	3'-9"	3'-3"
2-550S162-43	7'-9"	7'-2"	6'-7"	6'-1"	5'-8"	7'-3"	6'-7"	6'-1"	5'-8"	5'-3"
2-550S162-54	8'-9"	8'-5"	8'-1"	7'-9"	7'-5"	8'-6"	8'-1"	7'-9"	7'-5"	6'-11"
2-550S162-68	9'-5"	9'-0"	8'-8"	8'-4"	8'-1"	9'-1"	8'-8"	8'-4"	8'-1"	7'-10"
2-550S162-97	10'-5"	10'-0"	9'-7"	9'-3"	9'-0"	10'-0"	9'-7"	9'-3"	8'-11"	8'-8"
2-800S162-33	4'-5"	3'-11"	3'-5"	3'-1"	2'-10"	3'-11"	3'-6"	3'-1"	2'-9"	2'-6"
2-800S162-43	9'-1"	8'-5"	7'-8"	6'-11"	6'-3"	8'-6"	7'-8"	6'-10"	6'-2"	5'-8"
2-800S162-54	10'-10"	10'-2"	9'-7"	9'-1"	8'-8"	10'-2"	9'-7"	9'-0"	8'-7"	8'-1"
2-800S162-68	12'-8"	11'-10"	11'-2"	10'-7"	10'-1"	11'-11"	11'-2"	10'-7"	10'-0"	9'-7"
2-800S162-97	14'-2"	13'-6"	13'-0"	12'-7"	12'-2"	13'-8"	13'-1"	12'-7"	12'-2"	11'-9"
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'-3"	9'-9"	11'-6"	10'-9"	10'-2"	9'-8"	8'-11"
2-1000S162-68	14'-5"	13'-5"	12'-8"	12'-0"	11'-6"	13'-6"	12'-8"	12'-0"	11'-5"	10'-11"
2-1000S162-97	17'-1"	16'-4"	15'-8"	14'-11"	14'-3"	16'-5"	15'-9"	14'-10"	14'-1"	13'-6"
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"	12'-0"
2-1200S162-97	19'-11"	18'-7"	17'-6"	16'-8"	15'-10"	18'-9"	17'-7"	16'-7"	15'-9"	15'-0"

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kPa, 1 pound per square inch = 6.895kPa.

a. Deflection criterion: $L/360$ for live loads, $L/240$ for total loads.

b. Design load assumptions:

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 header.

TABLE 603.6(15)
BACK-TO-BACK HEADER SPANS
Headers Supporting Roof and Ceiling Only (33 ksi steel)^{a, b}

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'-6"	—	—	—	—	—	—	—	—	—
2-350S162-54	3'-6"	3'-1"	2'-8"	2'-4"	2'-0"	2'-7"	2'-1"	—	—	—
2-350S162-68	4'-4"	3'-11"	3'-7"	3'-3"	2'-11"	3'-5"	3'-0"	2'-8"	2'-4"	2'-1"
2-350S162-97	5'-5"	5'-0"	4'-8"	4'-6"	4'-1"	4'-6"	4'-2"	3'-10"	3'-6"	3'-3"
2-550S162-33	—	—	—	—	—	—	—	—	—	—
2-550S162-43	3'-10"	3'-3"	2'-9"	2'-2"	—	2'-6"	—	—	—	—
2-550S162-54	5'-1"	4'-7"	4'-1"	3'-8"	3'-4"	3'-11"	3'-5"	2'-11"	2'-6"	2'-0"
2-550S162-68	6'-2"	5'-8"	5'-2"	4'-9"	4'-5"	5'-0"	4'-6"	4'-1"	3'-9"	3'-4"
2-550S162-97	7'-9"	7'-2"	6'-8"	6'-3"	5'-11"	6'-6"	6'-0"	5'-7"	5'-2"	4'-10"
2-800S162-33	—	—	—	—	—	—	—	—	—	—
2-800S162-43	4'-10"	4'-1"	3'-6"	2'-11"	2'-3"	3'-3"	2'-5"	—	—	—
2-800S162-54	6'-6"	5'-10"	5'-3"	4'-9"	4'-4"	5'-1"	4'-6"	3'-11"	3'-4"	2'-10"
2-800S162-68	8'-1"	7'-5"	6'-10"	6'-4"	5'-11"	6'-8"	6'-1"	5'-6"	5'-0"	4'-7"
2-800S162-97	10'-3"	9'-7"	8'-11"	8'-5"	7'-11"	8'-8"	8'-0"	7'-6"	7'-0"	6'-7"
2-1000S162-43	4'-8"	4'-1"	3'-8"	3'-4"	2'-8"	3'-6"	2'-10"	—	—	—
2-1000S162-54	7'-5"	6'-8"	6'-1"	5'-6"	5'-0"	5'-10"	5'-1"	4'-6"	3'-11"	3'-4"
2-1000S162-68	9'-4"	8'-7"	7'-11"	7'-4"	6'-10"	7'-8"	7'-0"	6'-4"	5'-10"	5'-4"
2-1000S162-97	11'-9"	11'-0"	10'-5"	9'-11"	9'-5"	10'-3"	9'-7"	8'-11"	8'-4"	7'-10"
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	10'-4"	9'-6"	8'-10"	8'-2"	7'-7"	8'-7"	7'-9"	7'-1"	6'-6"	6'-0"
2-1200S162-97	12'-10"	12'-1"	11'-5"	10'-10"	10'-4"	11'-2"	10'-6"	9'-11"	9'-5"	9'-0"

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kPa, 1 pound per square inch = 6.895kPa.

a. Deflection criterion: $L/360$ for live loads, $L/240$ for total loads.

b. Design load assumptions:

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 header.

TABLE 603.6(16)
BACK-TO-BACK HEADER SPANS
Headers Supporting Roof and Ceiling Only (50 ksi steel)^{a, b}

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'-3"	—	—	—	—	—	—	—	—	—
2-350S162-43	3'-8"	3'-3"	2'-10"	2'-6"	2'-2"	2'-8"	2'-3"	—	—	—
2-350S162-54	4'-9"	4'-4"	4'-0"	3'-8"	3'-8"	3'-10"	3'-5"	3'-1"	2'-9"	2'-5"
2-350S162-68	5'-7"	5'-4"	5'-2"	4'-11"	4'-7"	5'-1"	4'-8"	4'-3"	3'-11"	3'-8"
2-350S162-97	6'-2"	5'-11"	5'-8"	5'-6"	5'-4"	5'-8"	5'-5"	5'-3"	5'-0"	4'-11"
2-550S162-33	3'-6"	2'-10"	2'-3"	—	—	2'-0"	—	—	—	—
2-550S162-43	5'-5"	4'-10"	4'-4"	3'-11"	3'-6"	4'-2"	3'-8"	3'-2"	2'-8"	2'-3"
2-550S162-54	7'-2"	6'-6"	6'-0"	5'-7"	5'-2"	5'-10"	5'-3"	4'-10"	4'-5"	4'-0"
2-550S162-68	8'-0"	7'-8"	7'-3"	6'-11"	6'-6"	7'-2"	6'-7"	6'-1"	5'-8"	5'-4"
2-550S162-97	8'-11"	8'-6"	8'-2"	7'-11"	7'-8"	8'-1"	7'-9"	7'-6"	7'-2"	6'-11"
2-800S162-33	2'-8"	2'-4"	2'-1"	1'-11"	—	2'-0"	—	—	—	—
2-800S162-43	5'-10"	5'-2"	4'-7"	4'-2"	3'-10"	4'-5"	3'-11"	3'-6"	3'-2"	2'-9"
2-800S162-54	8'-4"	7'-8"	7'-1"	6'-7"	6'-1"	6'-10"	6'-3"	5'-8"	5'-2"	4'-9"
2-800S162-68	9'-9"	9'-2"	8'-8"	8'-3"	7'-10"	8'-6"	7'-11"	7'-4"	6'-10"	6'-5"
2-800S162-97	12'-1"	11'-7"	11'-2"	10'-8"	10'-2"	11'-0"	10'-4"	9'-9"	9'-3"	8'-10"
2-1000S162-43	4'-8"	4'-1"	2'-8"	3'-4"	3'-0"	3'-6"	10'-1"	2'-9"	2'-6"	2'-3"
2-1000S162-54	9'-3"	8'-2"	7'-3"	6'-7"	6'-0"	7'-0"	6'-2"	5'-6"	5'-0"	4'-6"
2-1000S162-68	11'-1"	10'-5"	9'-10"	9'-4"	8'-11"	9'-8"	9'-1"	8'-5"	7'-10"	7'-4"
2-1000S162-97	13'-9"	12'-11"	12'-2"	11'-7"	11'-1"	11'-11"	11'-3"	10'-7"	10'-1"	9'-7"
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'-6"	10'-11"	10'-4"	9'-11"	10'-8"	10'-0"	9'-2"	8'-4"	7'-7"
2-1200S162-97	15'-4"	14'-5"	13'-7"	12'-11"	12'-4"	13'-4"	12'-6"	11'-10"	11'-3"	10'-9"

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kPa, 1 pound per square inch = 6.895kPa.

a. Deflection criterion: $L/360$ for live loads, $L/240$ for total loads.

b. Design load assumptions:

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 header.

TABLE 603.6(17)
BACK-TO-BACK HEADER SPANS
Headers Supporting One Floor, Roof and Ceiling (33 ksi steel)^{a, b}

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	3'-3"	2'-9"	2'-5"	2'-0"	—	3'-2"	2'-9"	2'-4"	—	—
2-350S162-68	4'-4"	3'-8"	3'-3"	2'-11"	2'-8"	4'-0"	3'-7"	3'-2"	2'-11"	2'-7"
2-350S162-97	5'-2"	4'-9"	4'-4"	4'-1"	3'-9"	5'-1"	4'-8"	4'-4"	4'-0"	3'-9"
2-550S162-33	—	—	—	—	—	—	—	—	—	—
2-550S162-43	3'-6"	2'-10"	2'-3"	—	—	3'-5"	2'-9"	2'-2"	—	—
2-550S162-54	4'-9"	4'-2"	3'-9"	3'-3"	2'-10"	4'-8"	4'-1"	3'-8"	3'-2"	2'-9"
2-550S162-68	5'-10"	5'-3"	4'-10"	4'-5"	4'-1"	5'-9"	5'-3"	4'-9"	4'-4"	4'-0"
2-550S162-97	7'-4"	6'-9"	6'-4"	5'-11"	5'-6"	7'-3"	6'-9"	6'-3"	5'-10"	5'-5"
2-800S162-33	—	—	—	—	—	—	—	—	—	—
2-800S162-43	4'-4"	3'-8"	2'-11"	2'-3"	—	4'-3"	3'-6"	2'-10"	2'-1"	—
2-800S162-54	6'-1"	5'-5"	4'-10"	4'-4"	3'-10"	6'-0"	5'-4"	4'-9"	4'-3"	3'-9"
2-800S162-68	7'-8"	7'-0"	6'-5"	5'-11"	5'-5"	7'-7"	6'-11"	6'-4"	5'-10"	5'-4"
2-800S162-97	9'-10"	9'-1"	8'-5"	7'-11"	7'-5"	9'-8"	8'-11"	8'-4"	7'-10"	7'-4"
2-1000S162-43	4'-4"	3'-9"	3'-4"	2'-8"	—	4'-3"	3'-8"	3'-3"	2'-6"	—
2-1000S162-54	6'-11"	6'-2"	5'-6"	5'-0"	4'-5"	6'-10"	6'-1"	5'-5"	4'-10"	4'-4"
2-1000S162-68	8'-10"	8'-1"	7'-5"	6'-10"	6'-4"	8'-8"	7'-11"	7'-3"	6'-8"	6'-2"
2-1000S162-97	11'-3"	10'-7"	9'-11"	9'-5"	8'-10"	11'-2"	10'-5"	9'-10"	9'-3"	8'-9"
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	9'-10"	9'-0"	8'-3"	7'-7"	7'-0"	9'-8"	8'-10"	8'-11"	7'-6"	6'-11"
2-1200S162-97	12'-4"	11'-7"	10'-11"	10'-4"	9'-10"	12'-3"	11'-5"	10'-9"	10'-3"	9'-9"

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kPa, 1 pound per square inch = 6.895kPa.

a. Deflection criterion: $L/360$ 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 live load is 10 psf.

c. Building width is in the direction of horizontal framing members supported by the header.

TABLE 603.6(18)
BACK-TO-BACK HEADER SPANS
Headers Supporting One Floor, Roof and Ceiling (50 ksi steel)^{a, b}

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	3'-4"	2'-11"	2'-6"	2'-2"	—	3'-3"	2'-10"	2'-5"	2'-1"	—
2-350S162-54	4'-6"	4'-1"	3'-8"	3'-4"	3'-0"	4'-5"	4'-0"	3'-7"	3'-3"	2'-11"
2-350S162-68	5'-0"	4'-9"	4'-7"	4'-5"	4'-3"	4'-11"	4'-8"	4'-6"	4'-4"	4'-2"
2-350S162-97	5'-6"	5'-3"	5'-1"	4'-11"	4'-9"	5'-5"	5'-2"	5'-0"	4'-10"	4'-8"
2-550S162-33	3'-1"	2'-5"	—	—	—	3'-0"	2'-3"	—	—	—
2-550S162-43	5'-1"	4'-6"	4'-0"	3'-6"	3'-1"	4'-11"	4'-5"	3'-11"	3'-5"	3'-0"
2-550S162-54	6'-8"	6'-2"	5'-7"	5'-2"	4'-9"	6'-6"	6'-0"	5'-6"	5'-1"	4'-8"
2-550S162-68	7'-2"	6'-10"	6'-7"	6'-4"	6'-1"	7'-0"	6'-9"	6'-6"	6'-3"	6'-0"
2-550S162-97	7'-11"	7'-7"	7'-3"	7'-0"	6'-10"	7'-9"	7'-5"	7'-2"	6'-11"	6'-9"
2-800S162-33	2'-5"	2'-2"	1'-11"	—	—	2'-5"	2'-1"	1'-10"	—	—
2-800S162-43	5'-5"	4'-9"	4'-3"	3'-9"	3'-5"	5'-3"	4'-8"	4'-1"	3'-9"	3'-5"
2-800S162-54	7'-11"	7'-2"	6'-7"	6'-1"	5'-7"	7'-9"	7'-1"	6'-6"	6'-0"	5'-6"
2-800S162-68	9'-5"	8'-9"	8'-3"	7'-9"	7'-4"	9'-3"	8'-8"	8'-2"	7'-8"	7'-3"
2-800S162-97	10'-9"	10'-3"	9'-11"	9'-7"	9'-3"	10'-7"	10'-1"	9'-9"	9'-5"	9'-1"
2-1000S162-43	4'-4"	3'-9"	3'-4"	3'-0"	2'-9"	4'-3"	3'-8"	3'-3"	2'-11"	2'-8"
2-1000S162-54	8'-6"	7'-5"	6'-8"	6'-0"	5'-5"	8'-4"	7'-4"	6'-6"	5'-10"	5'-4"
2-1000S162-68	10'-8"	10'-0"	9'-5"	8'-11"	8'-4"	10'-7"	9'-10"	9'-4"	8'-9"	8'-3"
2-1000S162-97	12'-11"	12'-4"	11'-8"	11'-1"	10'-6"	12'-9"	12'-2"	11'-6"	10'-11"	10'-5"
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'-9"	11'-0"	10'-5"	9'-10"	9'-1"	11'-8"	10'-11"	10'-3"	9'-9"	8'-11"
2-1200S162-97	14'-9"	13'-9"	13'-0"	12'-4"	11'-9"	14'-7"	13'-8"	12'-10"	12'-3"	11'-8"

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kPa, 1 pound per square inch = 6.895kPa.

a. Deflection criterion: $L/360$ 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 live load is 10 psf.

c. Building width is in the direction of horizontal framing members supported by the header.

TABLE 603.6(19)
BACK-TO-BACK HEADER SPANS
Headers Supporting One Floor, Roof and Ceiling (33 ksi steel)^{a, b}

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'-4"	—	—	—	—	—	—	—	—	—
2-350S162-68	3'-3"	2'-10"	2'-6"	2'-2"	—	2'-7"	2'-2"	—	—	—
2-350S162-97	4'-4"	4'-0"	3'-8"	3'-4"	3'-1"	3'-9"	3'-4"	3'-1"	2'-9"	2'-6"
2-550S162-33	—	—	—	—	—	—	—	—	—	—
2-550S162-43	2'-2"	—	—	—	—	—	—	—	—	—
2-550S162-54	3'-8"	3'-2"	2'-8"	2'-3"	—	2'-10"	2'-3"	—	—	—
2-550S162-68	4'-9"	4'-4"	3'-11"	3'-6"	3'-2"	4'-0"	3'-6"	3'-1"	2'-9"	2'-4"
2-550S162-97	6'-3"	5'-9"	5'-4"	5'-0"	4'-8"	5'-6"	5'-0"	4'-7"	4'-3"	3'-11"
2-800S162-33	—	—	—	—	—	—	—	—	—	—
2-800S162-43	2'-11"	2'-0"	—	—	—	—	—	—	—	—
2-800S162-54	4'-9"	4'-2"	3'-7"	3'-1"	2'-7"	3'-9"	3'-1"	2'-5"	—	—
2-800S162-68	6'-4"	5'-9"	5'-3"	4'-9"	4'-4"	5'-4"	4'-9"	4'-3"	3'-10"	3'-4"
2-800S162-97	8'-5"	7'-9"	7'-3"	6'-9"	6'-4"	7'-4"	6'-9"	6'-3"	5'-10"	5'-5"
2-1000S162-43	3'-4"	2'-5"	—	—	—	—	—	—	—	—
2-1000S162-54	5'-6"	4'-10"	4'-2"	3'-7"	3'-0"	4'-4"	3'-7"	2'-11"	2'-2"	—
2-1000S162-68	7'-4"	6'-8"	6'-1"	5'-7"	5'-1"	6'-3"	5'-7"	5'-0"	4'-5"	4'-0"
2-1000S162-97	9'-11"	8'-3"	8'-7"	8'-1"	7'-7"	8'-9"	8'-1"	7'-6"	7'-0"	6'-6"
2-1200S162-54	5'-6"	4'-10"	4'-4"	3'-11"	3'-5"	4'-5"	3'-11"	3'-3"	2'-6"	—
2-1200S162-68	8'-2"	7'-5"	6'-9"	6'-3"	5'-8"	6'-11"	6'-3"	5'-7"	5'-0"	4'-6"
2-1200S162-97	10'-10"	10'-2"	9'-8"	9'-2"	8'-7"	9'-9"	9'-2"	8'-6"	7'-11"	7'-5"

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kPa, 1 pound per square inch = 6.895kPa.

a. Deflection criterion: $L/360$ 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 live load is 10 psf.

c. Building width is in the direction of horizontal framing members supported by the header.

TABLE 603.6(20)
BACK-TO-BACK HEADER SPANS
Headers Supporting One Floor, Roof and Ceiling (50 ksi steel)^{a, b}

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'-6"	2'-0"	—	—	—	—	—	—	—	—
2-350S162-54	3'-8"	3'-3"	2'-11"	2'-7"	2'-3"	3'-0"	2'-7"	2'-2"	—	—
2-350S162-68	4'-7"	4'-5"	4'-1"	3'-9"	3'-6"	4'-2"	3'-9"	3'-5"	3'-1"	2'-10"
2-350S162-97	5'-1"	4'-10"	4'-8"	4'-6"	4'-5"	4'-10"	4'-7"	4'-5"	4'-3"	4'-1"
2-550S162-33	—	—	—	—	—	—	—	—	—	—
2-550S162-43	3'-11"	3'-5"	2'-11"	2'-5"	—	3'-0"	2'-5"	—	—	—
2-550S162-54	5'-7"	5'-0"	4'-7"	4'-2"	3'-9"	4'-8"	4'-2"	3'-8"	3'-3"	2'-11"
2-550S162-68	6'-7"	6'-4"	5'-11"	5'-6"	5'-1"	6'-0"	5'-6"	5'-0"	4'-7"	4'-3"
2-550S162-97	7'-4"	7'-0"	6'-9"	6'-6"	6'-4"	6'-11"	6'-8"	6'-5"	6'-2"	6'-0"
2-800S162-33	1'-11"	—	—	—	—	—	—	—	—	—
2-800S162-43	4'-2"	3'-8"	3'-4"	3'-0"	2'-6"	3'-5"	3'-0"	2'-4"	—	—
2-800S162-54	6'-7"	5'-11"	5'-5"	4'-11"	4'-6"	5'-6"	4'-11"	4'-5"	3'-11"	3'-6"
2-800S162-68	8'-3"	7'-8"	7'-1"	6'-8"	6'-2"	7'-3"	6'-7"	6'-1"	5'-7"	5'-2"
2-800S162-97	9'-11"	9'-6"	9'-2"	8'-10"	8'-7"	9'-5"	9'-0"	8'-7"	8'-2"	7'-9"
2-1000S162-43	3'-4"	2'-11"	2'-7"	2'-5"	2'-2"	2'-8"	2'-5"	2'-2"	1'-11"	—
2-1000S162-54	6'-7"	5'-10"	5'-3"	4'-9"	4'-4"	5'-4"	4'-9"	4'-3"	3'-10"	3'-6"
2-1000S162-68	9'-4"	8'-9"	8'-1"	7'-7"	7'-1"	8'-3"	7'-7"	6'-11"	6'-5"	5'-11"
2-1000S162-97	11'-7"	10'-11"	10'-4"	9'-10"	9'-5"	10'-5"	9'-10"	9'-3"	8'-10"	8'-5"
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	10'-4"	9'-8"	8'-8"	7'-11"	7'-2"	8'-11"	7'-11"	7'-1"	6'-5"	5'-10"
2-1200S162-97	12'-11"	12'-2"	11'-6"	11'-0"	10'-6"	11'-8"	11'-0"	10'-5"	9'-10"	9'-5"

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kPa, 1 pound per square inch = 6.895kPa.

a. Deflection criterion: $L/360$ 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 live load is 10 psf.

c. Building width is in the direction of horizontal framing members supported by the header.

TABLE 603.6(21)
BACK-TO-BACK HEADER SPANS
Headers Supporting Two Floors, Roof and Ceiling (33 ksi steel)^{a, b}

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	—	—	—	—	—	—	—	—	—	—
2-350S162-68	2'-5"	—	—	—	—	2'-4"	—	—	—	—
2-350S162-97	3'-6"	3'-2"	2'-10"	2'-6"	2'-3"	3'-6"	3'-1"	2'-9"	2'-6"	2'-3"
2-550S162-33	—	—	—	—	—	—	—	—	—	—
2-550S162-43	—	—	—	—	—	—	—	—	—	—
2-550S162-54	2'-6"	—	—	—	—	2'-5"	—	—	—	—
2-550S162-68	3'-9"	3'-3"	2'-9"	2'-4"	—	3'-8"	3'-2"	2'-9"	2'-4"	—
2-550S162-97	5'-3"	4'-9"	4'-4"	3'-11"	3'-8"	5'-2"	4'-8"	4'-3"	3'-11"	3'-7"
2-800S162-33	—	—	—	—	—	—	—	—	—	—
2-800S162-43	—	—	—	—	—	—	—	—	—	—
2-800S162-54	3'-5"	2'-8"	—	—	—	3'-4"	2'-7"	—	—	—
2-800S162-68	5'-1"	4'-5"	3'-11"	3'-4"	2'-11"	5'-0"	4'-4"	3'-10"	3'-4"	2'-10"
2-800S162-97	7'-0"	6'-5"	5'-11"	5'-5"	5'-0"	7'-0"	6'-4"	5'-10"	5'-5"	5'-0"
2-1000S162-43	—	—	—	—	—	—	—	—	—	—
2-1000S162-54	3'-11"	3'-1"	2'-3"	—	—	3'-10"	3'-0"	2'-2"	—	—
2-1000S162-68	5'-10"	5'-2"	4'-6"	4'-0"	3'-5"	5'-9"	5'-1"	4'-6"	3'-11"	3'-4"
2-1000S162-97	8'-5"	7'-8"	7'-1"	6'-6"	6'-1"	8'-4"	7'-7"	7'-0"	6'-6"	6'-0"
2-1200S162-54	4'-2"	3'-6"	2'-7"	—	—	4'-1"	3'-5"	2'-6"	—	—
2-1200S162-68	6'-6"	5'-9"	5'-1"	4'-6"	3'-11"	6'-6"	5'-8"	5'-0"	4'-5"	3'-10"
2-1200S162-97	9'-5"	8'-8"	8'-0"	7'-5"	6'-11"	9'-5"	8'-7"	7'-11"	7'-4"	6'-10"

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kPa, 1 pound per square inch = 6.895kPa.

a. Deflection criterion: $L/360$ 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.

TABLE 603.6(22)
BACK-TO-BACK HEADER SPANS
Headers Supporting Two Floors, Roof and Ceiling (50 ksi steel)^{a, b}

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'-9"	2'-3"	—	—	—	2'-8"	2'-3"	—	—	—
2-350S162-68	3'-11"	3'-6"	3'-2"	2'-10"	2'-6"	3'-11"	3'-6"	3'-1"	2'-9"	2'-6"
2-350S162-97	4'-9"	4'-6"	4'-4"	4'-1"	3'-10"	4'-8"	4'-6"	4'-4"	4'-1"	3'-9"
2-550S162-33	—	—	—	—	—	—	—	—	—	—
2-550S162-43	2'-9"	2'-0"	—	—	—	2'-8"	—	—	—	—
2-550S162-54	4'-5"	3'-10"	3'-4"	2'-11"	2'-5"	4'-4"	3'-9"	3'-3"	2'-10"	2'-5"
2-550S162-68	5'-8"	5'-2"	4'-8"	4'-3"	3'-11"	5'-8"	5'-1"	4'-8"	4'-3"	3'-10"
2-550S162-97	6'-10"	6'-6"	6'-3"	6'-0"	5'-7"	6'-9"	6'-5"	6'-3"	5'-11"	5'-6"
2-800S162-33	—	—	—	—	—	—	—	—	—	—
2-800S162-43	3'-2"	2'-7"	—	—	—	3'-1"	2'-6"	—	—	—
2-800S162-54	5'-2"	4'-7"	4'-0"	3'-6"	3'-0"	5'-2"	4'-6"	3'-11"	3'-5"	2'-11"
2-800S162-68	6'-11"	6'-3"	5'-8"	5'-2"	4'-9"	6'-10"	6'-2"	5'-7"	5'-2"	4'-8"
2-800S162-97	9'-3"	8'-8"	8'-3"	7'-9"	7'-4"	9'-2"	8'-8"	8'-2"	7'-9"	7'-4"
2-1000S162-43	2'-6"	2'-2"	2'-0"	—	—	2'-6"	2'-2"	1'-11"	—	—
2-1000S162-54	5'-0"	4'-4"	3'-11"	3'-6"	3'-2"	4'-11"	4'-4"	3'-10"	3'-6"	3'-2"
2-1000S162-68	7'-10"	7'-2"	6'-6"	5'-11"	5'-6"	7'-9"	7'-1"	6'-5"	5'-11"	5'-5"
2-1000S162-97	10'-1"	9'-5"	8'-11"	8'-6"	8'-0"	10'-0"	9'-5"	8'-10"	8'-5"	7'-11"
2-1200S162-54	—	—	—	—	—	—	—	—	—	—
2-1200S162-68	7'-4"	6'-8"	6'-1"	5'-6"	5'-1"	7'-3"	6'-7"	6'-0"	5'-6"	5'-0"
2-1200S162-97	9'-5"	8'-8"	8'-1"	7'-6"	7'-1"	9'-4"	8'-8"	8'-0"	7'-6"	7'-0"

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kPa, 1 pound per square inch = 6.895kPa.

a. Deflection criterion: $L/360$ 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.

TABLE 603.6(23)
BACK-TO-BACK HEADER SPANS
Headers Supporting Two Floors, Roof and ceiling (33 ksi steel)^{a, b}

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	—	—	—	—	—	—	—	—	—	—
2-350S162-68	2'-2"	—	—	—	—	—	—	—	—	—
2-350S162-97	3'-3"	3'-0"	2'-8"	2'-4"	2'-1"	3'-1"	2'-9"	2'-6"	2'-2"	—
2-550S162-33	—	—	—	—	—	—	—	—	—	—
2-550S162-43	—	—	—	—	—	—	—	—	—	—
2-550S162-54	2'-2"	—	—	—	—	—	—	—	—	—
2-550S162-68	3'-6"	3'-0"	2'-6"	2'-1"	—	3'-2"	2'-9"	2'-3"	—	—
2-550S162-97	5'-0"	4'-6"	4'-1"	3'-9"	3'-5"	4'-8"	4'-3"	3'-11"	3'-7"	3'-3"
2-800S162-33	—	—	—	—	—	—	—	—	—	—
2-800S162-43	—	—	—	—	—	—	—	—	—	—
2-800S162-54	3'-0"	2'-3"	—	—	—	2'-7"	—	—	—	—
2-800S162-68	4'-9"	4'-2"	3'-7"	3'-1"	2'-7"	4'-5"	3'-10"	3'-3"	2'-9"	2'-3"
2-800S162-97	6'-9"	6'-1"	5'-7"	5'-2"	4'-9"	6'-4"	5'-10"	5'-4"	4'-11"	4'-7"
2-1000S162-43	—	—	—	—	—	—	—	—	—	—
2-1000S162-54	3'-6"	2'-8"	—	—	—	3'-1"	2'-2"	—	—	—
2-1000S162-68	5'-6"	4'-10"	4'-2"	3'-7"	3'-1"	5'-1"	4'-6"	3'-10"	3'-4"	2'-9"
2-1000S162-97	8'-0"	7'-4"	6'-9"	6'-3"	5'-9"	7'-7"	7'-0"	6'-5"	5'-11"	5'-6"
2-1200S162-54	3'-11"	3'-0"	2'-0"	—	—	3'-5"	2'-6"	—	—	—
2-1200S162-68	6'-2"	5'-5"	4'-9"	4'-1"	3'-6"	5'-9"	5'-0"	4'-4"	3'-9"	3'-2"
2-1200S162-97	9'-1"	8'-4"	7'-8"	7'-1"	6'-7"	8'-8"	7'-11"	7'-4"	6'-9"	6'-3"

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kPa, 1 pound per square inch = 6.895kPa.

a. Deflection criterion: $L/360$ 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.

TABLE 603.6(24)
BACK-TO-BACK HEADER SPANS
Headers Supporting Two Floors, Roof and Ceiling (50 ksi steel)^{a, b}

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'-6"	2'-1"	—	—	—	2'-3"	—	—	—	—
2-350S162-68	3'-9"	3'-4"	2'-11"	2'-7"	2'-4"	3'-6"	3'-1"	2'-9"	2'-5"	2'-2"
2-350S162-97	4'-6"	4'-4"	4'-2"	3'-11"	3'-8"	4'-4"	4'-2"	4'-0"	3'-9"	3'-6"
2-550S162-33	—	—	—	—	—	—	—	—	—	—
2-550S162-43	2'-5"	—	—	—	—	—	—	—	—	—
2-550S162-54	4'-1"	3'-7"	3'-1"	2'-7"	2'-2"	3'-10"	3'-3"	2'-10"	2'-4"	—
2-550S162-68	5'-5"	4'-11"	4'-5"	4'-0"	3'-8"	5'-1"	4'-7"	4'-2"	3'-10"	3'-5"
2-550S162-97	6'-5"	6'-2"	5'-11"	5'-9"	5'-4"	6'-3"	6'-0"	5'-9"	5'-6"	5'-2"
2-800S162-33	—	—	—	—	—	—	—	—	—	—
2-800S162-43	2'-11"	2'-2"	—	—	—	2'-6"	—	—	—	—
2-800S162-54	4'-11"	4'-3"	3'-8"	3'-2"	2'-8"	4'-6"	3'-11"	3'-5"	2'-11"	2'-4"
2-800S162-68	6'-7"	5'-11"	5'-4"	4'-11"	4'-6"	6'-2"	5'-7"	5'-1"	4'-8"	4'-3"
2-800S162-97	8'-9"	8'-5"	7'-11"	7'-6"	7'-0"	8'-5"	8'-1"	7'-9"	7'-3"	6'-10"
2-1000S162-43	2'-4"	2'-1"	—	—	—	2'-2"	1'-11"	—	—	—
2-1000S162-54	4'-8"	4'-1"	3'-8"	3'-3"	3'-0"	4'-4"	3'-10"	3'-5"	3'-1"	2'-9"
2-1000S162-68	7'-6"	6'-9"	6'-2"	5'-8"	5'-2"	7'-1"	6'-5"	5'-10"	5'-4"	4'-11"
2-1000S162-97	9'-9"	9'-2"	8'-7"	8'-2"	7'-8"	9'-5"	8'-10"	8'-5"	7'-11"	7'-5"
2-1200S162-54	—	—	—	—	—	—	—	—	—	—
2-1200S162-68	7'-0"	6'-4"	5'-9"	5'-3"	4'-9"	6'-7"	6'-0"	5'-5"	5'-0"	4'-6"
2-1200S162-97	9'-1"	8'-4"	7'-9"	7'-3"	6'-9"	8'-8"	8'-0"	7'-6"	7'-0"	6'-7"

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kPa, 1 pound per square inch = 6.895kPa.

a. Deflection criterion: $L/360$ 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.

TABLE 603.7(1)
TOTAL NUMBER OF JACK AND KING STUDS REQUIRED AT EACH END OF AN OPENING

SIZE OF OPENING (feet-inches)	24 O.C. STUD SPACING		16 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 603.7(2)
HEADER TO KING STUD CONNECTION REQUIREMENTS^{a, b, c, d}

HEADER SPAN (feet)	BASIC WIND SPEED (mph), EXPOSURE		
	85 B or Seismic Design Categories A, B, C, D ₀ , D ₁ and D ₂	85 C or less than 110 B	Less than 110 C
≤ 4'	4-No. 8 screws	4-No. 8 screws	6-No. 8 screws
> 4' to 8'	4-No. 8 screws	4-No. 8 screws	8-No. 8 screws
> 8' to 12'	4-No. 8 screws	6-No. 8 screws	10-No. 8 screws
> 12'to 16'	4-No. 8 screws	8-No. 8 screws	12-No. 8 screws

For SI: 1 inch = 25.4 mm, 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 no less than 4.

c. For roof slopes of 6:12 or greater, the required number of screws may be reduced by half, but the total number of screws shall be no less than four.

d. Screws can be replaced by an uplift connector which has a capacity of the number of screws multiplied by 164 pounds (e.g., 12-No. 8 screws can be replaced by an uplift connector whose capacity exceeds 12×164 pounds = 1,968 pounds).

TABLE 603.8
HEAD AND SILL TRACK SPAN
F_y = 33 ksi

BASIC WIND SPEED (mph)		ALLOWABLE HEAD AND SILL TRACK SPAN ^{a,b,c} (ft-in.)					
EXPOSURE		TRACK DESIGNATION					
B	C	350T125-33	350T125-43	350T125-54	550T125-33	550T125-43	550T125-54
85	—	5'-0"	5'-7"	6'-2"	5'-10"	6'-8"	7'-0"
90	—	4'-10"	5'-5"	6'-0"	5'-8"	6'-3"	6'-10"
100	85	4'-6"	5'-1"	5'-8"	5'-4"	5'-11"	6'-5"
110	90	4'-2"	4'-9"	5'-4"	5'-1"	5'-7"	6'-1"
120	100	3'-11"	4'-6"	5'-0"	4'-10"	5'-4"	5'-10"
130	110	3'-8"	4'-2"	4'-9"	4'-1"	5'-1"	5'-7"
140	120	3'-7"	4'-1"	4'-7"	3'-6"	4'-11"	5'-5"
150	130	3'-5"	3'-10"	4'-4"	2'-11"	4'-7"	5'-2"
—	140	3'-1"	3'-6"	4'-1"	2'-3"	4'-0"	4'-10"
—	150	2'-9"	3'-4"	3'-10"	2'-0"	3'-7"	4'-7"

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

a. Deflection limit: $L/240$.

b. Head and sill track spans are based on components and cladding wind speeds and 48 inch tributary span.

c. For openings less than 4 feet in height that have both a head track and sill track, the above 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 above spans are permitted to be multiplied by a factor of 1.5.

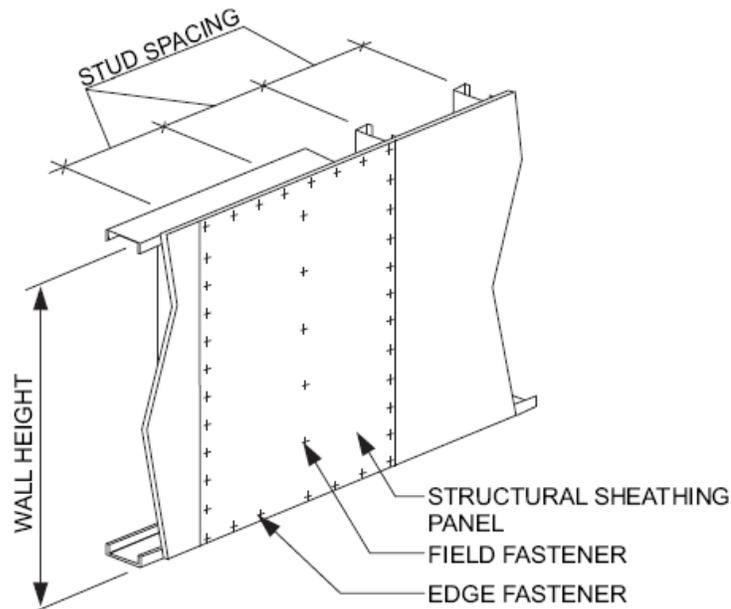
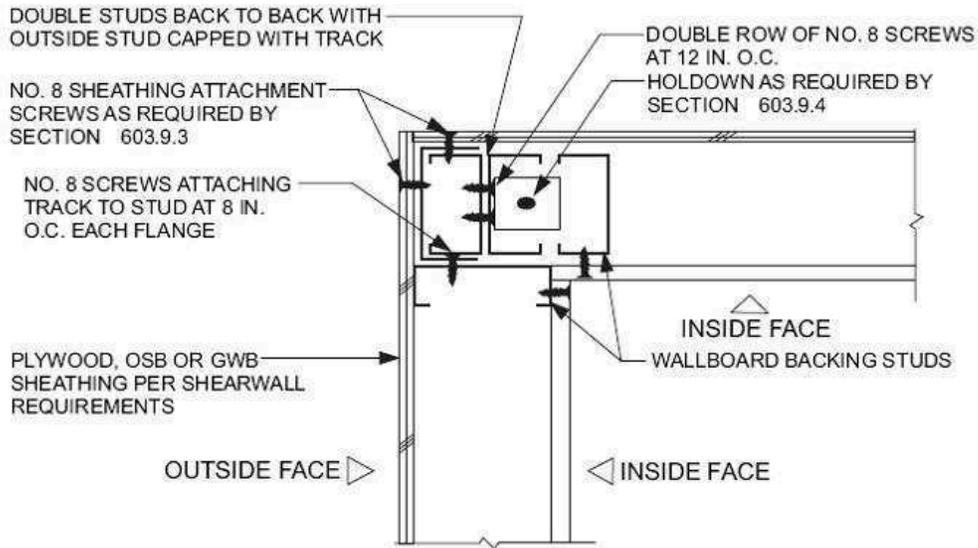


FIGURE 603.9
STRUCTURAL SHEATHING FASTENING PATTERN



For SI: 1 inch = 25.4 mm.

**FIGURE 603.9.2
CORNER STUD HOLD DOWN DETAIL**

**TABLE 603.9.2(1)
MINIMUM PERCENTAGE OF FULL HEIGHT
STRUCTURAL SHEATHING ON EXTERIOR WALLS^{a,b}**

WALL SUPPORTING	ROOF SLOPE	BASIC WIND SPEED AND EXPOSURE (mph)						
		85 B	90 B	100 B	< 110B		100 C	< 110 C
				85 C	90 C			
Roof and ceiling only (One story or top floor of two or three story building)	3:12	8	9	9	12	16	20	
	6:12	12	13	15	20	26	35	
	9:12	21	23	25	30	50	58	
	12:12	30	33	35	40	66	75	
One story, roof and ceiling (First floor of a two-story building or second floor of a three story building)	3:12	24	27	30	35	50	66	
	6:12	25	28	30	40	58	74	
	9:12	35	38	40	55	74	91	
	12:12	40	45	50	65	100	115	
Two story, roof and ceiling (First floor of a three story building)	3:12	40	45	51	58	84	112	
	6:12	38	43	45	60	90	113	
	9:12	49	53	55	80	98	124	
	12:12	50	57	65	90	134	155	

For SI: 1 mile per hour = 0.447 m/s.

a. Linear interpolation is permitted.

b. For hip-roofed homes the minimum percentage of full height sheathing, based upon 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 603.9.2(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

SECTION 604 WOOD STRUCTURAL PANELS

604.1 Identification and grade. Wood structural panels shall conform to DOC PS 1 or DOC PS 2 or, when manufactured in Canada, CSA O437 or CSA O325. All panels shall be identified by a grade mark or certificate of inspection issued by an approved agency.

604.2 Allowable spans. The maximum allowable spans for wood structural panel wall sheathing shall not exceed the values set forth in Table 602.3(3).

604.3 Installation. Wood structural panel wall sheathing shall be attached to framing in accordance with Table 602.3(1) or Table 602.3(3). Wood structural panels marked Exposure 1 or Exterior are considered water-repellent sheathing under the code.

SECTION 605 PARTICLEBOARD

605.1 Identification and grade. Particleboard shall conform to ANSI A208.1 and shall be so identified by a grade mark or certificate of inspection issued by an approved agency. Particleboard shall comply with the grades specified in Table 602.3(4).

SECTION 606 GENERAL MASONRY CONSTRUCTION

606.1 General. Masonry construction shall be designed and constructed in accordance with the provisions of this section or in accordance with the provisions of ACI 530/ASCE 5/TMS 402 TMS 402/ACI 530/ASCE 5.

606.1.1 Professional registration not required. When the empirical design provisions of *TMS 402/ACI 530/ASCE 5* Chapter 5 or the provisions of this section are used to design masonry, project drawings, typical details and specifications are not required to bear the seal of the architect or engineer responsible for design, unless otherwise required by the state law of the jurisdiction having authority.

606.2 Thickness of masonry. The nominal thickness of masonry walls shall conform to the requirements of Sections 606.2.1 through 606.2.4.

606.2.1 Minimum thickness. The minimum thickness of masonry bearing walls more than one story high shall be 8 inches (203 mm). Solid masonry walls of one-story dwellings and garages shall not be less than 6 inches (152 mm) in thickness when not greater than 9 feet (2743 mm) in height, provided that when gable construction is used, an additional 6 feet (1829 mm) is permitted to the peak of the gable. Masonry walls shall be laterally supported in either the horizontal or vertical direction at intervals as required by Section 606.9.

606.2.2 Rubble stone masonry wall. The minimum thickness of rough, random or coursed rubble stone masonry walls shall be 16 inches (406 mm).

606.2.3 Change in thickness. Where walls of masonry of hollow units or masonry-bonded hollow walls are decreased in thickness, a course of solid masonry shall be constructed between the wall below and the thinner wall above, or special units or construction shall be used to transmit the loads from face shells or wythes above to those below.

606.2.4 Parapet walls. Unreinforced solid masonry parapet walls shall not be 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 D₀, D₁ or D₂, or on townhouses in Seismic Design Category C shall be reinforced in accordance with Section 606.12.

606.3 Corbeled masonry. Corbeled masonry shall be in accordance with Sections 606.3.1 through 606.3.3.

606.3.1 Units. Solid masonry units or masonry units filled with mortar or grout shall be used for corbeling.

606.3.2 Corbel projection. The maximum projection of one unit shall not exceed one-half the height of the unit or one-third the thickness at right angles to the wall. The maximum corbeled projection beyond the face of the wall shall not exceed:

1. One-half of the wall thickness for multiwythe walls bonded by mortar or grout and wall ties or masonry headers, or
2. One-half the wythe thickness for single wythe walls, masonry-bonded hollow walls, multiwythe walls with open collar joints and veneer walls.

606.3.3 Corbeled masonry supporting floor or roof-framing members. When corbeled masonry is used to support floor or roof-framing members, the top course of the corbel shall be a header course or the top course bed joint shall have ties to the vertical wall.

606.4 Support conditions. Bearing and support conditions shall be in accordance with Sections 606.4.1 and 606.4.2.

606.4.1 Bearing on support. Each masonry wythe shall be supported by at least two-thirds of the wythe thickness.

606.4.2 Support at foundation. Cavity wall or masonry veneer construction may be supported on an 8-inch (203 mm) foundation wall, provided the 8-inch (203 mm) wall is corbeled to the width of the wall system above with masonry constructed of solid masonry units or masonry units filled with mortar or grout. The total horizontal projection of the corbel shall not exceed 2 inches (51 mm) with individual corbels projecting not more than one-third the thickness of the unit or one-half the height of the unit. The hollow space behind the corbeled masonry shall be filled with mortar or grout.

606.5 Allowable stresses. Allowable compressive stresses in masonry shall not exceed the values prescribed in Table 606.5. In determining the stresses in masonry, the effects of all loads and conditions of loading and the influence of all forces affecting the design and strength of the several parts shall be taken into account.

606.5.1 Combined units. In walls or other structural members composed of different kinds or grades of units, materials or mortars, the maximum stress shall not exceed the allowable stress for the weakest of the combination of units, materials and mortars of which the member is composed. The net thickness of any facing unit that is used to resist stress shall not be less than 1.5 inches (38 mm).

606.6 Piers. The unsupported height of masonry piers shall not exceed ten 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. Where hollow masonry units are solidly filled with concrete or Type M, S or N mortar, the allowable compressive stress shall be permitted to be increased as provided in Table 606.5.

606.6.1 Pier cap. Hollow piers shall be capped with 4 inches (102 mm) of solid masonry or concrete or shall have cavities of the top course filled with concrete or grout or other approved methods.

606.7 Chases. Chases and recesses in masonry walls shall not be deeper than one-third the wall thickness, and the maximum length of a horizontal chase or horizontal projection shall not exceed 4 feet (1219 mm), and shall have at least 8 inches (203 mm) of masonry in back of the chases and recesses and between adjacent chases or recesses and the jambs of openings. Chases and recesses in masonry walls shall be designed and constructed so as not to reduce the required strength or required fire resistance of the wall and in no case shall a chase or recess be permitted within the required area of a pier. Masonry directly above chases or recesses wider than 12 inches (305 mm) shall be supported on noncombustible lintels.

**TABLE 606.5
ALLOWABLE COMPRESSIVE STRESSES FOR
EMPIRICAL DESIGN OF MASONRY**

CONSTRUCTION; COMPRESSIVE STRENGTH OF UNIT, GROSS AREA	ALLOWABLE COMPRESSIVE STRESSES ^a GROSS CROSS-SECTIONAL AREA ^b	
	Type M or S mortar	Type N mortar
Solid masonry of brick and other solid units of clay or shale; sand-lime or concrete brick:		
8,000+ psi	350	300
4,500 psi	225	200
2,500 psi	160	140
1,500 psi	115	100
Grouted ^c masonry, of clay or shale; sand-lime or concrete:		
4,500+ psi	225	200
2,500 psi	160	140
1,500 psi	115	100
Solid masonry of solid concrete masonry units:		
3,000+ psi	225	200
2,000 psi	160	140
1,200 psi	115	100
Masonry of hollow load-bearing units:		
2,000+ psi	140	120
1,500 psi	115	100
1,000 psi	75	70
700 psi	60	55
Hollow walls (cavity or masonry bonded ^d) solid units:		
2,500+ psi	160	140
1,500 psi	115	100
Hollow units	75	70
Stone ashlar masonry:		
Granite	720	640
Limestone or marble	450	400
Sandstone or cast stone	360	320
Rubble stone masonry:		
Coarse, rough or random	120	100

For SI: 1 pound per square inch = 6.895 kPa.

- Linear interpolation shall be used for determining allowable stresses for masonry units having compressive strengths that are intermediate between those given in the table.
- Gross cross-sectional area shall be calculated on the actual rather than nominal dimensions.
- See Section 608.
- Where floor and roof loads are carried upon one wythe, the gross cross-sectional area is that of the wythe under load; if both wythes are loaded, the gross cross-sectional area is that of the wall minus the area of the cavity between the wythes. Walls bonded with metal ties shall be considered as cavity walls unless the collar joints are filled with mortar or grout.

606.8 Stack bond. 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 mm²) shall be provided in horizontal bed joints spaced not more than 16 inches (406 mm) on center vertically.

606.9 Lateral support. Masonry walls shall be laterally supported in either the horizontal or the vertical direction. The maximum spacing between lateral supports shall not exceed the distances in Table 606.9. Lateral support shall be provided by cross walls, pilasters, buttresses or structural frame members when the limiting distance is taken horizontally, or by floors or roofs when the limiting distance is taken vertically.

**TABLE 606.9
SPACING OF LATERAL SUPPORT FOR MASONRY WALLS**

CONSTRUCTION	MAXIMUM WALL LENGTH TO THICKNESS OR WALL HEIGHT TO THICKNESS ^{a,b}
Bearing walls:	
Solid or solid grouted	20
All other	18
Nonbearing walls:	
Exterior	18
Interior	36

For SI: 1 foot = 304.8 mm.

- a. Except for cavity walls and cantilevered walls, the thickness of a wall shall be its nominal thickness measured perpendicular to the face of the wall. For cavity walls, the thickness shall be determined as the sum of the nominal thicknesses of the individual wythes. For cantilever walls, except for parapets, the ratio of height to nominal thickness shall not exceed 6 for solid masonry, or 4 for hollow masonry. For parapets, see Section 606.2.4.
- b. An additional unsupported height of 6 feet is permitted for gable end walls.

606.9.1 Horizontal lateral support. Lateral support in the horizontal direction provided by intersecting masonry walls shall be provided by one of the methods in Section 606.9.1.1 or Section 606.9.1.2.

606.9.1.1 Bonding pattern. Fifty percent of the units at the intersection shall be laid in an overlapping masonry bonding pattern, with alternate units having a bearing of not less than 3 inches (76 mm) on the unit below.

606.9.1.2 Metal reinforcement. Interior nonloadbearing walls shall be anchored at their intersections, at vertical intervals of not more than 16 inches (406 mm) with joint reinforcement of at least 9 gage [0.148 in. (4mm)], or ¼ inch (6 mm) galvanized mesh hardware cloth. Intersecting

masonry walls, other than interior nonloadbearing walls, shall be anchored at vertical intervals of not more than 8 inches (203 mm) with joint reinforcement of at least 9 gage and shall extend at least 30 inches (762 mm) in each direction at the intersection. Other metal ties, joint reinforcement or anchors, if used, shall be spaced to provide equivalent area of anchorage to that required by this section.

606.9.2 Vertical lateral support. Vertical lateral support of masonry walls in Seismic Design Category A, B or C shall be provided in accordance with one of the methods in Section 606.9.2.1 or Section 606.9.2.2.

606.9.2.1 Roof structures. Masonry walls shall be anchored to roof structures with metal strap anchors spaced in accordance with the manufacturer's instructions, ½ inch (13 mm) bolts spaced not more than 6 feet (1829 mm) on center, or other approved anchors. Anchors shall be embedded at least 16 inches (406 mm) into the masonry, or be hooked or welded to bond beam reinforcement placed not less than 6 inches (152 mm) from the top of the wall.

606.9.2.2 Floor diaphragms. Masonry walls shall be anchored to floor diaphragm framing by metal strap anchors spaced in accordance with the manufacturer's instructions, ½-inch-diameter (13 mm) bolts spaced at intervals not to exceed 6 feet (1829 mm) and installed as shown in Figure 606.11(1), or by other approved methods.

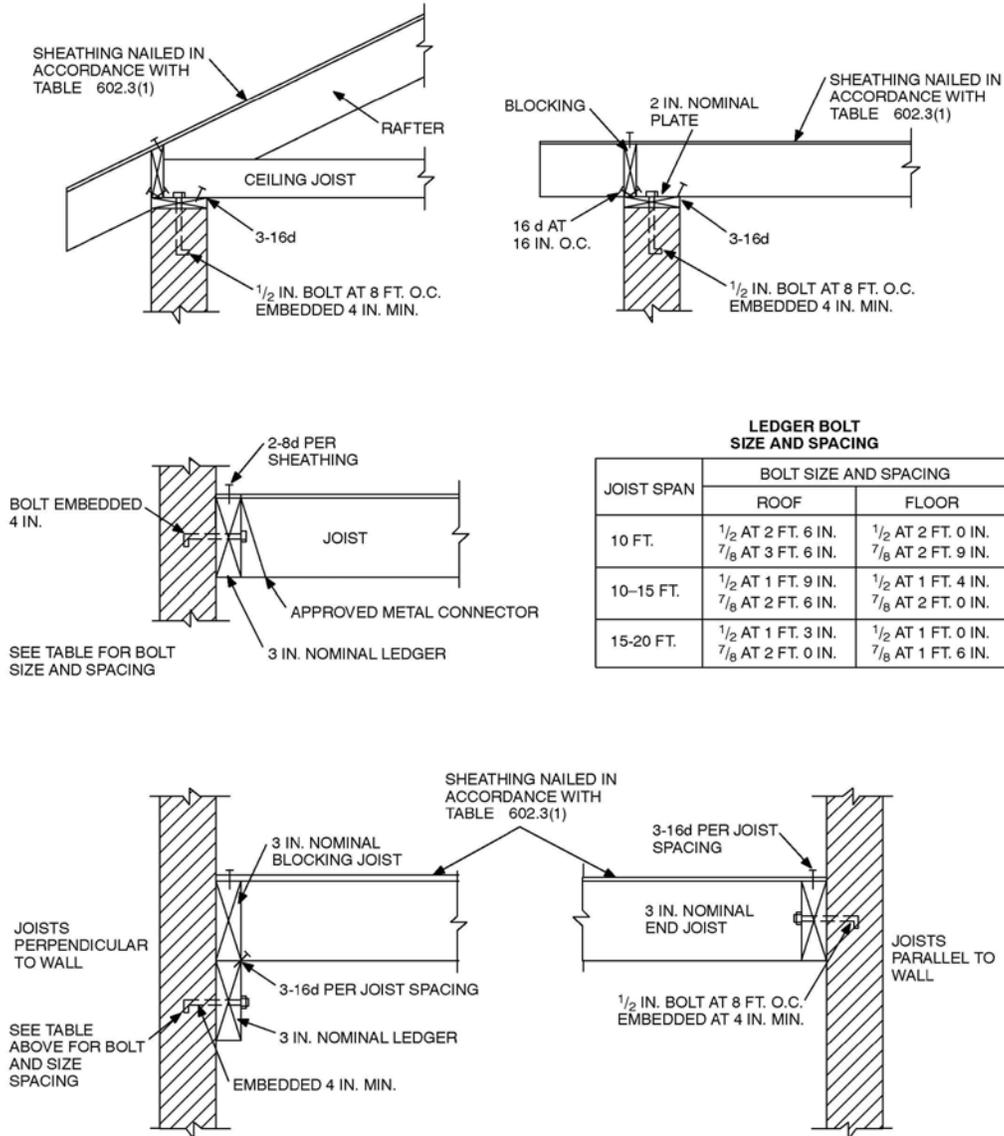
606.10 Lintels. Masonry over openings shall be supported by steel lintels, reinforced concrete or masonry lintels or masonry arches, designed to support load imposed.

606.11 Anchorage. Masonry walls shall be anchored to floor and roof systems in accordance with the details shown in Figure 606.11(1), 606.11(2) or 606.11(3). Footings may be considered as points of lateral support.

606.12 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 D₀, D₁ or D₂. Townhouses in Seismic Design Category C shall comply with the requirements of Section 606.12.2. These requirements shall not apply to glass unit masonry conforming to Section 610 or masonry veneer conforming to Section 703.7.

606.12.1 General. Masonry structures and masonry elements shall comply with the requirements of Sections 606.12.2 through 606.12.4 based on the seismic design category established in Table 301.2(1). Masonry structures and masonry elements shall comply with the requirements of Section 606.12 and Figures 606.11(1), 606.11(2) and 606.11(3) or shall be designed in accordance with *TMS 402/ACI 530/ASCE 5*.

606.12.1.1 Floor and roof diaphragm construction. Floor and roof diaphragms shall be constructed of wood structural panels attached to wood framing in accordance with Table 602.3(1) or to cold-formed steel floor framing in accordance with Table 505.3.1(2) or to cold-formed steel roof framing in accordance with Table 804.3. 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, D₀, D₁ and D₂, 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.

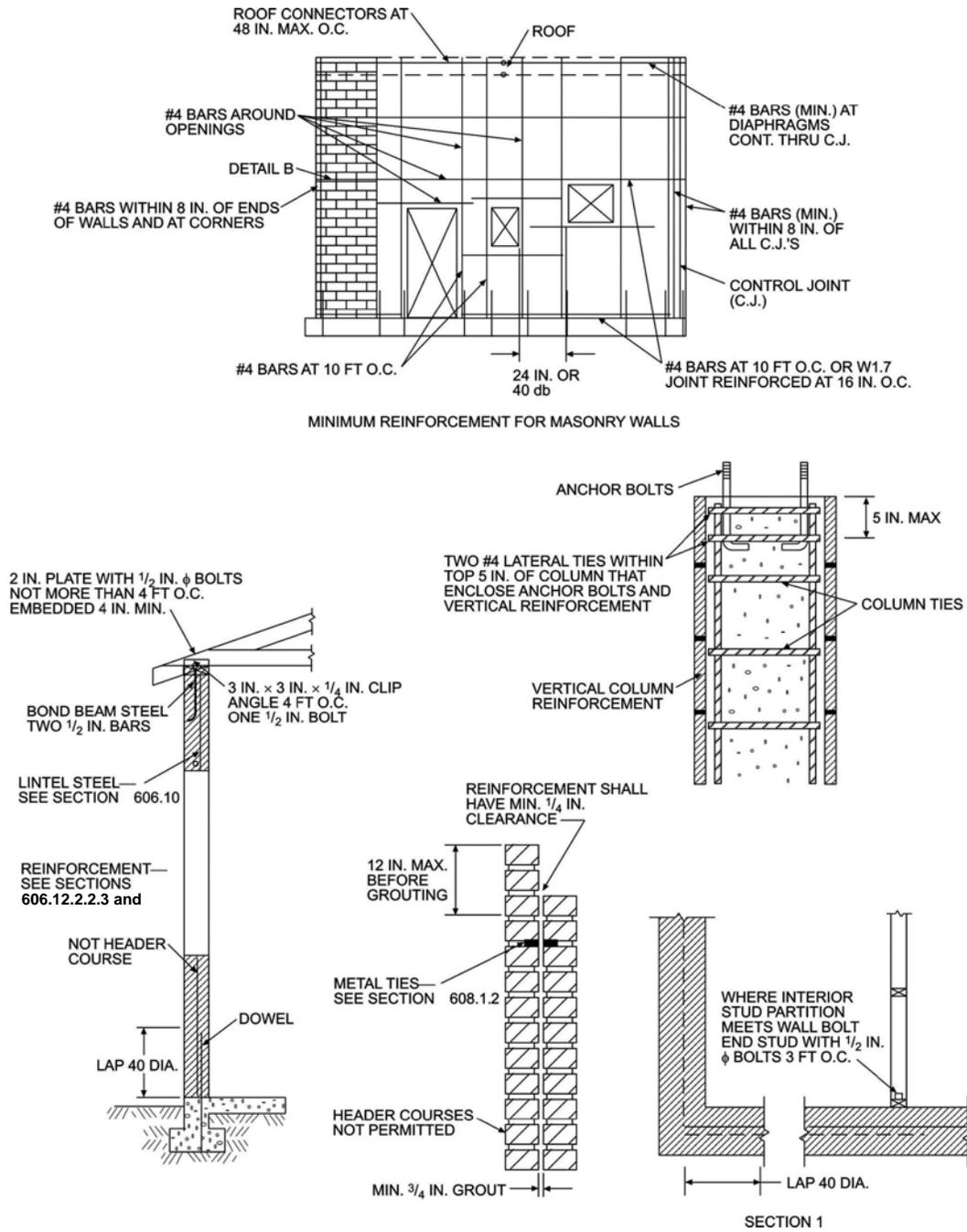


NOTE: Where bolts are located in hollow masonry, the cells in the courses receiving the bolt shall be grouted solid.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kPa.

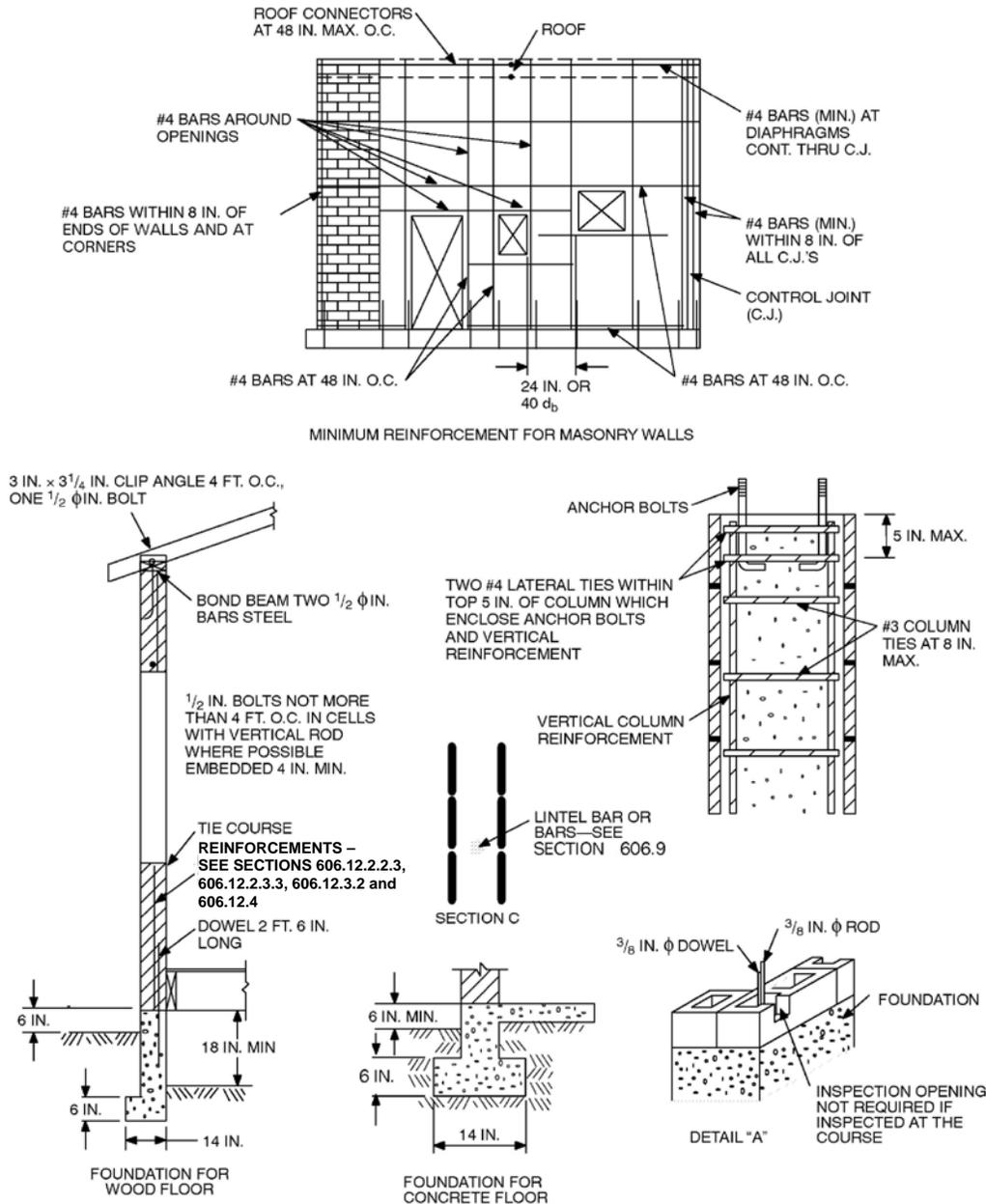
FIGURE 606.11(1)

ANCHORAGE REQUIREMENTS FOR MASONRY WALLS LOCATED IN SEISMIC DESIGN CATEGORY A, B OR C AND WHERE WIND LOADS ARE LESS THAN 30 PSF



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

FIGURE 606.11(2)
REQUIREMENTS FOR REINFORCED GROUTED MASONRY CONSTRUCTION IN SEISMIC DESIGN CATEGORY C



NOTE: A full bed joint must be provided. All 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.
 For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

FIGURE 606.11(3)
REQUIREMENTS FOR REINFORCED MASONRY CONSTRUCTION IN SEISMIC DESIGN CATEGORY D₀, D₁, OR D₂

606.12.2 Seismic Design Category C. Townhouses located in Seismic Design Category C shall comply with the requirements of this section.

606.12.2.1 Minimum length of wall without openings. Table 606.12.2.1 shall be used to determine the minimum required solid wall length without openings at each masonry exterior wall. The provided percentage of solid wall length shall include only those wall segments that are 3 feet (914 mm) or longer. The maximum clear distance between wall segments included in determining the solid wall length shall not exceed 18 feet (5486 mm). Shear wall segments required to meet the minimum wall length shall be in accordance with Section 606.12.2.2.3.

606.12.2.2 Design of elements not part of the lateral force-resisting system.

606.12.2.2.1 Load-bearing frames or columns. Elements not part of the lateral-force-resisting system shall be analyzed to determine their effect on the response of the system. The frames or columns shall be adequate for vertical load carrying capacity and induced moment caused by the design story drift.

606.12.2.2.2 Masonry partition walls. Masonry partition walls, masonry screen walls and other masonry elements that are not designed to resist vertical or lateral loads, other than those induced by their own weight, shall be isolated from the structure so that vertical and lateral forces are not imparted to these elements. Isolation joints and connectors between these elements and the structure shall be designed to accommodate the design story drift.

606.12.2.2.3 Reinforcement requirements for masonry elements. Masonry elements listed in Section 606.12.2.2.2 shall be reinforced in either the horizontal or vertical direction as shown in Figure 606.11(2) and in accordance with the following:

1. Horizontal reinforcement. Horizontal joint reinforcement shall consist of at least two longitudinal W1.7 wires spaced not more than 16 inches (406 mm) for walls greater than 4 inches (102 mm) in width and at least one longitudinal W1.7 wire spaced not more than 16 inches (406 mm) for walls not exceeding 4 inches (102 mm) in width; or at least one No. 4 bar spaced not more than 48 inches (1219 mm). Where two longitudinal wires of joint reinforcement are used, the space between these wires shall be the widest that the mortar joint will accommodate.

Horizontal reinforcement shall be provided within 16 inches (406 mm) of the top and bottom of these masonry elements.

2. Vertical reinforcement. Vertical reinforcement shall consist of at least one No. 4 bar spaced not more than 48 inches (1219 mm). Vertical reinforcement shall be located within 16 inches (406 mm) of the ends of masonry walls.

606.12.2.3 Design of elements part of the lateral-force-resisting system.

606.12.2.3.1 Connections to masonry shear walls. Connectors shall be provided to transfer forces between masonry walls and horizontal elements in accordance with the requirements of *Section 1.7.4 of TMS 402/ACI 530/ASCE 5*. Connectors shall be designed to transfer horizontal design forces acting either perpendicular or parallel to the wall, but not less than 200 pounds per linear foot (2919 N/m) of wall. The maximum spacing between connectors shall be 4 feet (1219 mm). Such anchorage mechanisms shall not induce tension stresses perpendicular to grain in ledgers or nailers.

606.12.2.3.2 Connections to masonry columns. Connectors shall be provided to transfer forces between masonry columns and horizontal elements in accordance with the requirements of *Section 1.7.4 of TMS 402/ACI 530/ASCE 5*. Where anchor bolts are used to connect horizontal elements to the tops of columns, the bolts shall be placed within lateral ties. Lateral ties shall enclose both the vertical bars in the column and the anchor bolts. There shall be a minimum of two No. 4 lateral ties provided in the top 5 inches (127 mm) of the column.

606.12.2.3.3 Minimum reinforcement requirements for masonry shear walls. Vertical reinforcement of at least one No. 4 bar shall be provided at corners, within 16 inches (406 mm) of each side of openings, within 8 inches (203 mm) of each side of movement joints, within 8 inches (203 mm) of the ends of walls, and at a maximum spacing of 10 feet (3048 mm).

Horizontal joint reinforcement shall consist of at least two wires of W1.7 spaced not more than 16 inches (406 mm); or bond beam reinforcement of at least one No. 4 bar spaced not more than 10 feet (3048 mm) shall be provided. Horizontal reinforcement shall also be

provided at the bottom and top of wall openings and shall extend not less than 24 inches (610 mm) nor less than 40 bar diameters past the opening; continuously at structurally connected roof and floor levels; and within 16 inches (406 mm) of the top of walls.

**TABLE 606.12.2.1
MINIMUM SOLID WALL LENGTH ALONG EXTERIOR WALL LINES**

SEISMIC DESIGN CATEGORY	MINIMUM SOLID WALL LENGTH (percent) ^a		
	One Story or Top Story of Two Story	Wall Supporting Light-framed 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 *Ohio 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.

606.12.3 Seismic Design Category D₀ or D₁. Structures in Seismic Design Category D₀ or D₁ shall comply with the requirements of Seismic Design Category C and the additional requirements of this section.

606.12.3.1 Design requirements. Masonry elements other than those covered by Section 606.12.2.2.2 shall be designed in accordance with the requirements of Chapter 1 and Sections 2.1 and 2.3 of *Section 1.7.4 of TMS 402/ACI 530/ASCE 5* and shall meet the minimum reinforcement requirements contained in Sections 606.12.3.2 and 606.12.3.2.1.

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 606.12.3.2 and 606.12.3.2.1.

606.12.3.2 Minimum reinforcement requirements for masonry walls. Masonry walls other than those covered by Section 606.12.2.2.3 shall be reinforced in both the vertical and horizontal direction. The sum of the cross-sectional area of horizontal and vertical reinforcement shall be at least 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 606.12.3.2 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.

606.12.3.2.1 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.

606.12.3.3 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 at least $\frac{3}{8}$ inch (9.5 mm) diameter. Lateral ties shall be embedded in grout.

606.12.3.4 Material restrictions. Type N mortar or masonry cement shall not be used as part of the lateral-force-resisting system.

606.12.3.5 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.

606.12.4 Seismic Design Category D₂. All structures in Seismic Design Category D₂ shall comply with the requirements of Seismic Design Category D₁ and to the additional requirements of this section.

606.12.4.1 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 at least 0.0015 times the gross cross-sectional area of masonry. Table 606.12.4.1 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 606.12.3.2
MINIMUM DISTRIBUTED WALL REINFORCEMENT FOR BUILDING ASSIGNED TO
SEISMIC DESIGN CATEGORY D₀ or D₁

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)	MINIMUM 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.

TABLE 606.12.4.1
MINIMUM REINFORCING FOR STACKED BONDED MASONRY WALLS IN SEISMIC DESIGN CATEGORY D₂

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.

606.12.4.2 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 at least 0.0025 times the gross cross-sectional area of masonry. Table 606.12.4.2 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 606.12.4.2
MINIMUM REINFORCING FOR STACKED BONDED MASONRY WALLS IN SEISMIC DESIGN CATEGORY D₂

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.

606.13 Protection for reinforcement. Bars shall be completely embedded in mortar or grout. Joint reinforcement embedded in horizontal mortar joints shall not have less than $\frac{5}{8}$ -inch (15.9 mm) mortar coverage from the exposed face. All

other reinforcement shall have a minimum coverage of one bar diameter over all bars, but not less than $\frac{3}{4}$ inch (19 mm), except where exposed to weather or soil, in which case the minimum coverage shall be 2 inches (51 mm).

606.14 Beam supports. Beams, girders or other concentrated loads supported by a wall or column shall have a bearing of at least 3 inches (76 mm) in length measured parallel to the beam upon solid masonry not less than 4 inches (102 mm) in thickness, or upon a metal bearing plate of adequate design and dimensions to distribute the load safely, or upon a continuous reinforced masonry member projecting not less than 4 inches (102 mm) from the face of the wall.

606.14.1 Joist bearing. Joists shall have a bearing of not less than $1\frac{1}{2}$ inches (38 mm), except as provided in Section 606.14, and shall be supported in accordance with Figure 606.11(1).

606.15 Metal accessories. Joint reinforcement, anchors, ties and wire fabric shall conform to the following: ASTM A 82 for wire anchors and ties; ASTM A 36 for plate, headed and bent-bar anchors; ASTM A 510 for corrugated sheet metal anchors and ties; ASTM A 951 for joint reinforcement; ASTM B 227 for copper-clad steel wire ties; or ASTM A 167 for stainless steel hardware.

606.15.1 Corrosion protection. Minimum corrosion protection of joint reinforcement, anchor ties and wire fabric for use in masonry wall construction shall conform to Table 606.15.1.

**TABLE 606.15.1
MINIMUM CORROSION PROTECTION**

MASONRY METAL ACCESSORY	STANDARD
Joint reinforcement, interior walls	ASTM A 641, Class 1
Wire ties or anchors in exterior walls completely embedded in mortar or grout	ASTM A 641, Class 3
Wire ties or anchors in exterior walls not completely embedded in mortar or grout	ASTM A 153, Class B-2
Joint reinforcement in exterior walls or interior walls exposed to moist environment	ASTM A 153, Class B-2
Sheet metal ties or anchors exposed to weather	ASTM A 153, Class B-2
Sheet metal ties or anchors completely embedded in mortar or grout	ASTM A 653, Coating Designation G60
Stainless steel hardware for any exposure	ASTM A 167, Type 304

**SECTION 607
UNIT MASONRY**

607.1 Mortar. Mortar for use in masonry construction shall comply with ASTM C 270. The type of mortar shall be in accordance with Sections 607.1.1, 607.1.2 and 607.1.3 and shall meet the proportion specifications of Table 607.1 or the property specifications of ASTM C 270.

607.1.1 Foundation walls. Masonry foundation walls constructed as set forth in Tables 404.1.1(1) through 404.1.1(4) and mortar shall be Type M or S.

607.1.2 Masonry in Seismic Design Categories A, B and C. Mortar for masonry serving as the lateral-force-resisting system in Seismic Design Categories A, B and C shall be Type M, S or N mortar.

607.1.3 Masonry in Seismic Design Categories D₀, D₁ and D₂. Mortar for masonry serving as the lateral-force-resisting system in Seismic Design Categories D₀, D₁ and D₂ shall be Type M or S portland cement-lime or mortar cement mortar.

607.2 Placing mortar and masonry units.

607.2.1 Bed and head joints. Unless otherwise required or indicated on the project drawings, head and bed joints shall be $\frac{3}{8}$ inch (10 mm) thick, except that the thickness of the bed joint of the starting course placed over foundations shall not be less than $\frac{1}{4}$ inch (7 mm) and not more than $\frac{3}{4}$ inch (19 mm).

607.2.1.1 Mortar joint thickness tolerance. Mortar joint thickness for load-bearing masonry shall be within the following tolerances from the specified dimensions:

1. Bed joint: + $\frac{1}{8}$ inch (3 mm).
2. Head joint: - $\frac{1}{4}$ inch (7 mm), + $\frac{3}{8}$ inch (10 mm).
3. Collarjoints: - $\frac{1}{4}$ inch(7mm),+ $\frac{3}{8}$ inch(10mm).

TABLE 607.1
MORTAR PROPORTIONS^{a, b}

PROPORTIONS BY VOLUME (cementitious materials)										
MORTAR	TYPE	Portland cement or blended cement	Mortar cement			Masonry cement			Hydrated lime ^c or lime putty	Aggregate ratio (measured in damp, loose conditions)
			M	S	N	M	S	N		
Cement-lime	M	1	—	—	—	—	—	—	1/4 over 1/4 to 1/2 over 1/2 to 1 1/4 over 1 1/4 to 2 1/2	Not less than 2 1/4 and not more than 3 times the sum of separate volumes of lime, if used, and cement
	S	1	—	—	—	—	—			
	N	1	—	—	—	—	—			
	O	1	—	—	—	—	—			
Mortar cement	M	1	1	—	1	—	—	—	—	
	M	—	—	—	—	—	—			
	S	1/2	—	—	1	—	—	—		
	S	—	—	1	—	—	—	—		
	N	—	—	—	1	—	—	—		
	O	—	—	—	1	—	—	—		
Masonry cement	M	1	—	—	—	—	1	—		
	M	—	—	—	1	—	—			
	S	1/2	—	—	—	—	1			
	S	—	—	—	—	1	—			
	N	—	—	—	—	—	1			
	O	—	—	—	—	—	1			

For SI: 1 cubic foot = 0.0283 m³, 1 pound = 0.454 kg.

a. For the purpose of these specifications, the weight of 1 cubic foot of the respective materials shall be considered to be as follows:

Portland Cement	94 pounds	Masonry Cement	Weight printed on bag
Mortar Cement	Weight printed on bag	Hydrated Lime	40 pounds
Lime Putty (Quicklime)	80 pounds	Sand, damp and loose	80 pounds of dry sand

b. Two air-entraining materials shall not be combined in mortar.

c. Hydrated lime conforming to the requirements of ASTM C270

607.2.2 Masonry unit placement. The mortar shall be sufficiently plastic and units shall be placed with sufficient pressure to extrude mortar from the joint and produce a tight joint. Deep furrowing of bed joints that produces voids shall not be permitted. Any units disturbed to the extent that initial bond is broken after initial placement shall be removed and relaid in fresh mortar. Surfaces to be in contact with mortar shall be clean and free of deleterious materials.

607.2.2.1 Solid masonry. Solid masonry units shall be laid with full head and bed joints and all interior vertical joints that are designed to receive mortar shall be filled.

607.2.2.2 Hollow masonry. For hollow masonry units, head and bed joints shall be filled solidly with mortar for a distance in from the face of the unit not less than the thickness of the face shell.

607.3 Installation of wall ties. The installation of wall ties shall be as follows:

1. The ends of wall ties shall be embedded in mortar joints. Wall tie ends shall engage outer face shells of hollow units by at least $\frac{1}{2}$ inch (13 mm). Wire wall ties shall be embedded at least $1\frac{1}{2}$ inches (38 mm) into the mortar bed of solid masonry units or solid grouted hollow units.
2. Wall ties shall not be bent after being embedded in grout or mortar.

SECTION 608 MULTIPLE WYTHE MASONRY

608.1 General. The facing and backing of multiple wythe masonry walls shall be bonded in accordance with Section 608.1.1, 608.1.2 or 608.1.3. In cavity walls, neither the facing nor the backing shall be less than 3 inches (76 mm) nominal in thickness and the cavity shall not be more than 4 inches (102 mm) nominal in width. The backing shall be at least as thick as the facing.

Exception: Cavities shall be permitted to exceed the 4-inch (102 mm) nominal dimension provided tie size and tie spacing have been established by calculation.

608.1.1 Bonding with masonry headers. Bonding with solid or hollow masonry headers shall comply with Sections 608.1.1.1 and 608.1.1.2.

608.1.1.1 Solid units. Where the facing and backing (adjacent wythes) of solid masonry construction are bonded by means of masonry headers, no less than 4 percent of the wall surface of each face shall be composed of headers extending not less than 3 inches (76 mm) into the backing. The distance between adjacent full-length headers shall not exceed 24 inches (610 mm) either vertically or horizontally. In walls in which a single header does not extend through the wall, headers from the opposite sides shall overlap at least 3 inches (76 mm), or headers from opposite sides

shall be covered with another header course overlapping the header below at least 3 inches (76 mm).

608.1.1.2 Hollow units. Where two or more hollow units are used to make up the thickness of a wall, the stretcher courses shall be bonded at vertical intervals not exceeding 34 inches (864 mm) by lapping at least 3 inches (76 mm) over the unit below, or by lapping at vertical intervals not exceeding 17 inches (432 mm) with units that are at least 50 percent thicker than the units below.

608.1.2 Bonding with wall ties or joint reinforcement. Bonding with wall ties or joint reinforcement shall comply with Sections 608.1.2.1 through 608.1.2.3.

608.1.2.1 Bonding with wall ties. Bonding with wall ties, except as required by Section 610, where the facing and backing (adjacent wythes) of masonry walls are bonded with $\frac{3}{16}$ -inch-diameter (5 mm) wall ties embedded in the horizontal mortar joints, there shall be at least one metal tie for each 4.5 square feet (0.418 m²) of wall area. Ties in alternate courses shall be staggered. The maximum vertical distance between ties shall not exceed 24 inches (610 mm), and the maximum horizontal distance shall not exceed 36 inches (914 mm). Rods or ties bent to rectangular shape shall be used with hollow masonry units laid with the cells vertical. In other walls, the ends of ties shall be bent to 90-degree (0.79 rad) angles to provide hooks no less than 2 inches (51 mm) long. Additional bonding ties shall be provided at all openings, spaced not more than 3 feet (914 mm) apart around the perimeter and within 12 inches (305 mm) of the opening.

608.1.2.2 Bonding with adjustable wall ties. Where the facing and backing (adjacent wythes) of masonry are bonded with adjustable wall ties, there shall be at least one tie for each 2.67 square feet (0.248 m²) of wall area. Neither the vertical nor the horizontal spacing of the adjustable wall ties shall exceed 24 inches (610 mm). The maximum vertical offset of bed joints from one wythe to the other shall be 1.25 inches (32 mm). The maximum clearance between connecting parts of the ties shall be $\frac{1}{16}$ inch (2 mm). When pintle legs are used, ties shall have at least two $\frac{3}{16}$ -inch-diameter (5 mm) legs.

608.1.2.3 Bonding with prefabricated joint reinforcement. Where the facing and backing (adjacent wythes) of masonry are bonded with

prefabricated joint reinforcement, there shall be at least one cross wire serving as a tie for each 2.67 square feet (0.248 m²) of wall area. The vertical spacing of the joint reinforcement shall not exceed 16 inches (406 mm). Cross wires on prefabricated joint reinforcement shall not be smaller than No. 9 gage. The longitudinal wires shall be embedded in the mortar.

608.1.3 Bonding with natural or cast stone. Bonding with natural and cast stone shall conform to Sections 608.1.3.1 and 608.1.3.2.

608.1.3.1 Ashlar masonry. In ashlar masonry, bonder units, uniformly distributed, shall be provided to the extent of not less than 10 percent of the wall area. Such bonder units shall extend not less than 4 inches (102 mm) into the backing wall.

608.1.3.2 Rubble stone masonry. Rubble stone masonry 24 inches (610 mm) or less in thickness shall have bonder units with a maximum spacing of 3 feet (914 mm) vertically and 3 feet (914 mm) horizontally, and if the masonry is of greater thickness than 24 inches (610 mm), shall have one bonder unit for each 6 square feet (0.557 m²) of wall surface on both sides.

608.2 Masonry bonding pattern. Masonry laid in running and stack bond shall conform to Sections 608.2.1 and 608.2.2.

608.2.1 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 608.2.2.

608.2.2 Masonry laid in stack bond. Where unit masonry is laid with less head joint offset than in Section ~~607.2.1~~ 608.2.1, 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.

SECTION 609 GROUTED MASONRY

609.1 General. Grouted multiple-wythe masonry is a form of construction in which the space between the wythes is solidly filled with grout. It is not necessary for the cores of masonry units to be filled with grout. Grouted hollow unit

masonry is a form of construction in which certain cells of hollow units are continuously filled with grout.

609.1.1 Grout. Grout shall consist of cementitious material and aggregate in accordance with ASTM C 476 and the proportion specifications of Table 609.1.1. Type M or Type S mortar to which sufficient water has been added to produce pouring consistency can be used as grout.

609.1.2 Grouting requirements. Maximum pour heights and the minimum dimensions of spaces provided for grout placement shall conform to Table 609.1.2. If the work is stopped for one 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.

609.1.3 Grout space (cleaning). Provision shall be made for cleaning grout space. Mortar projections that project more than 0.5 inch (13 mm) into grout space and any other foreign matter shall be removed from grout space prior to inspection and grouting.

609.1.4 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 in no case more than 1½ hours after water has been added. Grouting shall be done in a continuous pour, in lifts not exceeding 5 feet (1524 mm). It shall be consolidated by puddling or mechanical vibrating during placing and reconsolidated after excess moisture has been absorbed but before plasticity is lost.

609.1.4.1 Grout pumped through aluminum pipes. Grout shall not be pumped through aluminum pipes.

609.1.5 Cleanouts. Where required by the building official, cleanouts shall be provided as specified in this section. The cleanouts shall be sealed before grouting and after inspection.

609.1.5.1 Grouted multiple-wythe masonry. Cleanouts shall be provided at the bottom course of the exterior wythe at each pour of grout where such pour exceeds 5 feet (1524 mm) in height.

609.1.5.2 Grouted hollow unit masonry. Cleanouts shall be provided at the bottom course of each cell to be grouted at each pour of grout, where such pour exceeds 4 feet (1219 mm) in height.

609.2 Grouted multiple-wythe masonry. Grouted multiple-wythe masonry shall conform to all the requirements specified in Section 609.1 and the requirements of this section.

609.2.1 Bonding of backup wythe. Where all interior vertical spaces are filled with grout in multiple-wythe construction, masonry headers shall not be permitted. Metal wall ties shall be used in accordance with Section 608.1.2 to prevent spreading of the wythes and to maintain the vertical alignment of the wall. Wall ties shall be installed in accordance with Section 608.1.2 when the backup wythe in multiple-wythe construction is fully grouted.

609.2.2 Grout spaces. Fine grout shall be used when interior vertical space to receive grout does not exceed 2 inches (51 mm) in thickness. Interior vertical spaces exceeding 2 inches (51 mm) in thickness shall use coarse or fine grout.

609.2.3 Grout barriers. Vertical grout barriers or dams shall be built of solid masonry across the grout space the entire height of the wall to control the flow of the grout horizontally. Grout barriers shall not be more than 25 feet (7620 mm) apart. The grouting of any section of a wall between control barriers shall be completed in one day with no interruptions greater than one hour.

609.3 Reinforced grouted multiple-wythe masonry. Reinforced grouted multiple-wythe masonry shall conform to all the requirements specified in Sections 609.1 and 609.2 and the requirements of this section.

609.3.1 Construction. The thickness of grout or mortar between masonry units and reinforcement shall not be less than $\frac{1}{4}$ inch (7 mm), except that $\frac{1}{4}$ -inch (7 mm) bars may be laid in horizontal mortar joints at least $\frac{1}{2}$ inch (13 mm) thick, and steel wire reinforcement may be laid in horizontal mortar joints at least twice the thickness of the wire diameter.

**TABLE 609.1.1
GROUT PROPORTIONS BY VOLUME FOR MASONRY CONSTRUCTION**

TYPE	PORTLAND CEMENT OR BLENDED CEMENT SLAG CEMENT	HYDRATED LIME OR LIME PUTTY	AGGREGATE MEASURED IN A DAMP, LOOSE CONDITION	
			Fine	Coarse
Fine	1	0 to 1/10	2¼ to 3 times the sum of the volume of the cementitious materials	—
Coarse	1	0 to 1/10	2¼ to 3 times the sum of the volume of the cementitious materials	1 to 2 times the sum of the volumes of the cementitious materials

**TABLE 609.1.2
GROUT SPACE DIMENSIONS AND POUR HEIGHTS**

GROUT TYPE	GROUT POUR MAXIMUM HEIGHT (feet)	MINIMUM WIDTH OF GROUT SPACES ^{a,b} (inches)	MINIMUM GROUT ^{b,c} SPACE DIMENSIONS FOR GROUTING CELLS OF HOLLOW UNITS (inches x inches)
Fine	1	0.75	1.5 × 2
	5	2	2 × 3
	12	2.5	2.5 × 3
	24	3	3 × 3
Coarse	1	1.5	1.5 × 3
	5	2	2.5 × 3
	12	2.5	3 × 3
	24	3	3 × 4

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

a. For grouting between masonry wythes.

b. Grout space dimension is the clear dimension between any masonry protrusion and shall be increased by the horizontal projection of the diameters of the horizontal bars within the cross section of the grout space.

c. Area of vertical reinforcement shall not exceed 6 percent of the area of the grout space.

609.4 Reinforced hollow unit masonry. Reinforced hollow unit masonry shall conform to all the requirements of Section 609.1 and the requirements of this section.

609.4.1 Construction. Requirements for construction shall be as follows:

1. Reinforced hollow-unit masonry shall be built to preserve the unobstructed vertical continuity of the cells to be filled. Walls and cross webs forming cells to be filled shall be full-bedded in mortar to prevent leakage of grout. Head and end joints shall be solidly filled with mortar for a distance in from the face of the wall or unit not less than the thickness of the longitudinal face shells. Bond shall be provided by lapping units in successive vertical courses.

2. Cells to be filled shall have vertical alignment sufficient to maintain a clear, unobstructed continuous vertical cell of dimensions prescribed in Table 609.1.2.
3. Vertical reinforcement shall be held in position at top and bottom and at intervals not exceeding 200 diameters of the reinforcement.
4. Cells containing reinforcement shall be filled solidly with grout. Grout shall be poured in lifts of 8-foot (2438 mm) maximum height. When a total grout pour exceeds 8 feet (2438 mm) in height, the grout shall be placed in lifts not exceeding 5 feet (1524 mm) and special inspection during grouting shall be required.
5. Horizontal steel shall be fully embedded by grout in an uninterrupted pour.

SECTION 610 GLASS UNIT MASONRY

610.1 General. Panels of glass unit masonry located in load-bearing and nonload-bearing exterior and interior walls shall be constructed in accordance with this section.

610.2 Materials. Hollow glass units shall be partially evacuated and have a minimum average glass face thickness of $3/16$ inch (5 mm). The surface of units in contact with mortar shall be treated with a polyvinyl butyral coating or latex-based paint. The use of reclaimed units is prohibited.

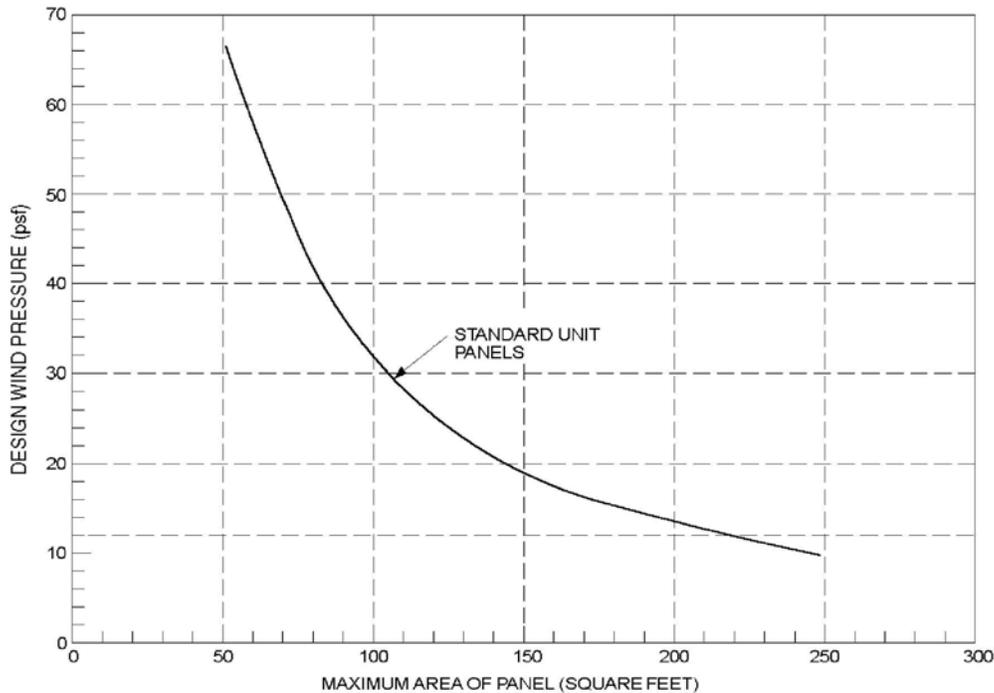
610.3 Units. Hollow or solid glass block units shall be standard or thin units.

610.3.1 Standard units. The specified thickness of standard units shall be at least $3\frac{7}{8}$ inches (98 mm).

610.3.2 Thin units. The specified thickness of thin units shall be at least $3\frac{1}{8}$ inches (79 mm) for hollow units and at least 3 inches (76 mm) for solid units.

610.4 Isolated panels. Isolated panels of glass unit masonry shall conform to the requirements of this section.

610.4.1 Exterior standard-unit panels. The maximum area of each individual standard-unit panel shall be 144 square feet (13.4 m²) when the design wind pressure is 20 psf (958 Pa). The maximum area of such panels subjected to design wind pressures other than 20 psf (958 Pa) shall be in accordance with Figure 610.4.1. The maximum panel dimension between structural supports shall be 25 feet (7620 mm) in width or 20 feet (6096 mm) in height.



For SI: 1 square foot=0.0929m², 1 pound per square foot = 0.0479 kPa.

FIGURE 610.4.1
GLASS UNIT MASONRY DESIGN WIND LOAD RESISTANCE

610.4.2 Exterior thin-unit panels. The maximum area of each individual thin-unit panel shall be 85 square feet (7.9 m²). The maximum dimension between structural supports shall be 15 feet (4572 mm) in width or 10 feet (3048 mm) in height. Thin units shall not be used in applications where the design wind pressure as stated in Table 301.2(1) exceeds 20 psf (958 Pa).

610.4.3 Interior panels. The maximum area of each individual standard-unit panel shall be 250 square feet (23.2 m²). The maximum area of each thin-unit

panel shall be 150 square feet (13.9 m²). The maximum dimension between structural supports shall be 25 feet (7620 mm) in width or 20 feet (6096 mm) in height.

610.4.4 Curved panels. The width of curved panels shall conform to the requirements of Sections 610.4.1, 610.4.2 and 610.4.3, except additional structural supports shall be provided at locations where a curved section joins a straight section, and at inflection points in multicurved walls.

610.5 Panel support. Glass unit masonry panels shall conform to the support requirements of this section.

610.5.1 Deflection. The maximum total deflection of structural members that support glass unit masonry shall not exceed $\frac{1}{600}$.

610.5.2 Lateral support. Glass unit masonry panels shall be laterally supported along the top and sides of the panel. Lateral supports for glass unit masonry panels shall be designed to resist a minimum of 200 pounds per lineal feet (2918 N/m) of panel, or the actual applied loads, whichever is greater. Except for single unit panels, lateral support shall be provided by panel anchors along the top and sides spaced a maximum of 16 inches (406 mm) on center or by channel-type restraints. Single unit panels shall be supported by channel-type restraints.

Exceptions:

1. Lateral support is not required at the top of panels that are one unit wide.
2. Lateral support is not required at the sides of panels that are one unit high.

610.5.2.1 Panel anchor restraints. Panel anchors shall be spaced a maximum of 16 inches (406 mm) on center in both jambs and across the head. Panel anchors shall be embedded a minimum of 12 inches (305 mm) and shall be provided with two fasteners so as to resist the loads specified in Section 610.5.2.

610.5.2.2 Channel-type restraints. Glass unit masonry panels shall be recessed at least 1 inch (25 mm) within channels and chases. Channel-type restraints shall be oversized to accommodate expansion material in the

opening, packing and sealant between the framing restraints, and the glass unit masonry perimeter units.

610.6 Sills. Before bedding of glass units, the sill area shall be covered with a water base asphaltic emulsion coating. The coating shall be a minimum of $\frac{1}{8}$ inch (3 mm) thick.

610.7 Expansion joints. Glass unit masonry panels shall be provided with expansion joints along the top and sides at all structural supports. Expansion joints shall be a minimum of $\frac{3}{8}$ inch (10 mm) in thickness and shall have sufficient thickness to accommodate displacements of the supporting structure. Expansion joints shall be entirely free of mortar and other debris and shall be filled with resilient material.

610.8 Mortar. Glass unit masonry shall be laid with Type S or N mortar. Mortar shall not be retempered after initial set. Mortar unused within $1\frac{1}{2}$ hours after initial mixing shall be discarded.

610.9 Reinforcement. Glass unit masonry panels shall have horizontal joint reinforcement spaced a maximum of 16 inches (406 mm) on center located in the mortar bed joint. Horizontal joint reinforcement shall extend the entire length of the panel but shall not extend across expansion joints. Longitudinal wires shall be lapped a minimum of 6 inches (152 mm) at splices. Joint reinforcement shall be placed in the bed joint immediately below and above openings in the panel. The reinforcement shall have not less than two parallel longitudinal wires of size W1.7 or greater, and have welded cross wires of size W1.7 or greater.

610.10 Placement. Glass units shall be placed so head and bed joints are filled solidly. Mortar shall not be furrowed. Head and bed joints of glass unit masonry shall be $\frac{1}{4}$ inch (6.4 mm) thick, except that vertical joint thickness of radial panels shall not be less than $\frac{1}{8}$ inch (3 mm) or greater than $\frac{5}{8}$ inch (16 mm). The bed joint thickness tolerance shall be minus $\frac{1}{16}$ inch (1.6 mm) and plus $\frac{1}{8}$ inch (3 mm). The head joint thickness tolerance shall be plus or minus $\frac{1}{8}$ inch (3 mm).

SECTION 611 EXTERIOR CONCRETE WALL CONSTRUCTION

611.1 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 or ACI 318.

611.1.1 Interior construction. These provisions are based on the assumption that interior walls and partitions, both load-bearing and nonload-bearing, floors and roof/ceiling assemblies are constructed of light-framed construction complying with the limitations of this code and the additional limitations of Section 611.2. Design and construction of light-framed assemblies shall be in accordance with the applicable provisions of this code. Where second-story exterior walls are of light-framed construction, they shall be designed and constructed as required by this code.

Aspects of concrete construction not specifically addressed by this code, including interior concrete walls, shall comply with ACI 318.

611.1.2 Other concrete walls. Exterior concrete walls constructed in accordance with this code shall comply with the shapes and minimum concrete cross-sectional dimensions of Table 611.3. Other types of forming systems resulting in concrete walls not in compliance with this section shall be designed in accordance with ACI 318.

611.2 Applicability limits. The provisions of this section shall apply to the construction of exterior concrete walls for buildings not greater than 60 feet (18 288 mm) in plan dimensions, floors with clear spans not greater than 32 feet (9754 mm) and roofs with clear spans not greater than 40 feet (12 192 mm). Buildings shall not exceed 35 feet (10 668 mm) in mean roof height or two stories in height above-grade. Floor/ceiling dead loads shall not exceed 10 pounds per square foot (479 Pa), roof/ceiling dead loads shall not exceed 15 pounds per square foot (718 Pa) and attic live loads shall not exceed 20 pounds per square foot (958 Pa). Roof overhangs shall not exceed 2 feet (610 mm) of horizontal projection beyond the exterior wall and the dead load of the overhangs shall not exceed 8 pounds per square foot (383 Pa).

Walls constructed in accordance with the provisions of this section shall be limited to buildings subjected to a maximum design wind speed of 130 miles per hour (58 m/s) Exposure B, 110 miles per hour (49 m/s) Exposure C and 100 miles per hour (45 m/s) Exposure D. Walls constructed in accordance with the provisions of this section shall be limited to detached one-, and two- *and three-* family dwellings and townhouses assigned to Seismic Design Category A or B, and detached one-, and two- *and three-* family dwellings assigned to Seismic Design Category C.

Buildings that are not within the scope of this section shall be designed in accordance with PCA 100 or ACI 318.

611.3 Concrete wall systems. Concrete walls constructed in accordance with these provisions shall comply with the shapes and minimum concrete cross-sectional dimensions of Table 611.3.

611.3.1 Flat wall systems. Flat concrete wall systems shall comply with Table 611.3 and Figure 611.3(1) and have a minimum nominal thickness of 4 inches (102 mm).

611.3.2 Waffle-grid wall systems. Waffle-grid wall systems shall comply with Table 611.3 and Figure 611.3(2). and shall have a minimum nominal thickness of 6 inches (152 mm) for the horizontal and vertical concrete members (cores). The core and web dimensions shall comply with Table 611.3. The maximum weight of waffle-grid walls shall comply with Table 611.3.

611.3.3 Screen-grid wall systems. Screen-grid wall systems shall comply with Table 611.3 and Figure 611.3(3) and shall have a minimum nominal thickness of 6 inches (152 mm) for the horizontal and vertical concrete members (cores). The core dimensions shall comply with Table 611.3. The maximum weight of screen-grid walls shall comply with Table 611.3.

611.4 Stay-in-place forms. Stay-in-place concrete forms shall comply with this section.

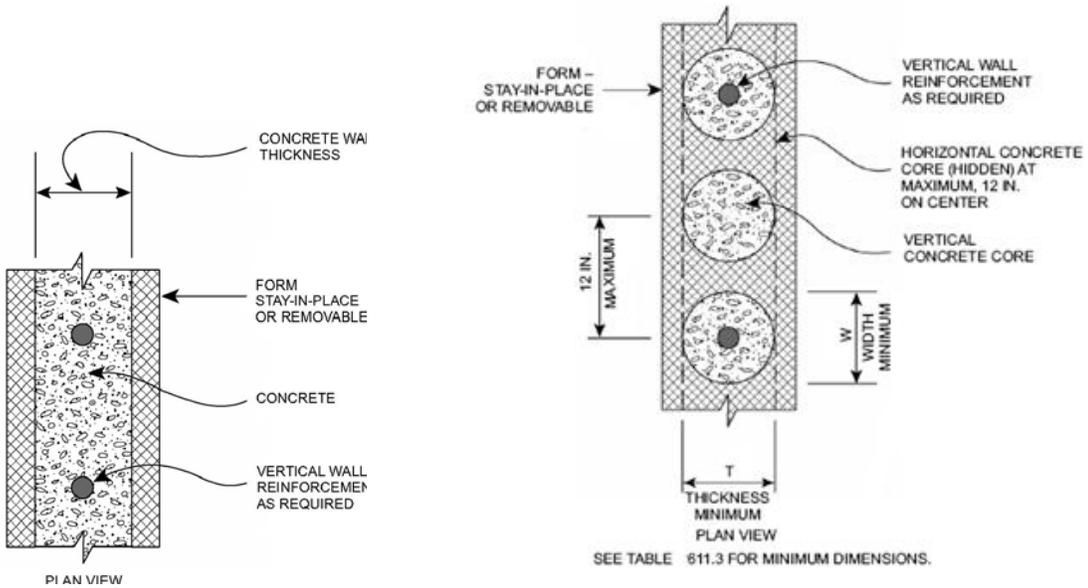
611.4.1 Surface burning characteristics. The flame spread index and smoke-developed index of forming material, other than foam plastic, left exposed on the interior shall comply with Section 302.9. The surface burning surfaces characteristics of foam plastic used in insulating concrete forms shall comply with Section 316.3.

**TABLE 611.3
DIMENSIONAL REQUIREMENTS FOR WALLS^{a,b}**

WALL TYPE AND NOMINAL THICKNESS	MAXIMUM WALL WEIGHT^c (psf)	MINIMUM WIDTH, W, OF VERTICAL CORES (inches)	MINIMUM THICKNESS, T, OF VERTICAL CORES (inches)	MAXIMUM SPACING OF VERTICAL CORES (inches)	MAXIMUM SPACING OF HORIZONTAL CORES (inches)	MINIMUM WEB THICKNESS (inches)
4" Flat ^d	50	N/A	N/A	N/A	N/A	N/A
6" Flat ^d	75	N/A	N/A	N/A	N/A	N/A
8" Flat ^d	100	N/A	N/A	N/A	N/A	N/A
10" Flat ^d	125	N/A	N/A	N/A	N/A	N/A
6" Waffle-grid	56	8 ^e	5.5 ^e	12	16	2
8" Waffle-grid	76	8 ^f	8 ^f	12	16	2
6" Screen-grid	53	6.25 ^g	6.25 ^g	12	12	N/A

For SI: 1 inch = 25.4 mm; 1 pound per square foot = 0.0479kPa, 1 pound per cubic foot = 2402.77 kg/m³, 1 square inch = 645.16 mm².

- a. Width "W," thickness "T," spacing and web thickness, refer to Figures 611.3(2) and 611.3(3).
- b. N/A indicates not applicable.
- c. Wall weight is based on a unit weight of concrete of 150 pcf. For flat walls the weight is based on the nominal thickness. The tabulated values do not include any allowance for interior and exterior finishes.
- d. Nominal wall thickness. The actual as-built thickness of a flat wall shall not be more than ½-inch less or more than ¼-inch more than the nominal dimension indicated.
- e. Vertical core is assumed to be elliptical-shaped. Another shape core is permitted provided the minimum thickness is 5 inches, the moment of inertia, I , about the centerline of the wall (ignoring the web) is not less than 65 in⁴, and the area, A , is not less than 31.25 in². The width used to calculate A and I shall not exceed 8 inches.
- f. Vertical core is assumed to be circular. Another shape core is permitted provided the minimum thickness is 7 inches, the moment of inertia, I , about the centerline of the wall (ignoring the web) is not less than 200 in⁴, and the area, A , is not less than 49 in². The width used to calculate A and I shall not exceed 8 inches.
- g. Vertical core is assumed to be circular. Another shape core is permitted provided the minimum thickness is 5.5 inches, the moment of inertia, I , about the centerline of the wall is not less than 76 in⁴, and the area, A , is not less than 30.25 in². The width used to calculate A and I shall not exceed 6.25 inches.

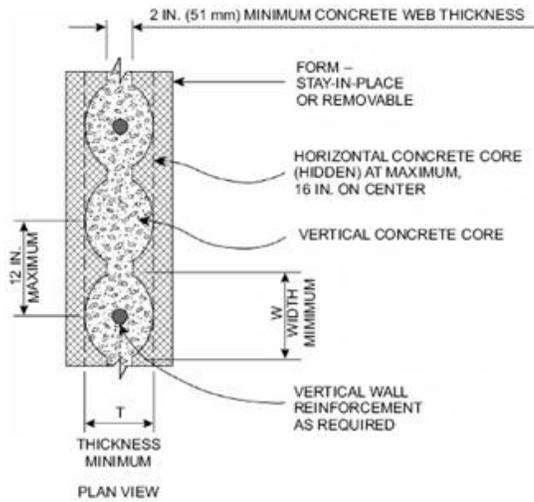


SEE TABLE 611.3 FOR MINIMUM DIMENSIONS

**FIGURE 611.3(1)
FLAT WALL SYSTEM**

For SI: 1 inch = 25.4 mm.

**FIGURE 611.3(2)
WAFFLE-GRID WALL SYSTEM**



SEE TABLE 611.3 FOR MINIMUM DIMENSIONS

For SI: 1 inch = 25.4 mm.

**FIGURE 611.3(3)
SCREEN-GRID WALL SYSTEM**

611.4.2 Interior covering. Stay-in-place forms constructed of rigid foam plastic shall be protected on the interior of the building as required by Sections 316.4 and 702.3.4. Where gypsum board is used to protect the foam plastic, it shall be installed with a mechanical fastening system. Use of adhesives is permitted in addition to mechanical fasteners.

611.4.3 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 of other stay-in-place forming systems shall be protected in accordance with this code.

Requirements for installation of masonry veneer, stucco and other finishes on the exterior of concrete walls and other construction details not covered in this section shall comply with the requirements of this code

611.5 Materials. Materials used in the construction of concrete walls shall comply with this section.

611.5.1 Concrete and materials for concrete. Materials used in concrete, and the concrete itself, shall conform to requirements of this section, or ACI 318.

611.5.1.1 Concrete mixing and delivery. Mixing and delivery of concrete shall comply with ASTM C 94 or ASTM C 685.

611.5.1.2 Maximum aggregate size. The nominal maximum size of coarse aggregate shall not exceed one-fifth the narrowest distance between sides of forms, or three-fourths the clear spacing between reinforcing bars or between a bar and the side of the form.

Exception: When approved, these limitations shall not apply where removable forms are used and workability and methods of consolidation permit concrete to be placed without honeycombs or voids.

611.5.1.3 Proportioning and slump of concrete. Proportions of materials for concrete shall be established to provide workability and consistency to permit concrete to be worked readily into forms and around reinforcement under conditions of placement to be employed, without segregation or

excessive bleeding. Slump of concrete placed in removable forms shall not exceed 6 inches (152 mm).

Exception: When approved, the slump is permitted to exceed 6 inches (152 mm) for concrete mixtures that are resistant to segregation, and are in accordance with the form manufacturer's recommendations.

Slump of concrete placed in stay-in-place forms shall exceed 6 inches (152 mm). Slump of concrete shall be determined in accordance with ASTM C 143.

611.5.1.4 Compressive strength. The minimum specified compressive strength of concrete, f' , shall comply with Section 402.2 and shall be not less than 2,500 pounds per square inch (17.2 MPa) at 28 days.

611.5.1.5 Consolidation of concrete. Concrete shall be consolidated by suitable means during placement and shall be worked around embedded items and reinforcement and into corners of forms. Where stay-in-place forms are used, concrete shall be consolidated by internal vibration.

Exception: When approved, self-consolidating concrete mixtures with slumps equal to or greater than 8 inches (203 mm) that are specifically designed for placement without internal vibration need not be internally vibrated.

611.5.2 Steel reinforcement and anchor bolts.

611.5.2.1 Steel reinforcement. Steel reinforcement shall comply with ASTM A 615, A 706, or A 996. ASTM A 996 bars produced from rail steel shall be Type R.

611.5.2.2 Anchor bolts. Anchor bolts for use with connection details in accordance with Figures 611.9(1) through 611.9(12) shall be bolts with heads complying with ASTM A 307 or ASTM F 1554. ASTM A 307 bolts shall be Grade A (i.e., with heads). ASTM F 1554 bolts shall be Grade 36 minimum. Instead of bolts with heads, it is permissible to use rods with threads on both ends fabricated from steel complying with ASTM A 36. The threaded end of the rod to be embedded in the concrete shall be provided with a hex or square nut.

611.5.2.3 Sheet steel angles and tension tie straps. Angles and tension tie straps for use with connection details in accordance with Figures 611.9(1) through 611.9(12) shall be fabricated from sheet steel complying with ASTM A 653 SS, ASTM A 792 SS, or ASTM A 875 SS. The steel shall be minimum Grade 33 unless a higher grade is required by the applicable figure.

611.5.3 Form materials and form ties. Forms shall be made of wood, steel, aluminum, plastic, a composite of cement and foam insulation, a composite of cement and wood chips, or other approved material suitable for supporting and containing concrete. Forms shall provide sufficient strength to contain concrete during the concrete placement operation.

Form ties shall be steel, solid plastic, foam plastic, a composite of cement and wood chips, a composite of cement and foam plastic, or other suitable material capable of resisting the forces created by fluid pressure of fresh concrete.

611.5.4 Reinforcement installation details.

611.5.4.1 Support and cover. Reinforcement shall be secured in the proper location in the forms with tie wire or other bar support system such that displacement will not occur during the concrete placement operation. Steel reinforcement in concrete cast against the earth shall have a minimum cover of 3 inches (76 mm). Minimum cover for reinforcement in concrete cast in removable forms that will be exposed to the earth or weather shall be 1½ 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 ¾ inch (19 mm). The minus tolerance for cover shall not exceed the smaller of one-third the required cover and ⅜ inch (10 mm). See Section 611.5.4.4 for cover requirements for hooks of bars developed in tension.

611.5.4.2 Location of reinforcement in walls. For location of reinforcement in foundation walls and above-grade walls, see Sections 404.1.2.3.7.2 and 611.6.5, respectively.

611.5.4.3 Lap splices. Vertical and horizontal wall reinforcement required by Sections 611.6 and 611.7 shall be the longest lengths practical. Where splices are necessary in reinforcement, the length of lap splices shall be in accordance with Table 611.5.4(1) and Figure 611.5.4 (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 611.5.4(1).

611.5.4.4 Development of bars in tension. Where bars are required to be developed in tension by other provisions of this code, development lengths and cover for hooks and bar extensions shall comply with Table 611.5.4(1) and Figure 611.5.4 (2). The development lengths shown in Table 611.5.4(1) also apply to bundled bars in lintels installed in accordance with Section 611.8.2.2.

611.5.4.5 Standard hooks. Where reinforcement is required by this code to terminate with a standard hook, the hook shall comply with Figure 611.5.4(3).

611.5.4.6 Webs of waffle-grid walls. Reinforcement, including stirrups, shall not be placed in webs of waffle-grid walls, including lintels. Webs are permitted to have form ties.

611.5.4.7 Alternate grade of reinforcement and spacing. Where tables in Sections 404.1.2 and 611.6 specify vertical wall reinforcement based on minimum bar size and maximum spacing, which are based on Grade 60 (420 MPa) steel reinforcement, different size bars and/or bars made from a different grade of steel are permitted provided an equivalent area of steel per linear foot of wall is provided. Use of Table 611.5.4(2) is permitted to determine the maximum bar spacing for different bar sizes than specified in the tables and/or bars made from a different grade of steel. Bars shall not be spaced less than one-half the wall thickness, or more than 48 inches (1219 mm) on center.

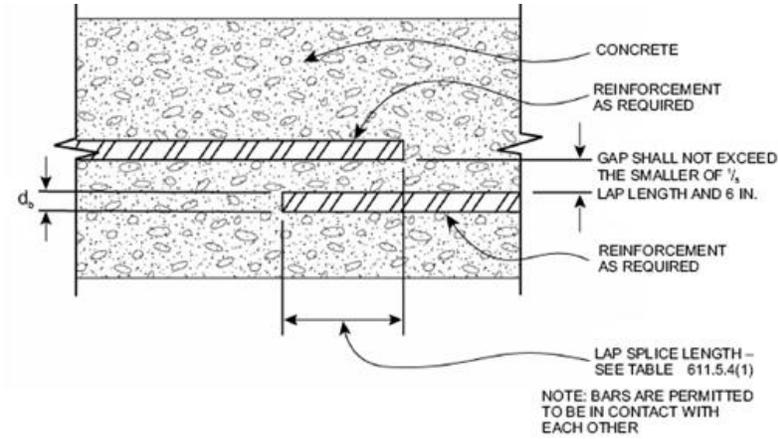
611.5.5 Construction joints in walls. Construction joints shall be made and located to not impair the strength of the wall. Construction joints in plain concrete walls, including walls required to have not less than No. 4 bars at 48 inches (1219 mm) on center by Section 611.6, shall be located at points of lateral support, and a minimum of one No. 4 bar shall extend across the construction joint at a spacing not to exceed 24 inches (610 mm) on center. Construction joint reinforcement shall have a minimum of 12 inches (305 mm) embedment on both sides of the joint. Construction joints in reinforced concrete walls shall be located in the middle third of the span between lateral supports, or located and constructed as required for joints in plain concrete walls.

Exception: Vertical wall reinforcement required by this code is permitted to be used in lieu of construction joint reinforcement, provided the spacing does not exceed 24 inches (610 mm), or the combination of wall reinforcement and No. 4 bars described above does not exceed 24 inches (610 mm).

611.6 Above-grade wall requirements.

611.6.1 General. The minimum thickness of load-bearing and nonload-bearing above-grade walls and reinforcement shall be as set forth in the appropriate table in this section based on the type of wall form to be used. Where the wall or building is not within the limitations of Section 611.2, design is required by the tables in this section, or the wall is not within the scope of the tables in this section, the wall shall be designed in accordance with ACI 318.

Above-grade concrete walls shall be constructed in accordance with this section and Figure 611.6(1), 611.6(2), 611.6(3), or 611.6(4). Above-grade concrete walls that are continuous with stem walls and not laterally supported by the slab-on-ground shall be designed and constructed in accordance with this section. Concrete walls shall be supported on continuous foundation walls or slabs-on-ground that are monolithic with the footing in accordance with Section 403. The minimum length of solid wall without openings shall be in accordance with Section 611.7. Reinforcement around openings, including lintels, shall be in accordance with Section 611.8. Lateral support for above-grade walls in the out-of-plane direction shall be provided by connections to the floor framing system, if applicable, and to ceiling and roof framing systems in accordance with Section 611.9. The wall thickness shall be equal to or greater than the thickness of the wall in the story above.



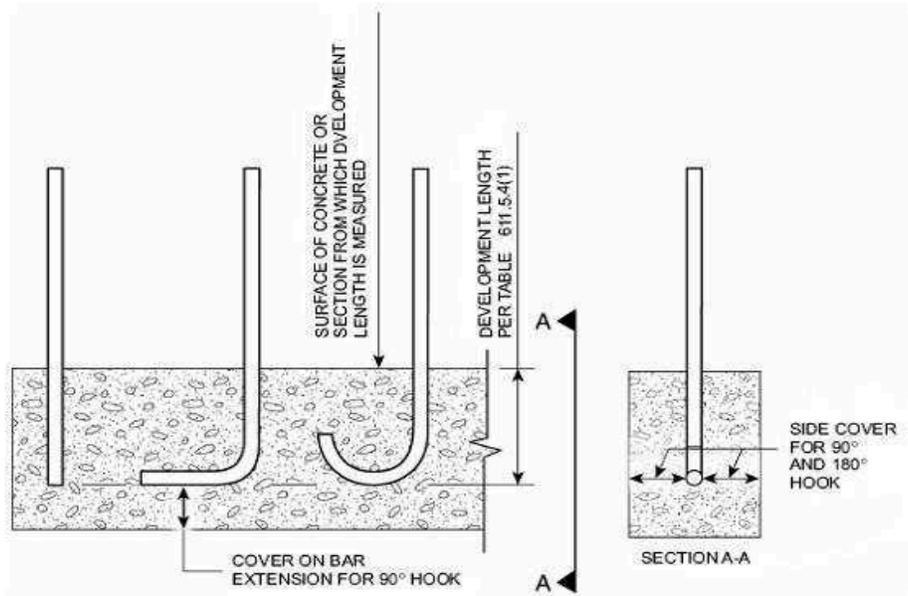
For SI: 1 inch = 25.4 mm.

**FIGURE 611.5.4(1)
LAP SPLICES**

**TABLE 611.5.4(1)
LAP SPLICE AND TENSION DEVELOPMENT LENGTHS**

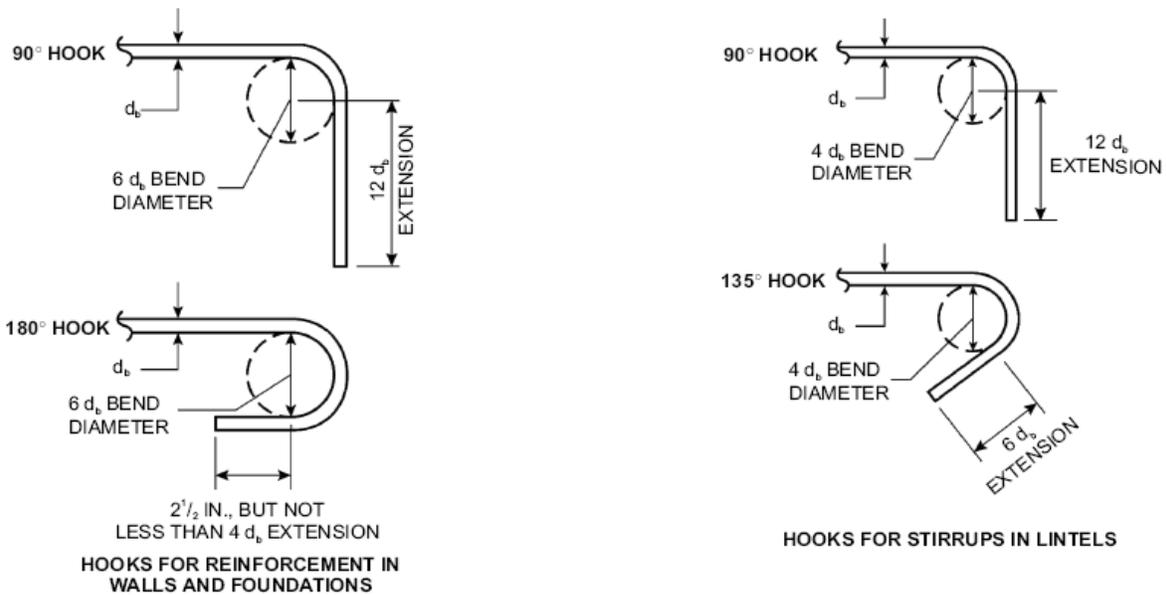
	BAR SIZE NO.	YIELD STRENGTH OF STEEL, f_y - psi (MPa)	
		40,000 (280)	60,000 (420)
		Splice length or tension development length (inches)	
Lap splice length-tension	4	20	30
	5	25	38
	6	30	45
Tension development length for straight bar	4	15	23
	5	19	28
	6	23	34
Tension development length for: a. 90-degree and 180-degree standard hooks with not less than 2½ inches of side cover perpendicular to plane of hook, and b. 90-degree standard hooks with not less than 2 inches of cover on the bar extension beyond the hook.	4	6	9
	5	7	11
	6	8	13
Tension development length for bar with 90-degree or 180-degree standard hook having less cover than required above.	4	8	12
	5	10	15
	6	12	18

For SI: 1 inch = 25.4 mm, 1 degree = 0.0175 rad.



For SI: 1 degree = 0.0175 rad.

FIGURE 611.5.4(2)
DEVELOPMENT LENGTH AND COVER FOR HOOKS AND BAR EXTENSION



For SI: 1 inch = 25.4 mm, 1 degree = 0.0175 rad.

FIGURE 611.5.4(3)
STANDARD HOOKS

TABLE 611.5.4(2)
MAXIMUM SPACING FOR ALTERNATE BAR SIZE AND/OR ALTERNATE GRADE OF STEEL^{a, b, c}

BAR SPACING FROM APPLICABLE TABLE IN SECTION 611.6 (inches)	BAR SIZE FROM APPLICABLE TABLE IN SECTION 611.6														
	#4					#5					#6				
	Alternate bar size and/or alternate grade of steel desired														
	Grade 60		Grade 40			Grade 60		Grade 40			Grade 60		Grade 40		
	#5	#6	#4	#5	#6	#4	#6	#4	#5	#6	#4	#5	#4	#5	#6
	Maximum spacing for alternate bar size and/or alternate grade of steel (inches)														
8	12	18	5	8	12	5	11	3	5	8	4	6	2	4	5
9	14	20	6	9	13	6	13	4	6	9	4	6	3	4	6
10	16	22	7	10	15	6	14	4	7	9	5	7	3	5	7
11	17	24	7	11	16	7	16	5	7	10	5	8	3	5	7
12	19	26	8	12	18	8	17	5	8	11	5	8	4	6	8
13	20	29	9	13	19	8	18	6	9	12	6	9	4	6	9
14	22	31	9	14	21	9	20	6	9	13	6	10	4	7	9
15	23	33	10	16	22	10	21	6	10	14	7	11	5	7	10
16	25	35	11	17	23	10	23	7	11	15	7	11	5	8	11
17	26	37	11	18	25	11	24	7	11	16	8	12	5	8	11
18	28	40	12	19	26	12	26	8	12	17	8	13	5	8	12
19	29	42	13	20	28	12	27	8	13	18	9	13	6	9	13
20	31	44	13	21	29	13	28	9	13	19	9	14	6	9	13
21	33	46	14	22	31	14	30	9	14	20	10	15	6	10	14
22	34	48	15	23	32	14	31	9	15	21	10	16	7	10	15
23	36	48	15	24	34	15	33	10	15	22	10	16	7	11	15
24	37	48	16	25	35	15	34	10	16	23	11	17	7	11	16
25	39	48	17	26	37	16	35	11	17	24	11	18	8	12	17
26	40	48	17	27	38	17	37	11	17	25	12	18	8	12	17
27	42	48	18	28	40	17	38	12	18	26	12	19	8	13	18
28	43	48	19	29	41	18	40	12	19	26	13	20	8	13	19
29	45	48	19	30	43	19	41	12	19	27	13	20	9	14	19
30	47	48	20	31	44	19	43	13	20	28	14	21	9	14	20
31	48	48	21	32	45	20	44	13	21	29	14	22	9	15	21
32	48	48	21	33	47	21	45	14	21	30	15	23	10	15	21
33	48	48	22	34	48	21	47	14	22	31	15	23	10	16	22
34	48	48	23	35	48	22	48	15	23	32	15	24	10	16	23
35	48	48	23	36	48	23	48	15	23	33	16	25	11	16	23
36	48	48	24	37	48	23	48	15	24	34	16	25	11	17	24
37	48	48	25	38	48	24	48	16	25	35	17	26	11	17	25
38	48	48	25	39	48	25	48	16	25	36	17	27	12	18	25
39	48	48	26	40	48	25	48	17	26	37	18	27	12	18	26
40	48	48	27	41	48	26	48	17	27	38	18	28	12	19	27
41	48	48	27	42	48	26	48	18	27	39	19	29	12	19	27
42	48	48	28	43	48	27	48	18	28	40	19	30	13	20	28

43	48	48	29	44	48	28	48	18	29	41	20	30	13	20	29
44	48	48	29	45	48	28	48	19	29	42	20	31	13	21	29
45	48	48	30	47	48	29	48	19	30	43	20	32	14	21	30
46	48	48	31	48	48	30	48	20	31	44	21	32	14	22	31
47	48	48	31	48	48	30	48	20	31	44	21	33	14	22	31
48	48	48	32	48	48	31	48	21	32	45	22	34	15	23	32

For SI: 1 inch = 25.4 mm.

- a. This table is for use with tables in Section 611.6 that specify the minimum bar size and maximum spacing of vertical wall reinforcement for foundation walls and above-grade walls. Reinforcement specified in tables in Section 611.6 is based on Grade 60 (420 MPa) steel reinforcement.
- b. Bar spacing shall not exceed 48 inches on center and shall not be less than one-half the nominal wall thickness.
- c. For Grade 50 (350 MPa) steel bars (ASTM A 996, Type R), use spacing for Grade 40 (280 MPa) bars or interpolate between Grade 40 (280 MPa) and Grade 60 (420 MPa).

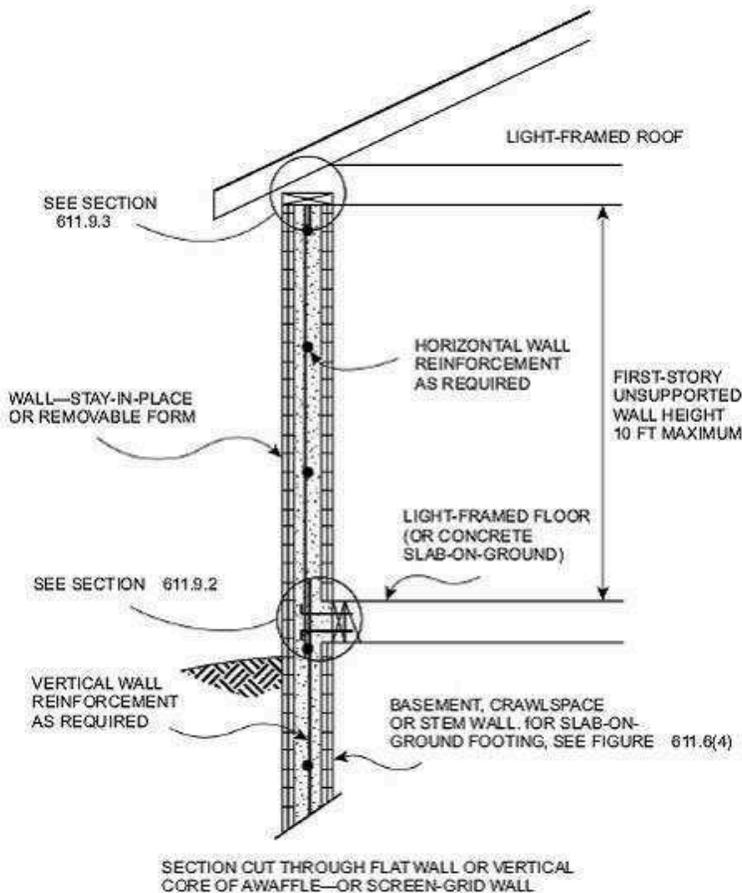
611.6.2 Wall reinforcement for wind. Vertical wall reinforcement for resistance to out-of-plane wind forces shall be determined from Table 611.6(1), 611.6(2), 611.6(3) or 611.6(4). Also, see Sections 611.7.2.2.2 and 611.7.2.2.3. There shall be a vertical bar at all corners of exterior walls. Unless more horizontal reinforcement is required by Section 611.7.2.2.1, the minimum horizontal reinforcement shall be four No. 4 bars [Grade 40 (280 MPa)] placed as follows: top bar within 12 inches (305 mm) of the top of the wall, bottom bar within 12 inches (305 mm) of the finish floor, and one bar each at approximately one-third and two-thirds of the wall height.

611.6.3 Continuity of wall reinforcement between stories. Vertical reinforcement required by this section shall be continuous between elements providing lateral support for the wall. Reinforcement in the wall of the story above shall be continuous with the reinforcement in the wall of the story below, or the foundation wall, if applicable. Lap splices, where required, shall comply with Section 611.5.4.3 and Figure 611.5.4(1). Where the above-grade wall is supported by a monolithic slab-on-ground and footing, dowel bars with a size and spacing to match the vertical above-grade concrete wall reinforcement shall be embedded in the monolithic slab-on-ground and footing the distance required to develop the dowel bar in tension in accordance with Section 611.5.4.4 and Figure 611.5.4(2) and lap-spliced with the above-grade wall reinforcement in accordance with Section 611.5.4.3 and Figure 611.5.4(1).

Exception: Where reinforcement in the wall above cannot be made continuous with the reinforcement in the wall below, the bottom of the reinforcement in the wall above shall be terminated in accordance with one of the following:

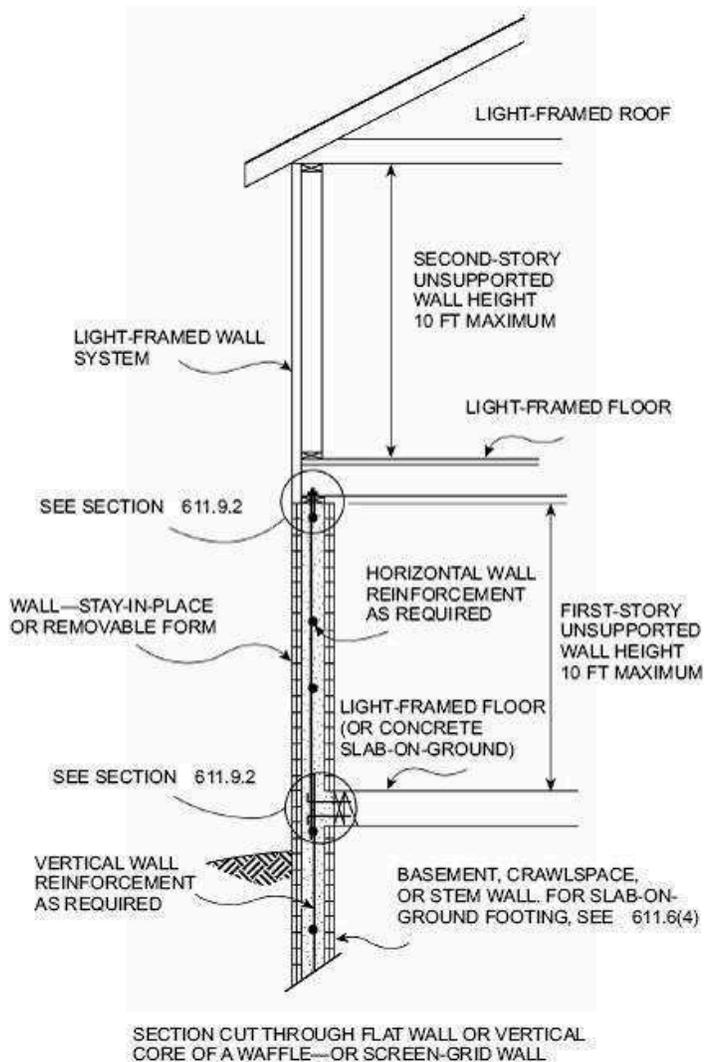
1. Extend below the top of the floor the distance required to develop the bar in tension in accordance with Section 611.5.4.4 and Figure 611.5.4(2).
2. Lap-spliced in accordance with Section 611.5.4.3 and Figure 611.5.4(1) with a dowel bar that extends into the wall below the distance required to develop the bar in tension in accordance with Section 611.5.4.4 and Figure 611.5.4(2).

Where a construction joint in the wall is located below the level of the floor and less than the distance required to develop the bar in tension, the distance required to develop the bar in tension shall be measured from the top of the concrete below the joint. See Section 611.5.5.



For SI: 1 foot = 304.8 mm.

FIGURE 611.6(1)
ABOVE-GRADE CONCRETE WALL CONSTRUCTION ONE



For SI: 1 foot = 304.8 mm.

FIGURE 611.6(2)
ABOVE-GRADE CONCRETE WALL CONSTRUCTION CONCRETE FIRST-STORY AND LIGHT-FRAMED SECOND-STORY

611.6.4 Termination of reinforcement. Where indicated in items 1 through 3 below, vertical wall reinforcement in the top-most story with concrete walls shall be terminated with a 90-degree (1.57 rad) standard hook complying with Section 611.5.4.5 and Figure 611.5.4(3).

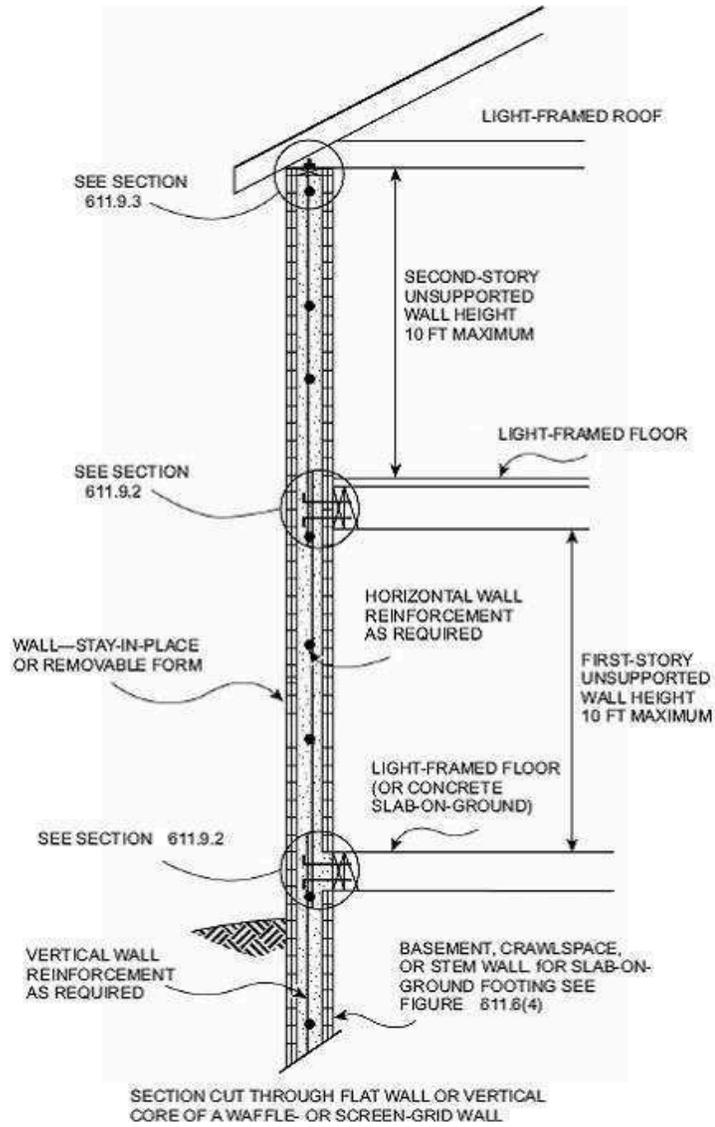
1. Vertical bars adjacent to door and window openings required by Section 611.8.1.2.
2. Vertical bars at the ends of required solid wall segments. See Section 611.7.2.2.2.
3. Vertical bars (other than end bars – see item 2) used as shear reinforcement in required solid wall segments where the reduction factor for design strength, R_3 , used is based on the wall having horizontal and vertical shear reinforcement. See Section 611.7.2.2.3.

The bar extension of the hook shall be oriented parallel to the horizontal wall reinforcement and be within 4 inches (102 mm) of the top of the wall.

Horizontal reinforcement shall be continuous around the building corners by bending one of the bars and lap-splicing it with the bar in the other wall in accordance with Section 611.5.4.3 and Figure 611.5.4(1).

Exception: In lieu of bending horizontal reinforcement at corners, separate bent reinforcing bars shall be permitted provided that the bent bar is lap-spliced with the horizontal reinforcement in both walls in accordance with Section 611.5.4.3 and Figure 611.5.4(1).

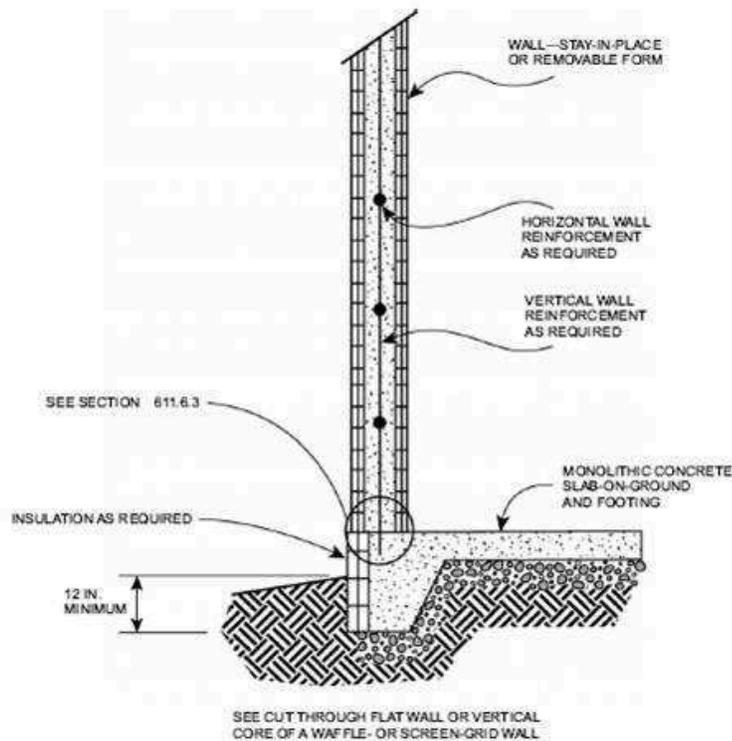
In required solid wall segments where the reduction factor for design strength, R_3 , is based on the wall having horizontal and vertical shear reinforcement in accordance with Section 611.7.2.2.1, horizontal wall reinforcement shall be terminated with a standard hook complying with Section 611.5.4.5 and Figure 611.5.4(3) or in a lap-splice, except at corners where the reinforcement shall be continuous as required above.



For SI: 1 foot = 304.8 mm.

FIGURE 611.6(3)
ABOVE-GRADE CONCRETE WALL CONSTRUCTION TWO-STORY

611.6.5 Location of reinforcement in wall. Except for vertical reinforcement at the ends of required solid wall segments, which shall be located as required by Section 611.7.2.2.2, the location of the vertical reinforcement shall not vary from the center of the wall by more than the greater of 10 percent of the wall thickness and $\frac{3}{8}$ -inch (10 mm). Horizontal and vertical reinforcement shall be located to provide not less than the minimum cover required by Section 611.5.4.1.



For SI: 1 inch = 25.4 mm.

FIGURE 611.6(4)
ABOVE-GRADE CONCRETE WALL SUPPORTED ON MONOLITHIC SLAB-ON-GROUND FOOTING

TABLE 611.6(1)
MINIMUM VERTICAL REINFORCEMENT FOR FLAT ABOVE-GRADE WALLS^{a, b, c, d, e}

MAXIMUM WIND SPEED (mph)			MAXIMUM UNSUPPORTED WALL HEIGHT PER STORY (feet)	MINIMUM VERTICAL REINFORCEMENT—BAR SIZE AND SPACING (inches) ^{f, g}							
				Nominal ^h wall thickness (inches)							
Exposure Category				4		6		8		10	
B	C	D	Top ⁱ	Side ⁱ	Top ⁱ	Side ⁱ	Top ⁱ	Side ⁱ	Top ⁱ	Side ⁱ	
85	—	—	8	4@48	4@48	4@48	4@48	4@48	4@48	4@48	4@48
			9	4@48	4@43	4@48	4@48	4@48	4@48	4@48	4@48
			10	4@47	4@36	4@48	4@48	4@48	4@48	4@48	4@48
90	—	—	8	4@48	4@47	4@48	4@48	4@48	4@48	4@48	4@48
			9	4@48	4@39	4@48	4@48	4@48	4@48	4@48	4@48
			10	4@42	4@34	4@48	4@48	4@48	4@48	4@48	4@48
100	85	—	8	4@48	4@40	4@48	4@48	4@48	4@48	4@48	4@48
			9	4@42	4@34	4@48	4@48	4@48	4@48	4@48	4@48
			10	4@34	4@34	4@48	4@48	4@48	4@48	4@48	4@48
110	90	85	8	4@44	4@34	4@48	4@48	4@48	4@48	4@48	4@48
			9	4@34	4@34	4@48	4@48	4@48	4@48	4@48	4@48
			10	4@34	4@31	4@48	4@37	4@48	4@48	4@48	4@48
120	100	90	8	4@36	4@34	4@48	4@48	4@48	4@48	4@48	4@48
			9	4@34	4@32	4@48	4@38	4@48	4@48	4@48	4@48
			10	4@30	4@27	4@48	5@48	4@48	4@48	4@48	4@48
130	110	100	8	4@34	4@34	4@48	4@48	4@48	4@48	4@48	4@48
			9	4@32	4@28	4@48	4@33	4@48	4@48	4@48	4@48
			10	4@26	4@23	4@48	5@43	4@48	4@48	4@48	4@48

For SI: 1 inch = 25.4 mm; 1 foot = 304.8 mm; 1 mile per hour = 0.447 m/s, 1 pound per square inch = 1.895kPa.

- a. Table is based on ASCE 7 components and cladding wind pressures for an enclosed building using a mean roof height of 35 ft, interior wall area 4, an effective wind area of 10 ft², and topographic factor, K_{zt} , and importance factor, I , equal to 1.0.
- b. Table is based on concrete with a minimum specified compressive strength of 2,500 psi.
- c. See Section 611.6.5 for location of reinforcement in wall.
- d. Deflection criterion is $L/240$, where L is the unsupported height of the wall in inches.
- e. Interpolation is not permitted.
- f. Where No.4 reinforcing bars at a spacing of 48 inches are specified in the table, use of bars with a minimum yield strength of 40,000 psi or 60,000 psi is permitted.
- g. Other than for No. 4 bars spaced at 48 inches on center, table values are based on reinforcing bars with a minimum yield strength of 60,000 psi. Vertical reinforcement with a yield strength of less than 60,000 psi and/or bars of a different size than specified in the table are permitted in accordance with Section 611.5.4.7 and Table 611.5.4(2).
- h. See Table 611.3 for tolerances on nominal thicknesses.
- i. Top means gravity load from roof and/or floor construction bears on top of wall. Side means gravity load from floor construction is transferred to wall from a wood ledger or cold-formed steel track bolted to side of wall. Where floor framing members span parallel to the wall, use of the top bearing condition is permitted.

TABLE 611.6(2)
MINIMUM VERTICAL REINFORCEMENT FOR WAFFLE-GRID ABOVE-GRADE WALLS^{a, b, c, d, e}

MAXIMUM WIND SPEED (mph)			MAXIMUM UNSUPPORTED WALL HEIGHT PER STORY (feet)	MINIMUM VERTICAL REINFORCEMENT—BAR SIZE AND SPACING (inches) ^{f, g}			
				Nominal ^h wall thickness (inches)			
Exposure Category				6		8	
B	C	D		Top ⁱ	Side ⁱ	Top ⁱ	Side ⁱ
85	—	—	8	4@48	4@36, 5@48	4@48	4@48
			9	4@48	4@30, 5@47	4@48	4@45
			10	4@48	4@26, 5@40	4@48	4@39
90	—	—	8	4@48	4@33, 5@48	4@48	4@48
			9	4@48	4@28, 5@43	4@48	4@42
			10	4@31, 5@48	4@24, 5@37	4@48	4@36
100	85	—	8	4@48	4@28, 5@44	4@48	4@43
			9	4@31, 5@48	4@24, 5@37	4@48	4@36
			10	4@25, 5@39	4@24, 5@37	4@48	4@31, 5@48
110	90	85	8	4@33, 5@48	4@25, 5@38	4@48	4@38
			9	4@26, 5@40	4@24, 5@37	4@48	4@31, 5@48
			10	4@24, 5@37	4@23, 5@35	4@48	4@27, 5@41
120	100	90	8	4@27, 5@42	4@24, 5@37	4@48	4@33, 5@48
			9	4@24, 5@37	4@23, 5@36	4@48	4@27, 5@43
			10	4@23, 5@35	4@19, 5@30	4@48	4@23, 5@36
130	110	100	8	4@24, 5@37	4@24, 5@37	4@48	4@29, 5@45
			9	4@24, 5@37	4@20, 5@32	4@48	4@24, 5@37
			10	4@19, 5@30	4@17, 5@26	4@23, 5@36	4@20, 5@31

For SI: 1 inch = 25.4 mm; 1 foot = 304.8 mm; 1 mile per hour = 0.447 m/s, 1 pound per square inch = 6.895kPa.

- Table is based on ASCE 7 components and cladding wind pressures for an enclosed building using a mean roof height of 35 ft (10 668 mm), interior wall area 4, an effective wind area of 10 ft² (0.9 m²), and topographic factor, K_{zt} , and importance factor, I , equal to 1.0.
- Table is based on concrete with a minimum specified compressive strength of 2,500 psi (17.2 MPa).
- See Section 611.6.5 for location of reinforcement in wall.
- Deflection criterion is $L/240$, where L is the unsupported height of the wall in inches.
- Interpolation is not permitted.
- Where No.4 reinforcing bars at a spacing of 48 inches are specified in the table, use of bars with a minimum yield strength of 40,000 psi or 60,000 psi is permitted.
- Other than for No. 4 bars spaced at 48 inches on center, table values are based on reinforcing bars with a minimum yield strength of 60,000 psi. Maximum spacings shown are the values calculated for the specified bar size. Where the bar used is Grade 60 (420 MPa) and the size specified in the table, the actual spacing in the wall shall not exceed a whole-number multiple of 12 inches (i.e., 12, 24, 36 and 48) that is less than or equal to the tabulated spacing. Vertical reinforcement with a yield strength of less than 60,000 psi and/or bars of a different size than specified in the table are permitted in accordance with Section 611.5.4.7 and Table 611.5.4(2).
- See Table 611.3 for minimum core dimensions and maximum spacing of horizontal and vertical cores.
- Top means gravity load from roof and/or floor construction bears on top of wall. Side means gravity load from floor construction is transferred to wall from a wood ledger or cold-formed steel track bolted to side of wall. Where floor framing members span parallel to the wall, the top bearing condition is permitted to be used.

TABLE 611.6(3)
MINIMUM VERTICAL REINFORCEMENT FOR 6-INCH SCREEN-GRID ABOVE-GRADE WALLS^{a, b, c, d, e}

MAXIMUM WIND SPEED (mph)			MAXIMUM UNSUPPORTED WALL HEIGHT PER STORY (feet)	MINIMUM VERTICAL REINFORCEMENT—BAR SIZE AND SPACING (inches) ^{f, g}	
				Nominal ^h wall thickness (inches)	
Exposure Category				6	
B	C	D		Top ⁱ	Side ⁱ
85	—	—	8	4@48	4@34, 5@48
			9	4@48	4@29, 5@45
			10	4@48	4@25, 5@39
90	—	—	8	4@48	4@31, 5@48
			9	4@48	4@27, 5@41
			10	4@30, 5@47	4@23, 5@35
100	85	—	8	4@48	4@27, 5@42
			9	4@30, 5@47	4@23, 5@35
			10	4@24, 5@38	4@22, 5@34
110	90	85	8	4@48	4@24, 5@37
			9	4@25, 5@38	4@22, 5@34
			10	4@22, 5@34	4@22, 5@34
120	100	90	8	4@26, 5@41	4@22, 5@34
			9	4@22, 5@34	4@22, 5@34
			10	4@22, 6@34	4@19, 5@26
130	110	100	8	4@22, 5@35	4@22, 5@34
			9	4@22, 5@34	4@20, 5@30
			10	4@19, 5@29	4@16, 5@25

For SI: 1 inch = 25.4 mm; 1 foot = 304.8 mm; 1 mph = 0.447 m/s, pound per square inch = 6.895kPa.

- Table is based on ASCE 7 components and cladding wind pressures for an enclosed building using a mean roof height of 35 ft, interior wall area 4, an effective wind area of 10 ft², and topographic factor, K_{zt} , and importance factor, I , equal to 1.0.
- Table is based on concrete with a minimum specified compressive strength of 2,500 psi.
- See Section 611.6.5 for location of reinforcement in wall.
- Deflection criterion is $L/240$, where L is the unsupported height of the wall in inches.
- Interpolation is not permitted.
- Where No.4 reinforcing bars at a spacing of 48 inches are specified in the table, use of bars with a minimum yield strength of 40,000 psi or 60,000 psi is permitted.
- Other than for No. 4 bars spaced at 48 inches on center, table values are based on reinforcing bars with a minimum yield strength of 60,000 psi (420 MPa). Maximum spacings shown are the values calculated for the specified bar size. Where the bar used is Grade 60 and the size specified in the table, the actual spacing in the wall shall not exceed a whole-number multiple of 12 inches (i.e., 12, 24, 36 and 48) that is less than or equal to the tabulated spacing. Vertical reinforcement with a yield strength of less than 60,000 psi and/or bars of a different size than specified in the table are permitted in accordance with Section 611.5.4.7 and Table 611.5.4(2).
- See Table 611.3 for minimum core dimensions and maximum spacing of horizontal and vertical cores.
- Top means gravity load from roof and/or floor construction bears on top of wall. Side means gravity load from floor construction is transferred to wall from a wood ledger or cold-formed steel track bolted to side of wall. Where floor framing members span parallel to the wall, use of the top bearing condition is permitted.

TABLE 611.6(4)
MINIMUM VERTICAL REINFORCEMENT FOR FLAT, WAFFLE- AND SCREEN-GRID ABOVE-GRADE WALLS
DESIGNED CONTINUOUS WITH FOUNDATION STEM WALLS^{a, b, c, d, e, k, l}

MAXIMUM WIND SPEED (mph)			HEIGHT OF STEM WALL ^{h, i} (feet)	MAXIMUM DESIGN LATERAL SOIL LOAD (psf/ft)	MAXIMUM UNSUPPORTED HEIGHT OF ABOVEGRADE WALL (feet)	MINIMUM VERTICAL REINFORCEMENT—BAR SIZE AND SPACING (inches) ^{f, g}								
Exposure Category						Wall type and nominal thickness ^j (inches)								
B	C	D				Flat			Waffle		Screen			
			4	6	8	10	6	8	6					
85	—	—	3	30	8	4@33	4@39	4@48	4@48	4@24	4@28	4@22		
					10	4@26	5@48	4@41	4@48	4@19	4@22	4@18		
			6	30	10	DR	5@22	6@35	6@43	DR	4@11	DR		
				60	10	DR	DR	6@26	6@28	DR	DR	DR		
90	—	—	3	30	8	4@30	4@36	4@48	4@48	4@22	4@26	4@21		
					10	4@24	5@44	4@38	4@48	4@17	4@21	4@17		
			6	30	10	DR	5@21	6@35	6@41	DR	4@10	DR		
				60	10	DR	DR	6@26	6@28	DR	DR	DR		
100	85	—	3	30	8	4@26	5@48	4@42	4@48	4@19	4@23	4@18		
					10	4@20	5@37	4@33	4@41	4@15	4@18	4@14		
			6	60	10	4@17	5@34	5@44	4@36	4@13	4@17	4@12		
				30	10	DR	5@20	6@35	6@38	DR	4@9	DR		
110	90	85	3	30	8	4@22	5@42	4@37	4@46	4@16	4@20	4@16		
					10	4@17	5@34	5@44	4@35	4@12	4@17	4@12		
			6	60	10	4@15	5@34	5@39	5@48	4@11	4@17	4@11		
				30	10	DR	5@18	6@35	6@35	DR	4@9	DR		
120	100	90	3	30	8	4@19	5@37	5@48	4@40	4@14	4@17	4@14		
					10	4@14	5@34	5@38	5@48	4@11	4@17	4@10		
			6	60	10	4@13	5@33	6@48	5@43	4@10	4@16	4@9		
				30	10	DR	5@16	6@33	6@32	DR	4@8	DR		
130	110	100	3	30	8	4@17	5@34	5@44	4@36	4@12	4@17	4@10		
					10	DR	5@32	6@47	5@42	4@9	4@15	DR		
			6	60	10	DR	5@29	6@43	5@39	DR	4@14	DR		
				30	10	DR	5@15	6@30	6@29	DR	4@7	DR		
6	60	10	DR	DR	6@21	6@27	DR	DR	DR					

For SI: 1 inch = 25.4 mm; 1 foot = 304.8 mm; 1 mile per hour = 0.447 m/s; 1 pound per square foot per foot = 0.1571kPa/m.
 a. Table is based on ASCE 7 components and cladding wind pressures for an enclosed building using a mean roof height of 35 ft (10 668 mm), interior wall area 4, an effective wind area of 10 ft², and topographic factor, *K_{zt}*, and importance factor, *I*, equal to 1.0.
 b. Table is based on concrete with a minimum specified compressive strength of 2,500 psi.
 c. See Section 611.6.5 for location of reinforcement in wall.

- d. Deflection criterion is $L/240$, where L is the height of the wall in inches from the exterior finish ground level to the top of the above-grade wall.
- e. Interpolation is not permitted. For intermediate values of basic wind speed, heights of stem wall and above-grade wall, and design lateral soil load, use next higher value.
- f. Where No.4 reinforcing bars at a spacing of 48 inches are specified in the table, use of bars with a minimum yield strength of 40,000 psi or 60,000 psi is permitted.
- g. Other than for No. 4 bars spaced at 48 inches on center, table values are based on reinforcing bars with a minimum yield strength of 60,000 psi. Maximum spacings shown are the values calculated for the specified bar size. In waffle and screen-grid walls where the bar used is Grade 60 and the size specified in the table, the actual spacing in the wall shall not exceed a whole-number multiple of 12 inches (i.e., 12, 24, 36 and 48) that is less than or equal to the tabulated spacing. Vertical reinforcement with a yield strength of less than 60,000 psi and/or bars of a different size than specified in the table are permitted in accordance with Section 611.5.4.7 and Table 611.5.4(2).
- h. Height of stem wall is the distance from the exterior finish ground level to the top of the slab-on-ground.
- i. Where the distance from the exterior finish ground level to the top of the slab-on-ground is equal to or greater than 4 feet, the stem wall shall be laterally supported at the top and bottom before backfilling. Where the wall is designed and constructed to be continuous with the above-grade wall, temporary supports bracing the top of the stem wall shall remain in place until the above-grade wall is laterally supported at the top by floor or roof construction.
- j. See Table 611.3 for tolerances on nominal thicknesses, and minimum core dimensions and maximum spacing of horizontal and vertical cores for waffle-and screen-grid walls.
- k. Tabulated values are applicable to construction where gravity loads bear on top of wall, and conditions where gravity loads from floor construction are transferred to wall from a wood ledger or cold-formed steel track bolted to side of wall. See Tables 611.6(1), 611.6(2) and 611.6(3).
- l. DR indicates design required.

611.7 Solid walls for resistance to lateral forces.

611.7.1 Length of solid wall. Each exterior wall line in each story shall have a total length of solid wall required by Section 611.7.1.1. A solid wall is a section of flat, waffle-grid or screen-grid wall, extending the full story height without openings or penetrations, except those permitted by Section 611.7.2. Solid wall segments that contribute to the total length of solid wall shall comply with Section 611.7.2.

611.7.1.1 Length of solid wall for wind. All buildings shall have solid walls in each exterior endwall line (the side of a building that is parallel to the span of the roof or floor framing) and sidewall line (the side of a building that is perpendicular to the span of the roof or floor framing) to resist lateral in-plane wind forces. The site-appropriate basic wind speed and exposure category shall be used in Tables 611.7(1A) through (1C) to determine the unreduced total length, UR, of solid wall required in each exterior endwall line and sidewall line. For buildings with a mean roof height of less than 35 feet (10 668 mm), the unreduced values determined from Tables 611.7(1A) through (1C) is permitted by multiplying by the applicable factor, R1, from Table 611.7(2); however, reduced values shall not be less than the minimum values in Tables 611.7(1A) through (1C).

Where the floor-to-ceiling height of a story is less than 10 feet (3048 mm), the unreduced values determined from Tables 611.7(1A) through (C), including minimum values, is permitted to be reduced by multiplying by the applicable factor, R_2 , from Table 611.7(3). To account for different design strengths than assumed in determining the values in Tables 611.7(1A) through (1C), the unreduced lengths determined from Tables 611.7(1A) through (1C), including minimum values, are permitted to be reduced by multiplying by the applicable factor, R_3 , from Table 611.7(4). The reductions permitted by Tables 611.7(2), 611.7(3) and 611.7(4) are cumulative.

The total length of solid wall segments, TL , in a wall line that comply with the minimum length requirements of Section 611.7.2.1 [see Figure 611.7(1)] shall be equal to or greater than the product of the unreduced length of solid wall from Tables 611.7(1A) through (1C), UR and the applicable reduction factors, if any, from Tables 611.7(2), 611.7(3) and 611.7(4) as indicated by Equation 611-1.

$$TL \geq R_1 \cdot R_2 \cdot R_3 \cdot UR \quad \text{(Equation 611-1)}$$

Where

TL = total length of solid wall segments in a wall line that comply with Section 611.7.2.1 [see Figure 611.7(1)], and

R_1 = 1.0 or reduction factor for mean roof height from Table 611.7(2),

R_2 = 1.0 or reduction factor for floor-to-ceiling wall height from Table 611.7(3),

R_3 = 1.0 or reduction factor for design strength from Table 611.7(4), and

UR = unreduced length of solid wall from Tables 611.7(1A) through (1C).

The total length of solid wall in a wall line, TL , shall not be less than that provided by two solid wall segments complying with the minimum length requirements of Section 611.7.2.1.

To facilitate determining the required wall thickness, wall type, number and grade of vertical bars at the each end of each solid wall segment, and whether shear reinforcement is required, use of Equation 611-2 is permitted.

$$R_3 \leq \frac{TL}{R_1 \bullet R_2 \bullet R_3 \bullet UR} \quad \text{Equation 611-2)}$$

After determining the maximum permitted value of the reduction factor for design strength, R_3 , in accordance with Equation 611-2, select a wall type from Table 611.7(4) with R_3 less than or equal to the value calculated.

611.7.2 Solid wall segments. Solid wall segments that contribute to the required length of solid wall shall comply with this section. Reinforcement shall be provided in accordance with Section 611.7.2.2 and Table 611.7(4). Solid wall segments shall extend the full story-height without openings, other than openings for the utilities and other building services passing through the wall. In flat walls and waffle-grid walls, such openings shall have an area of less than 30 square inches (19 355 mm²) with no dimension exceeding 6¼ inches (159 mm), and shall not be located within 6 inches (152 mm) of the side edges of the solid wall segment. In screen-grid walls, such openings shall be located in the portion of the solid wall segment between horizontal and vertical cores of concrete and opening size and location are not restricted provided no concrete is removed.

611.7.2.1 Minimum length of solid wall segment and maximum spacing. Only solid wall segments equal to or greater than 24 inches (610 mm) in length shall be included in the total length of solid wall required by Section 611.7.1. In addition, no more than two solid wall segments equal to or greater than 24 inches (610 mm) in length and less than 48 inches (1219 mm) in length shall be included in the required total length of solid wall. The maximum clear opening width shall be 18 feet (5486 mm). See Figure 611.7(1).

611.7.2.2 Reinforcement in solid wall segments.

611.7.2.2.1 Horizontal shear reinforcement. Where reduction factors for design strength, R_3 , from Table 611.7(4) based on horizontal and vertical shear reinforcement being provided are used, solid wall segments shall have horizontal reinforcement consisting of minimum No. 4 bars. Horizontal shear reinforcement shall be the same grade of steel required for the vertical reinforcement at the ends of solid wall segments by Section 611.7.2.2.2.

The spacing of horizontal reinforcement shall not exceed the smaller of one-half the length of the solid wall segment, minus 2 inches (51 mm), and 18 inches (457 mm). Horizontal shear reinforcement shall terminate in accordance with Section 611.6.4.

611.7.2.2.2 Vertical reinforcement. Vertical reinforcement applicable to the reduction factor(s) for design strength, R_3 , from Table 611.7(4) that is used, shall be located at each end of each solid wall segment in accordance with the applicable detail in Figure 611.7(2). The No. 4 vertical bar required on each side of an opening by Section 611.8.1.2 is permitted to be used as reinforcement at the ends of solid wall segments where installed in accordance with the applicable detail in Figure 611.7(2). There shall be not less than two No. 4 bars at each end of solid wall segments located as required by the applicable detail in Figure 611.7(2). One of the bars at each end of solid wall segments shall be deemed to meet the requirements for vertical wall reinforcement required by Section 611.6.

The vertical wall reinforcement at each end of each solid wall segment shall be developed below the bottom of the adjacent wall opening [see Figure 611.7(3)] by one of the following methods:

1. Where the wall height below the bottom of the adjacent opening is equal to or greater than 22 inches (559 mm) for No. 4 or 28 inches (711 mm) for No. 5 vertical wall reinforcement, reinforcement around openings in accordance with Section 611.8.1 shall be sufficient, or
2. Where the wall height below the bottom of the adjacent opening is less than required by Item 1 above, the vertical wall reinforcement adjacent to the opening shall extend into the footing far enough to develop the bar in tension in accordance with Section 611.5.4.4 and Figure 611.5.4(2), or shall be lap-spliced with a dowel that is embedded in the footing far enough to develop the dowel-bar in tension.

611.7.2.2.3 Vertical shear reinforcement. Where reduction factors for design strength, R_3 , from Table 611.7(4) based on horizontal and vertical shear reinforcement being provided are used, solid wall segments shall have vertical reinforcement consisting of minimum No. 4 bars. Vertical shear reinforcement shall be the same grade of steel

required by Section 611.7.2.2.2 for the vertical reinforcement at the ends of solid wall segments. The spacing of vertical reinforcement throughout the length of the segment shall not exceed the smaller of one third the length of the segment, and 18 inches (457 mm). Vertical shear reinforcement shall be continuous between stories in accordance with Section 611.6.3, and shall terminate in accordance with Section 611.6.4. Vertical shear reinforcement required by this section is permitted to be used for vertical reinforcement required by Table 611.6(1), 611.6(2), 611.6(3) or 611.6(4), whichever is applicable.

611.7.2.3 Solid wall segments at corners. At all interior and exterior corners of exterior walls, a solid wall segment shall extend the full height of each wall story. The segment shall have the length required to develop the horizontal reinforcement above and below the adjacent opening in tension in accordance with Section 611.5.4.4. For an exterior corner, the limiting dimension is measured on the outside of the wall, and for an interior corner the limiting dimension is measured on the inside of the wall. See Section 611.8.1. The length of a segment contributing to the required length of solid wall shall comply with Section 611.7.2.1.

The end of a solid wall segment complying with the minimum length requirements of Section 611.7.2.1 shall be located no more than 6 feet (1829 mm) from each corner.

TABLE 611.7(1A)
UNREDUCED LENGTH, *U_R*, OF SOLID WALL REQUIRED IN EACH EXTERIOR ENDWALL FOR WIND PERPENDICULAR TO RIDGE ONE STORY OR TOP STORY OF TWO-STORY^{a,c,d,e,f,g}

SIDEWALL LENGTH (feet)	ENDWALL LENGTH (feet)	ROOF SLOPE	UNREDUCED LENGTH, <i>U_R</i> , OF SOLID WALL REQUIRED IN ENDWALLS FOR WIND PERPENDICULAR TO RIDGE (feet)						Minimum ^b
			Basic Wind Speed (mph) Exposure						
			85B	90B	100B	110B	120B	130B	
					85C	90C	100C	110C	
			85D	90D	100D				
15	15	< 1:12	0.90	1.01	1.25	1.51	1.80	2.11	0.98
		5:12	1.25	1.40	1.73	2.09	2.49	2.92	1.43
		7:12	1.75	1.96	2.43	2.93	3.49	4.10	1.64
		12:12	2.80	3.13	3.87	4.68	5.57	6.54	2.21
	30	< 1:12	0.90	1.01	1.25	1.51	1.80	2.11	1.09
		5:12	1.25	1.40	1.73	2.09	2.49	2.92	2.01
		7:12	2.43	2.73	3.37	4.08	4.85	5.69	2.42
		12:12	4.52	5.07	6.27	7.57	9.01	10.58	3.57

	45	< 1:12	0.90	1.01	1.25	1.51	1.80	2.11	1.21
		5:12	1.25	1.40	1.73	2.09	2.49	2.92	2.59
		7:12	3.12	3.49	4.32	5.22	6.21	7.29	3.21
		12:12	6.25	7.00	8.66	10.47	12.45	14.61	4.93
	60	< 1:12	0.90	1.01	1.25	1.51	1.80	2.11	1.33
		5:12	1.25	1.40	1.73	2.09	2.49	2.92	3.16
		7:12	3.80	4.26	5.26	6.36	7.57	8.89	3.99
		12:12	7.97	8.94	11.05	13.36	15.89	18.65	6.29
30	15	< 1:12	1.61	1.80	2.23	2.70	3.21	3.77	1.93
		5:12	2.24	2.51	3.10	3.74	4.45	5.23	2.75
		7:12	3.15	3.53	4.37	5.28	6.28	7.37	3.12
		12:12	4.90	5.49	6.79	8.21	9.77	11.46	4.14
	30	< 1:12	1.61	1.80	2.23	2.70	3.21	3.77	2.14
		5:12	2.24	2.51	3.10	3.74	4.45	5.23	3.78
		7:12	4.30	4.82	5.96	7.20	8.57	10.05	4.52
		12:12	7.79	8.74	10.80	13.06	15.53	18.23	6.57
	45	< 1:12	1.61	1.80	2.23	2.70	3.21	3.77	2.35
		5:12	2.24	2.51	3.10	3.74	4.45	5.23	4.81
		7:12	5.44	6.10	7.54	9.12	10.85	12.73	5.92
		12:12	10.69	11.98	14.81	17.90	21.30	25.00	9.00
	60	< 1:12	1.61	1.80	2.23	2.70	3.21	3.77	2.56
		5:12	2.24	2.51	3.10	3.74	4.45	5.23	5.84
		7:12	6.59	7.39	9.13	11.04	13.14	15.41	7.32
		12:12	13.58	15.22	18.82	22.75	27.07	31.77	11.43
60	15	< 1:12	2.99	3.35	4.14	5.00	5.95	6.98	3.83
		5:12	4.15	4.65	5.75	6.95	8.27	9.70	5.37
		7:12	5.91	6.63	8.19	9.90	11.78	13.83	6.07
		12:12	9.05	10.14	12.54	15.16	18.03	21.16	8.00
	30	< 1:12	2.99	3.35	4.14	5.00	5.95	6.98	4.23
		5:12	4.15	4.65	5.75	6.95	8.27	9.70	7.31
		7:12	7.97	8.94	11.05	13.36	15.89	18.65	8.71
		12:12	14.25	15.97	19.74	23.86	28.40	33.32	12.57
	45	< 1:12	3.11	3.48	4.30	5.20	6.19	7.26	4.63
		5:12	4.31	4.84	5.98	7.23	8.60	10.09	9.25
		7:12	10.24	11.47	14.19	17.15	20.40	23.84	11.35
		12:12	19.84	22.24	27.49	33.23	39.54	46.40	17.14

60	< 1:12	3.22	3.61	4.46	5.39	6.42	7.53	5.03
	5:12	4.47	5.01	6.19	7.49	8.91	10.46	11.19
	7:12	12.57	14.09	17.42	21.05	25.05	29.39	13.99
	12:12	25.61	28.70	35.49	42.90	51.04	59.90	21.71

For SI: 1 inch = 25.4 mm; 1 foot = 304.8 mm; 1 mile per hour = 0.447 m/s, 1 pound-force per linear foot = 0.146kN/m, 1 pound per square foot = 47.88 Pa.

- a. Tabulated lengths were derived by calculating design wind pressures in accordance with Figure 6-10 of ASCE 7 for a building with a mean roof height of 35 feet (10 668 mm). For wind perpendicular to the ridge, the effects of a 2-foot overhang on each endwall are included. The design pressures were used to calculate forces to be resisted by solid wall segments in each endwall [Table 611.7(1A) or 611.7(1B) or sidewall (Table 611.7(1C)], as appropriate. The forces to be resisted by each wall line were then divided by the default design strength of 840 pounds per linear foot (12.26 kN/m) of length to determine the required solid wall length. The actual mean roof height of the building shall not exceed the least horizontal dimension of the building.
- b. Tabulated lengths in the “minimum” column are based on the requirement of Section 6.1.4.1 of ASCE 7 that the main wind-force resisting system be designed for a minimum service level force of 10 psf multiplied by the area of the building projected onto a vertical plane normal to the assumed wind direction. Tabulated lengths in shaded cells are less than the “minimum” value. Where the minimum controls, it is permitted to be reduced in accordance with Notes c, d and e. See Section 611.7.1.1.
- c. For buildings with a mean roof height of less than 35 feet, tabulated lengths are permitted to be reduced by multiplying by the appropriate factor, R_1 , from Table 611.7(2). The reduced length shall not be less than the “minimum” value shown in the table.
- d. Tabulated lengths for “one story or top story of two-story” are based on a floor-to-ceiling height of 10 feet. Tabulated lengths for “first story of two-story” are based on floor-to-ceiling heights of 10 feet each for the first and second story. For floor-to-ceiling heights less than assumed, use the lengths in Table 611.7(1A), (1B) or (1C), or multiply the value in the table by the reduction factor, R_2 , from Table 611.7(3).
- e. Tabulated lengths are based on the default design shear strength of 840 pounds per linear foot of solid wall segment. The tabulated lengths are permitted to be reduced by multiplying by the applicable reduction factor for design strength, R_3 , from Table 611.7(4).
- f. The reduction factors, R_1 , R_2 , and R_3 , in Tables 611.7(2), 611.7(3), and 611.7(4), respectively, are permitted to be compounded, subject to the limitations of Note b. However, the minimum number and minimum length of solid walls segments in each wall line shall comply with Sections 611.7.1 and 611.7.2.1, respectively.
- g. For intermediate values of sidewall length, endwall length, roof slope and basic wind speed, use the next higher value, or determine by interpolation.

TABLE 611.7(1B)
UNREDUCED LENGTH, *U_R*, OF SOLID WALL REQUIRED IN EACH EXTERIOR ENDWALL FOR WIND PERPENDICULAR TO RIDGE FIRST STORY OF TWO-STORY^{a,c,d,e,f,g}

SIDEWALL LENGTH (feet)	ENDWALL LENGTH (feet)	ROOF SLOPE	UNREDUCED LENGTH, <i>U_R</i> , OF SOLID WALL REQUIRED IN ENDWALLS FOR WIND PERPENDICULAR TO RIDGE (feet)						
			Basic Wind Speed (mph) Exposure						Minimum ^b
			85B	90B	100B	110B	120B	130B	
					85C	90C	100C	110C	
						85D	90D	100D	
Velocity pressure (psf)									
			11.51	12.90	15.95	19.28	22.94	26.92	
15	15	< 1:12	2.60	2.92	3.61	4.36	5.19	6.09	2.59
		5:12	3.61	4.05	5.00	6.05	7.20	8.45	3.05
		7:12	3.77	4.23	5.23	6.32	7.52	8.82	3.26
		12:12	4.81	5.40	6.67	8.06	9.60	11.26	3.83
	30	< 1:12	2.60	2.92	3.61	4.36	5.19	6.09	2.71
		5:12	3.61	4.05	5.00	6.05	7.20	8.45	3.63
		7:12	4.45	4.99	6.17	7.46	8.88	10.42	4.04
		12:12	6.54	7.33	9.06	10.96	13.04	15.30	5.19
	45	< 1:12	2.60	2.92	3.61	4.36	5.19	6.09	2.83
		5:12	3.61	4.05	5.00	6.05	7.20	8.45	4.20
		7:12	5.14	5.76	7.12	8.60	10.24	12.01	4.83
		12:12	8.27	9.27	11.46	13.85	16.48	19.34	6.55
	60	< 1:12	2.60	2.92	3.61	4.36	5.19	6.09	2.95
		5:12	3.61	4.05	5.00	6.05	7.20	8.45	4.78
		7:12	5.82	6.52	8.06	9.75	11.60	13.61	5.61
		12:12	9.99	11.20	13.85	16.74	19.92	23.37	7.90
30	15	< 1:12	4.65	5.21	6.45	7.79	9.27	10.88	5.16
		5:12	6.46	7.24	8.95	10.82	12.87	15.10	5.98
		7:12	6.94	7.78	9.62	11.62	13.83	16.23	6.35
		12:12	8.69	9.74	12.04	14.55	17.32	20.32	7.38
	30	< 1:12	4.65	5.21	6.45	7.79	9.27	10.88	5.38
		5:12	6.46	7.24	8.95	10.82	12.87	15.10	7.01
		7:12	8.09	9.06	11.21	13.54	16.12	18.91	7.76
		12:12	11.58	12.98	16.05	19.40	23.08	27.09	9.81
	45	< 1:12	4.65	5.21	6.45	7.79	9.27	10.88	5.59
		5:12	6.46	7.24	8.95	10.82	12.87	15.10	8.04
		7:12	9.23	10.35	12.79	15.46	18.40	21.59	9.16
		12:12	14.48	16.22	20.06	24.25	28.85	33.86	12.24
	60	< 1:12	4.65	5.21	6.45	7.79	9.27	10.88	5.80
		5:12	6.46	7.24	8.95	10.82	12.87	15.10	9.08
		7:12	10.38	11.63	14.38	17.38	20.69	24.27	10.56
		12:12	17.37	19.47	24.07	29.10	34.62	40.63	14.67
60	15	< 1:12	8.62	9.67	11.95	14.45	17.19	20.17	10.30

		5:12	11.98	13.43	16.61	20.07	23.88	28.03	11.85
		7:12	13.18	14.78	18.27	22.08	26.28	30.83	12.54
		12:12	16.32	18.29	22.62	27.34	32.53	38.17	14.48
	30	< 1:12	8.62	9.67	11.95	14.45	17.19	20.17	10.70
		5:12	11.98	13.43	16.61	20.07	23.88	28.03	13.79
		7:12	15.25	17.09	21.13	25.54	30.38	35.66	15.18
		12:12	21.52	24.12	29.82	36.05	42.89	50.33	19.05
	45	< 1:12	8.97	10.06	12.43	15.03	17.88	20.99	11.10
		5:12	12.46	13.97	17.27	20.88	24.84	29.15	15.73
		7:12	17.67	19.80	24.48	29.59	35.21	41.32	17.82
		12:12	27.27	30.56	37.79	45.68	54.35	63.78	23.62
	60	< 1:12	9.30	10.43	12.89	15.58	18.54	21.76	11.50
5:12		12.91	14.47	17.90	21.63	25.74	30.20	17.67	
7:12		20.14	22.58	27.91	33.74	40.15	47.11	20.46	
12:12		33.19	37.19	45.99	55.59	66.14	77.62	28.19	

For SI: 1 inch = 25.4 mm; 1 foot = 304.8 mm; 1 mile per hour = 0.447 m/s, 1 pound force per linear foot = 0.146kN/m, 1 pound per square foot = 47.88 Pa.

- a. Tabulated lengths were derived by calculating design wind pressures in accordance with Figure 6-10 of ASCE 7 for a building with a mean roof height of 35 feet (10 668 mm). For wind perpendicular to the ridge, the effects of a 2-foot (610 mm) overhang on each endwall are included. The design pressures were used to calculate forces to be resisted by solid wall segments in each endwall [Table 611.7(1A) or 611.7(1B)] or sidewall [Table 611.7(1C)], as appropriate. The forces to be resisted by each wall line were then divided by the default design strength of 840 pounds per linear foot (12.26 kN/m) of length to determine the required solid wall length. The actual mean roof height of the building shall not exceed the least horizontal dimension of the building.
- b. Tabulated lengths in the “minimum” column are based on the requirement of Section 6.1.4.1 of ASCE 7 that the main wind-force resisting system be designed for a minimum service level force of 10 psf multiplied by the area of the building projected onto a vertical plane normal to the assumed wind direction. Tabulated lengths in shaded cells are less than the “minimum” value. Where the minimum controls, it is permitted to be reduced in accordance with Notes c, d and e. See Section 611.7.1.1.
- c. For buildings with a mean roof height of less than 35 feet tabulated lengths are permitted to be reduced by multiplying by the appropriate factor, R_1 , from Table 611.7(2). The reduced length shall not be less than the “minimum” value shown in the table.
- d. Tabulated lengths for “one story or top story of two-story” are based on a floor-to-ceiling height of 10 feet. Tabulated lengths for “first story of two-story” are based on floor-to-ceiling heights of 10 feet each for the first and second story. For floor-to-ceiling heights less than assumed, use the lengths in Table 611.7(1A), (1B) or (1C), or multiply the value in the table by the reduction factor, R_2 , from Table 611.7(3).
- e. Tabulated lengths are based on the default design shear strength of 840 pounds per linear foot of solid wall segment. The tabulated lengths are permitted to be reduced by multiplying by the applicable reduction factor for design strength, R_3 , from Table 611.7(4).
- f. The reduction factors, R_1 , R_2 , and R_3 , in Tables 611.7(2), 611.7(3), and 611.7(4), respectively, are permitted to be compounded, subject to the limitations of Note b. However, the minimum number and minimum length of solid walls segments in each wall line shall comply with Sections 611.7.1 and 611.7.2.1, respectively.
- g. For intermediate values of sidewall length, endwall length, roof slope and basic wind speed, use the next higher value, or determine by interpolation.

TABLE 611.7(1C)
UNREDUCED LENGTH, UR, OF SOLID WALL REQUIRED IN EACH EXTERIOR SIDEWALL FOR WIND PARALLEL TO RIDGE^{a,c,d,e,f,g}

SIDEWALL LENGTH (feet)	ENDWALL LENGTH (feet)	ROOF SLOPE	UNREDUCED LENGTH, UR, OF SOLID WALL REQUIRED IN ENDWALLS SIDEWALLS FOR WIND PERPENDICULAR PARALLEL TO RIDGE (feet)						
			Basic Wind Speed (mph) Exposure						Minimum ^b
			85B	90B	100B	110B	120B	130B	
					85C	90C	100C	110C	
						85D	90D	100D	
One story or top story of two-story									
< 30	15	< 1:12	0.95	1.06	1.31	1.59	1.89	2.22	0.90
		5:12	1.13	1.26	1.56	1.88	2.24	2.63	1.08
		7:12	1.21	1.35	1.67	2.02	2.40	2.82	1.17
		12:12	1.43	1.60	1.98	2.39	2.85	3.34	1.39
	30	< 1:12	1.77	1.98	2.45	2.96	3.53	4.14	1.90
		5:12	2.38	2.67	3.30	3.99	4.75	5.57	2.62
		7:12	2.66	2.98	3.69	4.46	5.31	6.23	2.95
		12:12	3.43	3.85	4.76	5.75	6.84	8.03	3.86
	45	< 1:12	2.65	2.97	3.67	4.43	5.27	6.19	2.99
		5:12	3.98	4.46	5.51	6.66	7.93	9.31	4.62
		7:12	4.58	5.14	6.35	7.68	9.14	10.72	5.36
		12:12	6.25	7.01	8.67	10.48	12.47	14.63	7.39
	60	< 1:12	3.59	4.03	4.98	6.02	7.16	8.40	4.18
		5:12	5.93	6.65	8.22	9.93	11.82	13.87	7.07
		7:12	6.99	7.83	9.69	11.71	13.93	16.35	8.38
		12:12	9.92	11.12	13.75	16.62	19.77	23.21	12.00
60	45	< 1:12	2.77	3.11	3.84	4.65	5.53	6.49	2.99
		5:12	4.15	4.66	5.76	6.96	8.28	9.72	4.62
		7:12	4.78	5.36	6.63	8.01	9.53	11.18	5.36
		12:12	6.51	7.30	9.03	10.91	12.98	15.23	7.39
	60	< 1:12	3.86	4.32	5.35	6.46	7.69	9.02	4.18
		5:12	6.31	7.08	8.75	10.57	12.58	14.76	7.07
		7:12	7.43	8.32	10.29	12.44	14.80	17.37	8.38
		12:12	10.51	11.78	14.56	17.60	20.94	24.57	12.00
First story of two-story									
< 30	15	< 1:12	2.65	2.97	3.67	4.44	5.28	6.20	2.52
		5:12	2.83	3.17	3.92	4.74	5.64	6.62	2.70
		7:12	2.91	3.26	4.03	4.87	5.80	6.80	2.79
		12:12	3.13	3.51	4.34	5.25	6.24	7.32	3.01
	30	< 1:12	4.81	5.39	6.67	8.06	9.59	11.25	5.14
		5:12	5.42	6.08	7.52	9.09	10.81	12.69	5.86
		7:12	5.70	6.39	7.90	9.55	11.37	13.34	6.19
		12:12	6.47	7.25	8.97	10.84	12.90	15.14	7.10
45	< 1:12	6.99	7.83	9.69	11.71	13.93	16.35	7.85	

		5:12	8.32	9.33	11.53	13.94	16.59	19.47	9.48
		7:12	8.93	10.01	12.37	14.95	17.79	20.88	10.21
		12:12	10.60	11.88	14.69	17.75	21.13	24.79	12.25
	60	< 1:12	9.23	10.35	12.79	15.46	18.40	21.59	10.65
		5:12	11.57	12.97	16.03	19.38	23.06	27.06	13.54
		7:12	12.63	14.15	17.50	21.15	25.17	29.54	14.85
		12:12	15.56	17.44	21.56	26.06	31.01	36.39	18.48
60	45	< 1:12	7.34	8.22	10.17	12.29	14.62	17.16	7.85
		5:12	8.72	9.77	12.08	14.60	17.37	20.39	9.48
		7:12	9.34	10.47	12.95	15.65	18.62	21.85	10.21
		12:12	11.08	12.41	15.35	18.55	22.07	25.90	12.25
	60	< 1:12	9.94	11.14	13.77	16.65	19.81	23.25	10.65
		5:12	12.40	13.89	17.18	20.76	24.70	28.99	13.54
		7:12	13.51	15.14	18.72	22.63	26.92	31.60	14.85
		12:12	16.59	18.59	22.99	27.79	33.06	38.80	18.48

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s, 1 pound force per linear foot = 0.146kN/m, 1 pound per square foot = 47.88 Pa.

- a. Tabulated lengths were derived by calculating design wind pressures in accordance with Figure 6-10 of ASCE 7 for a building with a mean roof height of 35 feet (10 668 mm). For wind perpendicular to the ridge, the effects of a 2-foot (610 mm) overhang on each endwall are included. The design pressures were used to calculate forces to be resisted by solid wall segments in each endwall [Table 611.7(1A) or 611.7(1B)] or sidewall [(Table 611.7(1C)], as appropriate. The forces to be resisted by each wall line were then divided by the default design strength of 840 pounds per linear foot (12.26 kN/m) of length to determine the required solid wall length. The actual mean roof height of the building shall not exceed the least horizontal dimension of the building.
- b. Tabulated lengths in the “minimum” column are based on the requirement of Section 6.1.4.1 of ASCE 7 that the main wind-force resisting system be designed for a minimum service level force of 10 psf multiplied by the area of the building projected onto a vertical plane normal to the assumed wind direction. Tabulated lengths in shaded cells are less than the “minimum” value. Where the minimum controls, it is permitted to be reduced in accordance with Notes c, d and e. See Section 611.7.1.1.
- c. For buildings with a mean roof height of less than 35 feet, tabulated lengths are permitted to be reduced by multiplying by the appropriate factor, R_1 , from Table 611.7(2). The reduced length shall not be less than the “minimum” value shown in the table.
- d. Tabulated lengths for “one story or top story of two-story” are based on a floor-to-ceiling height of 10 feet. Tabulated lengths for “first story of two-story” are based on floor-to-ceiling heights of 10 feet each for the first and second story. For floor-to-ceiling heights less than assumed, use the lengths in Table 611.7(1A), (1B) or (1C), or multiply the value in the table by the reduction factor, R_2 , from Table 611.7(3).
- e. Tabulated lengths are based on the default design shear strength of 840 pounds per linear foot of solid wall segment. The tabulated lengths are permitted to be reduced by multiplying by the applicable reduction factor for design strength, R_3 , from Table 611.7(4).
- f. The reduction factors, R_1 , R_2 , and R_3 , in Tables 611.7(2), 611.7(3), and 611.7(4), respectively, are permitted to be compounded, subject to the limitations of Note b. However, the minimum number and minimum length of solid walls segments in each wall line shall comply with Sections 611.7.1 and 611.7.2.1, respectively.
- g. For intermediate values of sidewall length, endwall length, roof slope and basic wind speed, use the next higher value, or determine by interpolation.

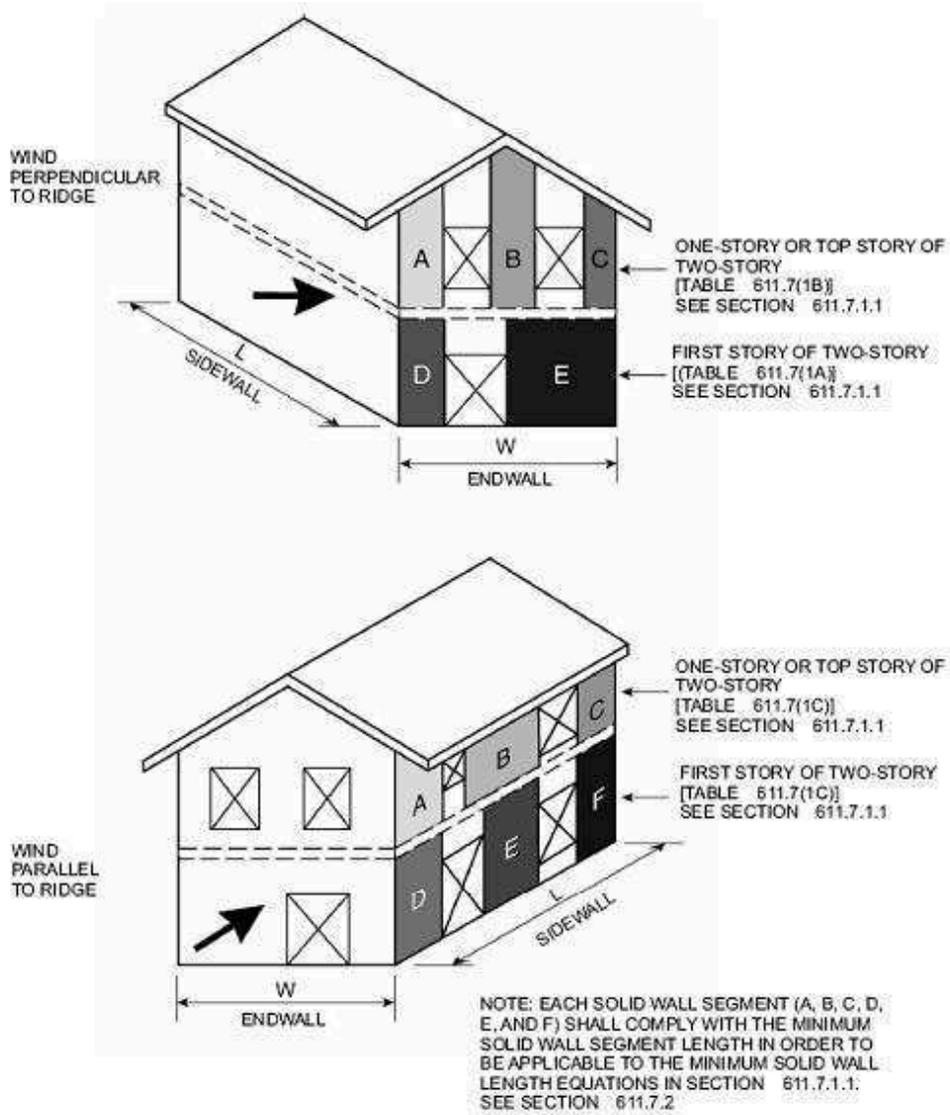
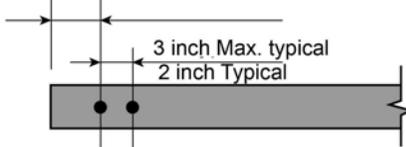
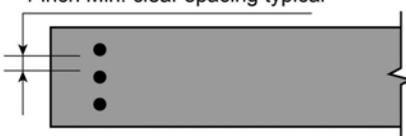


FIGURE 611.7(1)
MINIMUM SOLID WALL LENGTH

DETAIL NO.	NOM. WALL THICKNESS, IN.	REINFORCEMENT LAYOUT AT ENDS OF SOLID WALL SEGMENTS	NOTES
1	4		<p>For SI: 1 inch = 25.4 mm.</p> <p>1. See Table 611.7(4) for use of details.</p>
2	4		<p>2. Minimum length of solid wall segment and size and grade of reinforcement in each end of each solid wall segment shall be determined from Table 611.7(4).</p>
3	6 8 10		<p>3. For minimum cover requirements, see Section 611.5.4.1.</p>
4	6		<p>4. For details 3 - 8 where two or more bars are in the same row parallel to the end of the segment, place bars so that corner bars are as close to the sides of the wall segments as minimum cover requirements of Section 611.5.4.1 will permit.</p>
5	8		
6	8		<p>5. For waffle- and screen-grid walls, each end of each solid wall segment shall have rectangular flanges. In the through-the-wall dimension, the flange shall not be less than 5 1/2 inches for 6-inch nominal waffle- and screen-grid forms, and not less than 7 1/2 inches for 8-inch nominal waffle-grid forms. In the in-plane dimension, flanges shall be long enough to accommodate the vertical reinforcement required by the layout detail selected and provide the cover required by Section 611.5.4.1. If necessary to achieve the required dimensions, form material shall be removed or flat wall forms are permitted. See Table 611.7(4), Note e.</p>
7	10		
8	10	 <p>* For minimum cover see Section 611.5.4.1</p>	

**FIGURE 611.7(2)
VERTICAL REINFORCEMENT LAYOUT DETAIL**

TABLE 611.7(2)
REDUCTION FACTOR, R_1 , FOR BUILDINGS WITH MEAN ROOF HEIGHT LESS THAN 35 FEET^a

MEAN ROOF HEIGHT ^{b,c} (feet)	REDUCTION FACTOR R_1 , FOR MEAN ROOF HEIGHT		
	Exposure category		
	B	C	D
< 15	0.96	0.84	0.87
20	0.96	0.89	0.91
25	0.96	0.93	0.94
30	0.96	0.97	0.98
35	1.00	1.00	1.00

For SI: 1 foot = 304.8 mm.

- a. See Section 611.7.1.1 and note c to Table 611.7(1A) for application of reduction factors in this table. This reduction is not permitted for “minimum” values.
- b. For intermediate values of mean roof height, use the factor for the next greater height, or determine by interpolation.
- c. Mean roof height is the average of the roof eave height and height of the highest point on the roof surface, except that for roof slopes of less than or equal to $2\frac{1}{8}:12$ (10 degrees), the mean roof height is permitted to be taken as the roof eave height.

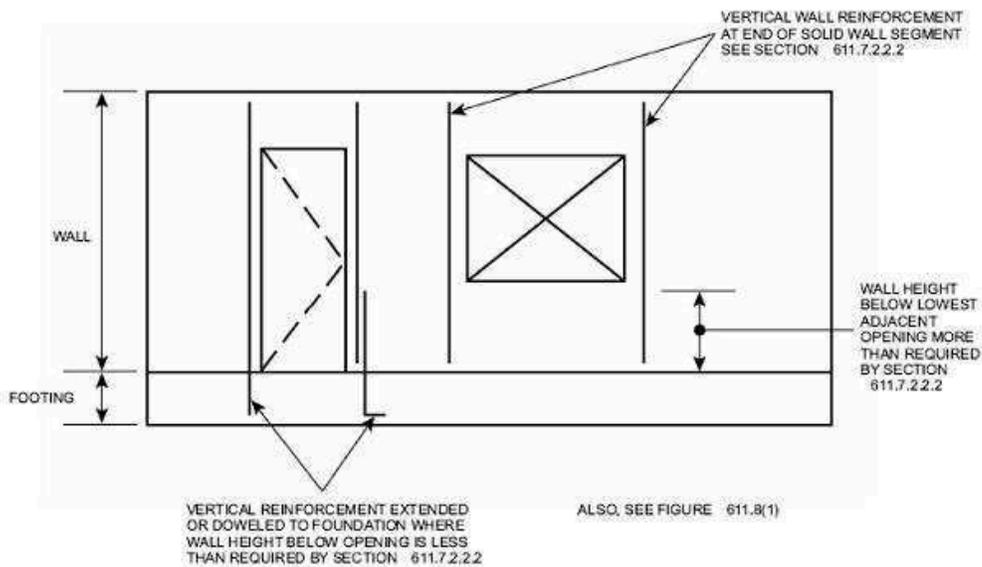


FIGURE 611.7(3)
VERTICAL WALL REINFORCEMENT ADJACENT TO WALL OPENINGS

TABLE 611.7(3)
REDUCTION FACTOR, R_2 , FOR FLOOR-TO-CEILING WALL HEIGHTS LESS THAN 10 FEET^{a,b}

STORY UNDER CONSIDERATION	FLOOR-TO-CEILING HEIGHT ^c (feet)	ENDWALL LENGTH (feet)	ROOF SLOPE	REDUCTION FACTOR, R_2
Endwalls—for wind perpendicular to ridge				
One story or top story of two-story	8	15	< 5:12	0.83
			7:12	0.90
			12:12	0.94
		60	< 5:12	0.83
			7:12	0.95
			12:12	0.98
First story of two-story	16 combined first and second story	15	< 5:12	0.83
			7:12	0.86
			12:12	0.89
		60	< 5:12	0.83
			7:12	0.91
			12:12	0.95
Sidewalls—for wind parallel to ridge				
One story or top story of two-story	8	15	< 1:12	0.84
			5:12	0.87
			7:12	0.88
			12:12	0.89
		60	< 1:12	0.86
			5:12	0.92
			7:12	0.93
First story of two-story	16 combined first and second story	15	< 1:12	0.83
			5:12	0.84
			7:12	0.85
			12:12	0.86
		60	< 1:12	0.84
			5:12	0.87
			7:12	0.88
			12:12	0.90

For SI: 1 foot = 304.8 mm.

- See Section 611.7.1.1 and Note d to Table 611.7(1A) for application of reduction factors in this table.
- For intermediate values of endwall length, and/or roof slope, use the next higher value, or determine by interpolation.
- Tabulated values in Table 611.7(1A) and (1C) for “one story or top story of two-story” are based on a floor-to-ceiling height of 10 feet (3048 mm). Tabulated values in Table 611.7(1B) and (1C) for “first story of two-story” are based on floor-to-ceiling heights of 10 feet each for the first and second story. For floor to ceiling heights between those shown in this table and those assumed in Table 611.7(1A), (1B) or (1C), use the solid wall lengths in Table 611.7(1A), (1B) or (1C), or determine the reduction factor by interpolating between 1.0 and the factor shown in this table.

TABLE 611.7(4)
REDUCTION FACTOR FOR DESIGN STRENGTH, R_3 , FOR FLAT, WAFFLE- AND SCREEN-GRID WALLS^{a,c}

NOMINAL THICKNESS OF WALL (inches)	VERTICAL BARS AT EACH END OF SOLID WALL SEGMENT		VERTICAL REINFORCEMENT LAYOUT DETAIL [see Figure R611.7(2)]	REDUCTION FACTOR, R_3 , FOR LENGTH OF SOLID WALL			
	Number of bars	Bar size		Horizontal and vertical shear reinforcement provided			
				No		Yes ^d	
				40,000 ^b	60,000 ^b	40,000 ^b	60,000 ^b
Flat walls							
4	2	4	1	0.74	0.61	0.74	0.50
	3	4	2	0.61	0.61	0.52	0.27
	2	5	1	0.61	0.61	0.48	0.25
	3	5	2	0.61	0.61	0.26	0.18
6	2	4	3	0.70	0.48	0.70	0.48
	3	4	4	0.49	0.38	0.49	0.33
	2	5	3	0.46	0.38	0.46	0.31
	3	5	4	0.38	0.38	0.32	0.16
8	2	4	3	0.70	0.47	0.70	0.47
	3	4	5	0.47	0.32	0.47	0.32
	2	5	3	0.45	0.31	0.45	0.31
	4	4	6	0.36	0.28	0.36	0.25
	3	5	5	0.31	0.28	0.31	0.16
	4	5	6	0.28	0.28	0.24	0.12
10	2	4	3	0.70	0.47	0.70	0.47
	2	5	3	0.45	0.30	0.45	0.30
	4	4	7	0.36	0.25	0.36	0.25
	6	4	8	0.25	0.22	0.25	0.13
	4	5	7	0.24	0.22	0.24	0.12
	6	5	8	0.22	0.22	0.12	0.08
Waffle-grid walls^e							
6	2	4	3	0.78	0.78	0.70	0.48
	3	4	4	0.78	0.78	0.49	0.25
	2	5	3	0.78	0.78	0.46	0.23
	3	5	4	0.78	0.78	0.24	0.16
8	2	4	3	0.78	0.78	0.70	0.47
	3	4	5	0.78	0.78	0.47	0.24
	2	5	3	0.78	0.78	0.45	0.23
	4	4	6	0.78	0.78	0.36	0.18
	3	5	5	0.78	0.78	0.23	0.16
	4	5	6	0.78	0.78	0.18	0.13
Screen-grid walls^e							
6	2	4	3	0.93	0.93	0.70	0.48
	3	4	4	0.93	0.93	0.49	0.25
	2	5	3	0.93	0.93	0.46	0.23
	3	5	4	0.93	0.93	0.24	0.16

For SI: 1 inch = 25.4 mm; 1,000 pounds per square inch = 6.895 MPa.

a. See note e to Table 611.7(1A) for application of adjustment factors in this table.

- b. Yield strength in pounds per square inch of vertical wall reinforcement at ends of solid wall segments.
- c. Values are based on concrete with a specified compressive strength, f'_c , of 2,500 psi. Where concrete with f'_c of not less than 3,000 psi is used, values in shaded cells are permitted to be decreased by multiplying by 0.91.
- d. Horizontal and vertical shear reinforcement shall be provided in accordance with Section 611.7.2.2.
- e. Each end of each solid wall segment shall have rectangular flanges. In the through-the-wall dimension, the flange shall not be less than 5½ inches for 6-inch nominal waffle-and screen-grid walls, and not less than 7½ inches for 8-inch nominal waffle-grid walls. In the in-plane dimension, flanges shall be long enough to accommodate the vertical reinforcement required by the layout detail selected from Figure 611.7(2) and provide the cover required by Section 611.5.4.1. If necessary to achieve the required dimensions, form material shall be removed or use of flat wall forms is permitted.

611.8 Requirements for lintels and reinforcement around openings.

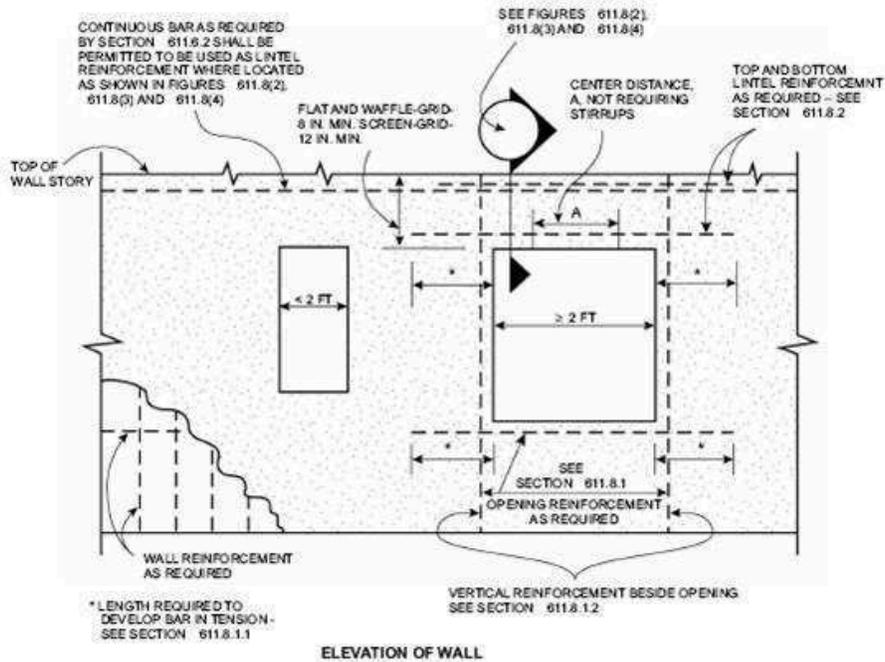
611.8.1 Reinforcement around openings. Reinforcement shall be provided around openings in walls equal to or greater than 2 feet (610mm) in width in accordance with this section and Figure 611.8(1), in addition to the minimum wall reinforcement required by Sections 404.1.2, 611.6 and 611.7. Vertical wall reinforcement required by this section is permitted to be used as reinforcement at the ends of solid wall segments required by Section 611.7.2.2.2 provided it is located in accordance with Section 611.8.1.2. Wall openings shall have a minimum depth of concrete over the width of the opening of 8 inches (203mm) in flat walls and waffle-grid walls, and 12 inches (305mm) in screen-grid walls. Wall openings in waffle-grid and screen-grid walls shall be located such that not less than one-half of a vertical core occurs along each side of the opening.

611.8.1.1 Horizontal reinforcement. Lintels complying with Section 611.8.2 shall be provided above wall openings equal to or greater than 2 feet (610mm) in width.

Exception: Continuous horizontal wall reinforcement placed within 12 inches (305mm) of the top of the wall story as required in Sections 404.1.2.2 and 611.6.2 is permitted in lieu of top or bottom lintel reinforcement required by Section 611.8.2 provided that the continuous horizontal wall reinforcement meets the location requirements specified in Figures 611.8(2), 611.8(3), and 611.8(4) and the size requirements specified in Tables 611.8(2) through 611.8(10).

Openings equal to or greater than 2 feet (610mm) in width shall have a minimum of one No.4 bar placed within 12 inches (305mm) of the bottom of the opening. See Figure 611.8(1).

Horizontal reinforcement placed above and below an opening shall extend beyond the edges of the opening the dimension required to develop the bar in tension in accordance with Section 611.5.4.4.

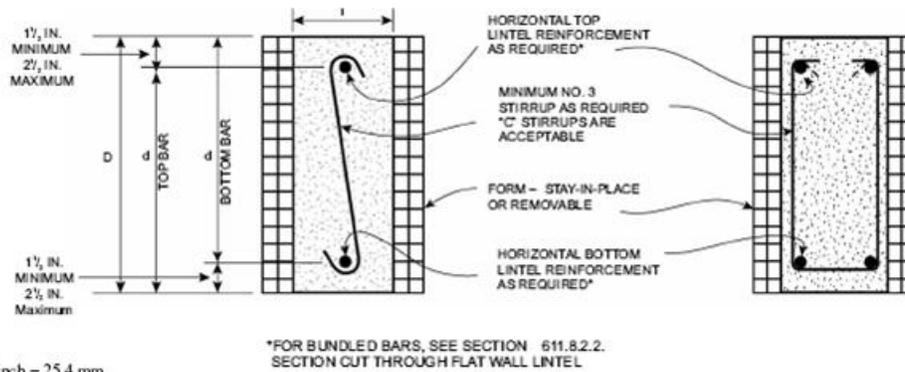


For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

FIGURE 611.8(1)
REINFORCEMENT OF OPENINGS

611.8.1.2 Vertical reinforcement. Not less than one No.4 bar [Grade 40 (280MPa)] shall be provided on each side of openings equal to or greater than 2 feet (610mm) in width. The vertical reinforcement required by this section shall extend the full height of the wall story and shall be located within 12 inches (305mm) of each side of the opening. The vertical reinforcement required on each side of an opening by this section is permitted to serve as reinforcement at the ends of solid wall segments in accordance with Section 611.7.2.2.2, provided it is located as required by the applicable detail in Figure 611.7(2). Where the vertical reinforcement required by this section is used to satisfy the requirements of Section 611.7.2.2.2 in waffle-and screen-grid walls, a concrete flange shall be created at the ends of the solid wall segments in accordance with Table

611.7(4), note e. In the top-most story, the reinforcement shall terminate in accordance with Section 611.6.4.

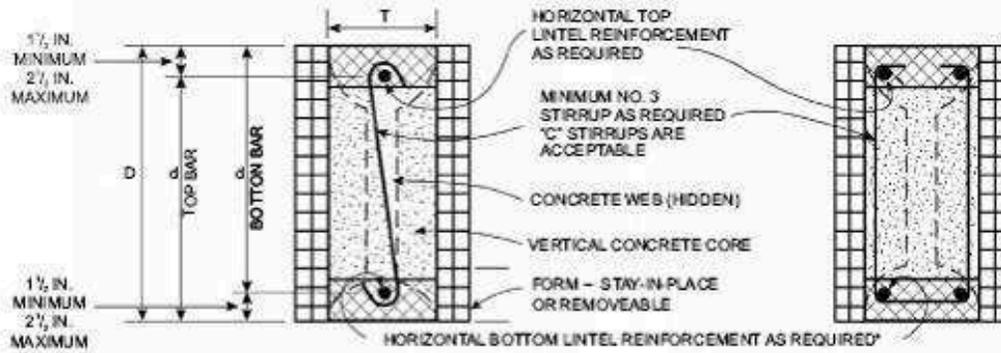


For SI: 1 inch = 25.4 mm.

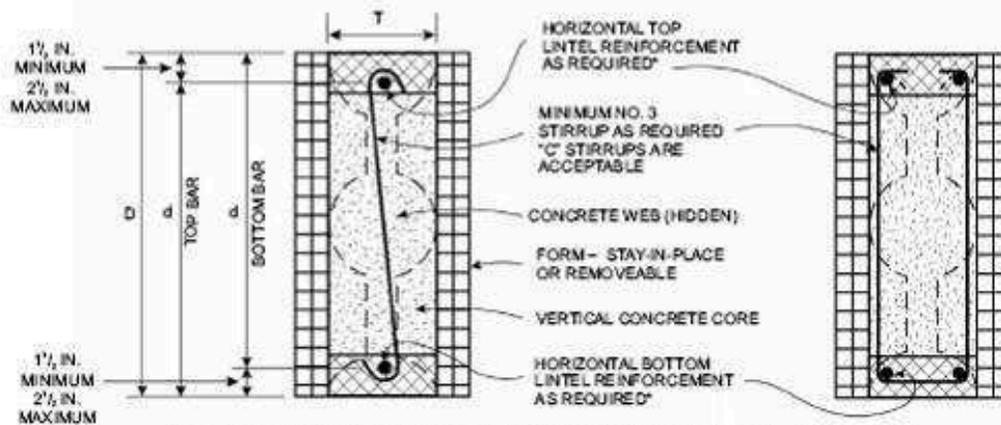
For SI: 1 inch = 25.4 mm.

FIGURE 611.8(2)
LINTEL FOR FLAT WALLS

611.8.2 Lintels. Lintels shall be provided over all openings equal to or greater than 2 feet (610 mm) in width. Lintels with uniform loading shall conform to Sections 611.8.2.1, and 611.8.2.2, or Section 611.8.2.3. Lintels supporting concentrated loads, such as from roof or floor beams or girders, shall be designed in accordance with ACI 318.



(a) SINGLE FORM HEIGHT SECTION CUT THROUGH VERTICAL CORE OF A WAFFLE-GRID LINTEL



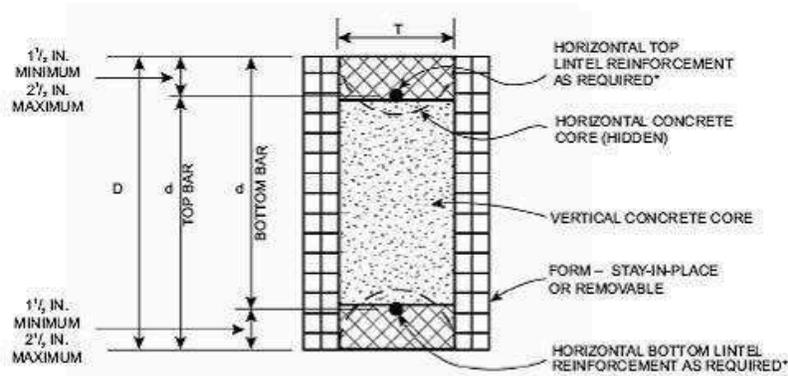
(b) DOUBLE FORM HEIGHT SECTION CUT THROUGH VERTICAL CORE OF A WAFFLE-GRID LINTEL

*FOR BUNDLED BARS, SEE SECTION 611.8.2.2

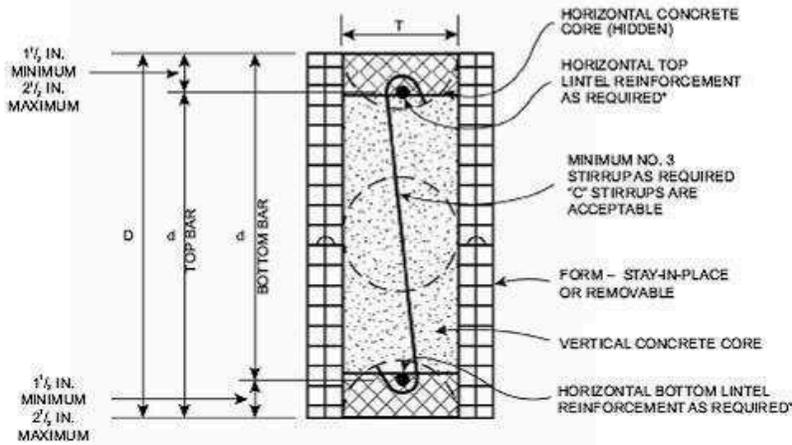
NOTE: CROSS-HATCHING REPRESENTS THE AREA IN WHICH FORM MATERIAL SHALL BE REMOVED, IF NECESSARY, TO CREATE FLANGES CONTINUOUS THE LENGTH OF THE LINTEL. FLANGES SHALL HAVE A MINIMUM THICKNESS OF 3 IN., AND A MINIMUM WIDTH OF 5 IN. AND 7 IN. IN 6 IN. NOMINAL AND 8 IN. NOMINAL WAFFLE-GRID WALLS, RESPECTIVELY. SEE NOTE a TO TABLES 611.8(6) AND 811.8(10).

For SI: 1 inch = 25.4 mm.

FIGURE 611.8(3)
LINTELS FOR WAFFLE-GRID WALLS



(a) SINGLE FORM HEIGHT SECTION CUT THROUGH VERTICAL CORE OF A SCREEN-GRID LINTEL



(b) DOUBLE FORM HEIGHT SECTION CUT THROUGH VERTICAL CORE OF A SCREEN-GRID LINTEL

*FOR BUNDLED BARS, SEE SECTION 611.8.2.2.

NOTE: CROSS-HATCHING REPRESENTS THE AREA IN WHICH FORM MATERIAL SHALL BE REMOVED, IF NECESSARY, TO CREATE FLANGES CONTINUOUS THE LENGTH OF THE LINTEL. FLANGES SHALL HAVE A MINIMUM THICKNESS OF 2.5 IN. AND A MINIMUM WIDTH OF 5 IN. SEE NOTE 3 TO TABLES 611.8(8) AND 611.8(10).

For SI: 1 inch = 25.4 mm.

FIGURE 611.8(4)
LINTELS FOR SCREEN-GRID WALLS

611.8.2.1 Lintels designed for gravity load-bearing conditions. Where a lintel will be subjected to gravity load condition 1 through 5 of Table 611.8(1), the clear span of the lintel shall not exceed that permitted by

Tables 611.8(2) through 611.8(8). The maximum clear span of lintels with and without stirrups in flat walls shall be determined in accordance with Tables 611.8(2) through 611.8(5), and constructed in accordance with Figure 611.8(2). The maximum clear span of lintels with and without stirrups in waffle-grid walls shall be determined in accordance with Tables 611.8(6) and 611.8(7), and constructed in accordance with Figure 611.8(3). The maximum clear span of lintels with and without stirrups in screen-grid walls shall be determined in accordance with Table 611.8(8), and constructed in accordance with Figure 611.8(4).

Where required by the applicable table, No. 3 stirrups shall be installed in lintels at a maximum spacing of $d/2$ where d equals the depth of the lintel, D , less the cover of the concrete as shown in Figures 611.8(2) through 611.8(4). The smaller value of d computed for the top and bottom bar shall be used to determine the maximum stirrup spacing. Where stirrups are required in a lintel with a single bar or two bundled bars in the top and bottom, they shall be fabricated like the letter “c” or “s” with 135-degree (2.36 rad) standard hooks at each end that comply with Section 611.5.4.5 and Figure 611.5.4(3) and installed as shown in Figures 611.8(2) through 611.8(4). Where two bars are required in the top and bottom of the lintel and the bars are not bundled, the bars shall be separated by a minimum of 1 inch (25 mm). The free end of the stirrups shall be fabricated with 90- or 135-degree (1.57 or 2.36 rad) standard hooks that comply with Section 611.5.4.5 and Figure 611.5.4(3) and installed as shown in Figures 611.8(2) and 611.8(3). For flat, waffle-grid and screen-grid lintels, stirrups are not required in the center distance, A , portion of spans in accordance with Figure 611.8(1) and Tables 611.8(2) through 611.8(8). See Section 611.8.2.2, item 5, for requirement for stirrups throughout lintels with bundled bars.

611.8.2.2 Bundled bars in lintels. It is permitted to bundle two bars in contact with each other in lintels if all of the following are observed:

1. Bars no larger than No. 6 are bundled.
2. Where the wall thickness is not sufficient to provide not less than 3 inches (76 mm) of clear space beside bars (total on both sides) oriented horizontally in a bundle, the bundled bars shall be oriented in a vertical plane.

3. Where vertically oriented bundled bars terminate with standard hooks to develop the bars in tension beyond the support (see Section 611.5.4.4), the hook extensions shall be staggered to provide a minimum of one inch (25 mm) clear spacing between the extensions.
4. Bundled bars shall not be lap spliced within the lintel span and the length on each end of the lintel that is required to develop the bars in tension.
5. Bundled bars shall be enclosed within stirrups throughout the length of the lintel. Stirrups and the installation thereof shall comply with Section 611.8.2.1.

611.8.2.3 Lintels without stirrups designed for nonload-bearing conditions. The maximum clear span of lintels without stirrups designed for nonload-bearing conditions of Table 611.8(1).1 shall be determined in accordance with this section. The maximum clear span of lintels without stirrups in flat walls shall be determined in accordance with Table 611.8(9), and the maximum clear span of lintels without stirrups in walls of waffle-grid or screen-grid construction shall be determined in accordance with Table 611.8(10).

TABLE 611.8(1)
LINTEL DESIGN LOADING CONDITIONS^{a, b, d}

DESCRIPTION OF LOADS AND OPENINGS ABOVE INFLUENCING DESIGN OF LINTEL		DESIGN LOAD CONDITION ^c	
Opening in wall of top story of two-story building, or first story of one-story building			
Wall supporting loads from roof, including attic floor, if applicable, and	Top of lintel equal to or less than W/2 below top of wall	2	
	Top of lintel greater than W/2 below top of wall	NLB	
Wall not supporting loads from roof or attic floor		NLB	
Opening in wall of first story of two-story building where wall immediately above is of concrete construction, or opening in basement wall of one-story building where wall immediately above is of concrete construction			
LB ledger board mounted to side of wall with bottom of ledger less than or equal to W/2 above top of lintel, and	Top of lintel greater than W/2 below bottom of opening in story above	1	
	Top of lintel less than or equal to W/2 below bottom of opening in story above, and	Opening is entirely within the footprint of the opening in the story above	1
		Opening is partially within the footprint of the opening in the story above	4
LB ledger board mounted to side of wall with bottom of ledger more than W/2 above top of lintel		NLB	
NLB ledger board mounted to side of wall with bottom of ledger less than or equal to W/2 above top of lintel, or no ledger board, and	Top of lintel greater than W/2 below bottom of opening in story above	NLB	
	Top of lintel less than or equal to W/2 below bottom of opening in story above, and	Opening is entirely within the footprint of the opening in the story above	NLB
		Opening is partially within the footprint of the opening in the story above	1
Opening in basement wall of two-story building where walls of two stories above are of concrete construction			
LB ledger board mounted to side of wall with bottom of ledger less than or equal to W/2 above top of lintel, and	Top of lintel greater than W/2 below bottom of opening in story above	1	
	Top of lintel less than or equal to W/2 below bottom of opening in story above, and	Opening is entirely within the footprint of the opening in the story above	1
		Opening is partially within the footprint of the opening in the story above	5
LB ledger board mounted to side of wall with bottom of ledger more than W/2 above top of lintel		NLB	
NLB ledger board mounted to side of wall with bottom of ledger less than or equal to W/2 above top of lintel, or no ledger board, and	Top of lintel greater than W/2 below bottom of opening in story above	NLB	
	Top of lintel less than or equal to W/2 below bottom of opening in story above, and	Opening is entirely within the footprint of the opening in the story above	NLB
		Opening is partially within the footprint of the opening in the story above	1
Opening in wall of first story of two-story building where wall immediately above is of light framed construction, or opening in basement wall of one-story building, where wall immediately above is of light framed construction			
Wall supporting loads from roof, second floor and top-story wall of light-framed construction, and	Top of lintel equal to or less than W/2 below top of wall	3	
	Top of lintel greater than W/2 below top of wall	NLB	
Wall not supporting loads from roof or second floor		NLB	

a. LB means load bearing, NLB means nonload-bearing, and W means width of opening.

b. Footprint is the area of the wall below an opening in the story above, bounded by the bottom of the opening and vertical lines extending downward from the edges of the opening.

c. For design loading condition "NLB" see Tables 611.8(9) and 611.8(10). For all other design loading conditions see Tables 611.8(2) through 611.8(8).

d. A NLB ledger board is a ledger attached to a wall that is parallel to the span of the floor, roof or ceiling framing that supports the edge of the floor, ceiling or roof.

TABLE 611.8(2)
MAXIMUM ALLOWABLE CLEAR SPANS FOR 4-INCH NOMINAL THICK FLAT LINTELS IN LOAD-BEARING WALLS^{a, b, c, d, e, f, m} ROOF CLEAR SPAN 40 FEET AND FLOOR CLEAR SPAN 32 FEET

LINTEL DEPTH, D ^g (inches)	NUMBER OF BARS AND BAR SIZE IN TOP AND BOTTOM OF LINTEL	STEEL YIELD STRENGTH ^h , f _y (psi)	DESIGN LOADING CONDITION DETERMINED FROM TABLE 611.8(1)									
			1	2		3		40		5		
			Maximum ground snow load (psf)									
				30	70	30	70	30	70	30	70	
Maximum clear span of lintel (feet - inches)												
8	Span without stirrups ^{i, j}		3-2	3-4	2-4	2-6	2-2	2-1	2-0	2-0	2-0	
	1-#4	40,000	5-2	5-5	4-1	4-3	3-10	3-7	3-4	2-9	2-9	
		60,000	6-2	6-5	4-11	5-1	4-6	4-2	3-8	2-11	2-10	
	1-#5	40,000	6-3	6-7	5-0	5-2	4-6	4-2	3-8	2-11	2-10	
		60,000	DR	DR	DR	DR	DR	DR	DR	DR	DR	
Center distance A ^{k, l}		1-1	1-2	0-8	0-9	0-7	0-6	0-5	0-4	0-4		
12	Span without stirrups ^{i, j}		3-4	3-7	2-9	2-11	2-8	2-6	2-5	2-2	2-2	
	1-#4	40,000	6-7	7-0	5-4	5-7	5-0	4-9	4-4	3-8	3-7	
		60,000	7-11	8-6	6-6	6-9	6-0	5-9	5-3	4-5	4-4	
	1-#5	40,000	8-1	8-8	6-7	6-10	6-2	5-10	5-4	4-6	4-5	
		60,000	9-8	10-4	7-11	8-2	7-4	6-11	6-2	4-10	4-8	
	2-#4 1-#6	40,000	9-1	9-8	7-4	7-8	6-10	6-6	6-0	4-10	4-8	
		60,000	DR	DR	DR	DR	DR	DR	DR	DR	DR	
Center distance A ^{k, l}		1-8	1-11	1-1	1-3	1-0	0-11	0-9	0-6	0-6		
16	Span without stirrups ^{i, j}		4-7	5-0	3-11	4-0	3-8	3-7	3-4	3-1	3-0	
	1-#4	40,000	6-8	7-3	5-6	5-9	5-2	4-11	4-6	3-10	3-8	
		60,000	9-3	10-1	7-9	8-0	7-2	6-10	6-3	5-4	5-2	
	1-#4	40,000	9-6	10-4	7-10	8-2	7-4	6-11	6-5	5-5	5-3	
		60,000	11-5	12-5	9-6	9-10	8-10	8-4	7-9	6-6	6-4	
	2-#4 1-#6	40,000	10-7	11-7	8-10	9-2	8-3	7-9	7-2	6-1	5-11	
		60,000	12-9	13-10	10-7	11-0	9-10	9-4	8-7	6-9	6-6	
	2-#5	40,000	13-0	14-1	10-9	11-2	9-11	9-2	8-2	6-6	6-3	
60,000		DR	DR	DR	DR	DR	DR	DR	DR	DR		
Center distance ^{k, l}		2-3	2-8	1-7	1-8	1-4	1-3	1-0	0-9	0-8		
20	Span without stirrups ^{i, j}		5-9	6-5	5-0	5-2	4-9	4-7	4-4	3-11	3-11	
	1-#4	40,000	7-5	8-2	6-3	6-6	5-10	5-7	5-1	4-4	4-2	
		60,000	9-0	10-0	7-8	7-11	7-1	6-9	6-3	5-3	5-1	
	1-#5	40,000	9-2	10-2	7-9	8-1	7-3	6-11	6-4	5-4	5-2	
		60,000	12-9	14-2	10-10	11-3	10-1	9-7	8-10	7-5	7-3	
	2-#4	40,000	11-10	13-2	10-1	10-5	9-4	8-11	8-2	6-11	6-9	

	1-#6	60,000	14-4	15-10	12-1	12-7	11-3	10-9	9-11	8-4	8-1	
	2-#5	40,000	14-7	16-2	12-4	12-9	11-4	10-6	9-5	7-7	7-3	
		60,000	17-5	19-2	14-9	15-3	13-5	12-4	11-0	8-8	8-4	
	2-#6	40,000	16-4	18-11	12-7	13-3	11-4	10-6	9-5	7-7	7-3	
		60,000	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR
Center distance $A^{k,1}$			2-9	3-5	2-0	2-2	1-9	1-7	1-4	0-11	0-11	
24	Span without stirrups ^{i,j}		6-11	7-9	6-1	6-3	5-9	5-7	5-3	4-9	4-8	
	1-#4	40,000	8-0	9-0	6-11	7-2	6-5	6-2	5-8	4-9	4-8	
		60,000	9-9	11-0	8-5	8-9	7-10	7-6	6-11	5-10	5-8	
	1-#5	40,000	10-0	11-3	8-7	8-11	8-0	7-7	7-0	5-11	5-9	
		60,000	13-11	15-8	12-0	12-5	11-2	10-7	9-10	8-3	8-0	
	2-#4 1-#6	40,000	12-11	14-6	11-2	11-6	10-5	9-10	9-1	7-8	7-5	
		60,000	15-7	17-7	13-6	13-11	12-7	11-11	11-0	9-3	9-0	
	2-#5	40,000	15-11	17-11	13-7	14-3	12-8	11-9	10-8	8-7	8-4	
		60,000	19-1	21-6	16-5	17-1	15-1	14-0	12-6	9-11	9-7	
	2-#6	40,000	17-7	21-1	14-1	14-10	12-8	11-9	10-8	8-7	8-4	
		60,000	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR
	Center distance $A^{k,1}$			3-3	4-1	2-5	2-7	2-1	1-11	1-7	1-2	1-1

For SI: 1 inch = 25.4 mm; 1 foot = 304.8 mm; 1 pound per square foot = 0.0479kPa; Grade 40 = 280 MPa; Grade 60 = 420 MPa.

- a. See Table 611.3 for tolerances permitted from nominal thickness.
- b. Table values are based on concrete with a minimum specified compressive strength of 2,500 psi. See note j.
- c. Table values are based on uniform loading. See Section 611.8.2 for lintels supporting concentrated loads.
- d. Deflection criterion is $L/240$, where L is the clear span of the lintel in inches, or $1/2$ -inch, whichever is less.
- e. Linear interpolation is permitted between ground snow loads and between lintel depths.
- f. DR indicates design required.
- g. Lintel depth, D , is permitted to include the available height of wall located directly above the lintel, provided that the increased lintel depth spans the entire length of the lintel.
- h. Stirrups shall be fabricated from reinforcing bars with the same yield strength as that used for the main longitudinal reinforcement.
- i. Allowable clear span without stirrups applicable to all lintels of the same depth, D . Top and bottom reinforcement for lintels without stirrups shall not be less than the least amount of reinforcement required for a lintel of the same depth and loading condition with stirrups. All other spans require stirrups spaced at not more than $d/2$.
- j. Where concrete with a minimum specified compressive strength of 3,000 psi (20.7 MPa) is used, clear spans for lintels without stirrups shall be permitted to be multiplied by 1.05. If the increased span exceeds the allowable clear span for a lintel of the same depth and loading condition with stirrups, the top and bottom reinforcement shall be equal to or greater than that required for a lintel of the same depth and loading condition that has an allowable clear span that is equal to or greater than that of the lintel without stirrups that has been increased.
- k. Center distance, A , is the center portion of the clear span where stirrups are not required. This is applicable to all longitudinal bar sizes and steel yield strengths.
- l. Where concrete with a minimum specified compressive strength of 3,000 psi is used, center distance, A , shall be permitted to be multiplied by 1.10.
- m. The maximum clear opening width between two solid wall segments shall be 18 feet (5486 mm). See Section 611.7.2.1. Lintel clear spans in the table greater than 18 feet are shown for interpolation and information only.

TABLE 611.8(3)
MAXIMUM ALLOWABLE CLEAR SPANS FOR 6-INCH NOMINAL THICK FLAT LINTELS IN LOAD-BEARING
WALLS^{a, b, c, d, e, f, m}
ROOF CLEAR SPAN 40 FEET AND FLOOR CLEAR SPAN 32 FEET

LINTEL DEPTH, D ^g (inches)	NUMBER OF BARS AND BAR SIZE IN TOP AND BOTTOM OF LINTEL	STEEL YIELD STRENGTH ^h , f _y (psi)	DESIGN LOADING CONDITION DETERMINED FROM TABLE 611.8(1)								
			1	2		3		4		5	
			Maximum ground snow load (psf)								
				30	70	30	70	30	70	30	70
Maximum clear span of lintel (feet - inches)											
8	Span without stirrups ^{i, j}		4-2	4-8	3-1	3-3	2-10	2-6	2-3	2-0	2-0
	1-#4	40,000	5-1	5-5	4-2	4-3	3-10	3-6	3-3	2-8	2-7
		60,000	6-2	6-7	5-0	5-2	4-8	4-2	3-11	3-3	3-2
	1-#5	40,000	6-3	6-8	5-1	5-3	4-9	4-3	4-0	3-3	3-2
		60,000	7-6	8-0	6-1	6-4	5-8	5-1	4-9	3-8	3-6
	2-#4 1-#6	40,000	7-0	7-6	5-8	5-11	5-3	4-9	4-5	3-8	3-6
		60,000	DR	DR	DR	DR	DR	DR	DR	DR	DR
Center distance A ^{k, l}		1-7	1-10	1-1	1-2	0-11	0-9	0-8	0-5	0-5	
12	Span without stirrups ^{i, j}		4-2	4-8	3-5	3-6	3-2	2-11	2-9	2-5	2-4
	1-#4	40,000	5-7	6-1	4-8	4-10	4-4	3-11	3-8	3-0	2-11
		60,000	7-9	8-6	6-6	6-9	6-1	5-6	5-1	4-3	4-1
	1-#5	40,000	7-11	8-8	6-8	6-11	6-2	5-7	5-2	4-4	4-2
		60,000	9-7	10-6	8-0	8-4	7-6	6-9	6-3	5-2	5-1
	2-#4 1-#6	40,000	8-11	9-9	7-6	7-9	6-11	6-3	5-10	4-10	4-8
		60,000	10-8	11-9	8-12	9-4	8-4	7-6	7-0	5-10	5-8
	2-#5	40,000	10-11	12-0	9-2	9-6	8-6	7-8	7-2	5-6	5-3
		60,000	12-11	14-3	10-10	11-3	10-1	9-0	8-1	6-1	5-10
	2-#6	40,000	12-9	14-0	10-8	11-1	9-7	8-1	7-3	5-6	5-3
		60,000	DR	DR	DR	DR	DR	DR	DR	DR	DR
Center distance A ^{k, l}		2-6	3-0	1-9	1-10	1-6	1-3	1-1	0-9	0-8	
16	Span without stirrups ^{i, j}		5-7	6-5	4-9	4-11	4-5	4-0	3-10	3-4	3-4
	1-#4	40,000	6-5	7-2	5-6	5-9	5-2	4-8	4-4	3-7	3-6
		60,000	7-10	8-9	6-9	7-0	6-3	5-8	5-3	4-4	4-3
	1-#5	40,000	7-11	8-11	6-10	7-1	6-5	5-9	5-4	4-5	4-4
		60,000	11-1	12-6	9-7	9-11	8-11	8-0	7-6	6-2	6-0
	2-#4 1-#6	40,000	10-3	11-7	8-10	9-2	8-3	7-6	6-11	5-9	5-7
		60,000	12-5	14-0	10-9	11-1	10-0	9-0	8-5	7-0	6-9
	2-#5	40,000	12-8	14-3	10-11	11-4	10-2	9-2	8-7	6-9	6-6
		60,000	15-2	17-1	13-1	13-7	12-3	11-0	10-3	7-11	7-7
	2-#6	40,000	14-11	16-9	12-8	13-4	11-4	9-8	8-8	6-9	6-6

		60,000	DR	DR	DR	DR	DR	DR	DR	DR	DR
	Center distance A ^{k,1}		3-3	4-1	2-5	2-7	2-1	1-9	1-6	1-0	1-0
20	Span without stirrups ^{i,j}		6-11	8-2	6-1	6-3	5-8	5-2	4-11	4-4	4-3
	1-#5	40,000	8-9	10-1	7-9	8-0	7-3	6-6	6-1	5-1	4-11
		60,000	10-8	12-3	9-5	9-9	8-10	8-0	7-5	6-2	6-0
	2-#4 1-#6	40,000	9-11	11-4	8-9	9-1	8-2	7-4	6-10	5-8	5-7
		60,000	13-9	15-10	12-2	12-8	11-5	10-3	9-7	7-11	7-9
	2-#5	40,000	14-0	16-2	12-5	12-11	11-7	10-6	9-9	7-11	7-8
		60,000	16-11	19-6	15-0	15-6	14-0	12-7	11-9	9-1	8-9
	2-#6	40,000	16-7	19-1	14-7	15-3	13-1	11-3	10-2	7-11	7-8
		60,000	19-11	22-10	17-4	18-3	15-6	13-2	11-10	9-1	8-9
Center distance A ^{k,1}			3-11	5-2	3-1	3-3	2-8	2-2	1-11	1-4	1-3
24	Span without stirrups ^{i,j}		8-2	9-10	7-4	7-8	6-11	6-4	5-11	5-3	5-2
	1-#5	40,000	9-5	11-1	8-7	8-10	8-0	7-3	6-9	5-7	5-5
		60,000	11-6	13-6	10-5	10-9	9-9	8-9	8-2	6-10	6-8
	2-#4 1-#6	40,000	10-8	12-6	9-8	10-0	9-0	8-2	7-7	6-4	6-2
		60,000	12-11	15-2	11-9	12-2	11-0	9-11	9-3	7-8	7-6
	2-#5	40,000	15-2	17-9	13-9	14-3	12-10	11-7	10-10	9-0	8-9
		60,000	18-4	21-6	16-7	17-3	15-6	14-0	13-1	10-4	10-0
	2-#6	40,000	18-0	21-1	16-4	16-11	14-10	12-9	11-8	9-2	8-11
		60,000	21-7	25-4	19-2	20-4	17-2	14-9	13-4	10-4	10-0
Center distance A ^{k,1}			4-6	6-2	3-8	4-0	3-3	2-8	2-3	1-7	1-6

For SI: 1 inch = 25.4 mm; 1 foot = 304.8 mm; 1 psf = 0.0479 kPa; Grade 40 = 280 MPa; Grade 60 = 420 MPa.

- a. See Table 611.3 for tolerances permitted from nominal thickness.
- b. Table values are based on concrete with a minimum specified compressive strength of 2,500 psi. See Note j.
- c. Table values are based on uniform loading. See Section 611.8.2 for lintels supporting concentrated loads.
- d. Deflection criterion is $L/240$, where L is the clear span of the lintel in inches, or $\frac{1}{2}$ -inch, whichever is less.
- e. Linear interpolation is permitted between ground snow loads and between lintel depths.
- f. DR indicates design required.
- g. Lintel depth, D , is permitted to include the available height of wall located directly above the lintel, provided that the increased lintel depth spans the entire length of the lintel.
- h. Stirrups shall be fabricated from reinforcing bars with the same yield strength as that used for the main longitudinal reinforcement.
- i. Allowable clear span without stirrups applicable to all lintels of the same depth, D . Top and bottom reinforcement for lintels without stirrups shall not be less than the least amount of reinforcement required for a lintel of the same depth and loading condition with stirrups. All other spans require stirrups spaced at not more than $d/2$.
- j. Where concrete with a minimum specified compressive strength of 3,000 psi is used, clear spans for lintels without stirrups shall be permitted to be multiplied by 1.05. If the increased span exceeds the allowable clear span for a lintel of the same depth and loading condition with stirrups, the top and bottom reinforcement shall be equal to or greater than that required for a lintel of the same depth and loading condition that has an allowable clear span that is equal to or greater than that of the lintel without stirrups that has been increased.

- k. Center distance, *A*, is the center portion of the clear span where stirrups are not required. This is applicable to all longitudinal bar sizes and steel yield strengths.
- l. Where concrete with a minimum specified compressive strength of 3,000 psi is used, center distance, *A*, shall be permitted to be multiplied by 1.10.
- m. The maximum clear opening width between two solid wall segments shall be 18 feet (5486 mm). See Section 611.7.2.1. Lintel clear spans in the table greater than 18 feet are shown for interpolation and information only.

TABLE 611.8(4)
MAXIMUM ALLOWABLE CLEAR SPANS FOR 8-INCH NOMINAL THICK FLAT LINTELS IN LOAD-BEARING WALLS^{a, b, c, d, e, f, m}

ROOF CLEAR SPAN 40 FEET AND FLOOR CLEAR SPAN 32 FEET

LINTEL DEPTH, D ^g (inches)	NUMBER OF BARS AND BAR SIZE IN TOP AND BOTTOM OF LINTEL	STEEL YIELD STRENGTH ^h , f _y (psi)	DESIGN LOADING CONDITION DETERMINED FROM TABLE 611.8(1)								
			1	2		3		4		5	
			Maximum ground snow load (psf)								
				30	70	30	70	30	70	30	70
Maximum clear span of lintel (feet - inches)											
8	Span without stirrups ^{i,j}		4-4	4-9	3-7	3-9	3-4	2-10	2-7	2-1	2-0
	1-#4	40,000	4-4	4-9	3-7	3-9	3-4	2-11	2-9	2-3	2-2
		60,000	6-1	6-7	5-0	5-3	4-8	4-0	3-9	3-1	3-0
	1-#5	40,000	6-2	6-9	5-2	5-4	4-9	4-1	3-10	3-2	3-1
		60,000	7-5	8-1	6-2	6-5	5-9	4-11	4-7	3-9	3-8
	2-#4 1-#6	40,000	6-11	7-6	5-9	6-0	5-4	4-7	4-4	3-6	3-5
		60,000	8-3	9-0	6-11	7-2	6-5	5-6	5-2	4-2	4-1
	2-#5	40,000	8-5	9-2	7-0	7-3	6-6	5-7	5-3	4-2	4-0
60,000		DR	DR	DR	DR	DR	DR	DR	DR	DR	
Center distance A ^{k,1}		2-1	2-6	1-5	1-6	1-3	0-11	0-10	0-6	0-6	
12	Span without stirrups ^{i,j}		4-10	5-8	4-0	4-2	3-9	3-2	3-0	2-7	2-6
	1-#4	40,000	5-5	6-1	4-8	4-10	4-4	3-9	3-6	2-10	2-10
		60,000	6-7	7-5	5-8	5-11	5-4	4-7	4-3	3-6	3-5
	1-#5	40,000	6-9	7-7	5-9	6-0	5-5	4-8	4-4	3-7	3-6
		60,000	9-4	10-6	8-1	8-4	7-6	6-6	6-1	5-0	4-10
	2-#4 1-#6	40,000	8-8	9-9	7-6	7-9	7-0	6-0	5-8	4-7	4-6
		60,000	10-6	11-9	9-1	9-5	8-5	7-3	6-10	5-7	5-5
	2-#5	40,000	10-8	12-0	9-3	9-7	8-7	7-5	6-11	5-6	5-4
		60,000	12-10	14-5	11-1	11-6	10-4	8-11	8-4	6-7	6-4
	2-#6	40,000	12-7	14-2	10-10	11-3	10-2	8-3	7-6	5-6	5-4
60,000		DR	DR	DR	DR	DR	DR	DR	DR	DR	
Center distance A ^{k,1}		3-2	4-0	2-4	2-6	2-0	1-6	1-4	0-11	0-10	
16	Span without stirrups ^{i,j}		6-5	7-9	5-7	5-10	5-2	4-5	4-2	3-7	3-6
	1-#4	40,000	6-2	7-1	5-6	5-8	5-1	4-5	4-2	3-5	3-4

	1-#5	60,000	7-6	8-8	6-8	6-11	6-3	5-5	5-1	4-2	4-0
		40,000	7-8	8-10	6-10	7-1	6-4	5-6	5-2	4-3	4-1
	2-#4 1-#6	60,000	9-4	10-9	8-4	8-7	7-9	6-8	6-3	5-2	5-0
		40,000	8-8	10-0	7-8	8-0	7-2	6-2	5-10	4-9	4-8
	2-#5	60,000	12-0	13-11	10-9	11-2	10-0	8-8	8-1	6-8	6-6
		40,000	12-3	14-2	11-0	11-4	10-3	8-10	8-3	6-9	6-7
	2-#6	60,000	14-10	17-2	13-3	13-8	12-4	10-8	10-0	7-11	7-8
		40,000	14-6	16-10	13-0	13-5	12-1	10-1	9-2	6-11	6-8
	Center distance ^{k,1}		60,000	17-5	20-2	15-7	16-1	14-6	11-10	10-8	7-11
20	Span without stirrups ^{i,j}		4-1	5-5	3-3	3-6	2-10	2-1	1-10	1-3	1-2
	1-#5	40,000	7-10	9-10	7-1	7-5	6-7	5-8	5-4	4-7	4-6
		60,000	8-4	9-11	7-8	8-0	7-2	6-3	5-10	4-9	4-8
	2-#4 1-#6	40,000	10-2	12-1	9-5	9-9	8-9	7-7	7-1	5-10	5-8
		60,000	9-5	11-3	8-8	9-0	8-1	7-0	6-7	5-5	5-3
	2-#5	40,000	11-6	13-8	10-7	11-0	9-11	8-7	8-0	6-7	6-5
		60,000	11-9	13-11	10-10	11-2	10-1	8-9	8-2	6-8	6-7
	2-#6	40,000	16-4	19-5	15-0	15-7	14-0	12-2	11-4	9-3	9-0
		60,000	16-0	19-0	14-9	15-3	13-9	11-10	10-10	8-3	8-0
Center distance A ^{k,1}		60,000	19-3	22-11	17-9	18-5	16-7	13-7	12-4	9-3	9-0
24	Span without stirrups ^{i,j}		4-10	6-10	4-1	4-5	3-7	2-8	2-4	1-7	1-6
	1-#5	40,000	9-2	11-9	8-7	8-11	8-0	6-11	6-6	5-7	5-6
		60,000	8-11	10-10	8-6	8-9	7-11	6-10	6-5	5-3	5-2
	2-#4 1-#6	40,000	10-11	13-3	10-4	10-8	9-8	8-4	7-10	6-5	6-3
		60,000	10-1	12-3	9-7	9-11	8-11	7-9	7-3	6-0	5-10
	2-#5	40,000	12-3	15-0	11-8	12-1	10-11	9-5	8-10	7-3	7-1
		60,000	12-6	15-3	11-11	12-4	11-1	9-7	9-0	7-5	7-3
	2-#6	40,000	17-6	21-3	16-7	17-2	15-6	13-5	12-7	10-4	10-1
		60,000	17-2	20-11	16-3	16-10	15-3	13-2	12-4	9-7	9-4
Center distance A ^{k,1}		60,000	20-9	25-3	19-8	20-4	18-5	15-4	14-0	10-7	10-3
Center distance A ^{k,1}		60,000	5-6	8-1	4-11	5-3	4-4	3-3	2-10	1-11	1-10

For SI: 1 inch = 25.4 mm; 1 foot = 304.8 mm; 1 psf = 0.0479kPa; Grade 40 = 280 MPa; Grade 60 = 420 MPa.

Note: Top and bottom reinforcement for lintels without stirrups shown in shaded cells shall be equal to or greater than that required for lintel of the same depth and loading condition that has an allowable clear span that is equal to or greater than that of the lintel without stirrups.

- See Table 611.3 for tolerances permitted from nominal thickness.
- Table values are based on concrete with a minimum specified compressive strength of 2,500 psi. See Note j.
- Table values are based on uniform loading. See Section 611.8.2 for lintels supporting concentrated loads.
- Deflection criterion is $L/240$, where L is the clear span of the lintel in inches, or 1/2-inch, whichever is less.
- Linear interpolation is permitted between ground snow loads and between lintel depths.
- DR indicates design required.

- g. Lintel depth, D , is permitted to include the available height of wall located directly above the lintel, provided that the increased lintel depth spans the entire length of the lintel.
- h. Stirrups shall be fabricated from reinforcing bars with the same yield strength as that used for the main longitudinal reinforcement.
- i. Allowable clear span without stirrups applicable to all lintels of the same depth, D . Top and bottom reinforcement for lintels without stirrups shall not be less than the least amount of reinforcement required for a lintel of the same depth and loading condition with stirrups. All other spans require stirrups spaced at not more than $d/2$.
- j. Where concrete with a minimum specified compressive strength of 3,000 psi is used, clear spans for lintels without stirrups shall be permitted to be multiplied by 1.05. If the increased span exceeds the allowable clear span for a lintel of the same depth and loading condition with stirrups, the top and bottom reinforcement shall be equal to or greater than that required for a lintel of the same depth and loading condition that has an allowable clear span that is equal to or greater than that of the lintel without stirrups that has been increased.
- k. Center distance, A , is the center portion of the clear span where stirrups are not required. This is applicable to all longitudinal bar sizes and steel yield strengths.
- l. Where concrete with a minimum specified compressive strength of 3,000 psi is used, center distance, A , shall be permitted to be multiplied by 1.10.
- m. The maximum clear opening width between two solid wall segments shall be 18 feet. See Section 611.7.2.1. Lintel clear spans in the table greater than 18 feet are shown for interpolation and information only.

TABLE 611.8(5)
MAXIMUM ALLOWABLE CLEAR SPANS FOR 10-INCH NOMINAL THICK FLAT LINTELS IN LOAD-BEARING WALLS^{a, b, c, d, e, f, m}

ROOF CLEAR SPAN 40 FEET AND FLOOR CLEAR SPAN 32 FEET

LINTEL DEPTH, D^g (inches)	NUMBER OF BARS AND BAR SIZE IN TOP AND BOTTOM OF LINTEL	STEEL YIELD STRENGTH ^h , f_y (psi)	DESIGN LOADING CONDITION DETERMINED FROM TABLE 611.8(1)									
			1	2		3		4		5		
			Maximum ground snow load (psf)									
				30	70	30	70	30	70	30	70	
Maximum clear span of lintel (feet - inches)												
8	Span without stirrups ^{i,j}		6-0	7-2	4-7	4-10	4-1	3-1	2-11	2-3	2-2	
	1-#4	40,000	4-3	4-9	3-7	3-9	3-4	2-9	2-7	2-1	2-1	
		60,000	5-11	6-7	5-0	5-3	4-8	3-10	3-8	2-11	2-11	
	1-#5	40,000	6-1	6-9	5-2	5-4	4-9	3-11	3-9	3-0	2-11	
		60,000	7-4	8-1	6-3	6-5	5-9	4-9	4-6	3-7	3-7	
	2-#4 1-#6	40,000	6-10	7-6	5-9	6-0	5-5	4-5	4-2	3-4	3-4	
		60,000	8-2	9-1	6-11	7-2	6-6	5-4	5-0	4-1	4-0	
	2-#5	40,000	8-4	9-3	7-1	7-4	6-7	5-5	5-1	4-1	4-0	
		60,000	9-11	11-0	8-5	8-9	7-10	6-6	6-1	4-8	4-6	
	2-#6	40,000	9-9	10-10	8-3	8-7	7-9	6-4	5-10	4-1	4-0	
60,000		DR	DR	DR	DR	DR	DR	DR	DR	DR		
Center distance $A^{k,l}$		2-6	3-1	1-10	1-11	1-7	1-1	0-11	0-7	0-7		
12	Span without stirrups ^{i,j}		5-5	6-7	4-7	4-10	4-3	3-5	3-3	2-8	2-8	
	1-#4	40,000	5-3	6-0	4-8	4-10	4-4	3-7	3-4	2-9	2-8	
		60,000	6-5	7-4	5-8	5-10	5-3	4-4	4-1	3-4	3-3	

	1-#5	40,000	6-6	7-6	5-9	6-0	5-5	4-5	4-2	3-5	3-4	
		60,000	7-11	9-1	7-0	7-3	6-7	5-5	5-1	4-2	4-0	
	2-#4 1-#6	40,000	7-4	8-5	6-6	6-9	6-1	5-0	4-9	3-10	3-9	
		60,000	10-3	11-9	9-1	9-5	8-6	7-0	6-7	5-4	5-3	
	2-#5	40,000	10-5	12-0	9-3	9-7	8-8	7-2	6-9	5-5	5-4	
		60,000	12-7	14-5	11-2	11-6	10-5	8-7	8-1	6-6	6-4	
	2-#6	40,000	12-4	14-2	10-11	11-4	10-2	8-5	7-8	5-7	5-5	
		60,000	14-9	17-0	13-1	13-6	12-2	10-0	9-1	6-6	6-4	
	Center distance A ^{k,1}			3-9	4-11	2-11	3-2	2-7	1-9	1-7	1-0	1-0
	16	Span without stirrups ^{i,j}		7-1	9-0	6-4	6-8	5-10	4-9	4-6	3-9	3-8
1-#4		40,000	5-11	7-0	5-5	5-8	5-1	4-3	4-0	3-3	3-2	
		60,000	7-3	8-7	6-8	6-11	6-3	5-2	4-10	3-11	3-10	
1-#5		40,000	7-4	8-9	6-9	7-0	6-4	5-3	4-11	4-0	3-11	
		60,000	9-0	10-8	8-3	8-7	7-9	6-5	6-0	4-11	4-9	
2-#4 1-#6		40,000	8-4	9-11	7-8	7-11	7-2	5-11	5-7	4-6	4-5	
		60,000	10-2	12-0	9-4	9-8	8-9	7-3	6-10	5-6	5-5	
2-#5		40,000	10-4	12-3	9-6	9-10	8-11	7-4	6-11	5-8	5-6	
		60,000	14-4	17-1	13-3	13-8	12-4	10-3	9-8	7-10	7-8	
2-#6		40,000	14-1	16-9	13-0	13-5	12-2	10-1	9-6	7-0	6-10	
	60,000	17-0	20-2	15-8	16-2	14-7	12-0	10-11	8-0	7-9		
Center distance ^{k,1}			4-9	6-8	4-0	4-4	3-6	2-5	2-2	1-5	1-4	
20	Span without stirrups ^{i,j}		8-7	11-4	8-1	8-5	7-5	6-1	5-9	4-10	4-9	
	1-#4	40,000	6-5	7-10	6-2	6-4	5-9	4-9	4-6	3-8	3-7	
		60,000	7-10	9-7	7-6	7-9	7-0	5-10	5-6	4-5	4-4	
	1-#5	40,000	8-0	9-9	7-8	7-11	7-2	5-11	5-7	4-6	4-5	
		60,000	9-9	11-11	9-4	9-8	8-9	7-3	6-10	5-6	5-5	
	2-#4 1-#6	40,000	9-0	11-1	8-8	8-11	8-1	6-9	6-4	5-2	5-0	
		60,000	11-0	13-6	10-6	10-11	9-10	8-2	7-9	6-3	6-2	
	2-#5	40,000	11-3	13-9	10-9	11-1	10-0	8-4	7-10	6-5	6-3	
		60,000	15-8	19-2	15-0	15-6	14-0	11-8	11-0	8-11	8-9	
	2-#6	40,000	15-5	18-10	14-8	15-2	13-9	11-5	10-9	8-6	8-3	
60,000		18-7	22-9	17-9	18-5	16-7	13-10	12-9	9-5	9-2		
Center distance A ^{k,1}			5-7	8-4	5-1	5-5	4-5	3-1	2-9	1-10	1-9	
24	Span without stirrups ^{i,j}		9-11	13-7	9-9	10-2	9-0	7-5	7-0	5-10	5-9	
	1-#5	40,000	8-6	10-8	8-5	8-8	7-10	6-6	6-2	5-0	4-11	
		60,000	10-5	13-0	10-3	10-7	9-7	8-0	7-6	6-1	6-0	
	2-#4	40,000	9-7	12-1	9-6	9-9	8-10	7-5	7-0	5-8	5-6	

1-#6	60,000	11-9	14-9	11-7	11-11	10-10	9-0	8-6	6-11	6-9
	40,000	12-0	15-0	11-9	12-2	11-0	9-2	8-8	7-1	6-11
2-#5	60,000	14-7	18-3	14-4	14-10	13-5	11-2	10-7	8-7	8-5
	40,000	14-3	17-11	14-1	14-7	13-2	11-0	10-4	8-5	8-3
2-#6	60,000	19-11	25-0	19-7	20-3	18-4	15-3	14-5	10-10	10-7
	Center distance A ^{k,1}	6-3	9-11	6-1	6-6	5-4	3-9	3-4	2-2	2-1

For SI: 1 inch = 25.4 mm; 1 foot = 304.8 mm; 1 pound per square foot = 0.0479kPa; Grade 40 = 280 MPa; Grade 60 = 420 MPa.

Note: Top and bottom reinforcement for lintels without stirrups shown in shaded cells shall be equal to or greater than that required for lintel of the same depth and loading condition that has an allowable clear span that is equal to or greater than that of the lintel without stirrups.

- a. See Table 611.3 for tolerances permitted from nominal thickness.
- b. Table values are based on concrete with a minimum specified compressive strength of 2,500 psi. See Note j.
- c. Table values are based on uniform loading. See Section 611.8.2 for lintels supporting concentrated loads.
- d. Deflection criterion is $L/240$, where L is the clear span of the lintel in inches, or $\frac{1}{2}$ -inch, whichever is less.
- e. Linear interpolation is permitted between ground snow loads and between lintel depths.
- f. DR indicates design required.
- g. Lintel depth, D , is permitted to include the available height of wall located directly above the lintel, provided that the increased lintel depth spans the entire length of the lintel.
- h. Stirrups shall be fabricated from reinforcing bars with the same yield strength as that used for the main longitudinal reinforcement.
- i. Allowable clear span without stirrups applicable to all lintels of the same depth, D . Top and bottom reinforcement for lintels without stirrups shall not be less than the least amount of reinforcement required for a lintel of the same depth and loading condition with stirrups. All other spans require stirrups spaced at not more than $d/2$.
- j. Where concrete with a minimum specified compressive strength of 3,000 psi is used, clear spans for lintels without stirrups shall be permitted to be multiplied by 1.05. If the increased span exceeds the allowable clear span for a lintel of the same depth and loading condition with stirrups, the top and bottom reinforcement shall be equal to or greater than that required for a lintel of the same depth and loading condition that has an allowable clear span that is equal to or greater than that of the lintel without stirrups that has been increased.
- k. Center distance, A , is the center portion of the clear span where stirrups are not required. This is applicable to all longitudinal bar sizes and steel yield strengths.
- l. Where concrete with a minimum specified compressive strength of 3,000 psi is used, center distance, A , shall be permitted to be multiplied by 1.10.
- m. The maximum clear opening width between two solid wall segments shall be 18 feet (5486 mm). See Section 611.7.2.1. Lintel clear spans in the table greater than 18 feet are shown for interpolation and information only.

TABLE 611.8(6)
MAXIMUM ALLOWABLE CLEAR SPANS FOR 6-INCH THICK WAFFLE-GRID LINTELS IN LOAD-BEARING
WALLS^{a, b, c, d, e, f, o}
MAXIMUM ROOF CLEAR SPAN 40 FEET AND MAXIMUM FLOOR SPAN 32 FEET

LINTEL DEPTH, D ^g (inches)	NUMBER OF BARS AND BAR SIZE IN TOP AND BOTTOM OF LINTEL	STEEL YIELD STRENGTH ^h , f _y (psi)	DESIGN LOADING CONDITION DETERMINED FROM TABLE 611.8(1)								
			1	2		3		4		5	
			Maximum ground snow load (psf)								
				30	70	30	70	30	70	30	70
Maximum clear span of lintel (feet - inches)											
8 ⁱ	Span without stirrups ^{k, l}		2-7	2-9	2-0	2-1	2-0	2-0	2-0	2-0	2-0
	1-#4	40,000	5-2	5-5	4-0	4-3	3-7	3-3	2-11	2-4	2-3
		60,000	5-9	6-3	4-0	4-3	3-7	3-3	2-11	2-4	2-3
	1-#5	40,000	5-9	6-3	4-0	4-3	3-7	3-3	2-11	2-4	2-3
		60,000	5-9	6-3	4-0	4-3	3-7	3-3	2-11	2-4	2-3
	2-#4 1-#6	40,000	5-9	6-3	4-0	4-3	3-7	3-3	2-11	2-4	2-3
		60,000	DR	DR	DR	DR	DR	DR	DR	DR	DR
Center distance A ^{m, n}		0-9	0-10	0-6	0-6	0-5	0-5	0-4	STL	STL	
12 ⁱ	Span without stirrups ^{k, l}		2-11	3-1	2-6	2-7	2-5	2-4	2-3	2-1	2-0
	1-#4	40,000	5-9	6-2	4-8	4-10	4-4	4-1	3-9	3-2	3-1
		60,000	8-0	8-7	6-6	6-9	6-0	5-5	4-11	3-11	3-10
	1-#5	40,000	8-1	8-9	6-8	6-11	6-0	5-5	4-11	3-11	3-10
		60,000	9-1	10-3	6-8	7-0	6-0	5-5	4-11	3-11	3-10
	2-#4 1-#6	40,000	9-1	9-9	6-8	7-0	6-0	5-5	4-11	3-11	3-10
		Center distance A ^{m, n}		1-3	1-5	0-10	0-11	0-9	0-8	0-6	STL
16 ⁱ	Span without stirrups ^{k, l}		4-0	4-4	3-6	3-7	3-4	3-3	3-1	2-10	2-10
	1-#4	40,000	6-7	7-3	5-6	5-9	5-2	4-10	4-6	3-9	3-8
		60,000	8-0	8-10	6-9	7-0	6-3	5-11	5-5	4-7	4-5
	1-#5	40,000	8-2	9-0	6-11	7-2	6-5	6-0	5-7	4-8	4-6
		60,000	11-5	12-6	9-3	9-9	8-4	7-7	6-10	5-6	5-4
	2-#4 1-#6	40,000	10-7	11-7	8-11	9-3	8-3	7-7	6-10	5-6	5-4
		60,000	12-2	14-0	9-3	9-9	8-4	7-7	6-10	5-6	5-4
	2-#5	40,000	12-2	14-2	9-3	9-9	8-4	7-7	6-10	5-6	5-4
60,000		DR	DR	DR	DR	DR	DR	DR	DR	DR	
Center distance A ^{m, n}		1-8	2-0	1-2	1-3	1-0	0-11	0-9	STL	STL	
20 ⁱ	Span without stirrups ^{k, l}		5-0	5-6	4-6	4-7	4-3	4-1	4-0	3-8	3-8
	1-#4	40,000	7-2	8-2	6-3	6-6	5-10	5-6	5-1	4-3	4-2
		60,000	8-11	9-11	7-8	7-11	7-1	6-8	6-2	5-2	5-0

1-#5	40,000	9-1	10-2	7-9	8-1	7-3	6-10	6-4	5-4	5-2	
	60,000	12-8	14-2	10-11	11-3	10-2	9-6	8-9	7-1	6-10	
2-#4 1-#6	40,000	10-3	11-5	8-9	9-1	8-2	7-8	7-1	6-0	5-10	
	60,000	14-3	15-11	11-9	12-5	10-8	9-9	8-9	7-1	6-10	
2-#5	40,000	14-6	16-3	11-6	12-1	10-4	9-6	8-6	6-11	6-8	
	60,000	DR	DR	DR	DR	DR	DR	DR	DR	DR	
Center distance A ^{m,n}		2-0	2-6	1-6	1-7	1-3	1-1	1-0	STL	STL	
Span without stirrups ^{k,1}		6-0	6-8	5-5	5-7	5-3	5-0	4-10	4-6	4-5	
24w ^j	1-#4	40,000	7-11	9-0	6-11	7-2	6-5	6-0	5-7	4-8	4-7
		60,000	9-8	10-11	8-5	8-9	7-10	7-4	6-10	5-9	5-7
	1-#5	40,000	9-10	11-2	8-7	8-11	8-0	7-6	7-0	5-10	5-8
		60,000	12-0	13-7	10-6	10-10	9-9	9-2	8-6	7-2	6-11
	2-#4 1-#6	40,000	11-1	12-7	9-8	10-1	9-1	8-6	7-10	6-7	6-5
		60,000	15-6	17-7	13-6	14-0	12-8	11-10	10-8	8-7	8-4
	2-#5	40,000	15-6	17-11	12-8	13-4	11-6	10-7	9-7	7-10	7-7
		60,000	DR	DR	DR	DR	DR	DR	DR	DR	DR
	Center distance A ^{m,n}		2-4	3-0	1-9	1-11	1-6	1-4	1-2	STL	STL

For SI: 1 inch = 25.4 mm; 1 pound per square foot = 0.0479 kPa; 1 foot = 304.8 mm; Grade 40 = 280 MPa; Grade 60 = 420 MPa.

- a. Where lintels are formed with waffle-grid forms, form material shall be removed, if necessary, to create top and bottom flanges of the lintel that are not less than 3 inches in depth (in the vertical direction), are not less than 5 inches (127 mm) in width for 6-inch nominal waffle-grid forms and not less than 7 inches in width for 8-inch nominal waffle-grid forms. See Figure 611.8(3). Flat form lintels shall be permitted in place of waffle-grid lintels. See Tables 611.8(2) through 611.8(5).
- b. See Table 611.3 for tolerances permitted from nominal thicknesses and minimum dimensions and spacing of cores.
- c. Table values are based on concrete with a minimum specified compressive strength of 2,500 psi (17.2 MPa). See Notes l and n. Table values are based on uniform loading. See Section 611.8.2 for lintels supporting concentrated loads.
- d. Deflection criterion is $L/240$, where L is the clear span of the lintel in inches, or 1/2-inch, whichever is less.
- e. Linear interpolation is permitted between ground snow loads.
- f. DR indicates design required. STL – stirrups required throughout lintel.
- g. Lintel depth, D , is permitted to include the available height of wall located directly above the lintel, provided that the increased lintel depth spans the entire length of the lintel.
- h. Stirrups shall be fabricated from reinforcing bars with the same yield strength as that used for the main longitudinal reinforcement.
- i. Lintels less than 24 inches in depth with stirrups shall be formed from flat-wall forms [see Tables 611.8(2) through 611.8(5)], or, if necessary, form material shall be removed from waffle-grid forms so as to provide the required cover for stirrups. Allowable spans for lintels formed with flat-wall forms shall be determined from Tables 611.8(2) through 611.8(5).
- j. Where stirrups are required for 24-inch (610 mm) deep lintels, the spacing shall not exceed 12 inches (305 mm) on center.
- k. Allowable clear span without stirrups applicable to all lintels of the same depth, D . Top and bottom reinforcement for lintels without stirrups shall not be less than the least amount of reinforcement required for a lintel of the same depth and loading condition with stirrups. All other spans require stirrups spaced at not more than $d/2$.

- l. Where concrete with a minimum specified compressive strength of 3,000 psi is used, clear spans for lintels without stirrups shall be permitted to be multiplied by 1.05. If the increased span exceeds the allowable clear span for a lintel of the same depth and loading condition with stirrups, the top and bottom reinforcement shall be equal to or greater than that required for a lintel of the same depth and loading condition that has an allowable clear span that is equal to or greater than that of the lintel without stirrups that has been increased.
- m. Center distance, *A*, is the center portion of the span where stirrups are not required. This is applicable to all longitudinal bar sizes and steel yield strengths.
- n. Where concrete with a minimum specified compressive strength of 3,000 psi is used, center distance, *A*, shall be permitted to be multiplied by 1.10.
- o. The maximum clear opening width between two solid wall segments shall be 18 feet. See Section 611.7.2.1. Lintel spans in the table greater than 18 feet are shown for interpolation and information only.

TABLE 611.8(7)
MAXIMUM ALLOWABLE CLEAR SPANS FOR 8-INCH THICK WAFFLE-GRID LINTELS IN LOAD-BEARING WALLS^{a, b, c, d, e, f, o}

MAXIMUM ROOF CLEAR SPAN 40 FEET AND MAXIMUM FLOOR CLEAR SPAN 32 FEET

LINTEL DEPTH, D ^g (inches)	NUMBER OF BARS AND BAR SIZE IN TOP AND BOTTOM OF LINTEL	STEEL YIELD STRENGTH ^h , f _y (psi)	DESIGN LOADING CONDITION DETERMINED FROM TABLE 611.8(1)									
			1	2		3		4		5		
				Maximum ground snow load (psf)								
				30	70	30	70	30	70	30	70	
Maximum clear span of lintel (feet - inches)												
8 ⁱ	Span with stirrups ^{k, l}		2-6	2-9	2-0	2-1	2-0	2-0	2-0	2-0	2-0	2-0
	1-#4	40,000	4-5	4-9	3-7	3-9	3-4	3-0	2-10	2-3	2-2	
		60,000	5-6	6-2	4-0	4-3	3-7	3-1	2-10	2-3	2-2	
	1-#5	40,000	5-6	6-2	4-0	4-3	3-7	3-1	2-10	2-3	2-2	
Center distance A ^{m, n}			0-9	0-10	0-6	0-6	0-5	0-4	0-4	STL	STL	
12 ⁱ	Span without stirrups ^{k, l}		2-10	3-1	2-6	2-7	2-5	2-3	2-2	2-0	2-0	
	1-#4	40,000	5-7	6-1	4-8	4-10	4-4	3-11	3-8	3-0	2-11	
		60,000	6-9	7-5	5-8	5-11	5-4	4-9	4-5	3-8	3-7	
	1-#5	40,000	6-11	7-7	5-10	6-0	5-5	4-10	4-6	3-9	3-7	
		60,000	8-8	10-1	6-7	7-0	5-11	5-2	4-8	3-9	3-7	
	2-#4 1-#6	40,000	8-8	9-10	6-7	7-0	5-11	5-2	4-8	3-9	3-7	
		60,000	8-8	10-1	6-7	7-0	5-11	5-2	4-8	3-9	3-7	
Center distance A ^{m, n}			1-2	1-5	0-10	0-11	0-9	0-7	0-6	STL	STL	
16 ⁱ	Span without stirrups ^{k, l}		3-10	4-3	3-6	3-7	3-4	3-2	3-0	2-10	2-9	
	1-#4	40,000	6-5	7-2	5-6	5-9	5-2	4-8	4-4	3-7	3-6	
		60,000	7-9	8-9	6-9	7-0	6-3	5-8	5-3	4-4	4-3	
	1-#5	40,000	7-11	8-11	6-10	7-1	6-5	5-9	5-4	4-5	4-4	
		60,000	9-8	10-11	8-4	8-8	7-10	7-0	6-6	5-2	5-1	
	2-#4 1-#6	40,000	9-0	10-1	7-9	8-0	7-3	6-6	6-1	5-0	4-11	
		60,000	11-5	13-10	9-2	9-8	8-3	7-2	6-6	5-2	5-1	
Center distance A ^{m, n}			1-6	1-11	1-2	1-3	1-0	0-10	0-8	STL	STL	
20 ⁱ	Span without stirrups ^{k, l}		4-10	5-5	4-5	4-7	4-3	4-0	3-11	3-7	3-7	
	1-#4	40,000	7-0	8-1	6-3	6-5	5-10	5-3	4-11	4-1	3-11	

		60,000	8-7	9-10	7-7	7-10	7-1	6-5	6-0	4-11	4-10
	1-#5	40,000	8-9	10-1	7-9	8-0	7-3	6-6	6-1	5-1	4-11
		60,000	10-8	12-3	9-6	9-10	8-10	8-0	7-5	6-2	6-0
	2-#4 1-#6	40,000	9-10	11-4	8-9	9-1	8-2	7-4	6-10	5-8	5-7
		60,000	12-0	13-10	10-8	11-0	9-11	9-0	8-4	6-8	6-6
	2-#5	40,000	12-3	14-1	10-10	11-3	10-2	8-11	8-1	6-6	6-4
		60,000	14-0	17-6	11-8	12-3	10-6	9-1	8-4	6-8	6-6
Center distance A ^{m, n}			1-10	2-5	1-5	1-7	1-3	1-0	0-11	STL	STL
24 ^j	Span without stirrups ^{k, 1}		5-9	6-7	5-5	5-6	5-2	4-11	4-9	4-5	4-4
	1-#4	40,000	7-6	8-10	6-10	7-1	6-5	5-9	5-5	4-6	4-4
		60,000	9-2	10-9	8-4	8-8	7-10	7-1	6-7	5-6	5-4
	1-#5	40,000	9-5	11-0	8-6	8-10	8-0	7-2	6-8	5-7	5-5
		60,000	11-5	13-5	10-5	10-9	9-9	8-9	8-2	6-10	6-8
	2-#4 1-#6	40,000	10-7	12-5	9-8	10-0	9-0	8-1	7-7	6-3	6-2
		60,000	12-11	15-2	11-9	12-2	11-0	9-11	9-3	7-8	7-6
	2-#5	40,000	13-2	15-6	12-0	12-5	11-2	9-11	9-2	7-5	7-3
		60,000	16-3	21-0	14-1	14-10	12-9	11-1	10-1	8-1	7-11
	2-#6	40,000	14-4	18-5	12-6	13-2	11-5	9-11	9-2	7-5	7-3
	Center distance A ^{m, n}			2-1	2-11	1-9	1-10	1-6	1-3	1-1	STL

For SI: 1 inch = 25.4 mm; 1 pound per square foot = 0.0479 kPa; 1 foot = 304.8 mm; Grade 40 = 280 MPa; Grade 60 = 420 MPa.

- a. Where lintels are formed with waffle-grid forms, form material shall be removed, if necessary, to create top and bottom flanges of the lintel that are not less than 3 inches in depth (in the vertical direction), are not less than 5 inches in width for 6-inch nominal waffle-grid forms and not less than 7 inches in width for 8-inch nominal waffle-grid forms. See Figure 611.8(3). Flat form lintels shall be permitted in lieu of waffle-grid lintels. See Tables 611.8(2) through 611.8(5).
- b. See Table 611.3 for tolerances permitted from nominal thicknesses and minimum dimensions and spacing of cores.
- c. Table values are based on concrete with a minimum specified compressive strength of 2,500 psi (17.2 MPa). See Notes 1 and n. Table values are based on uniform loading. See Section 611.8.2 for lintels supporting concentrated loads.
- d. Deflection criterion is $L/240$, where L is the clear span of the lintel in inches, or $1/2$ -inch, whichever is less.
- e. Linear interpolation is permitted between ground snow loads.
- f. DR indicates design required. STL – stirrups required throughout lintel.
- g. Lintel depth, D , is permitted to include the available height of wall located directly above the lintel, provided that the increased lintel depth spans the entire length of the lintel.
- h. Stirrups shall be fabricated from reinforcing bars with the same yield strength as that used for the main longitudinal reinforcement.
- i. Lintels less than 24 inches in depth with stirrups shall be formed from flat-walls forms [see Tables 611.8(2) through 611.8(5)], or, if necessary, form material shall be removed from waffle-grid forms so as to provide the required cover for stirrups. Allowable spans for lintels formed with flat-wall forms shall be determined from Tables 611.8(2) through 611.8(5).
- j. Where stirrups are required for 24-inch (610 mm) deep lintels, the spacing shall not exceed 12 inches on center.
- k. Allowable clear span without stirrups applicable to all lintels of the same depth, D . Top and bottom reinforcement for lintels without stirrups shall not be less than the least amount of reinforcement required for a lintel of the same depth and loading condition with stirrups. All other spans require stirrups spaced at not more than $d/2$.
- l. Where concrete with a minimum specified compressive strength of 3,000 psi is used, clear spans for lintels without stirrups shall be permitted to be multiplied by 1.05. If the increased span exceeds the allowable clear span for a lintel of the same depth and loading condition with stirrups, the top and bottom reinforcement shall be equal to or greater than that required

- for a lintel of the same depth and loading condition that has an allowable clear span that is equal to or greater than that of the lintel without stirrups that has been increased.
- m. Center distance, *A*, is the center portion of the span where stirrups are not required. This is applicable to all longitudinal bar sizes and steel yield strengths.
- n. Where concrete with a minimum specified compressive strength of 3,000 psi is used, center distance, *A*, shall be permitted to be multiplied by 1.10.
- o. The maximum clear opening width between two solid wall segments shall be 18 feet. See Section 611.7.2.1. Lintel spans in the table greater than 18 feet are shown for interpolation and information only.

TABLE 611.8(8)
MAXIMUM ALLOWABLE CLEAR SPANS FOR 6-INCH THICK SCREEN-GRID LINTELS IN LOAD-BEARING WALLS^{a, b, c, d, e, f, p}
ROOF CLEAR SPAN 40 FEET AND FLOOR CLEAR SPAN 32 FEET

LINTEL DEPTH, D ^g (inches)	NUMBER OF BARS AND BAR SIZE IN TOP AND BOTTOM OF LINTEL	STEEL YIELD STRENGTH ^h , f _y (psi)	DESIGN LOADING CONDITION DETERMINED FROM TABLE 611.8(1)								
			1	2		3		4		5	
				Maximum ground snow load (psf)							
				30	70	30	70	30	70	30	70
Maximum clear span of lintel (feet - inches)											
12 ^{i, j}	Span without stirrups		2-9	2-11	2-4	2-5	2-3	2-3	2-2	2-0	2-0
16 ^{i, j}	Span without stirrups		3-9	4-0	3-4	3-5	3-2	3-1	3-0	2-9	2-9
20 ^{i, j}	Span without stirrups		4-9	5-1	4-3	4-4	4-1	4-0	3-10	3-7	3-7
24 ^k	Span without stirrups ^{l, m}		5-8	6-3	5-2	5-3	5-0	4-10	4-8	4-4	4-4
	1-#4	40,000	7-11	9-0	6-11	7-2	6-5	6-1	5-8	4-9	4-7
		60,000	9-9	11-0	8-5	8-9	7-10	7-5	6-10	5-9	5-7
	1-#5	40,000	9-11	11-2	8-7	8-11	8-0	7-7	7-0	5-11	5-9
		60,000	12-1	13-8	10-6	10-10	9-9	9-3	8-6	7-2	7-0
	2-#4 1-#6	40,000	11-2	12-8	9-9	10-1	9-1	8-7	7-11	6-8	6-6
		60,000	15-7	17-7	12-8	13-4	11-6	10-8	9-8	7-11	7-8
	2-#5	40,000	14-11	18-0	12-2	12-10	11-1	10-3	9-4	7-8	7-5
		60,000	DR	DR	DR	DR	DR	DR	DR	DR	DR
	Center distance A ^{n, o}		2-0	2-6	1-6	1-7	1-4	1-2	1-0	STL	STL

For SI: 1 inch = 25.4 mm; 1 pound per square foot = 0.0479kPa; 1 foot = 304.8 mm; Grade 40 = 280MPa; Grade 60 = 420MPa.

- a. Where lintels are formed with screen-grid forms, form material shall be removed if necessary to create top and bottom flanges of the lintel that are not less than 5 inches in width and not less than 2.5 inches in depth (in the vertical direction). See Figure 611.8(4). Flat form lintels shall be permitted in lieu of screen-grid lintels. See Tables 611.8(2) through 611.8(5).
- b. See Table 611.3 for tolerances permitted from nominal thickness and minimum dimensions and spacings of cores.
- c. Table values are based on concrete with a minimum specified compressive strength of 2,500 psi. See Notes m and o. Table values are based on uniform loading. See Section 611.7.2.1 for lintels supporting concentrated loads.
- d. Deflection criterion is *L*/240, where *L* is the clear span of the lintel in inches, or 1/2-inch, whichever is less.
- e. Linear interpolation is permitted between ground snow loads.
- f. DR indicates design required. STL indicates stirrups required throughout lintel.

- g. Lintel depth, D , is permitted to include the available height of wall located directly above the lintel, provided that the increased lintel depth spans the entire length of the lintel.
- h. Stirrups shall be fabricated from reinforcing bars with the same yield strength as that used for the main longitudinal reinforcement.
- i. Stirrups are not required for lintels less than 24 inches in depth fabricated from screen-grid forms. Top and bottom reinforcement shall consist of a No. 4 bar having a yield strength of 40,000 psi or 60,000 psi.
- j. Lintels between 12 and 24 inches in depth with stirrups shall be formed from flat-wall forms [see Tables 611.8(2) through 611.8(5)], or form material shall be removed from screen-grid forms to provide a concrete section comparable to that required for a flat wall. Allowable spans for flat lintels with stirrups shall be determined from Tables 611.8(2) through 611.8(5).
- k. Where stirrups are required for 24-inch deep lintels, the spacing shall not exceed 12 inches on center.
- l. Allowable clear span without stirrups applicable to all lintels of the same depth, D . Top and bottom reinforcement for lintels without stirrups shall not be less than the least amount of reinforcement required for a lintel of the same depth and loading condition with stirrups. All other spans require stirrups spaced at not more than 12 inches.
- m. Where concrete with a minimum specified compressive strength of 3,000 psi is used, clear spans for lintels without stirrups shall be permitted to be multiplied by 1.05. If the increased span exceeds the allowable clear span for a lintel of the same depth and loading condition with stirrups, the top and bottom reinforcement shall be equal to or greater than that required for a lintel of the same depth and loading condition that has an allowable clear span that is equal to or greater than that of the lintel without stirrups that has been increased.
- n. Center distance, A , is the center portion of the span where stirrups are not required. This is applicable to all longitudinal bar sizes and steel yield strengths.
- o. Where concrete with a minimum specified compressive strength of 3,000 psi is used, center distance, A , shall be permitted to be multiplied by 1.10.
- p. The maximum clear opening width between two solid wall segments shall be 18 feet (5486 mm). See Section 611.7.2.1. Lintel spans in the table greater than 18 feet are shown for interpolation and information only.

TABLE 611.8(9)
MAXIMUM ALLOWABLE CLEAR SPANS FOR FLAT LINTELS WITHOUT STIRRUPS IN NONLOAD-BEARING WALLS^{a, b, c, d, e, g, h}

LINTEL DEPTH, D^f (inches)	NUMBER OF BARS AND BAR SIZE	STEEL YIELD STRENGTH, f_y (psi)	NOMINAL WALL THICKNESS (inches)								
			4		6		8		10		
			Lintel Supporting								
			Concrete Wall	Light-framed Gable	Concrete Wall	Light-framed Gable	Concrete Wall	Light-framed Gable	Concrete Wall	Light-framed Gable	
8	1-#4	40,000	10-11	11-5	9-7	11-2	7-10	9-5	7-3	9-2	
		60,000	12-5	11-7	10-11	13-5	9-11	13-2	9-3	12-10	
	1-#5	40,000	12-7	11-7	11-1	13-8	10-1	13-5	9-4	13-1	
		60,000	DR	DR	12-7	16-4	11-6	14-7	10-9	14-6	
	2-#4 1-#6	40,000	DR	DR	12-0	15-3	10-11	15-0	10-2	14-8	
		60,000	DR	DR	DR	DR	12-2	15-3	11-7	15-3	
	2-#5	40,000	DR	DR	DR	DR	12-7	16-7	11-9	16-7	
		60,000	DR	DR	DR	DR	DR	DR	13-3	16-7	
	2-#6	40,000	DR	DR	DR	DR	DR	DR	13-2	17-8	
		60,000	DR	DR	DR	DR	DR	DR	DR	DR	
	12	1-#4	40,000	11-5	9-10	10-6	12-0	9-6	11-6	8-9	11-1

	1-#5	60,000	11-5	9-10	11-8	13-3	10-11	14-0	10-1	13-6
		40,000	11-5	9-10	11-8	13-3	11-1	14-4	10-3	13-9
	2-#4 1-#6	60,000	11-5	9-10	11-8	13-3	11-10	16-0	11-9	16-9
		40,000	DR	DR	11-8	13-3	11-10	16-0	11-2	15-6
	2-#5	60,000	DR	DR	11-8	13-3	11-10	16-0	11-11	18-4
		40,000	DR	DR	11-8	13-3	11-10	16-0	11-11	18-4
16	1-#4	40,000	13-6	13-0	11-10	13-8	10-7	12-11	9-11	12-4
		60,000	13-6	13-0	13-8	16-7	12-4	15-9	11-5	15-0
	1-#5	40,000	13-6	13-0	13-10	17-0	12-6	16-1	11-7	15-4
		60,000	13-6	13-0	13-10	17-1	14-0	19-7	13-4	18-8
	2-#4 1-#6	40,000	13-6	13-0	13-10	17-1	13-8	18-2	12-8	17-4
		60,000	13-6	13-0	13-10	17-1	14-0	20-3	14-1	—
	2-#5	40,000	13-6	13-0	13-10	17-1	14-0	20-3	14-1	—
		60,000	DR	DR	13-10	17-1	14-0	20-3	14-1	—
20	1-#4	40,000	14-11	15-10	13-0	14-10	11-9	13-11	10-10	13-2
		60,000	15-3	15-10	14-11	18-1	13-6	17-0	12-6	16-2
	1-#5	40,000	15-3	15-10	15-2	18-6	13-9	17-5	12-8	16-6
		60,000	15-3	15-10	15-8	20-5	15-9	—	14-7	20-1
	2-#4 1-#6	40,000	15-3	15-10	15-8	20-5	14-11	—	13-10	—
		60,000	15-3	15-10	15-8	20-5	15-10	—	15-11	—
	2-#5	40,000	15-3	15-10	15-8	20-5	15-10	—	15-11	—
		60,000	15-3	15-10	15-8	20-5	15-10	—	15-11	—
24	1-#4	40,000	16-1	17-1	13-11	15-10	12-7	14-9	11-8	13-10
		60,000	16-11	18-5	16-1	19-3	14-6	18-0	13-5	17-0
	1-#5	40,000	16-11	18-5	16-3	19-8	14-9	18-5	13-8	17-4
		60,000	16-11	18-5	17-4	—	17-0	—	15-8	—
	2-#4 1-#6	40,000	16-11	18-5	17-4	—	16-1	—	14-10	—
		60,000	16-11	18-5	17-4	—	17-6	—	17-1	—
	2-#5	40,000	16-11	18-5	17-4	—	17-6	—	17-4	—
		60,000	16-11	18-5	17-4	—	17-6	—	17-8	—

For SI: 1 inch = 25.4 mm; 1 foot = 304.8 mm; Grade 40 = 280 MPa; Grade 60 = 420 MPa.

- See Table 611.3 for tolerances permitted from nominal thickness.
- Table values are based on concrete with a minimum specified compressive strength of 2,500 psi. See Note e.
- Deflection criterion is $L/240$, where L is the clear span of the lintel in inches, or $\frac{1}{2}$ -inch, whichever is less.
- Linear interpolation between lintels depths, D , is permitted provided the two cells being used to interpolate are shaded.
- Where concrete with a minimum specified compressive strength of 3,000 psi is used, spans in cells that are shaded shall be permitted to be multiplied by 1.05.
- Lintel depth, D , is permitted to include the available height of wall located directly above the lintel, provided that the increased lintel depth spans the entire length of the lintel.
- DR indicates design required.
- The maximum clear opening width between two solid wall segments shall be 18 feet (5486 mm). See Section 611.7.2.1. Lintel spans in the table greater than 18 feet are shown for interpolation and information purposes only.

TABLE 611.8(10)
MAXIMUM ALLOWABLE CLEAR SPANS FOR WAFFLE-GRID AND SCREEN GRID LINTELS
WITHOUT STIRRUPS IN NONLOAD-BEARING WALLS^{c, d, e, f, g}

LINTEL DEPTH ^h , <i>D</i> (inches)	FORM TYPE AND NOMINAL WALL THICKNESS (inches)					
	6-inch Waffle-grid ^a		8-inch Waffle-grid ^a		6-inch Screen-grid ^b	
	Lintel supporting					
	Concrete Wall	Light-framed Gable	Concrete Wall	Light-framed Gable	Concrete Wall	Light-framed Gable
Maximum Clear Span of Lintel (feet - inches)						
8	10-3	8-8	8-8	8-3	—	—
12	9-2	7-6	7-10	7-1	8-8	6-9
16	10-11	10-0	9-4	9-3	—	—
20	12-5	12-2	10-7	11-2	—	—
24	13-9	14-2	11-10	12-11	13-0	12-9

For SI: 1 inch = 25.4 mm; 1 foot = 304.8 mm; Grade 40 = 280 MPa; Grade 60 = 420 MPa

- a. Where lintels are formed with waffle-grid forms, form material shall be removed, if necessary, to create top and bottom flanges of the lintel that are not less than 3 inches in depth (in the vertical direction), are not less than 5 inches in width for 6-inch waffle-grid forms and not less than 7 inches in width for 8-inch waffle-grid forms. See Figure 611.8(3). Flat form lintels shall be permitted in lieu of waffle-grid lintels. See Tables 611.8(2) through 611.8(5).
- b. Where lintels are formed with screen-grid forms, form material shall be removed if necessary to create top and bottom flanges of the lintel that are not less than 5 inches in width and not less than 2.5 inches in depth (in the vertical direction). See Figure 611.8(4). Flat form lintels shall be permitted in lieu of screen-grid lintels. See Tables 611.8(2) through 611.8(5).
- c. See Table 611.3 for tolerances permitted from nominal thickness and minimum dimensions and spacing of cores.
- d. Table values are based on concrete with a minimum specified compressive strength of 2,500 psi. See Note g.
- e. Deflection criterion is $L/240$, where L is the clear span of the lintel in inches, or 1/2-inch, whichever is less.
- f. Top and bottom reinforcement shall consist of a No. 4 bar having a minimum yield strength of 40,000 psi.
- g. Where concrete with a minimum specified compressive strength of 3,000 psi is used, spans in shaded cells shall be permitted to be multiplied by 1.05.
- h. Lintel depth, D , is permitted to include the available height of wall located directly above the lintel, provided that the increased lintel depth spans the entire length of the lintel.

611.9 Requirements for connections—general. Concrete walls shall be connected to footings, floors, ceilings and roofs in accordance with this section.

611.9.1 Connections between concrete walls and light-framed floor, ceiling and roof systems. Connections between concrete walls and light-framed floor, ceiling and roof systems using the prescriptive details of Figures 611.9(1) through 611.9(12) shall comply with this section and Sections 611.9.2 and 611.9.3.

611.9.1.1 Anchor bolts. Anchor bolts used to connect light-framed floor, ceiling and roof systems to concrete walls in accordance with Figures 611.9(1) through 611.9(12) 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 611.5.2.2. Anchor bolts with J-or L-hooks shall not be used where the connection details in these figures are used.

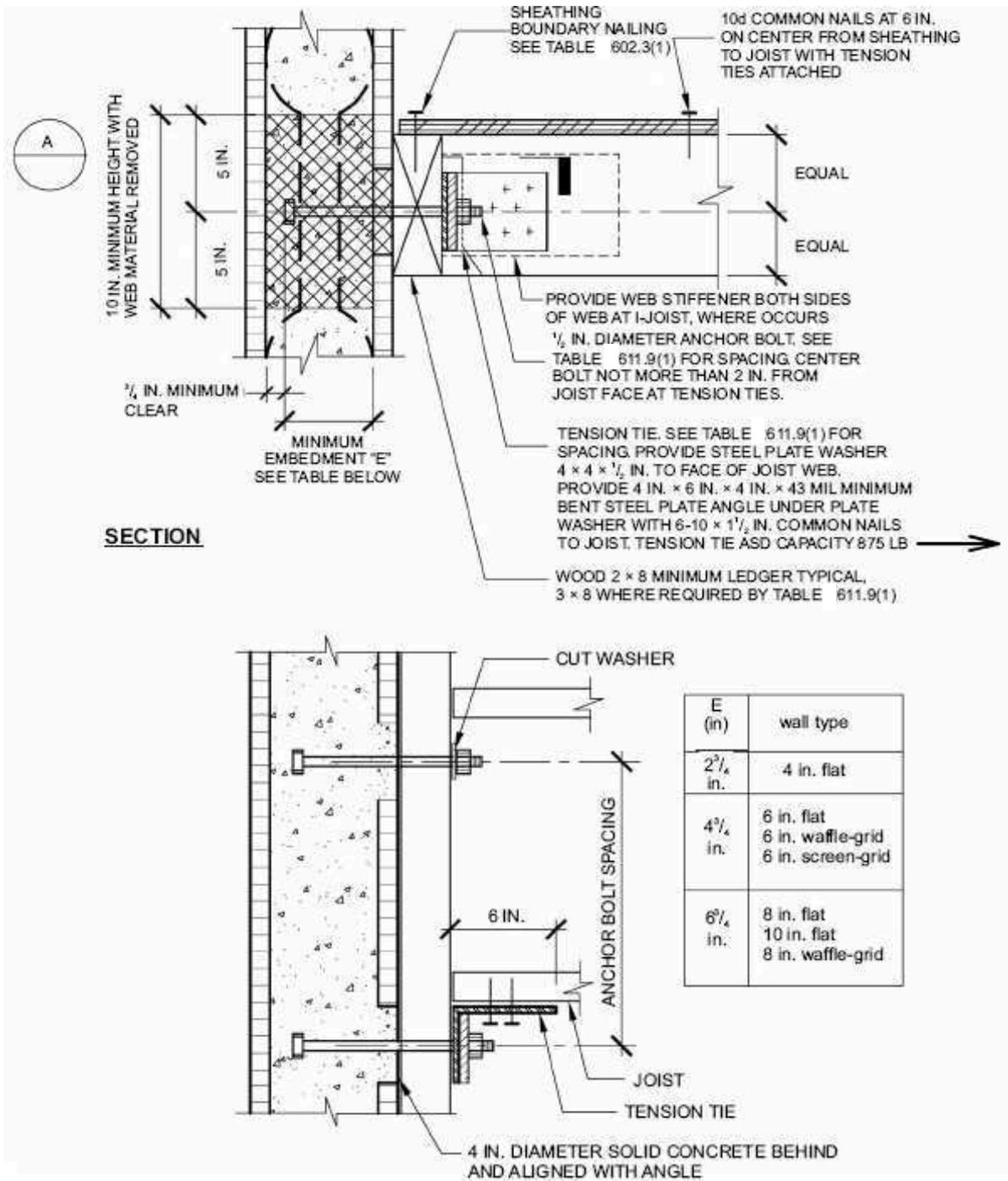
611.9.1.2 Removal of stay-in-place form material at bolts. Holes in stay-in-place forms for installing bolts for attaching face-mounted wood ledger boards to the wall shall be a minimum of 4 inches (102 mm) in diameter for forms not greater than 1½ inches (38 mm) in thickness, and increased 1 inch (25 mm) in diameter for each ½-inch (13 mm) increase in form thickness. Holes in stay-in-place forms for installing bolts for attaching face-mounted cold-formed steel tracks to the wall shall be a minimum of 4 inches (102 mm) square. The wood ledger board or steel track shall be in direct contact with the concrete at each bolt location.

Exception: A vapor retarder or other material less than or equal to 1/16-inch (1.6 mm) in thickness is permitted to be installed between the wood ledger or cold-formed track and the concrete.

611.9.2 Connections between concrete walls and light-framed floor systems. Connections between concrete walls and light-framed floor systems shall be in accordance with one of the following:

1. For floor systems of wood frame construction, the provisions of Section 611.9.1 and the prescriptive details of Figures 611.9(1) through 611.9(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 502, or AF&PA/WFCM, if applicable.
2. For floor systems of cold-formed steel construction, the provisions of Section 611.9.1 and the prescriptive details of Figures 611.9(5) through 611.9(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 505, 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 AF&PA/NDS for wood frame construction or AISI S100 for cold-formed steel frame construction.



For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 pound-force = 4.448 N.

FIGURE 611.9(1)

WOOD FRAMED FLOOR TO SIDE OF CONCRETE WALL, FRAMING PERPENDICULAR

611.9.3 Connections between concrete walls and light-framed ceiling and roof systems. Connections between concrete walls and light-framed ceiling and roof systems shall be in accordance with one of the following:

1. For ceiling and roof systems of wood frame construction, the provisions of Section 611.9.1 and the prescriptive details of Figures 611.9(9) and 611.9(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 802, or AF&PA/WFCM, if applicable.
2. For ceiling and roof systems of cold-formed-steel construction, the provisions of Section 611.9.1 and the prescriptive details of Figures 611.9(11) and 611.9(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 AF&PA/NDS for wood-frame construction or AISI S100 for cold-formed-steel frame construction.

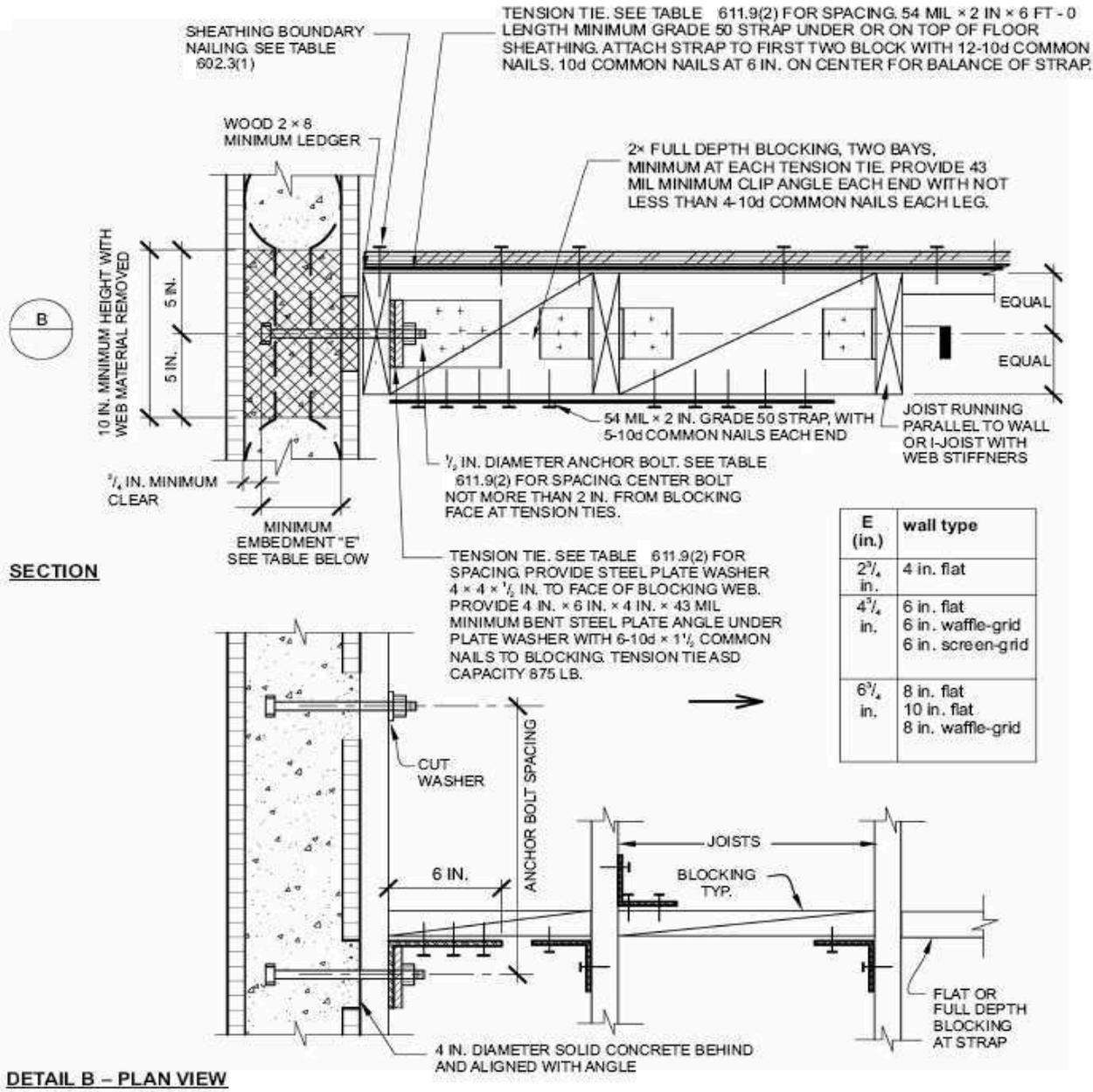
611.10 Floor, roof and ceiling diaphragms. Floors and roofs in all buildings with exterior walls of concrete shall be designed and constructed as diaphragms. Where gable-end walls occur, ceilings shall also be designed and constructed as diaphragms. The design and construction of floors, roofs and ceilings of wood framing or cold-formed-steel framing serving as diaphragms shall comply with the applicable requirements of this code, or AF&PA/WFCM or AISI S230, if applicable.

TABLE 611.9(1)
WOOD FRAMED FLOOR TO SIDE OF CONCRETE WALL, FRAMING PERPENDICULAR^{a, b, c}

ANCHOR BOLT SPACING (inches)	TENSION TIE SPACING (inches)	BASIC WIND SPEED (mph)					
		85B	90B	100B	110B	120B	130B
				85C	90C	100C	110C
				85D	90D	100D	
12	12						
12	24						
12	36						
12	48						
16	16					A	A
16	32						
16	48						
19.2	19.2	A	A	A	A	A	
19.2	38.4	A	A	A			

For SI: 1 inch = 25.4 mm; 1 mile per hour = 0.447 m/s.

- This table is for use with the detail in Figure R611.9(1). Use of this detail is permitted where a cell is not shaded and prohibited where shaded.
- Wall design per other provisions of Section R611 is required.
- Letter "A" indicates that a minimum nominal 3 x 8 ledger is required.



For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound-force = 4.448 N.

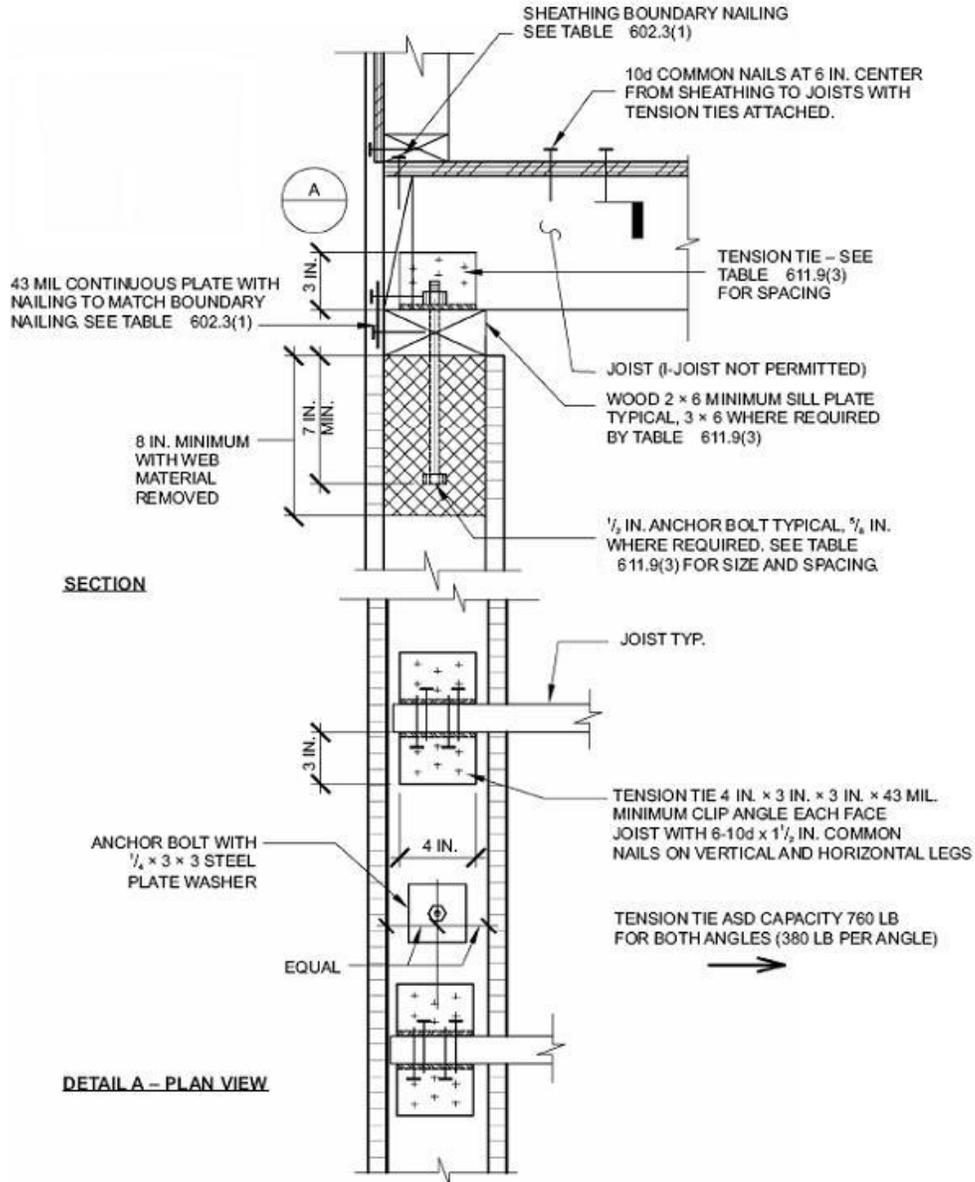
FIGURE 611.9(2)
WOOD FRAMED FLOOR TO SIDE OF CONCRETE WALL FRAMING PARALLEL

TABLE 611.9(2)
WOOD FRAMED FLOOR TO SIDE OF CONCRETE WALL, FRAMING PARALLEL^{a, b}

ANCHOR BOLT SPACING (inches)	TENSION TIE SPACING (inches)	BASIC WIND SPEED (mph) AND WIND EXPOSURE CATEGORY						
		85B	90B	100B	110B	120B	130B	
				85C	90C	100C	110C	
					85D	90D	100D	
12	12							
12	24							
12	36							
12	48							
16	16							
16	32							
16	48							
19.2	19.2							
19.2	38.4							
24	24							
24	48							

For SI: 1 inch = 25.4 mm; 1 mph = 0.447 m/s.

- a. This table is for use with the detail in Figure 611.9(2). Use of this detail is permitted where a cell is not shaded and prohibited where shaded.
- b. Wall design per other provisions of Section 611 is required.



For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 pound-force = 4.448 N.

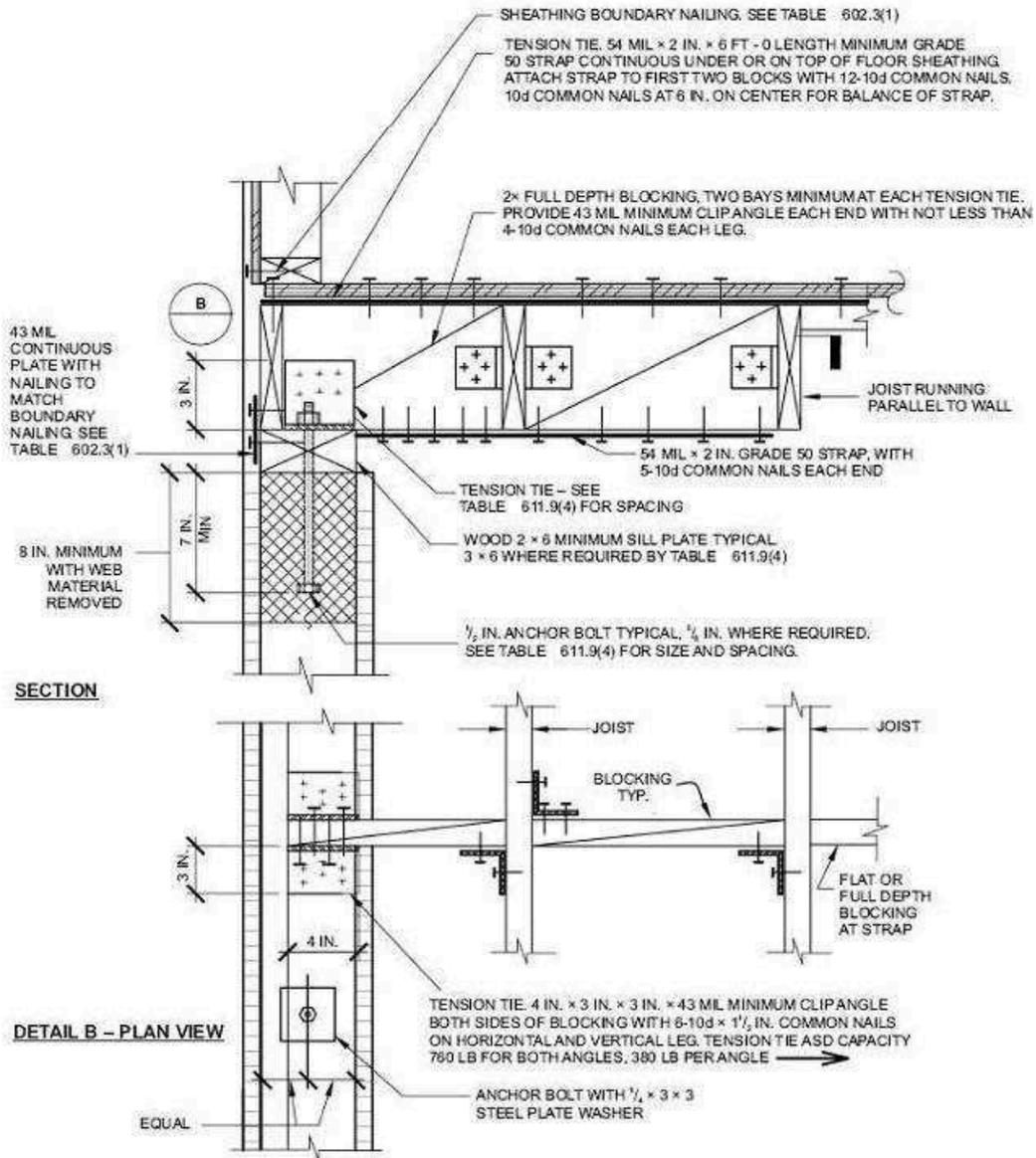
FIGURE 611.9(3)
WOOD FRAMED FLOOR TO TOP OF CONCRETE WALL FRAMING PERPENDICULAR

TABLE 611.9(3)
WOOD FRAMED FLOOR TO TOP OF CONCRETE WALL, FRAMING PERPENDICULAR^{a, b, c, d, e}

ANCHOR BOLT SPACING (inches)	TENSION TIE SPACING (inches)	BASIC WIND SPEED (mph) AND WIND EXPOSURE CATEGORY					
		85B	90B	100B	110B	120B	130B
				85C	90C	100C	110C
					85D	90D	100D
12	12						
12	24						
12	36						
12	48						
16	16					6 A	6 B
16	32					6 A	6 B
16	48						
19.2	19.2				6 A	6 A	6 B
19.2	38.4				6 A	6 A	
24	24			6 A	6 B	6 A	
24	48			6 A			

For SI: 1 inch = 25.4 mm; 1 mile per hour = 0.447 m/s.

- This table is for use with the detail in Figure 611.9(3). Use of this detail is permitted where cell is not shaded, prohibited where shaded.
- Wall design per other provisions in Section 611 is required.
- For wind design, minimum 4-inch nominal wall is permitted in unshaded cells with no number.
- Number 6 indicates minimum permitted nominal wall thickness in inches necessary to develop required strength (capacity) of connection. As a minimum, this nominal thickness shall occur in the portion of the wall indicated by the cross-hatching in Figure 611.9(3). For the remainder of the wall, see Note b.
- Letter "A" indicates that a minimum nominal 3 x 6 sill plate is required. Letter "B" indicates that a $\frac{5}{8}$ inch (16 mm) diameter anchor bolt and a minimal nominal 3 x 6 sill plate are required.



For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound-force = 4.448 N.

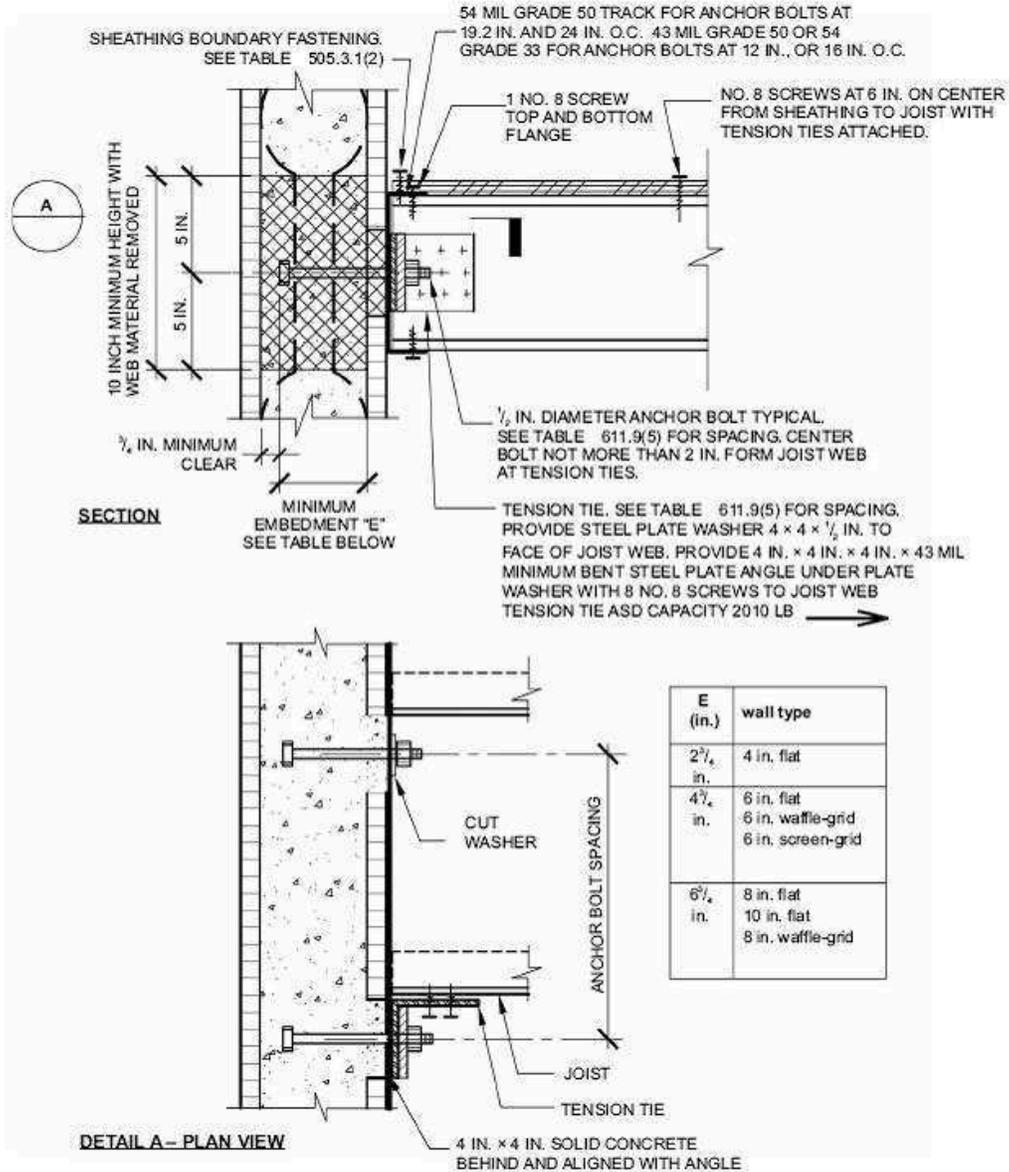
FIGURE 611.9(4)
WOOD FRAMED FLOOR TO TOP OF CONCRETE WALL FRAMING PARALLEL

TABLE 611.9(4)
WOOD FRAMED FLOOR TO TOP OF CONCRETE WALL, FRAMING PARALLEL^{a, b, c, d, e}

ANCHOR BOLT SPACING (inches)	TENSION TIE SPACING (inches)	BASIC WIND SPEED (mph) AND WIND EXPOSURE CATEGORY					
		85B	90B	100B	110B	120B	130B
				85C	90C	100C	110C
					85D	90D	100D
	12						
12	24						
12	36						
12	48						
16	16					6 A	6 B
16	32					6 A	6 B
16	48						
19.2	19.2				6 A	6 A	6 B
19.2	38.4				6 A	6 A	
24	24			6 A	6 B	6 B	
24	48			6 A			

For SI: 1 inch = 25.4 mm; 1 mile per hour = 0.447 m/s.

- This table is for use with the detail in Figure 611.9(4). Use of this detail is permitted where a cell is not shaded, prohibited where shaded.
- Wall design per other provisions of Section 611 is required.
- For wind design, minimum 4-inch nominal wall is permitted in unshaded cells with no number.
- Number 6 indicates minimum permitted nominal wall thickness in inches necessary to develop required strength (capacity) of connection. As a minimum, this nominal thickness shall occur in the portion of the wall indicated by the cross-hatching in Figure 611.9(4). For the remainder of the wall, see Note b.
- Letter "A" indicates that a minimum nominal 3 x 6 sill plate is required. Letter "B" indicates that a $\frac{5}{8}$ inch diameter anchor bolt and a minimal nominal 3 x 6 sill plate are required.



For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 pound-force = 4.448 N.

FIGURE 611.9(5)
COLD-FORMED STEEL FLOOR TO SIDE OF CONCRETE WALL, FRAMING PERPENDICULAR

TABLE 611.9(5)**COLD-FORMED STEEL FRAMED FLOOR TO SIDE OF CONCRETE WALL, FRAMING PERPENDICULAR^{a, b, c, d}**

ANCHOR BOLT SPACING (inches)	TENSION TIE SPACING (inches)	BASIC WIND SPEED (mph) AND WIND EXPOSURE CATEGORY					
		85B	90B	100B	110B	120B	130B
				85C	90C	100C	110C
					85D	90D	100D
12	12						
12	24						
12	36						6
12	48					6	6
16	16						
16	32						
16	48					6	6
19.2	19.2						
19.2	38.4						6
24	24						
24	48					6	6

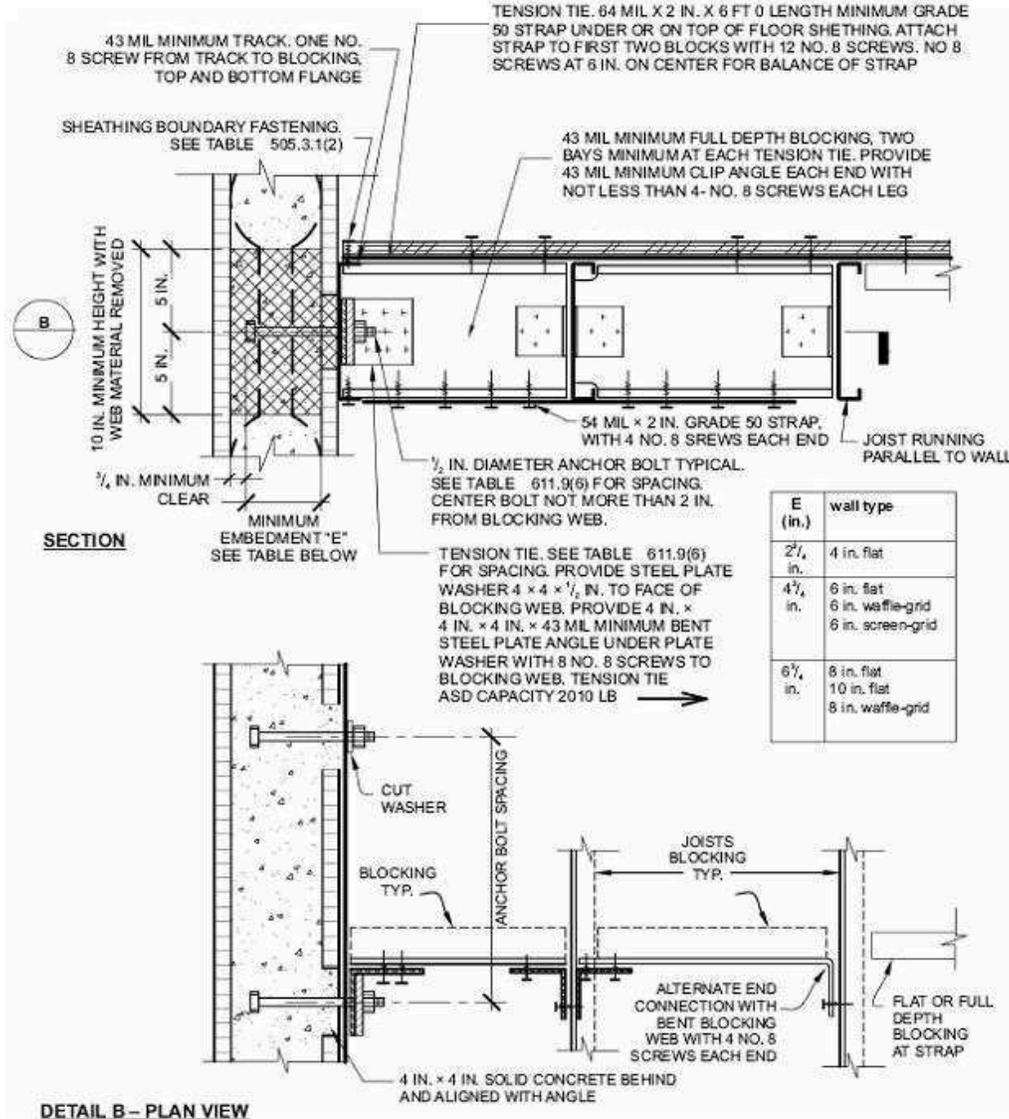
For SI: 1 inch = 25.4 mm; 1 mile per hour = 0.4470 m/s.

a. This table is for use with the detail in Figure 611.9(5). Use of this detail is permitted where a cell is not shaded.

b. Wall design per other provisions of Section 611 is required.

c. For wind design, minimum 4-inch nominal wall is permitted in unshaded cells with no number.

d. Number 6 indicates minimum permitted nominal wall thickness in inches necessary to develop required strength (capacity) of connection. As a minimum, this nominal thickness shall occur in the portion of the wall indicated by the cross-hatching in Figure 611.9(5). For the remainder of the wall, see Note b.



For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 pound-force = 4.448 N.

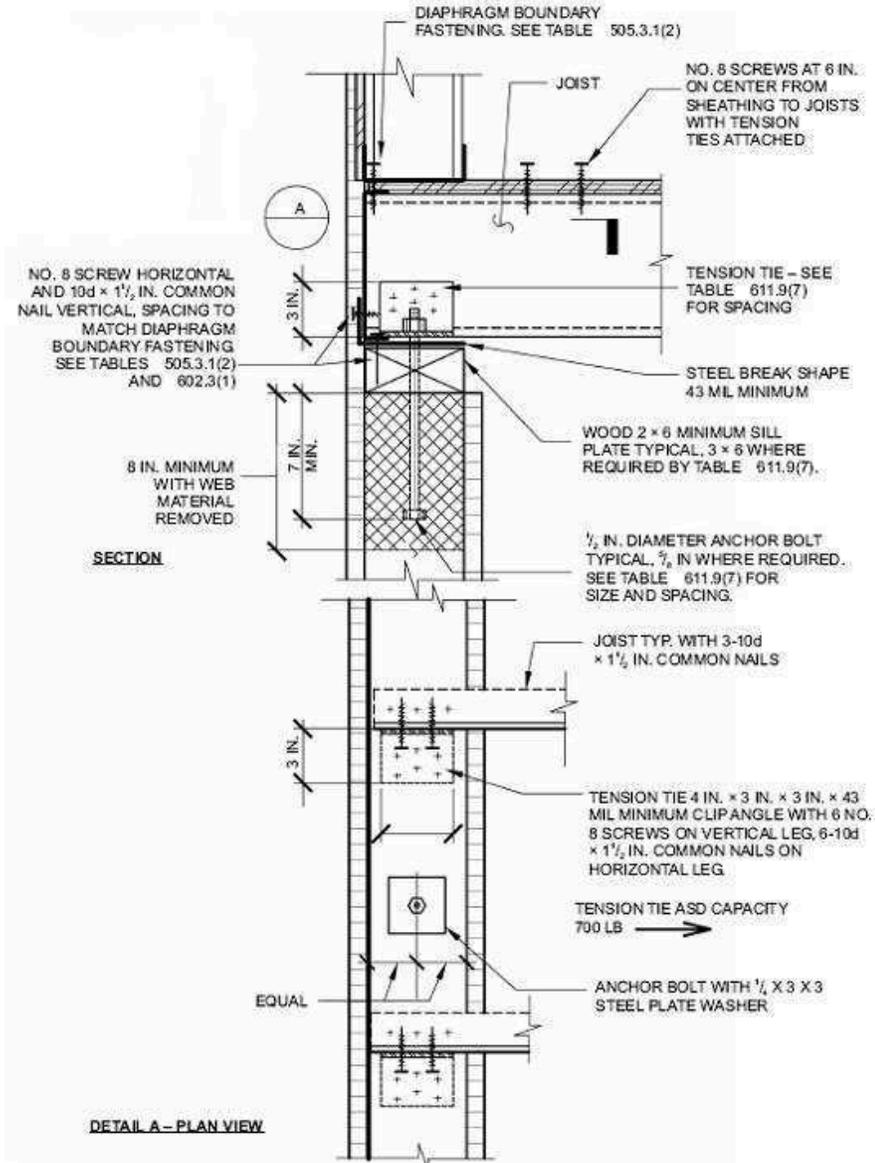
FIGURE 611.9(6)
COLD-FORMED STEEL FLOOR TO SIDE OF CONCRETE WALL, FRAMING PARALLEL

TABLE 611.9(6)
COLD-FORMED STEEL FRAMED FLOOR TO SIDE OF CONCRETE WALL, FRAMING PARALLEL^{a, b, c, d}

ANCHOR BOLT SPACING (inches)	TENSION TIE SPACING (inches)	BASIC WIND SPEED (mph) AND WIND EXPOSURE CATEGORY						
		85B	90B	100B	110B	120B	130B	
				85C	90C	100C	110C	
			85D	90D	100D			
12	12							
12	24							
12	36							6
12	48					6		6
16	16							
16	32							
16	48					6		6
19.2	19.2							
19.2	38.4							6
24	24							
24	48					6		6

For SI: 1 inch = 25.4 mm; 1 mile per hour = 0.447 m/s.

- This table is for use with the detail in Figure 611.9(6). Use of this detail is permitted where a cell is not shaded.
- Wall design per other provisions of Section 611 is required.
- For wind design, minimum 4-inch nominal wall is permitted in unshaded cells with no number.
- Number 6 indicates minimum permitted nominal wall thickness in inches necessary to develop required strength (capacity) of connection. As a minimum, this nominal thickness shall occur in the portion of the wall indicated by the cross-hatching in Figure 611.9(6). For the remainder of the wall, see Note b.



For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 pound-force = 4.448 N.

FIGURE 611.9(7)
COLD-FORMED STEEL FLOOR TO TOP OF CONCRETE WALL FRAMING PERPENDICULAR

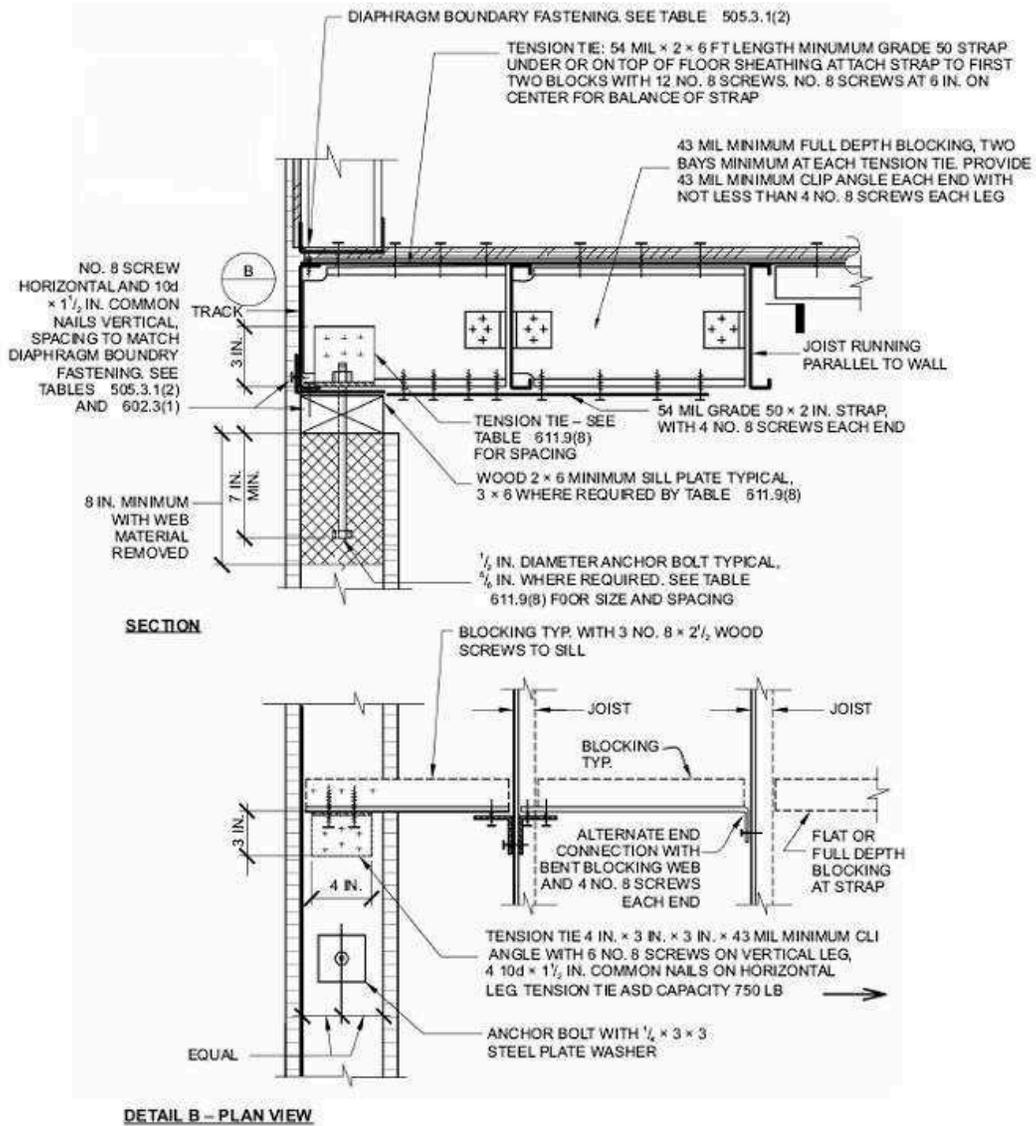
TABLE 611.9(7)

COLD-FORMED STEEL FRAMED FLOOR TO TOP OF CONCRETE WALL, FRAMING PERPENDICULAR^{a, b, c, d, e}

ANCHOR BOLT SPACING (inches)	TENSION TIE SPACING (inches)	BASIC WIND SPEED (mph) AND WIND EXPOSURE CATEGORY					
		85B	90B	100B	110B	120B	130B
				858C	90C	100C	110C
					85D	90D	100D
12	12						
12	24						
16	16					6 A	6 B
16	32					6 A	6 B
19.2	19.2				6 A	8 B	8 B
19.2	38.4				6 A	8 B	8 B
24	24			6 A	8 B	8 B	

For SI: 1 inch = 25.4 mm; 1 mph = 0.447 m/s.

- This table is for use with the detail in Figure 611.9(7). Use of this detail is permitted where a cell is not shaded, prohibited where shaded.
- Wall design per other provisions of Section 611 is required.
- For wind design, minimum 4-inch nominal wall is permitted in unshaded cells with no number.
- Numbers 6 and 8 indicate minimum permitted nominal wall thickness in inches necessary to develop required strength (capacity) of connection. As a minimum, this nominal thickness shall occur in the portion of the wall indicated by the cross-hatching in Figure 611.9(7). For the remainder of the wall, see Note b.
- Letter "A" indicates that a minimum nominal 3 x 6 sill plate is required. Letter "B" indicates that a $5/8$ inch diameter anchor bolt and a minimum nominal 3 x 6 sill plate are required.



For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 pound-force = 4.448 N.

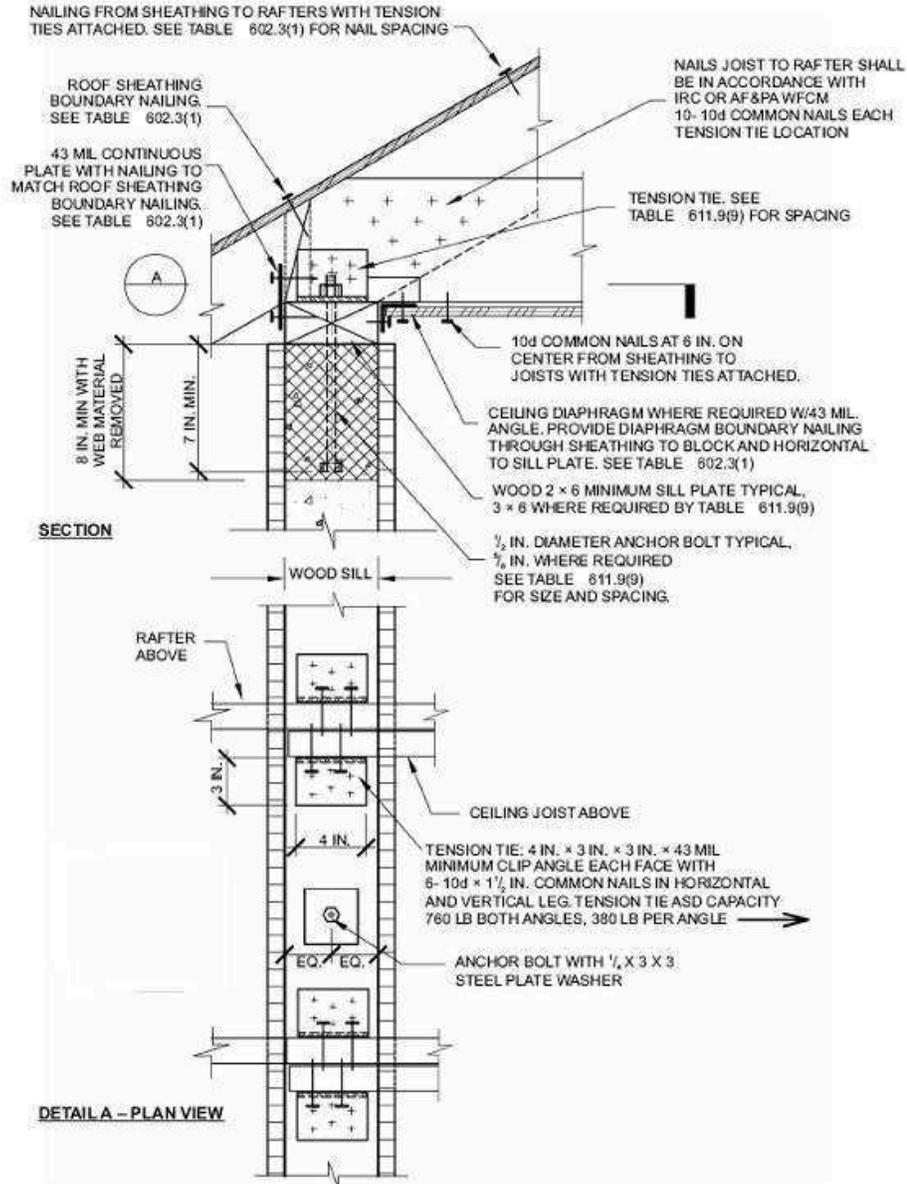
FIGURE 611.9(8)
COLD-FORMED STEEL FLOOR TO TOP OF CONCRETE WALL, FRAMING PARALLEL

TABLE 611.9(8)
COLD-FORMED STEEL FRAMED FLOOR TO TOP OF CONCRETE WALL, FRAMING PARALLEL ^{a, b, c, d, e}

ANCHOR BOLT SPACING (inches)	TENSION TIE SPACING (inches)	BASIC WIND SPEED (mph) AND WIND EXPOSURE CATEGORY					
		85B	90B	100B	110B	120B	130B
				85C	90C	100C	110C
					85D	90D	100D
12	12						
12	24						
16	16					6 A	6 B
16	32					6 A	6 B
19.2	19.2				6 A	8 B	8 B
19.2	38.4				6 A	8 B	8 B
24	24			6 A	8 B	8 B	

For SI: 1 inch = 25.4 mm; 1 mph = 0.447 m/s.

- a. This table is for use with the detail in Figure 611.9(8). Use of this detail is permitted where a cell is not shaded, prohibited where shaded.
- b. Wall design per other provisions of Section 611 is required.
- c. For wind design, minimum 4-inch nominal wall is permitted in unshaded cells with no number.
- d. Numbers 6 and 8 indicate minimum permitted nominal wall thickness in inches necessary to develop required strength (capacity) of connection. As a minimum, this nominal thickness shall occur in the portion of the wall indicated by the cross-hatching in Figure 611.9(8). For the remainder of the wall, see Note b.
- e. Letter "A" indicates that a minimum nominal 3 x 6 sill plate is required. Letter "B" indicates that a $\frac{5}{8}$ inch diameter anchor bolt and a minimum nominal 3 x 6 sill plate are required.



For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 pound-force = 4.448 N.

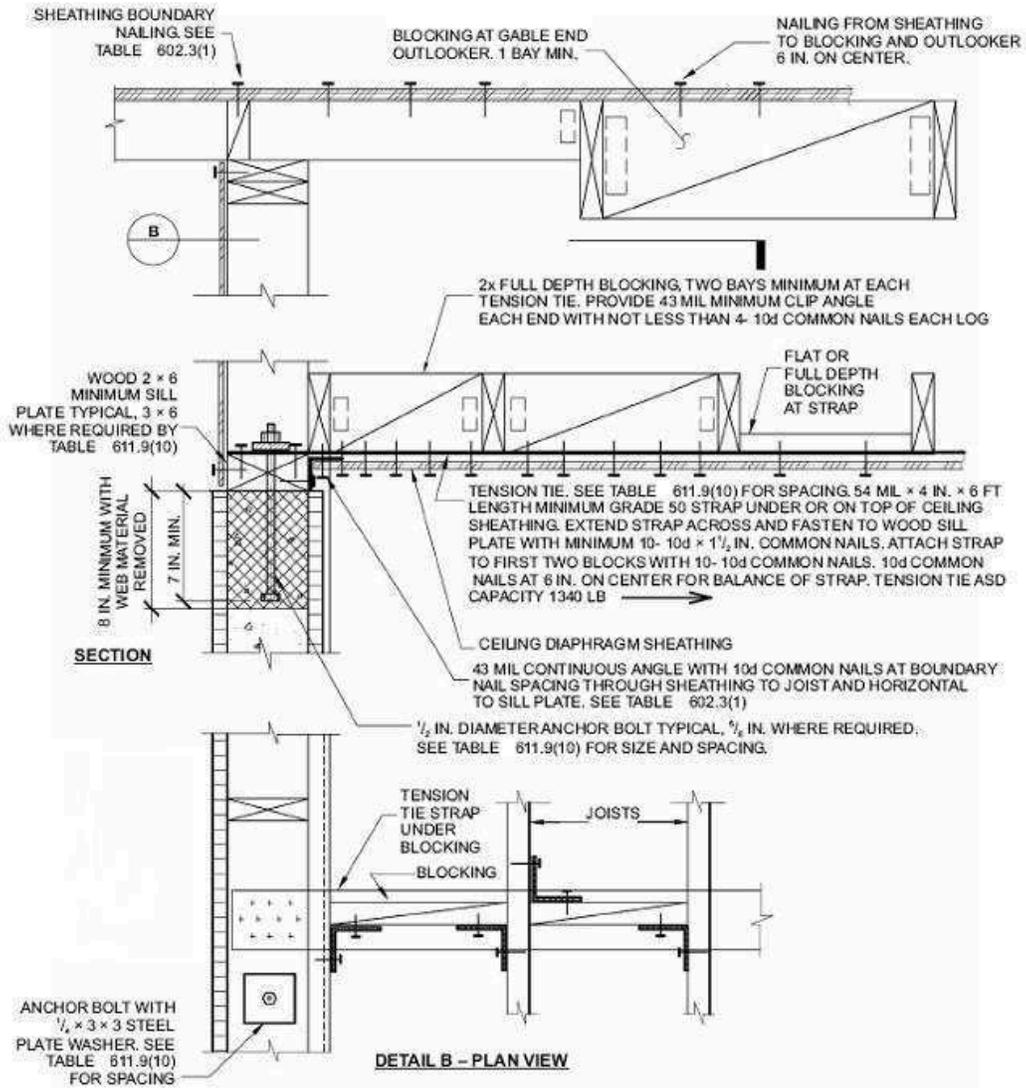
FIGURE 611.9(9)
WOOD FRAMED ROOF TO TOP OF CONCRETE WALL, FRAMING PERPENDICULAR

TABLE 611.9(9)
WOOD FRAMED ROOF TO TOP OF CONCRETE WALL, FRAMING PERPENDICULAR^{a, b, c, d, e}

ANCHOR BOLT SPACING (inches)	TENSION TIE SPACING (inches)	BASIC WIND SPEED (mph) AND WIND EXPOSURE CATEGORY					
		85B	90B	100B	110B	120B	130B
				85C	90C	100C	110C
					85D	90D	100D
12	12						
12	24						
12	36						
12	48						
16	16						6
16	32						6
16	48						
19.2	19.2					6	6 A
19.2	38.4					6	
24	24				6 A	6 A	6 B
24	48						

For SI: 1 inch = 25.4 mm; 1 mph = 0.447 m/s.

- This table is for use with the detail in Figure 611.9(9). Use of this detail is permitted where cell a is not shaded, prohibited where shaded.
- Wall design per other provisions of Section 611 is required.
- For wind design, minimum 4-inch nominal wall is permitted in unshaded cells with no number.
- Number 6 indicates minimum permitted nominal wall thickness in inches necessary to develop required strength (capacity) of connection. As a minimum, this nominal thickness shall occur in the portion of the wall indicated by the cross-hatching in Figure 611.9(9). For the remainder of the wall, see Note b.
- Letter "A" indicates that a minimum nominal 3 x 6 sill plate is required. Letter "B" indicates that a $\frac{5}{8}$ inch diameter anchor bolt and a minimum nominal 3 x 6 sill plate are required.



For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound-force = 4.448 N.

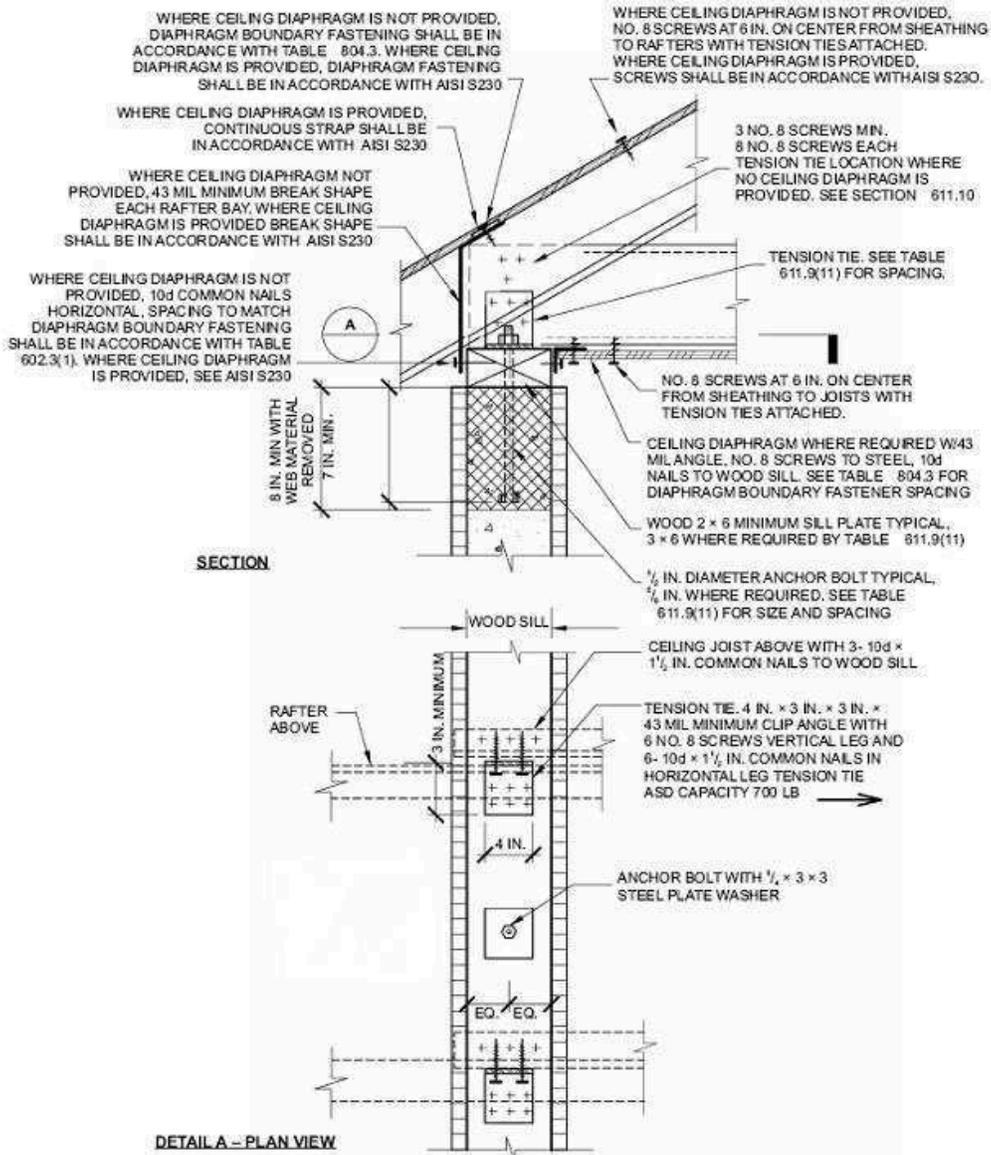
FIGURE 611.9(10)
WOOD FRAMED ROOF TO TOP OF CONCRETE WALL FRAMING PARALLEL

TABLE 611.9(10)
WOOD FRAMED ROOF TO TOP OF CONCRETE WALL, FRAMING PARALLEL^{a, b, c, d, e}

ANCHOR BOLT SPACING (inches)	TENSION TIE SPACING (inches)	BASIC WIND SPEED (mph) AND WIND EXPOSURE CATEGORY					
		85B	90B	100B	110B	120B	130B
				85C	90C	100C	110C
					85D	90D	100D
12	12						
12	24						
12	36						
12	48						
16	16					6	6
16	32					6	6
16	48					6	6
19.2	19.2				6	6	6 A
19.2	38.4				6	6	6 A
24	24			6	6 A	6 A	6 B
24	48			6	6 A	6 B	6 B

For SI: 1 inch = 25.4 mm; 1 mph = 0.447 m/s.

- This table is for use with the detail in Figure 611.9(10). Use of this detail is permitted where a cell is not shaded.
- Wall design per other provisions of Section 611 is required.
- For wind design, minimum 4-inch nominal wall is permitted in cells with no number.
- Number 6 indicates minimum permitted nominal wall thickness in inches necessary to develop required strength (capacity) of connection. As a minimum, this nominal thickness shall occur in the portion of the wall indicated by the cross-hatching in Figure 611.9(10). For the remainder of the wall, see Note b.
- Letter "A" indicates that a minimum nominal 3 x 6 sill plate is required. Letter "B" indicates that a $\frac{5}{8}$ inch diameter anchor bolt and a minimum nominal 3 x 6 sill plate are required.



For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 pound-force = 4.448 N.

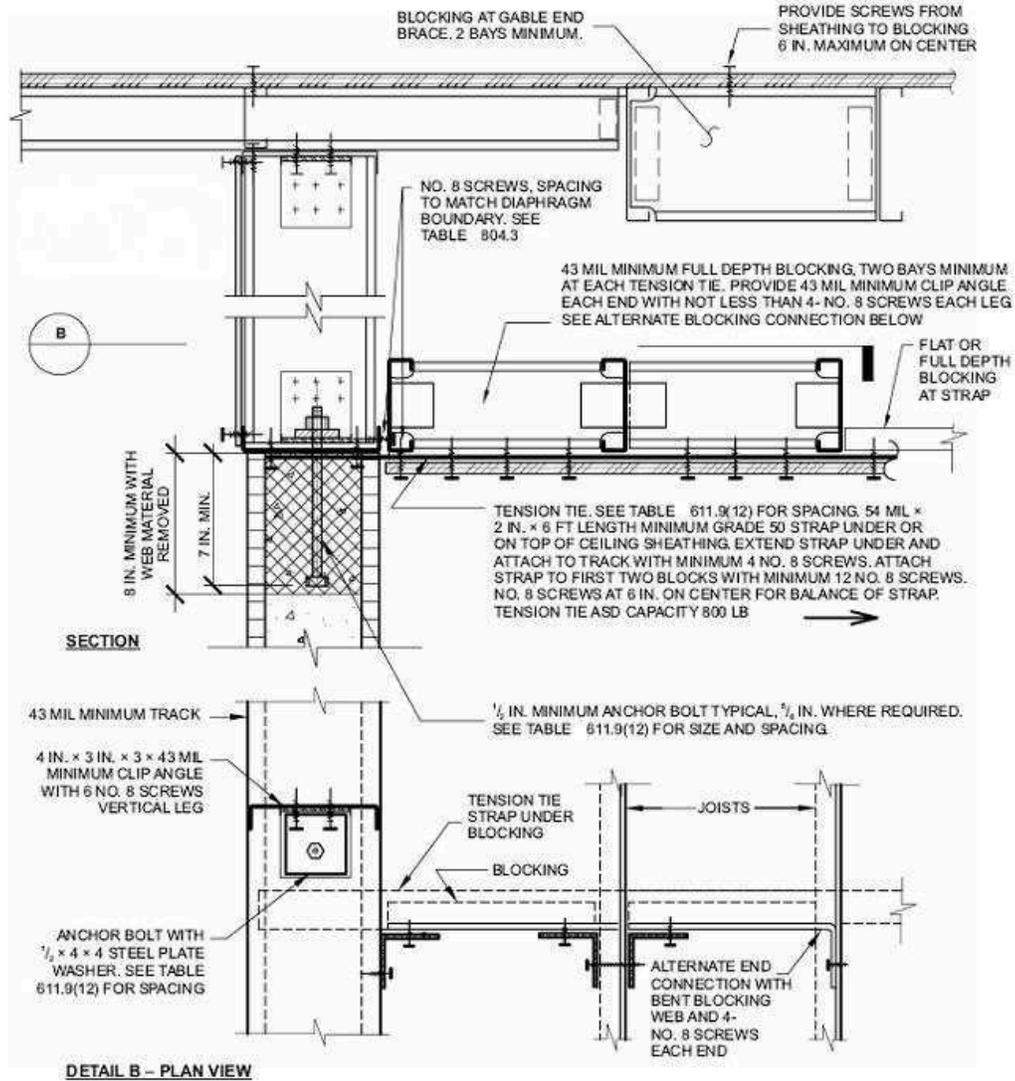
FIGURE 611.9(11)
COLD-FORMED STEEL ROOF TO TOP OF CONCRETE WALL, FRAMING PERPENDICULAR

TABLE 611.9(11)
COLD-FORMED STEEL ROOF TO TOP OF CONCRETE WALL, FRAMING PERPENDICULAR^{a, b, c, d, e}

ANCHOR BOLT SPACING (inches)	TENSION TIE SPACING (inches)	BASIC WIND SPEED (mph) AND WIND EXPOSURE CATEGORY					
		85B	90B	100B	110B	120B	130B
				85C	90C	100C	110C
					85D	90D	100D
12	12						
12	24						
16	16					6	6
16	32					6	6
19.2	19.2				6	6	8 B
19.2	38.4				6	6	8 B
24	24			6	6	8 B	

For SI: 1 inch = 25.4 mm; 1 mile per hour = 0.447 m/s.

- a. This table is for use with the detail in Figure 611.9(11). Use of this detail is permitted where a cell is not shaded, prohibited where shaded.
- b. Wall design per other provisions of Section 611 is required.
- c. For wind design, minimum 4-inch nominal wall is permitted in unshaded cells with no number.
- d. Numbers 6 and 8 indicate minimum permitted nominal wall thickness in inches necessary to develop required strength (capacity) of connection. As a minimum, this nominal thickness shall occur in the portion of the wall indicated by the cross-hatching in Figure 611.9(11). For the remainder of the wall, see Note b.
- e. Letter "B" indicates that a $\frac{5}{8}$ inch diameter anchor bolt and a minimum nominal 3 x 6 sill plate are required.



For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound-force = 4.448 N.

FIGURE 611.9(12)
COLD-FORMED STEEL ROOF TO TOP OF CONCRETE WALL, FRAMING PARALLEL

TABLE 611.9(12)
COLD-FORMED STEEL ROOF TO TOP OF CONCRETE WALL, FRAMING PARALLEL^{a, b, c, d, e}

ANCHOR BOLT SPACING (inches)	TENSION TIE SPACING (inches)	BASIC WIND SPEED (mph) AND WIND EXPOSURE CATEGORY					
		85B	90B	100B	110B	120B	130B
				85C	90C	100C	110C
					85D	90D	100D
12	12						
12	24						
16	16						
16	32						
19.2	19.2					6	6
19.2	38.4					6	6
24	24			6	6	8 B	8 B

For SI: 1 inch = 25.4 mm; 1 mile per hour = 0.447 m/s.

- This table is for use with the detail in Figure 611.9(12). Use of this detail is permitted where a cell is not shaded.
- Wall design per other provisions of Section 611 is required.
- For wind design, minimum 4-inch nominal wall is permitted in cells with no number.
- Numbers 6 and 8 indicate minimum permitted nominal wall thickness in inches necessary to develop required strength (capacity) of connection. As a minimum, this nominal thickness shall occur in the portion of the wall indicated by the cross-hatching in Figure 611.9(12). For the remainder of the wall, see Note b.
- Letter "B" indicates that a $\frac{5}{8}$ inch diameter anchor bolt is required.

SECTION 612 EXTERIOR WINDOWS AND DOORS

612.1 General. This section prescribes performance and construction requirements for exterior window and door installed in wall. Windows and doors shall be installed and flashed in accordance with the fenestration manufacturer's written installation instructions. Window and door openings shall be flashed in accordance with Section 703.8. Written installation instructions shall be provided by the fenestration manufacturer for each window or door.

612.2 Window sills. *Deleted.*

612.3 Window fall prevention devices. Window fall prevention devices and window guards, where provided, shall comply with the requirements of ASTM F 2090.

612.4 Window opening limiting devices. *Where provided,* window opening limiting devices shall comply with the provisions of this section.

612.4.1 General requirements. Window opening limiting devices shall be self acting and shall be positioned to prohibit the free passage of a 4-in. (102-mm) diameter rigid sphere through the window opening when the window opening limiting device is installed in accordance with the manufacturer's instructions.

612.4.2 Operation for emergency escape. Window opening limiting devices shall be designed with release mechanisms to allow for emergency escape through the window opening without the need for keys, tools or special knowledge. Window opening limiting devices shall comply with all of the following:

1. Release of the window opening-limiting device shall require no more than 15 pounds (66 N) of force.
2. The window opening limiting device release mechanism shall operate properly in all types of weather.
3. Window opening limiting devices shall have their release mechanisms clearly identified for proper use in an emergency.
4. The window opening limiting device shall not reduce the minimum net clear opening area of the window unit below what is required by Section 310.1.1 of the code.

612.5 Performance. Exterior windows and doors shall be designed to resist the design wind loads specified in Table 301.2(2) adjusted for height and exposure per Table 301.2(3).

612.6 Testing and labeling. Exterior windows and sliding doors shall be tested by an approved independent laboratory, and bear a label identifying manufacturer, performance characteristics and approved inspection agency to indicate compliance with AAMA/WDMA/CSA 101/I.S.2/A440. Exterior side-hinged doors shall be tested and labeled as conforming to AAMA/WDMA/CSA 101/I.S.2/A440 or comply with Section 612.8.

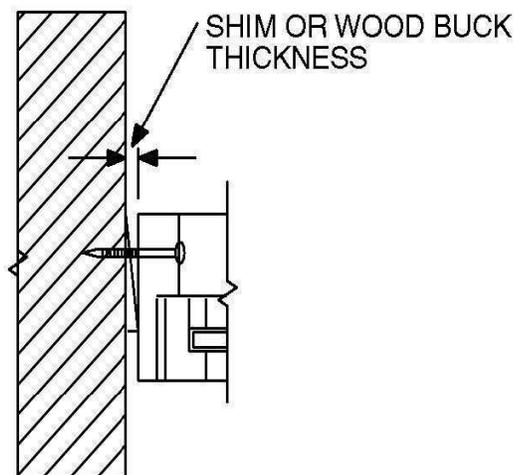
Exception: Decorative glazed openings.

612.6.1 Comparative analysis. Structural wind load design pressures for window and door units smaller than the size tested in accordance with Section 612.6 shall be permitted to be higher than the design value of the tested unit

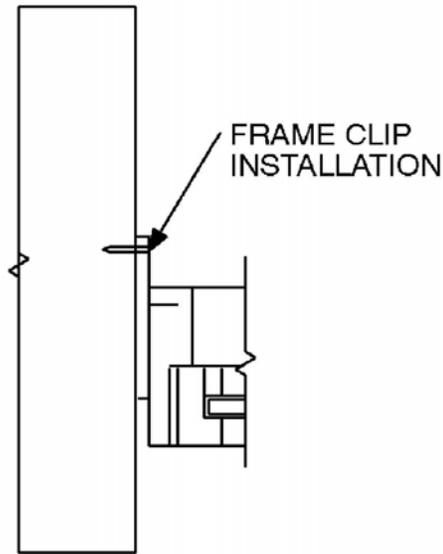
provided such higher pressures are determined by accepted engineering analysis. All components of the small unit shall be the same as those of the tested unit. Where such calculated design pressures are used, they shall be validated by an additional test of the window or door unit having the highest allowable design pressure.

612.7 Vehicular access doors. Vehicular access doors shall be tested in accordance with either ASTM E 330 or ANSI/ DASHMA 108, and shall meet the acceptance criteria of ANSI/DASHMA 108.

612.8 Other exterior window and door assemblies. Exterior windows and door assemblies not included within the scope of Section 612.6 or Section 612.7 shall be tested in accordance with ASTM E 330. Glass in assemblies covered by this exception shall comply with Section 308.5.

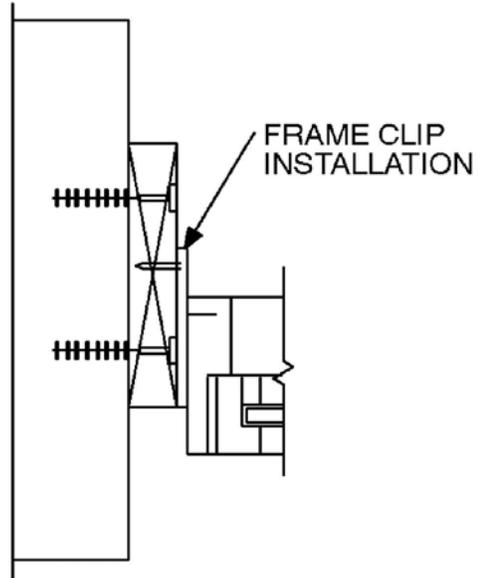


**FIGURE 612.8(1)
THROUGH THE FRAME**



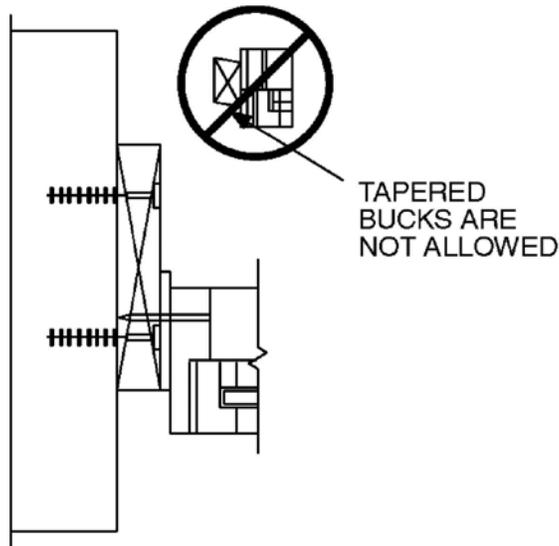
APPLY FRAME CLIP TO WINDOW OR DOOR IN ACCORDANCE WITH PUBLISHED MANUFACTURER'S RECOMMENDATIONS.

**FIGURE 612.8(2)
FRAME CLIP**



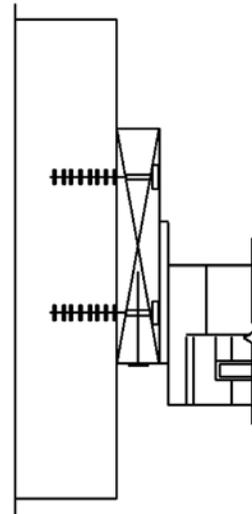
APPLY FRAME CLIP TO WINDOW OR DOOR FRAME IN ACCORDANCE WITH PUBLISHED MANUFACTURER'S RECOMMENDATIONS. ANCHORS SHALL BE PROVIDED TO TRANSFER LOAD FROM THE FRAME CLIP INTO THE ROUGH OPENING SUBSTRATE.

**FIGURE 612.8(4)
FRAME CLIP**



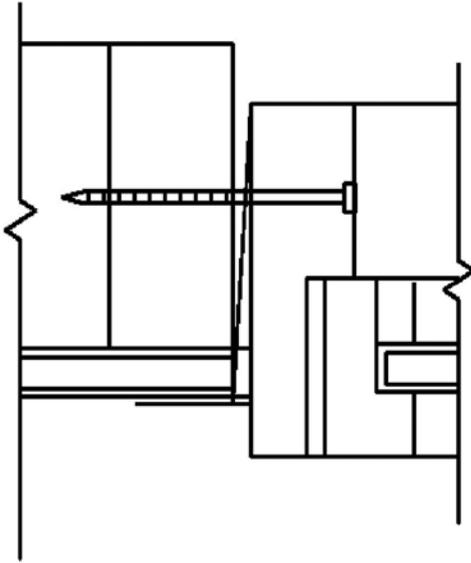
THROUGH THE FRAME ANCHORING METHOD. ANCHORS SHALL BE PROVIDED TO TRANSFER LOAD FROM THE WINDOW OR DOOR FRAME INTO THE ROUGH OPENING SUBSTRATE.

**FIGURE 612.8(3)
THROUGH THE FRAME**

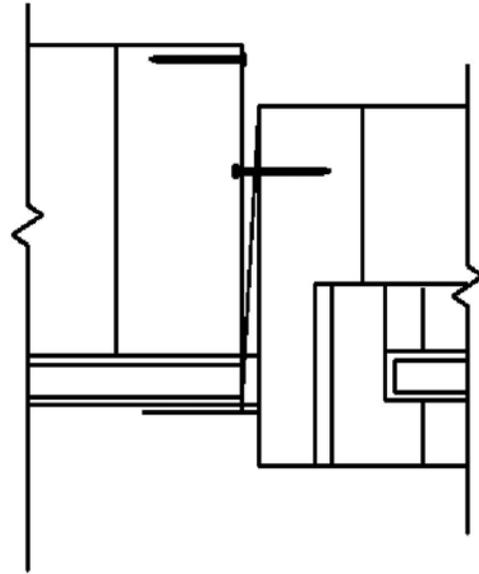


APPLY ANCHORS THROUGH FLANGE IN ACCORDANCE WITH PUBLISHED MANUFACTURER'S RECOMMENDATIONS.

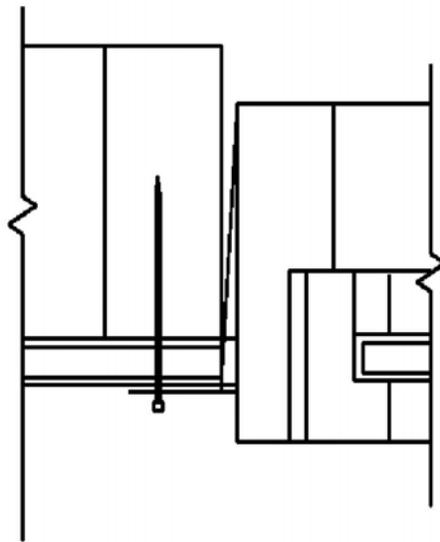
**FIGURE 612.8(5)
THROUGH THE FLANGE**



**FIGURE 612.8(6)
THROUGH THE FLANGE**



**FIGURE 612.8(7)
FRAME CLIP**



**FIGURE 612.8(8)
THROUGH THE FLANGE**

612.9 Wind-borne debris protection. Protection of exterior windows and glass doors in buildings located in wind-borne debris regions shall be in accordance with Section 301.2.1.2.

612.9.1 Fenestration testing and labeling. Fenestration shall be tested by an approved independent laboratory, listed by an approved entity, and bear a label identifying manufacturer, performance characteristics, and approved inspection agency to indicate compliance with the requirements of the following specification:

1. ASTM E 1886 and ASTM E 1996; or
2. AAMA 506.

612.10 Anchorage methods. The methods cited in this section apply only to anchorage of window and glass door assemblies to the main force-resisting system.

612.10.1 Anchoring requirements. Window and glass door assemblies shall be anchored in accordance with the published manufacturer's recommendations to achieve the design pressure specified. Substitute anchoring systems used for substrates not specified by the fenestration manufacturer shall provide equal or greater anchoring performance as demonstrated by accepted engineering practice.

612.10.2 Anchorage details. Products shall be anchored in accordance with the minimum requirements illustrated in Figures 612.8(1), 612.8(2), 612.8(3), 612.8(4), 612.8(5), 612.8(6), 612.8(7) and 612.8(8).

612.10.2.1 Masonry, concrete or other structural substrate. Where the wood shim or buck thickness is less than 1½ inches (38 mm), window and glass door assemblies shall be anchored through the jamb, or by jamb clip and anchors shall be embedded directly into the masonry, concrete or other substantial substrate material. Anchors shall adequately transfer load from the window or door frame into the rough opening substrate [see Figures 612.8(1) and 612.8(2).]

Where the wood shim or buck thickness is 1½ inches (38 mm) or more, the buck is securely fastened to the masonry, concrete or other substantial substrate, and the buck extends beyond the interior face of the window or door frame, window and glass door assemblies shall be anchored through

the jamb, or by jamb clip, or through the flange to the secured wood buck. Anchors shall be embedded into the secured wood buck to adequately transfer load from the window or door frame assembly [Figures 612.8(3), 612.8(4) and 612.8(5)].

612.10.2.2 Wood or other approved framing material. Where the framing material is wood or other approved framing material, window and glass door assemblies shall be anchored through the frame, or by frame clip, or through the flange. Anchors shall be embedded into the frame construction to adequately transfer load [Figures 612.8(6), 612.8(7) and 612.8(8)].

612.11 Mullions. Mullions shall be tested by an approved testing laboratory in accordance with AAMA 450, or be engineered in accordance with accepted engineering practice. Mullions tested as stand-alone units or qualified by engineering shall use performance criteria cited in Sections 612.11.1, 612.11.2 and 612.11.3. Mullions qualified by an actual test of an entire assembly shall comply with Sections 612.11.1 and 612.11.3.

612.11.1 Load transfer. Mullions shall be designed to transfer the design pressure loads applied by the window and door assemblies to the rough opening substrate.

612.11.2 Deflection. Mullions shall be capable of resisting the design pressure loads applied by the window and door assemblies to be supported without deflecting more than $L/175$, where L is the span of the mullion in inches.

612.11.3 Structural safety factor. Mullions shall be capable of resisting a load of 1.5 times the design pressure loads applied by the window and door assemblies to be supported without exceeding the appropriate material stress levels. If tested by an approved laboratory, the 1.5 times the design pressure load shall be sustained for 10 seconds, and the permanent deformation shall not exceed 0.4 percent of the mullion span after the 1.5 times design pressure load is removed.

SECTION 613

STRUCTURAL INSULATED PANEL WALL CONSTRUCTION

613.1 General. Structural insulated panel (SIP) walls shall be designed in accordance with the provisions of this section.

613.2 Applicability limits. The provisions of this section shall control the construction of exterior structural insulated panel walls and interior load-bearing structural insulated panel walls for buildings not greater than 60 feet (18 288 mm) in length perpendicular to the joist or truss span, not greater than 40 feet (12 192 mm) in width parallel to the joist or truss span and not greater than two stories in height with each wall not greater than 10 feet (3048 mm) high. All exterior walls installed in accordance with the provisions of this section shall be considered as load-bearing walls. Structural insulated panel walls constructed in accordance with the provisions of this section shall be limited to sites subjected to a maximum design wind speed of 130 miles per hour (58 m/s), Exposure A, B or C, and a maximum ground snow load of 70 pounds per foot (3.35 kPa), and Seismic Design Categories A, B, and C.

613.3 Materials. SIPs shall comply with the following criteria:

613.3.1 Core. The core material shall be composed of foam plastic insulation meeting one of the following requirements:

1. ASTM C 578 and have a minimum density of 0.90 pounds per cubic feet (14.4 kg/m³); or
2. Polyurethane meeting the physical properties shown in Table 613.3.1, or;
3. An approved alternative *in accordance with section 106.5*.

All cores shall meet the requirements of Section 316.

613.3.2 Facing. Facing materials for SIPs shall be wood structural panels conforming to DOC PS 1 or DOC PS 2, each having a minimum nominal thickness of $\frac{7}{16}$ inch (11 mm) and shall meet the additional minimum properties specified in Table 613.3.2. Facing shall be identified by a grade mark or certificate of inspection issued by an approved agency.

613.3.3 Adhesive. Adhesives used to structurally laminate the foam plastic insulation core material to the structural wood facers shall conform to ASTM D 2559 or approved alternative specifically intended for use as an adhesive used in the lamination of structural insulated panels. Each container of adhesive shall bear a label with the adhesive manufacturer's name, adhesive name and type and the name of the quality assurance agency.

613.3.4 Lumber. The minimum lumber framing material used for SIPs prescribed in this document is NLGA graded No. 2 Spruce-pine-fir. Substitution of other wood species/grades that meet or exceed the mechanical properties and specific gravity of No. 2 Spruce-pine-fir shall be permitted.

**TABLE 613.3.1
MINIMUM PROPERTIES FOR POLYURETHANE INSULATION USED AS SIPs CORE**

PHYSICAL PROPERTY	POLYURETHANE
Density, core nominal. (ASTM D 1622)	2.2 lb/ft ³
Compressive resistance at yield or 10% deformation, whichever occurs first. (ASTM D 1621)	19 psi (perpendicular to rise)
Flexural strength, min. (ASTM C 203)	30 psi
Tensile strength, min. (ASTM D 1623)	35 psi
Shear strength, min. (ASTM C 273)	25 psi
Substrate adhesion, min. (ASTM D 1623)	22 psi
Water vapor permeance of 1.00-in. thickness, max. (ASTM E 96)	2.3 perm
Water absorption by total immersion, max. (ASTM C 272)	4.3% (volume)
Dimensional stability (change in dimensions), max. [ASTM D2126 (7 days at 158°F/100% humidity and 7 days at -20°F)]	2%

For SI: 1 pound per cubic foot = 16.02 kg/m³, 1 pound per square inch = 6.895 kPa, °C = [(°F) - 32]1.8.

**TABLE 613.3.2
MINIMUM PROPERTIES^a FOR WOOD STRUCTURAL PANEL
FACING MATERIAL USED IN SIP WALLS**

THICKNESS (inch)	PRODUCT	FLATWISE STIFFNESS ^b (lb ^f -in ² /ft)		FLATWISE STRENGTH ^c (lb ^f -in/ft)		TENSION ^c (lb ^f /ft)		DENSITY ^{b,d} (pcf)
		Along	Across	Along	Across	Along	Across	
⁷ / ₁₆	Sheathing	54,700	27,100	950	870	6,800	6,500	35

For SI: 1 inch = 25.4 mm, 1 lb^f-in²/ft = 9.415 x 10⁻⁶ kPa/m, 1 lb^f-in/ft = 3.707 x 10⁻⁴ kN/m, 1 lb^f/ft = 0.0146 N/mm, 1 pound per cubic foot = 16.018 kg/m³.

- Values listed in Table 613.3.2 are qualification test values and are not to be used for design purposes.
- Mean test value shall be in accordance with Section 7.6 of DOC PS 2.
- Characteristic test value (5th percent with 75% confidence).
- Density shall be based on oven-dry weight and oven-dry volume.

613.3.5 SIP screws. Screws used for the erection of SIPs as specified in Section 613.5 shall be fabricated from steel, shall be provided by the SIPs manufacturer and shall be sized to penetrate the wood member to which the assembly is being attached by a minimum of 1 inch (25 mm). The screws shall be corrosion resistant and have a minimum shank diameter of 0.188 inch (4.7 mm) and a minimum head diameter of 0.620 inch (15.5 mm).

613.3.6 Nails. Nails specified in Section 613 shall be common or galvanized box unless otherwise stated.

613.4 SIP wall panels. SIPs shall comply with Figure 613.4 and shall have minimum panel thickness in accordance with Tables 613.5(1) and 613.5(2) for above-grade walls. All SIPs shall be identified by grade mark or certificate of inspection issued by an approved agency.

613.4.1 Labeling. All panels shall be identified by grade mark or certificate of inspection issued by an approved agency. Each (SIP) shall bear a stamp or label with the following minimum information:

1. Manufacturer name/logo.
2. Identification of the assembly.
3. Quality assurance agency.

613.5 Wall construction. Exterior walls of SIP construction shall be designed and constructed in accordance with the provisions of this section and Tables 613.5(1) and 613.5(2) and Figures 613.5(1) through 613.5(5). SIP walls shall be fastened to other wood building components in accordance with Tables 602.3(1) through 602.3(4).

Framing shall be attached in accordance with ~~Section~~ Table 602.3(1) unless otherwise provided for in Section 613.

613.5.1 Top plate connection. SIP walls shall be capped with a double top plate installed to provide overlapping at corner, intersections and splines in accordance with Figure 613.5.1. The double top plates shall be made up of a single 2 by top plate having a width equal to the width of the panel core, and shall be recessed into the SIP below. Over this top plate a cap plate shall be placed. The cap plate width shall match the SIP thickness and overlap the facers on both sides of the panel. End joints in top plates shall be offset at least 24 inches (610 mm).

613.5.2 Bottom (sole) plate connection. SIP walls shall have full bearing on a sole plate having a width equal to the nominal width of the foam core. When SIP walls are supported directly on continuous foundations, the wall wood sill plate shall be anchored to the foundation in accordance with Figure 613.5.2 and Section 403.1.

613.5.3 Wall bracing. SIP walls shall be braced in accordance with Section 602.10. SIP walls shall be considered continuous wood structural panel

sheathing for purposes of computing required bracing. SIP walls shall meet the requirements of Section 602.10.4 except that SIPs corners shall be fabricated as shown in Figure 613.9. When SIP walls are used for wall bracing, the SIP bottom plate shall be attached to wood framing below in accordance with Table 602.3(1).

613.6 Interior load-bearing walls. Interior load-bearing walls shall be constructed as specified for exterior walls.

613.7 Drilling and notching. The maximum vertical chase penetration in SIPs shall have a maximum side dimension of 2 inches (51 mm) centered in the panel core. Vertical chases shall have a minimum spacing of 24-inches (610 mm) on center. Maximum of two horizontal chases shall be permitted in each wall panel, one at 14 inches (360 mm) from the bottom of the panel and one at mid-height of the wall panel. The maximum allowable penetration size in a wall panel shall be circular or rectangular with a maximum dimension of 12 inches (305 mm). Overcutting of holes in facing panels shall not be permitted.

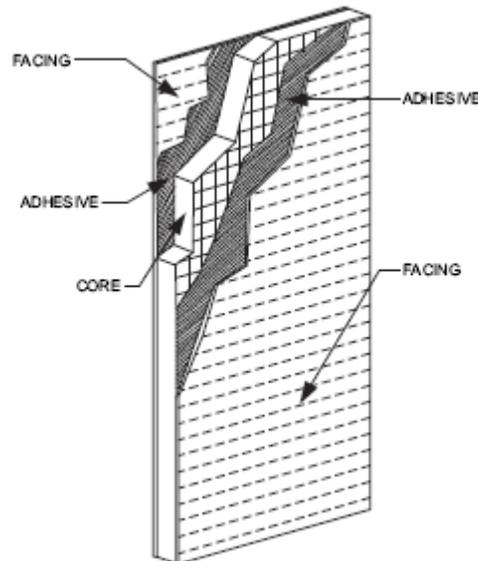


FIGURE 613.4
SIP WALL PANEL

TABLE 613.5(1)
MINIMUM THICKNESS FOR SIP WALL SUPPORTING SIP LIGHT-FRAME ROOF ONLY (inches)

WIND SPEED (3-second gust)		SNOW LOAD (psf)	BUILDING WIDTH (feet)															
			24			28			32			36			40			
Exp. A/B	Exp. C		Wall Height (ft)			Wall Height (ft)			Wall Height (ft)			Wall Height (ft)			Wall Height (ft)			
		8	9	10	8	9	10	8	9	10	8	9	10	8	9	10		
85	—	20	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
		30	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
		50	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
		70	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
100	85	20	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
		30	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
		50	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
		70	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
110	100	20	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
		30	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
		50	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
		70	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
120	110	20	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
		30	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
		50	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
		70	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	6.5	4.5	4.5	6.5	
130	120	20	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
		30	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
		50	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	6.5	4.5	4.5	6.5	4.5	4.5	6.5	
		70	4.5	4.5	4.5	4.5	4.5	6.5	4.5	4.5	6.5	4.5	6.5	N/A	4.5	6.5	N/A	
—	130	20	4.5	4.5	6.5	4.5	4.5	N/A	4.5	4.5	N/A	4.5	4.5	N/A	4.5	6.5	N/A	
		30	4.5	4.5	N/A	4.5	4.5	N/A	4.5	4.5	N/A	4.5	6.5	N/A	4.5	6.5	N/A	
		50	4.5	6.5	N/A	4.5	6.5	N/A	4.5	N/A	N/A	6.5	N/A	N/A	6.5	N/A	N/A	
		70	4.5	N/A	N/A	6.5	N/A	N/A	6.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

For SI: 1 inch = 25.4 mm; 1 foot = 304.8 mm; 1 pound per square foot = 0.0479kPa.

Maximum deflection criterion: $L/240$.

Maximum roof dead load: 10 psf.

Maximum roof live load: 70 psf.

Maximum ceiling dead load: 5 psf.

Maximum ceiling live load: 20 psf.

Wind loads based on Table 301.2 (2).

N/A indicates not applicable.

TABLE 613.5(2)

MINIMUM THICKNESS FOR SIP WALLS SUPPORTING SIP OR LIGHT-FRAME ONE STORY AND ROOF (inches)

WIND SPEED (3-second gust)		SNOW LOAD (psf)	BUILDING WIDTH (feet)															
			24			28			32			36			40			
Exp. A/B	Exp. C		Wall Height (feet)			Wall Height (feet)			Wall Height (feet)			Wall Height (feet)			Wall Height (feet)			
		8	9	10	8	9	10	8	9	10	8	9	10	8	9	10		
85	—	20	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
		30	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
		50	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
		70	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	6.5	6.5	6.5	6.5	6.5
100	85	20	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
		30	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	6.5	4.5	6.5	6.5	6.5
		50	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	6.5	6.5	6.5	6.5	6.5	N/A	N/A	N/A
		70	4.5	4.5	4.5	4.5	4.5	6.5	6.5	6.5	N/A	6.5	N/A	N/A	N/A	N/A	N/A	N/A
110	100	20	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	6.5
		30	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	6.5	4.5	6.5	6.5	6.5	6.5
		50	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	6.5	4.5	6.5	6.5	6.5	6.5	6.5	N/A
		70	4.5	4.5	4.5	4.5	4.5	6.5	6.5	6.5	N/A	6.5	N/A	N/A	N/A	N/A	N/A	N/A
120	110	20	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	6.5	4.5	4.5	6.5	4.5	6.5	N/A	
		30	4.5	4.5	4.5	4.5	4.5	6.5	4.5	4.5	6.5	4.5	6.5	N/A	6.5	6.5	N/A	
		50	4.5	4.5	6.5	4.5	4.5	6.5	4.5	6.5	N/A	6.5	N/A	N/A	N/A	N/A	N/A	
		70	4.5	4.5	6.5	4.5	6.5	N/A	6.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
130	120	20	4.5	4.5	6.5	4.5	4.5	6.5	4.5	6.5	N/A	4.5	6.5	N/A	6.5	N/A	N/A	
		30	4.5	4.5	6.5	4.5	4.5	N/A	4.5	6.5	N/A	6.5	N/A	N/A	6.5	N/A	N/A	
		50	4.5	6.5	N/A	4.5	6.5	N/A	6.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
		70	4.5	6.5	N/A	6.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
—	130	20	6.5	N/A	N/A	6.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
		30	6.5	N/A	N/A	N/A	N/A	N/A										
		50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
		70	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

For SI: 1 inch = 25.4 mm; 1 foot = 304.8 mm; 1 pound per square foot = 0.0479kPa.

Maximum deflection criterion: $L/240$.

Maximum roof dead load: 10 psf.

Maximum roof live load: 70 psf.

Maximum ceiling dead load: 5 psf.

Maximum ceiling live load: 20 psf.

Maximum second floor live load: 30 psf.

Maximum second floor dead load: 10 psf.

Maximum second floor dead load from walls: 10 psf.

Maximum first floor live load: 40 psf.

Maximum first floor dead load: 10 psf.

Wind loads based on Table 301.2 (2).

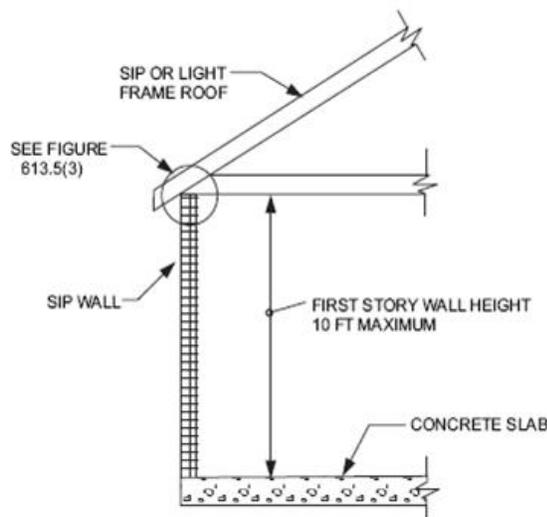
N/A indicates not applicable.

613.8 Connection. SIPs shall be connected at vertical in-plane joints in accordance with Figure 613.8 or by other approved methods.

613.9 Corner framing. Corner framing of SIP walls shall be constructed in accordance with Figure 613.9.

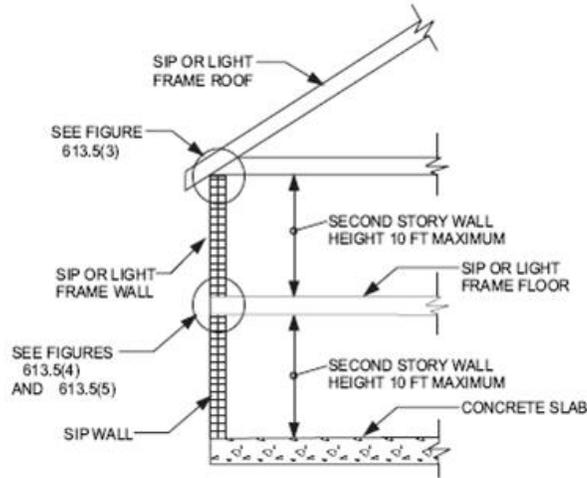
613.10 Headers. SIP headers shall be designed and constructed in accordance with Table 613.10 and Figure 613.5.1. SIPs headers shall be continuous sections without splines. Headers shall be at least $11 \frac{7}{8}$ inches (302mm) deep. Headers longer than 4 feet (1219mm) shall be constructed in accordance with Section 602.7.

613.10.1 Wood structural panel box headers. Wood structural panel box headers shall be allowed where SIP headers are not applicable. Wood structural panel box headers shall be constructed in accordance with Figure 602.7.2 and Table 602.7.2.



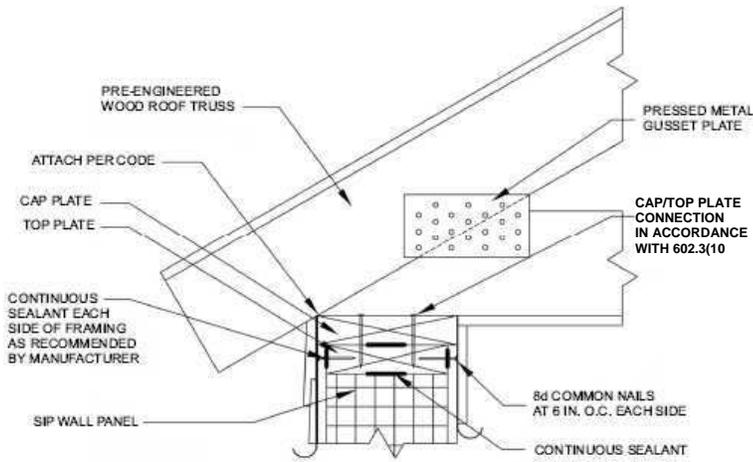
For SI: 1 foot = 304.8 mm.

FIGURE 613.5(1)
MAXIMUM ALLOWABLE HEIGHT OF SIP WALLS



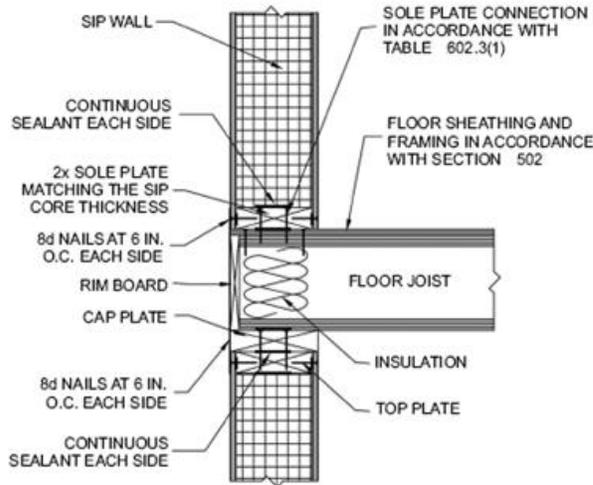
For SI: 1 foot = 304.8 mm.

FIGURE 613.5(2)
MAXIMUM ALLOWABLE HEIGHT OF SIP WALLS



For SI: 1 inch = 25.4 mm.

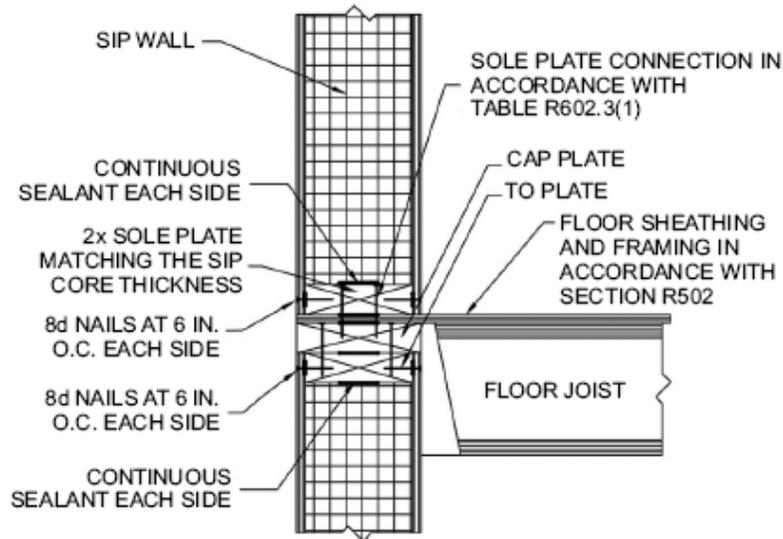
FIGURE 613.5(3)
TRUSSED ROOF TO TOP PLATE CONNECTION



For SI: 1 inch = 25.4 mm.

Note: Figures illustrate SIP-specific attachment requirements. Other connections shall be made in accordance with Table 602.3(1) and (2) as appropriate.

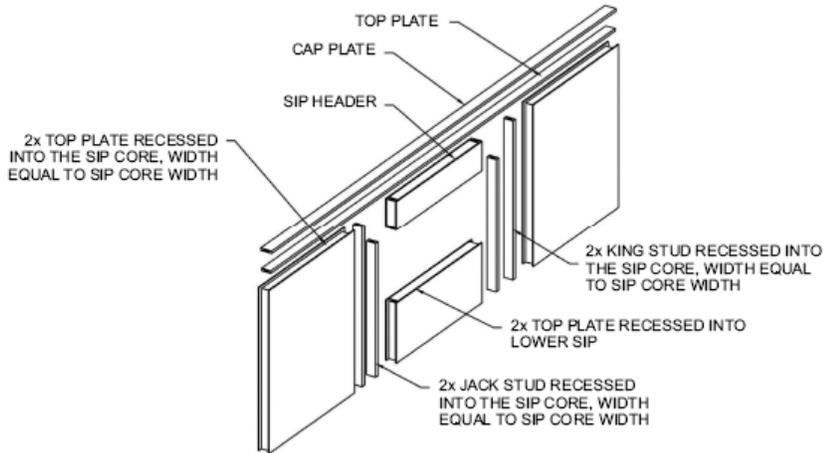
FIGURE 613.5(4)
SIP WALL TO WALL PLATFORM FRAME CONNECTION



For SI: 1 inch = 25.4 mm.

Note: Figures illustrate SIP-specific attachment requirements. Other connections shall be made in accordance with Tables 602.3(1) and (2), as appropriate.

FIGURE 613.5(5)
SIP WALL TO WALL BALLOON FRAME CONNECTION
(I-Joist floor shown for illustration only)



For SI: 1 inch = 25.4 mm.

Notes:

1. Top plates shall be continuous over header.
2. Lower 2x top plate shall have a width equal to the SIP core width and shall be recessed into the top edge of the panel. Cap plate shall be placed over the recessed top plate and shall have a width equal to the SIPs width.
3. SIP facing surfaces shall be nailed to framing and cripples with 8d common or galvanized box nails spaced 6 inches on center.
4. Galvanized nails shall be hot-dipped or tumbled. Framing shall be attached in accordance to Section 602.3(1) unless otherwise provide for in Section 613.

FIGURE R613.5.1
SIP WALL FRAMING CONFIGURATION

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

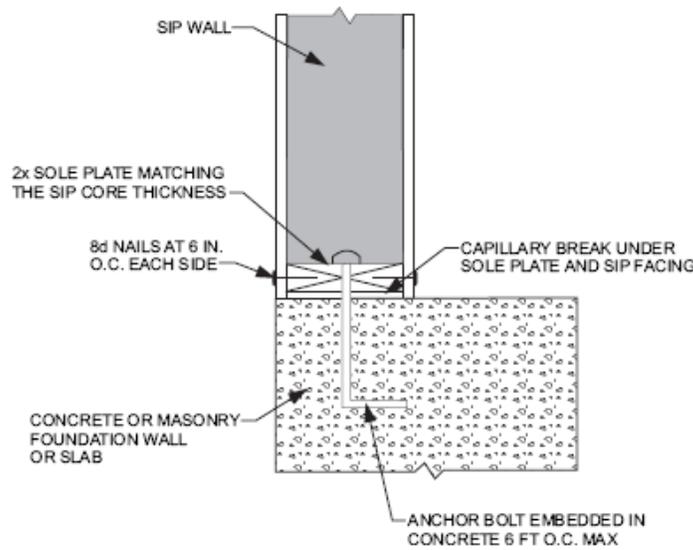
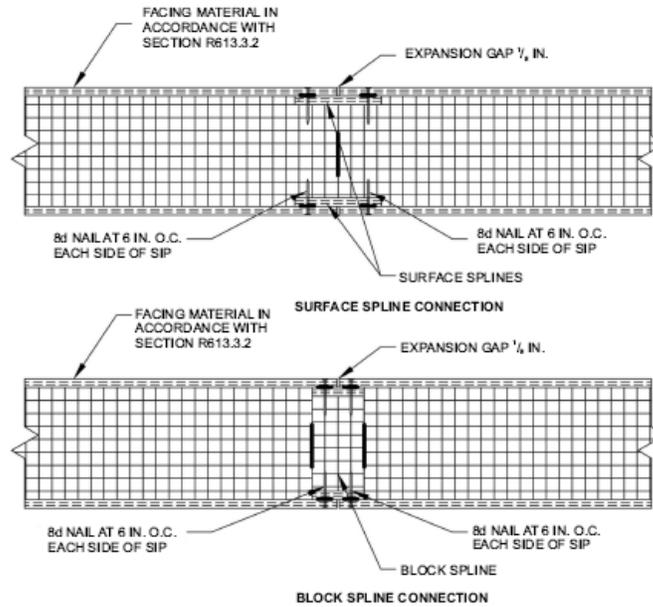


FIGURE 613.5.2
SIP WALL TO CONCRETE SLAB FOR FOUNDATION WALL ATTACHMENT



For SI: 1 inch = 25.4 mm.

FIGURE 613.8
TYPICAL SIP CONNECTION DETAILS FOR VERTICAL IN-PLANE JOINTS

For SI: 1 inch = 25.4 mm.

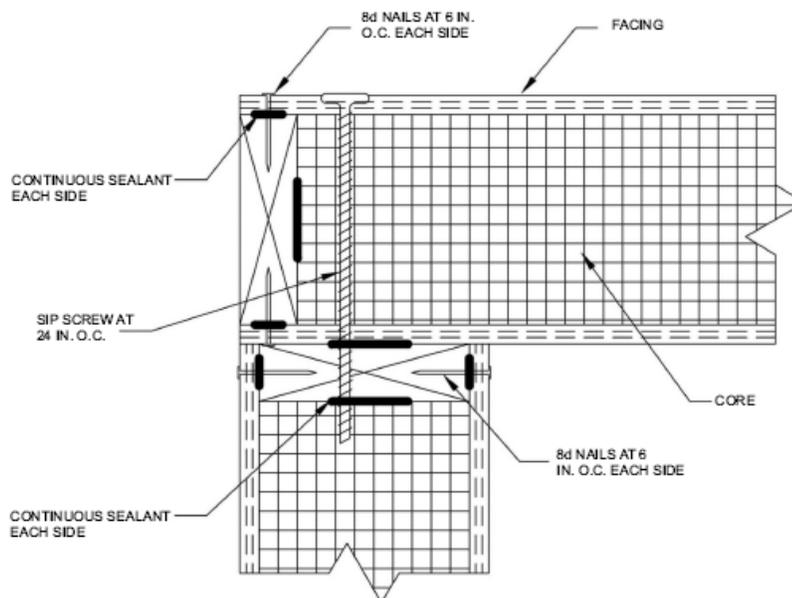


FIGURE 613.9
SIP CORNER FRAMING DETAIL

TABLE 613.10
MAXIMUM SPANS FOR 11⁷/₈ INCH DEEP SIP HEADERS (feet)

LOAD CONDITION	SNOW LOAD (psf)	BUILDING WIDTH (feet)				
		24	28	32	36	40
Supporting roof only	20	4	4	4	4	2
	30	4	4	4	2	2
	50	2	2	2	2	2
	70	2	2	2	N/A	N/A
Supporting roof and one-story	20	2	2	N/A	N/A	N/A
	30	2	2	N/A	N/A	N/A
	50	2	N/A	N/A	N/A	N/A
	70	N/A	N/A	N/A	N/A	N/A

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

Maximum deflection criterion: $L/360$.

Maximum roof dead load: 10 psf.

Maximum ceiling load: 5 psf.

Maximum second floor live load: 30 psf.

Maximum second floor dead load: 10 psf.

Maximum second floor dead load from walls: 10 psf.

N/A indicates not applicable.

Effective: 07/01/2014

R.C. 119.032 review dates: 01/01/2018

CERTIFIED ELECTRONICALLY

Certification

04/14/2014

Date

Promulgated Under: 119.03
Statutory Authority: 3781.10(A)
Rule Amplifies: 3781.01, 3781.06, 3781.10, 3781.11, 3791.04, 4740.14
Prior Effective Dates: 5/27/06, 1/1/13

4101:8-11-01 Energy efficiency.

[Comment: When a reference is made within this rule to a federal statutory provision, an industry consensus standard, or any other technical publication, the specific date and title of the publication as well as the name and address of the promulgating agency are listed in rule 4101:8-44-01 of the Administrative Code. The application of the referenced standards shall be limited and as prescribed in section 102.5 of rule 4101:8-1-01 of the Administrative Code.]

**SECTION 1101
GENERAL**

1101.1 Scope. This chapter regulates the energy efficiency for the design and construction of buildings regulated by this code. *Buildings in R-3 occupancies shall comply with Chapter 13 of the Ohio Building Code for energy efficiency.*

Exception: Portions of the building envelope that do not enclose conditioned space are exempt from thermal envelope provisions of this chapter.

1101.2 Compliance. Compliance shall be demonstrated by meeting the requirements of *one of the following options:*

1. The “International Energy Conservation Code”; *or*
2. *Sections 1101 through 1104* of this chapter; *or*
3. *Section 1105 – “The Ohio Home Builder’s Association (OHBA) Alternative Energy Code Option”.*

Climate zones from Figure 1101.2 or Table 1101.2 shall be used in determining the applicable requirements from this chapter.

1101.2.1 Warm humid counties. *Deleted.*

1101.2.2 Modification to International Energy Conservation Code. *The following changes shall be made to the International Energy Conservation Code:*

- 1. Table 402.4.2- Delete the last row.**
- 2. Table 402.4.2- First row, second column, delete “Air-permeable insulation is inside of an air barrier.”**
- 3. Section 402.4.3 shall read “Fireplaces. New wood- burning fireplaces shall have doors or tight-fitting flue dampers and outdoor combustion air. If using tight-fitting doors on factory-built fireplaces listed and labeled in**

accordance with UL 127, the doors shall be tested and listed for the fireplace.”

4. Section 403.9 – Delete section and all subsections.

1101.3 Identification. Materials, systems and equipment shall be identified in a manner that will allow a determination of compliance with the applicable provisions of this chapter.

1101.4 Building thermal envelope insulation. An R-value identification mark shall be applied by the manufacturer to each piece of building thermal envelope insulation 12 inches (305 mm) or more wide. Alternately, the insulation installers shall provide a certification listing the type, manufacturer and R-value of insulation installed in each element of the building thermal envelope. For blown or sprayed insulation (fiberglass and cellulose), the initial installed thickness, settled thickness, settled R-value, installed density, coverage area and number of bags installed shall be listed on the certification. For sprayed polyurethane foam (SPF) insulation, the installed thickness of the area covered and R-value of installed thickness shall be listed on the certificate. The insulation installer shall sign, date and post the certificate in a conspicuous location on the job site.

1101.4.1 Blown or sprayed roof/ceiling insulation. The thickness of blown in or sprayed roof/ceiling insulation (fiberglass or cellulose) shall be written in inches (mm) on markers that are installed at least one for every 300 ft² (28 m²) throughout the attic space. The markers shall be affixed to the trusses or joists and marked with the minimum initial installed thickness with numbers a minimum of 1 inch (25 mm) high. Each marker shall face the attic access opening. Spray polyurethane foam thickness and installed R-value shall be listed on the certificate provided by the insulation installer.

1101.4.2 Insulation mark installation. Insulating materials shall be installed such that the manufacturer’s R-value mark is readily observable upon inspection.

1101.5 Fenestration product rating. U-factors of fenestration products (windows, doors and skylights) shall be determined in accordance with NFRC 100 by an accredited, independent laboratory, and labeled and certified by the manufacturer. Products lacking such a labeled U-factor shall be assigned a default U-factor from Tables 1101.5(1) and 1101.5(2). The solar heat gain coefficient (SHGC) of glazed fenestration products (windows, glazed doors and skylights) shall be determined in accordance with NFRC 200 by an accredited, independent laboratory, and labeled and certified by the manufacturer. Products lacking such a labeled SHGC shall be assigned a default SHGC from Table 1101.5(3).

1101.6 Insulation product rating. The thermal resistance (R-value) of insulation shall be determined in accordance with the CFR Title 16, Part 460, in units of $h \cdot ft^2 \cdot ^\circ F/Btu$ at a mean temperature of 75°F (24°C).

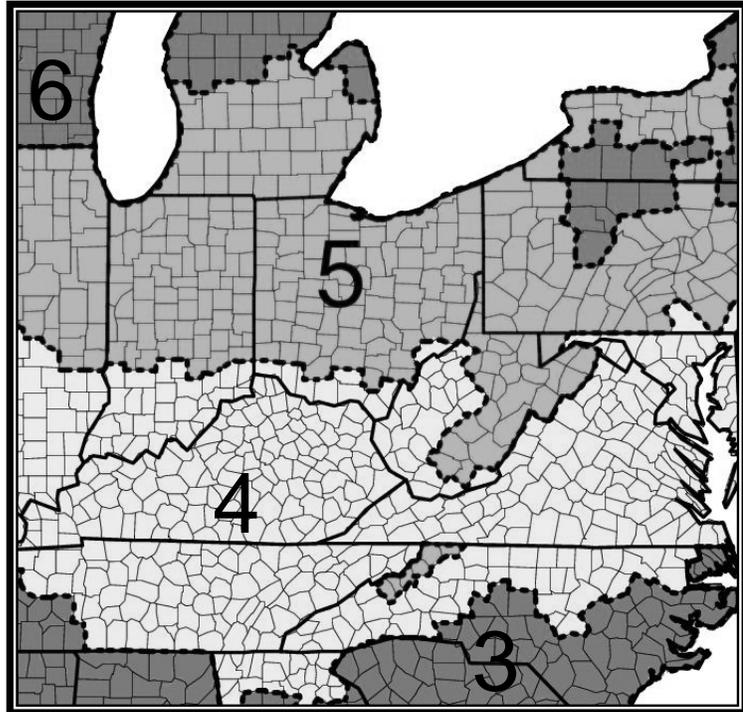
1101.7 Installation. All materials, systems and equipment shall be installed in accordance with the manufacturer's installation instructions and the provisions of this code.

1101.7.1 Protection of exposed foundation insulation. Insulation applied to the exterior of basement walls, crawl space walls, and the perimeter of slab-on-grade floors shall have a rigid, opaque and weather-resistant protective covering to prevent the degradation of the insulation's thermal performance. The protective covering shall cover the exposed exterior insulation and extend a minimum of 6 inches (152 mm) below grade.

1101.8 Above code programs. *Deleted.*

1101.9 Certificate. A permanent certificate shall be posted on or in the electrical distribution panel. The certificate shall not cover or obstruct the visibility of the circuit directory label, service disconnect label or other required labels. The certificate shall be completed by the builder or registered design professional. The certificate shall list the predominant R-values of insulation installed in or on ceiling/roof, walls, foundation (slab, basement wall, crawlspace wall and/or floor) and ducts outside conditioned spaces; U-factors for fenestration; and the solar heat gain coefficient (SHGC) of fenestration. Where there is more than one value for each component, the certificate shall list the value covering the largest area. The certificate shall list the types and efficiencies of heating, cooling and service water heating equipment. Where a gas-fired unvented room heater, electric furnace and/or baseboard electric heater is installed in the residence, the certificate shall list "gas-fired unvented room heater," "electric furnace" or "baseboard electric heater," as appropriate. An efficiency shall not be listed for gas-fired unvented room heaters, electric furnaces or electric base board heaters.

**FIGURE 1101.2
CLIMATE ZONES**



**TABLE 1101.2
CLIMATE ZONES BY STATE AND COUNTIES**

OHIO
Zone 5 except
Zone 4
Adams
Brown
Clermont
Gallia
Hamilton
Lawrence
Pike
Scioto
Washington

**TABLE 1101.5(1)
DEFAULT GLAZED FENESTRATION U-FACTORS**

FRAME TYPE	SINGLE PANE	DOUBLE PANE	SKYLIGHT	
			Single	Double
Metal	1.2	0.8	2	1.3
Metal with thermal break	1.1	0.65	1.9	1.1
Nonmetal or metal clad	0.95	0.55	1.75	1.05
Glazed block	0.6			

**TABLE 1101.5(2)
DEFAULT DOOR U-FACTORS**

DOOR TYPE	U-FACTOR
Uninsulated metal	1.2
Insulated metal	0.6
Wood	0.5
Insulated, nonmetal edge, max 45% glazing, any glazing double pane	0.35

**TABLE 1101.5(3)
DEFAULT GLAZED FENESTRATION SHGC**

SINGLE GLAZED		DOUBLE GLAZED		GLAZED BLOCK
Clear	Tinted	Clear	Tinted	
0.8	0.7	0.7	0.6	0.6

SECTION 1102 BUILDING THERMAL ENVELOPE

1102.1 Insulation and fenestration criteria. The building thermal envelope shall meet the requirements of Table 1102.1 based on the climate zone specified in Table N1101.2.

1102.1.1 R-value computation. Insulation material used in layers, such as framing cavity insulation and insulating sheathing, shall be summed to compute the component R-value. The manufacturer's settled R-value shall be used for blown insulation. Computed R-values shall not include an R-value for other building materials or air films.

1102.1.2 U-factor alternative. An assembly with a U-factor equal to or less than that specified in Table 1102.1.2 shall be permitted as an alternative to the R-value in Table 1102.1.

1102.1.3 Total UA alternative. If the total building thermal envelope UA (sum of U-factor times assembly area) is less than or equal to the total UA

resulting from using the U-factors in Table 1102.1.2, (multiplied by the same assembly area as in the proposed building), the building shall be considered in compliance with Table 1102.1. The UA calculation shall be done using a method consistent with the ASHRAE Handbook of Fundamentals and shall include the thermal bridging effects of framing materials. The SHGC requirements shall be met in addition to UA compliance.

**TABLE 1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT^a**

CLIMATE ZONE	FENESTRATION U-FACTOR ^b	SKYLIGHT ^b U-FACTOR	GLAZED FENESTRATION SHGC ^b	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE ⁱ	FLOOR R-VALUE	BASEMENT ^c WALL R-VALUE	SLAB ^d R-VALUE AND DEPTH	CRAWL SPACE ^c WALL R-VALUE
4	0.35	0.60	NR	38	13	5/10	19	10/13	10, 2 ft	10/13
5	0.35	0.60	NR	38	20 or 13 + 5 ^h	13/17	30 ^e	10/13	10, 2 ft	10/13

- a. R-values are minimums. U-factors and solar heat gain coefficient (SHGC) are maximums. R-19 batts compressed in to nominal 2 x 6 framing cavity such that the R-value is reduced by R-1 or more shall be marked with the compressed batt R-value in addition to the full thickness R-value.
- b. The fenestration U-factor column excludes skylights. The SHGC column applies to all glazed fenestration.
- c. "10/13" means R-10 continuous insulated sheathing on the interior or exterior of the home or R-13 cavity insulation at the interior of the basement wall.
- d. R-5 shall be added to the required slab edge R-values for heated slabs.
- e. *Deleted.*
- f. *Deleted.*
- g. Or insulation sufficient to fill the framing cavity, R-19 minimum.
- h. "13+5" means R-13 cavity insulation plus R-5 insulated sheathing. If structural sheathing covers 25% or less of the exterior, insulating sheathing is not required where structural sheathing is used. If structural sheathing covers more than 25% of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2.
- i. The second R-value applies when more than half the insulation is on the interior of the mass wall.
- j. *Deleted.*

1102.2 Specific insulation requirements.

1102.2.1 Ceilings with attic spaces. When Section 1102.1 would require R-38 in the ceiling, R-30 shall be deemed to satisfy the requirement for R-38 wherever the full height of uncompressed R-30 insulation extends over the wall top plate at the eaves. Similarly R-38 shall be deemed to satisfy the requirement for R-49 wherever the full height of uncompressed R-38 insulation extends over the wall top plate at the eaves. This reduction shall not apply to the U-factor alternative approach in Section 1102.1.2 and the Total UA alternative in Section 1102.1.3.

1102.2.2 Ceilings without attic spaces. Where Section 1102.1 would require insulation levels above R-30 and the design of the roof/ceiling assembly does not allow sufficient space for the required insulation, the minimum required

insulation for such roof/ceiling assemblies shall be R-30. This reduction of insulation from the requirements of Section 1102.1 shall be limited to 500 square feet (46 m²) or twenty per cent of the total insulated ceiling area, whichever is less. This reduction shall not apply to the U-factor alternative approach in Section 1102.1.2 and the Total UA alternative in Section 1102.1.3.

1102.2.3 Access hatches and doors. Access doors from conditioned spaces to unconditioned spaces (e.g., attics and crawl spaces) shall be weatherstripped and insulated to a level equivalent to the insulation on the surrounding surfaces. Access shall be provided to all equipment which prevents damaging or compressing the insulation. A wood framed or equivalent baffle or retainer is required to be provided when loose fill insulation is installed, the purpose of which is to prevent the loose fill insulation from spilling into the living space when the attic access is opened and to provide a permanent means of maintaining the installed R-value of the loose fill insulation.

1102.2.4 Mass walls. Mass walls, for the purposes of this chapter, shall be considered above-grade walls of concrete block, concrete, insulated concrete form (ICF), masonry cavity, brick (other than brick veneer), earth (adobe, compressed earth block, rammed earth) and solid timber/logs.

1102.2.5 Steel-frame ceilings, walls and floors. Steel-frame ceilings, walls and floors shall meet the insulation requirements of Table 1102.2.5 or shall meet the U-factor requirements in Table 1102.1.2. The calculation of the U-factor for a steel-frame envelope assembly shall use a series-parallel path calculation method.

Exception: *Deleted.*

1102.2.6 Floors. Floor insulation shall be installed to maintain permanent contact with the underside of the subfloor decking.

1102.2.7 Basement walls. Exterior walls associated with conditioned basements shall be insulated from the top of the basement wall down to 10 feet (3048 mm) below grade or to the basement floor, whichever is less. Walls associated with unconditioned basements shall meet this requirement unless the floor overhead is insulated in accordance with Sections 1102.1 and 1102.2.6.

1102.2.8 Slab-on-grade floors. Slab-on-grade floors with a floor surface less than 12 inches below grade shall be insulated in accordance with Table 1102.1. The insulation shall extend downward from the top of the slab on the outside or inside of the foundation wall. Insulation located below grade shall

be extended the distance provided in Table 1102.1 by any combination of vertical insulation, insulation extending under the slab or insulation extending out from the building. Insulation extending away from the building shall be protected by pavement or by a minimum of 10 inches (254 mm) of soil. The top edge of the insulation installed between the exterior wall and the edge of the interior slab shall be permitted to be cut at a 45-degree (0.79 rad) angle away from the exterior wall. Slab-edge insulation is not required in jurisdictions designated by the *building* official as having a very heavy termite infestation.

**TABLE 1102.1.2
EQUIVALENT U-FACTORS^a**

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT U-FACTOR	CEILING U-FACTOR	FRAME WALL U-FACTOR	MASS WALL U-FACTOR ^b	FLOOR U-FACTOR	BASEMENT WALL U-FACTOR	CRAWL SPACE WALL U-FACTOR
4	0.35	0.60	0.030	0.082	0.141	0.047	0.059	0.065
5	0.35	0.60	0.030	0.057	0.082	0.033	0.059	0.065

- a. Nonfenestration U-factors shall be obtained from measurement, calculation or approved *referenced publications approved in accordance with this code*.
- b. When more than half the insulation is on the interior, the mass wall U-factors shall be a maximum of 0.10 in zone 4 and the same as the frame wall U-factor in zone 5.
- c. Deleted.

**TABLE 1102.2.5
STEEL-FRAME CEILING, WALL AND FLOOR INSULATION (R-VALUE)**

WOOD FRAME R-VALUE REQUIREMENT	COLD-FORMED STEEL EQUIVALENT R-VALUE ^a
Steel Truss Ceilings^a	
R-30	R-38 or R-30 + 3 or R-26 + 5
R-38	R-49 or R-38 + 3
R-49	R-38 + 5
Steel Joist Ceilings^b	
R-30	R-38 in 2 x 4 or 2 x 6 or 2 x 8 R-49 in any framing
R-38	R-49 in 2 x 4 or 2 x 6 or 2 x 8 or 2 x 10
Steel Framed Wall	
R-13	R-13 + 5 or R15 + 4 or R-21 + 3 or R-0 + 10
R-19	R-13 + 9 or R-19 + 8 or R-25 + 7
R-21	R-13 + 10 or R-19 + 9 or R-25 + 8
Steel Joist Floor	
R-13	R-19 in 2 x 6 R-19 + R-6 in 2 x 8 or 2 x 10
R-19	R-19 + R-6 in 2 x 6 R-19 + R-12 in 2 x 8 or 2 x 10

For SI: 1 inch = 25.4 mm.

- a. Cavity insulation R-value is listed first, followed by continuous insulation R-value.
- b. Insulation exceeding the height of the framing shall cover the framing.

1102.2.9 Crawl space walls. As an alternative to insulating floors over crawl spaces, insulation of crawl space walls shall be permitted when the crawl space is not vented to the outside. Crawl space wall insulation shall be permanently fastened to the wall and extend downward from the floor to the finished grade level and then vertically and/or horizontally for at least an additional 24 inches (610 mm). Exposed earth in unvented crawl space foundations shall be covered with a continuous Class I vapor retarder. All joints of the vapor retarder shall overlap by 6 inches (152 mm) and be sealed or taped. The edges of the vapor retarder shall extend at least 6 inches (152 mm) up the stem wall and shall be attached to the stem wall.

1102.2.10 Masonry veneer. Insulation shall not be required on the horizontal portion of the foundation that supports a masonry veneer.

1102.2.11 Thermally isolated sunroom insulation. The minimum ceiling insulation R-values shall be R-19 in zones 1 through 4 and R-24 in zone 5. The minimum wall R-value shall be R-13 in all zones. New wall(s) separating the sunroom from conditioned space shall meet the building thermal envelope requirements.

1102.3 Fenestration.

1102.3.1 U-factor. An area-weighted average of fenestration products shall be permitted to satisfy the U-factor requirements.

1102.3.2 Glazed fenestration SHGC. An area-weighted average of fenestration products more than 50 percent glazed shall be permitted to satisfy the solar heat gain coefficient (SHGC) requirements.

1102.3.3 Glazed fenestration exemption. Up to 15 square feet (1.4 m²) of glazed fenestration per dwelling unit shall be permitted to be exempt from U-factor and SHGC requirements in Section 1102.1. This exemption shall not apply to the U-factor alternative approach in Section 1102.1.2 and the Total UA alternative in Section 1102.1.3.

1102.3.4 Opaque door exemption. One side-hinged opaque door assembly up to 24 square feet (2.22 m²) in area is exempted from the U-factor requirement in Section 1102.1.1. This exemption shall not apply to the U-factor alternative approach in Section 1102.1.2 and the Total UA alternative in Section 1102.1.3.

1102.3.5 Thermally isolated sunroom U-factor. For zones 4 through 8 the maximum fenestration U-factor shall be 0.50 and the maximum skylight U-factor shall be 0.75. New windows and doors separating the sunroom from conditioned space shall meet the building thermal envelope requirements.

1102.3.6 Replacement fenestration. Where some or all of an existing fenestration unit is replaced with a new fenestration product, including sash and glazing, the replacement fenestration unit shall meet the applicable requirements for U-factor and solar heat gain coefficient (SHGC) in Table 1102.1.

1102.4 Air leakage.

1102.4.1 Building thermal envelope. The building thermal envelope shall be durably sealed to limit infiltration. The sealing methods between dissimilar materials shall allow for differential expansion and contraction. The following shall be caulked, gasketed, weatherstripped or otherwise sealed with an air barrier material, suitable film or solid material.

1. All joints, seams and penetrations.
2. Site-built windows, doors and skylights.
3. Openings between window and door assemblies and their respective jambs and framing.
4. Utility penetrations.
5. Dropped ceilings or chases adjacent to the thermal envelope.
6. Knee walls.
7. Walls and ceilings separating the garage from conditioned spaces.
8. Behind tubs and showers on exterior walls.
9. Common walls between dwelling units.
10. Attic access openings.
11. Rim joists junction.
12. Other sources of infiltration.

1102.4.2 Air sealing and insulation. Building envelope air tightness and insulation installation shall be demonstrated to comply with one of the following options given by Section 1102.4.2.1 or 1102.4.2.2.

1102.4.2.1 Testing option. Tested air leakage is less than 7 ACH when tested with a blower door at a pressure of 50 pascals (0.007 psi). Testing shall occur after rough in and after installation of penetrations of the building envelope, including penetrations for utilities, plumbing, electrical, ventilation and combustion appliances.

During testing:

1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed;
2. Dampers shall be closed, but not sealed; including exhaust, intake, makeup air, back draft, and flue dampers;
3. Interior doors shall be open;
4. Exterior openings for continuous ventilation systems and heat recovery ventilators shall be closed and sealed;
5. Heating and cooling system(s) shall be turned off;
6. HVAC ducts shall not be sealed; and
7. Supply and return registers shall not be sealed.

1102.4.2.2 Visual inspection option. The items listed in Table 1102.4.2, applicable to the method of construction, are field verified.

1102.4.3 Fireplaces. New wood-burning fireplaces shall have ~~gasketed~~ doors or tight-fitting flue dampers and outdoor combustion air. If using tight-fitting doors on factory-built fireplaces listed and labeled in accordance with UL 127, the doors shall be tested and listed for the fireplace.

1102.4.4 Fenestration air leakage. Windows, skylights and sliding glass doors shall have an air infiltration rate of no more than 0.3 cubic foot per minute per square foot [$1.5(\text{L/s})/\text{m}^2$], and swinging doors no more than 0.5 cubic foot per minute per square foot [$2.5(\text{L/s})/\text{m}^2$], when tested according to NFRC 400 or AAMA/WDMA/CSA 101/I.S.2/ A440 by an *approved agency*, and listed and labeled by the manufacturer.

Exception: Site-built windows, skylights and doors.

1102.4.5 Recessed lighting. Recessed luminaires installed in the building thermal envelope shall be sealed to limit air leakage between conditioned and unconditioned spaces. All recessed luminaires shall be IC-rated and labeled as meeting ASTM E 283 when tested at 1.57 ~~psi~~ psf (75 Pa) pressure differential with no more than 2.0 cfm (0.944 L/s) of air movement from the conditioned space to the ceiling cavity. All recessed luminaires shall be sealed with a gasket or caulk between the housing and the interior wall or ceiling covering.

1102.5 Maximum fenestration U-factor and SHGC. The area-weighted average maximum fenestration U-factor permitted using trade-offs from Section 1102.1.3 shall be 0.48 in Zones 4 and 5 for vertical fenestration, and 0.75 in Zones 4 through 8 for skylights.

SECTION 1103 SYSTEMS

1103.1 Controls. At least one thermostat shall be installed for each separate heating and cooling system.

1103.1.1 Programmable thermostat. Where the primary heating system is a forced air furnace, at least one thermostat per dwelling unit shall be capable of controlling the heating and cooling system on a daily schedule to maintain different temperature set points at different times of the day. This thermostat shall include the capability to set back or temporarily operate the system to maintain zone temperatures down to 55°F (13°C) or up to 85°F (29°C). The thermostat shall initially be programmed with a heating temperature set point no higher than 70°F (21°C) and a cooling temperature set point no lower than 78°F (26°C).

1103.1.2 Heat pump supplementary heat. Heat pumps having supplementary electric-resistance heat shall have controls that, except during defrost, prevent supplemental heat operation when the heat pump compressor can meet the heating load.

1103.2 Ducts.

1103.2.1 Insulation. Supply ducts in attics shall be insulated to a minimum of R-8. All other ducts shall be insulated to a minimum of R-6.

Exception: Ducts or portions thereof located completely inside the building thermal envelope.

1103.2.2 Sealing. Ducts, air handlers, filter boxes and building cavities used as ducts shall be sealed. Joints and seams shall comply with Section M1601.4. Duct tightness shall be verified by either of the following:

1. Post-construction test: Leakage to outdoors shall be less than or equal to 8 cfm (3.78 L/s) per 100 ft² (9.29 m²) of conditioned floor area or a total leakage less than or equal to 12 cfm (5.66 L/s) per 100 ft² (9.29 m²) of conditioned floor area when tested at a pressure differential of 0.1 inch w.g. (25 Pa) across the entire system, including the manufacturer's air handler end closure. All register boots shall be taped or otherwise sealed during the test.
2. Rough-in test: Total leakage shall be less than or equal to 6 cfm (2.83 L/s) per 100 ft² (9.29 m²) of conditioned floor area when tested at a pressure differential of 0.1 inch w.g. (25 Pa) across the roughed in system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test. If the air handler is not installed at the time of the test, total leakage shall be less than or equal to 4 cfm (1.89 L/s) per 100 ft² (9.29 m²) of conditioned floor area.

Exception: Duct tightness test is not required if the air handler and all ducts are located within conditioned space.

1103.2.3 Building cavities. Building framing cavities shall not be used as supply ducts.

1103.3 Mechanical system piping insulation. Mechanical system piping capable of carrying fluids above 105°F (40°C) or below 55°F (13°C) shall be insulated to a minimum of R-3.

1103.4 Circulating hot water systems. All circulating service hot water piping shall be insulated to at least R-2. Circulating hot water systems shall include an automatic or readily accessible manual switch that can turn off the hot water circulating pump when the system is not in use.

1103.5 Mechanical ventilation. Outdoor air intakes and exhausts shall have automatic or gravity dampers that close when the ventilation system is not operating.

**TABLE 1102.4.2
AIR BARRIER AND INSULATION INSPECTION**

COMPONENT	CRITERIA
Air barrier and thermal barrier	Exterior thermal envelope insulation for framed walls is installed in substantial contact and continuous alignment with building envelope air barrier. Breaks or joints in the air barrier are filled or repaired. Air-permeable insulation is not used as a sealing material. Air permeable insulation is inside of an air barrier.
Ceiling/attic	Air barrier in any dropped ceiling/soffit is substantially aligned with insulation and any gaps are sealed. Attic access (except unvented attic), knee wall door, or drop down stair is sealed.
Walls	Corners and headers are insulated. Junction of foundation and sill plate is sealed.
Windows and doors	Space between window/door jambs and framing is sealed.
Rim joists	Rim joists are insulated and include an air barrier.
Floors (including above garage and cantilevered floors)	Insulation is installed to maintain permanent contact with underside of subfloor decking. Air barrier is installed at any exposed edge of floor.
Crawlspace walls	Insulation is permanently attached to walls. Exposed earth in unvented crawlspaces is covered with Class I vapor retarder with overlapping joints taped.
Shafts, penetrations	Duct shafts, utility penetrations, knee walls and flue shafts opening to exterior or unconditioned space are sealed.
Narrow cavities	Batts in narrow cavities are cut to fit, or narrow cavities are filled by sprayed/blown insulation.
Garage separation	Air sealing is provided between the garage and conditioned spaces.
Recessed lighting	Recessed light fixtures are airtight, IC rated and sealed to drywall. Exception—fixtures in conditioned space.
Plumbing and wiring	Insulation is placed between outside and pipes. Batt insulation is cut to fit around wiring and plumbing, or sprayed/blown insulation extends behind piping and wiring.
Shower/tub on exterior wall	Showers and tubs on exterior walls have insulation and an air barrier separating them from the exterior wall.
Electrical/phone box on exterior wall	Air barrier extends behind boxes or air sealed type boxes are installed.
Common wall	Air barrier is installed in common wall between dwelling units.
HVAC register boots	HVAC register boots that penetrate building envelope are sealed to subfloor or drywall.
Fireplace	Fireplace walls include an air barrier.

1103.6 Equipment sizing. Heating and cooling equipment shall be sized as specified in Section M1401.3.

1103.7 Snow melt system controls. Snow-and ice-melting systems supplied through energy service to the building shall include automatic controls capable of shutting off the system when the pavement temperature is above 50°F (10°C) and no precipitation is falling and an automatic or manual control that will allow shutoff when the outdoor temperature is above 40°F (5°C).

1103.8 Pools. ~~Where regulations are adopted and enforced by the local jurisdiction, residential swimming pools shall be provided with energy conserving measures in accordance with Sections 1103.8.1 through 1103.8.3 Deleted.~~

1103.8.1 Pool heaters. ~~All pool heaters shall be equipped with a readily accessible on off switch to allow shutting off the heater without adjusting the thermostat setting. Pool heaters fired by natural gas or LPG shall not have continuously burning pilot lights. Deleted.~~

1103.8.2 Time switches. ~~Time switches that can automatically turn off and on heaters and pumps according to a preset schedule shall be installed on swimming pool heaters and pumps. Deleted.~~

Exceptions:-

- ~~1. Where public health standards require 24 hour pump operation.~~
- ~~2. Where pumps are required to operate solar and waste heat recovery pool heating systems.~~

1103.8.3 Pool covers. ~~Heated pools shall be equipped with a vapor retardant pool cover on or at the water surface. Pools heated to more than 90°F (32°C) shall have a pool cover with a minimum insulation value of R-12. Deleted.~~

**SECTION 1104
LIGHTING SYSTEMS**

1104.1 Lighting equipment. A minimum of 50 percent of the lamps in permanently installed lighting fixtures shall be high-efficacy lamps.

**SECTION 1105
OHIO HOME BUILDERS ASSOCIATION (OHBA) ALTERNATIVE
ENERGY CODE OPTION**

1105.1 General

1105.1.1 Scope. *This section provides an alternative set of requirements for regulating the energy efficiency for the design and construction of new buildings regulated by this code. Buildings in R-3 occupancies shall comply with Chapter 13 of the Ohio Building Code for energy efficiency.*

Exception: *Portions of the building envelope that do not enclose conditioned space are exempt from thermal envelope provisions of this*

section.

1105.1.2 Compliance. *Compliance shall be demonstrated by meeting the requirements of this section, known as the OHBA Alternative Code. The applicant shall choose to comply with either Compliance Path #1 or Compliance Path #2 and shall demonstrate compliance with all applicable requirements of that one chosen path. The chosen path shall be identified on the construction documents. The requirements in this section are in lieu of the requirements found in Sections 1101 through 1104.*

1105.1.3 Identification. *Materials, systems and equipment shall be identified in a manner that will allow a determination of compliance with the applicable provisions of this section.*

1105.1.4 Building thermal envelope insulation. *An R-value identification mark shall be applied by the manufacturer to each piece of building thermal envelope insulation 12 inches (305 mm) or more wide. Alternately, the insulation installers shall provide a certification listing the type, manufacturer and R-value of insulation installed in each element of the building thermal envelope. For blown or sprayed insulation (fiberglass and cellulose), the initial installed thickness, settled thickness, settled R-value, installed density, coverage area and number of bags installed shall be listed on the certification. For sprayed polyurethane foam (SPF) insulation, the installed thickness of the area covered and R-value of installed thickness shall be listed on the certificate. The insulation installer shall sign, date and post the certificate in a conspicuous location on the job site.*

1105.1.4.1 Blown or sprayed roof/ceiling insulation. *The thickness of blown in or sprayed roof/ceiling insulation (fiberglass or cellulose) shall be written in inches (mm) on markers that are installed at least one for every 300 ft² (28 m²) throughout the attic space. The markers shall be affixed to the trusses or joists and marked with the minimum initial installed thickness with numbers a minimum of 1 inch (25 mm) high. Each marker shall face the attic access opening. Spray polyurethane foam thickness and installed R-value shall be listed on the certificate provided by the insulation installer.*

1105.1.4.2 Insulation mark installation. *Insulating materials shall be installed such that the manufacturer's R-value mark is readily observable upon inspection.*

1105.1.5 Fenestration product rating. *U-factors of fenestration products (windows, doors and skylights) shall be determined in accordance with NFRC 100 by an accredited, independent laboratory, and labeled and certified by the manufacturer. Products lacking such a labeled U-factor shall be assigned a default U-factor from Tables 1105.1.5(1) and 1105.1.5(2). The solar heat gain*

coefficient (SHGC) of glazed fenestration products (windows, glazed doors and skylights) shall be determined in accordance with NFRC 200 by an accredited, independent laboratory, and labeled and certified by the manufacturer. Products lacking such a labeled SHGC shall be assigned a default SHGC from Table 1105.1.5(3).

1105.1.6 Insulation product rating. The thermal resistance (R-value) of insulation shall be determined in accordance with the CFR Title 16, Part 460, in units of $h \cdot ft^2 \cdot ^\circ F/Btu$ at a mean temperature of 75°F (24°C).

1105.1.7 Installation. All materials, systems and equipment shall be installed in accordance with the manufacturer's installation instructions and the provisions of this code.

1105.1.7.1 Protection of exposed foundation insulation. Insulation applied to the exterior of basement walls, crawl space walls, and the perimeter of slab-on-grade floors shall have a rigid, opaque and weather-resistant protective covering to prevent the degradation of the insulation's thermal performance. The protective covering shall cover the exposed exterior insulation and extend a minimum of 6 inches (152 mm) below grade.

1105.1.8 Certificate. A permanent certificate shall be posted on or in the electrical distribution panel. The certificate shall not cover or obstruct the visibility of the circuit directory label, service disconnect label or other required labels. The certificate shall be completed by the builder or registered design professional. The certificate shall list the predominant R-values of insulation installed in or on ceiling/roof, walls, foundation (slab, basement wall, crawlspace wall and/or floor) and ducts outside conditioned spaces; U-factors for fenestration; and the solar heat gain coefficient (SHGC) of fenestration. Where there is more than one value for each component, the certificate shall list the value covering the largest area. The certificate shall list the types and efficiencies of heating, cooling and service water heating equipment. Where a gas-fired unvented room heater, electric furnace and/or baseboard electric heater is installed in the residence, the certificate shall list "gas-fired unvented room heater," "electric furnace" or "baseboard electric heater," as appropriate. An efficiency shall not be listed for gas-fired unvented room heaters, electric furnaces or electric base board heaters.

**TABLE 1105.1.5(1)
DEFAULT GLAZED FENESTRATION U-FACTORS**

FRAME TYPE	SINGLE PANE	DOUBLE PANE	SKYLIGHT	
			Single	Double
Metal	1.2	0.8	2	1.3
Metal with thermal break	1.1	0.65	1.9	1.1

<i>Nonmetal or metal clad</i>	0.95	0.55	1.75	1.05
<i>Glazed block</i>	0.6			

**TABLE 1105.1.5(2)
DEFAULT DOOR U-FACTORS**

DOOR TYPE	U-FACTOR
<i>Uninsulated metal</i>	1.2
<i>Insulated metal</i>	0.6
<i>Wood</i>	0.5
<i>Insulated, nonmetal edge, max 45% glazing, any glazing double pane</i>	0.35

**TABLE 1105.1.5(3)
DEFAULT GLAZED FENESTRATION SHGC**

SINGLE GLAZED		DOUBLE GLAZED		GLAZED BLOCK
<i>Clear</i>	<i>Tinted</i>	<i>Clear</i>	<i>Tinted</i>	
0.8	0.7	0.7	0.6	0.6

1105.2 Building thermal envelope.

1105.2.1 Insulation and fenestration criteria. *The building thermal envelope shall meet the requirements of either Compliance Path #1 or Compliance Path #2 of Table 1105.2.1*

1105.2.1.1 R-value computation. *Insulation material used in layers, such as framing cavity insulation and insulating sheathing, shall be summed to compute the component R-value. The manufacturer's settled R-value shall be used for blown insulation. Computed R-values shall not include an R-value for other building materials or air films.*

1105.2.1.2 U-factor alternative. *An assembly with a U-factor equal to or less than that specified in Table 1105.2.1.2 shall be permitted as an alternative to the corresponding compliance path R-value in Table 1105.2.1.*

1105.2.1.3 Total UA alternative. *If the total building thermal envelope UA (sum of U-factor times assembly area) is less than or equal to the total UA resulting from using the U-factors in Table 1105.2.1.2, (multiplied by the same assembly area as in the proposed building), the building shall be considered in compliance with Table 1105.2.1. The UA calculation shall be done using a method consistent with the ASHRAE Handbook of Fundamentals and shall include the thermal bridging effects of framing materials. The SHGC requirements shall be met in addition to UA compliance.*

**TABLE 1105.2.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT^a**

	FENESTRATION U-FACTOR^b	SKYLIGHT^b U-FACTOR	GLAZED FENESTRATION SHGC^{b,e}	CEILING R- VALUE	WOOD FRAME WALL R- VALUE	MASS WALL R- VALUEⁱ	FLOOR R- VALUE	BASEMENT^c WALL R- VALUE	SLAB^d R- VALUE AND DEPTH	CRAWL SPACE^c WALL R- VALUE
<i>Compliance Path #1</i>	0.32	0.60	NR	49	15 or 13 + 3 ^h	13/17	30 ^g	10/13 (minimum 4 feet)	10, 2 ft	10/13
<i>Compliance Path #2</i>	0.32	0.60	NR	49	13	13/17	30 ^g	10/13 (minimum 4 feet)	10, 2 ft	10/13

a. R-values are minimums. U-factors and solar heat gain coefficient (SHGC) are maximums. R-19 batts compressed in to nominal 2 x 6 framing cavity such that the R-value is reduced by R-1 or more shall be marked with the compressed batt R-value in addition to the full thickness R-value.

b. The fenestration U-factor column excludes skylights. The SHGC column applies to all glazed fenestration.

c. "10/13" means R-10 continuous insulated sheathing on the interior or exterior of the home or R-13 cavity insulation at the interior of the basement wall.

d. R-5 shall be added to the required slab edge R-values for heated slabs.

e. Deleted.

f. Deleted.

g. Or insulation sufficient to fill the framing cavity, R-19 minimum.

h. "13+3" means R-13 cavity insulation plus R-3 insulated sheathing. If structural sheathing covers 25% or less of the exterior, insulating sheathing is not required where structural sheathing is used.

i. The second R-value applies when more than half the insulation is on the interior of the mass wall.

j. Deleted.

1105.2.2 Specific insulation requirements.

1105.2.2.1 Ceilings with attic spaces. When Section 1105.2.1 would require R-49 in the ceiling, R-38 shall be deemed to satisfy the requirement for R-49 wherever the full height of uncompressed R-38 insulation extends over the wall top plate at the eaves. This reduction shall not apply to the U-factor alternative approach in Section 1105.2.1.2 and the Total UA alternative in Section 1105.2.1.3.

1105.2.2.2 Ceilings without attic spaces. Where Section 1105.2.1 would require insulation levels above R-30 and the design of the roof/ceiling assembly does not allow sufficient space for the required insulation, the minimum required insulation for such roof/ceiling assemblies shall be R-30. This reduction of insulation from the requirements of Section 1105.2.1 shall be limited to 500 square feet (46 m²) or twenty per cent of the total insulated ceiling area, whichever is less. This reduction shall not apply to the U-factor alternative approach in Section 1105.2.1.2 and the Total UA alternative in Section 1105.2.1.3.

1105.2.2.3 Access hatches and doors. Access doors from conditioned spaces to unconditioned spaces (e.g., attics and crawl spaces) shall be

weatherstripped and insulated to a level equivalent to the insulation on the surrounding surfaces. Access shall be provided to all equipment which prevents damaging or compressing the insulation. A wood framed or equivalent baffle or retainer is required to be provided when loose fill insulation is installed, the purpose of which is to prevent the loose fill insulation from spilling into the living space when the attic access is opened and to provide a permanent means of maintaining the installed R-value of the loose fill insulation.

1105.2.2.4 Mass walls. *Mass walls, for the purposes of this section, shall be considered above-grade walls of concrete block, concrete, insulated concrete form (ICF), masonry cavity, brick (other than brick veneer), earth (adobe, compressed earth block, rammed earth) and solid timber/logs.*

1105.2.2.5 Steel-frame ceilings, walls and floors. *Steel-frame ceilings, walls and floors shall meet the insulation requirements of Table 1105.2.2.5 or shall meet the U-factor requirements in Table 1105.2.1.2. The calculation of the U-factor for a steel-frame envelope assembly shall use a series-parallel path calculation method.*

Exception: Deleted.

1105.2.2.6 Floors. *Floor insulation shall be installed to maintain permanent contact with the underside of the subfloor decking.*

1105.2.2.7 Basement walls. *Exterior walls associated with conditioned basements shall be insulated from the top of the basement wall ~~down to 10 feet (3048 mm) below grade or to the basement floor, whichever is less, unless otherwise as specified in Table 1105.2.1.~~ Walls associated with unconditioned basements shall meet this requirement unless the floor overhead is insulated in accordance with Sections 1105.2.1 and 1105.2.2.6.*

1105.2.2.8 Slab-on-grade floors. *Slab-on-grade floors with a floor surface less than 12 inches below grade shall be insulated in accordance with Table 1105.2.1. The insulation shall extend downward from the top of the slab on the outside or inside of the foundation wall. Insulation located below grade shall be extended the distance provided in Table 1105.2.1 by any combination of vertical insulation, insulation extending under the slab or insulation extending protected by pavement or by a minimum of 10 inches (254 mm) of soil. The top edge of the insulation installed between the exterior wall and the edge of the interior slab shall be permitted to be cut at a 45-degree (0.79 rad) angle away from the exterior wall. Slab-edge*

insulation is not required in jurisdictions designated by the building official as having a very heavy termite infestation.

**TABLE 1105.2.1.2
EQUIVALENT U-FACTORS^a**

	FENESTRATION U-FACTOR	SKYLIGHT U-FACTOR	CEILING U- FACTOR	FRAME WALL U- FACTOR	MASS WALL U- FACTOR^b	FLOOR U- FACTOR	BASEMENT WALL U- FACTOR	CRAWL SPACE WALL U- FACTOR
<i>Compliance Path #1</i>	0.32	0.60	0.026	0.077	0.082	0.033	0.059 (minimum 4 feet)	0.065
<i>Compliance Path #2</i>	0.32	0.60	0.026	0.082	0.082	0.033	0.059 (minimum 4 feet)	0.065

- a. Nonfenestration U-factors shall be obtained from measurement, calculation or approved referenced publications approved in accordance with this code.*
- b. When more than half the insulation is on the interior, the mass wall U-factors shall be the same as the frame wall U-factor.*
- c. Deleted.*

**TABLE 1105.2.2.5
STEEL-FRAME CEILING, WALL AND FLOOR INSULATION (R-VALUE)**

WOOD FRAME R-VALUE REQUIREMENT	COLD-FORMED STEEL EQUIVALENT R-VALUE^a
Steel Truss Ceilings^a	
R-30	R-38 or R-30 + 3 or R-26 + 5
R-38	R-49 or R-38 + 3
R-49	R-38 + 5
Steel Joist Ceilings^b	
R-30	R-38 in 2 x 4 or 2 x 6 or 2 x 8 R-49 in any framing
R-38	R-49 in 2 x 4 or 2 x 6 or 2 x 8 or 2 x 10
Steel Framed Wall	
R-13	R-13 + 5 or R15 + 4 or R-21 + 3 or R-0 + 10
R-15 or R-13+3	R-0 + 11.2 or R-13 + 6.1 or R-15 + 5.7 or R-19 + 5.0 or R-21 + 4.7
R-19	R-13 + 9 or R-19 + 8 or R-25 + 7
R-21	R-13 + 10 or R-19 + 9 or R-25 + 8
Steel Joist Floor	
R-13	R-19 in 2 x 6, R-19 + 6 in 2 x 8 or 2 x 10
R-19	R-19 + 6 in 2 x 6, R-19 + 12 in 2 x 8 or 2 x 10
R-30	R-19 + 6 in 2 x 6, R-19 + 12 in 2 x 8 or 2 x 10

For SI: 1 inch = 25.4 mm.

- a. Cavity insulation R-value is listed first, followed by continuous insulation R-value.*
- b. Insulation exceeding the height of the framing shall cover the framing.*

1105.2.2.9 Crawl space walls. *As an alternative to insulating floors over crawl spaces, insulation of crawl space walls shall be permitted when the crawl space is not vented to the outside. Crawl space wall insulation shall be permanently fastened to the wall and extend downward from the floor to the finished grade level and then vertically and/or horizontally for at least an additional 24 inches (610 mm). Exposed earth in unvented crawl space foundations shall be covered with a continuous Class I vapor retarder. All joints of the vapor retarder shall overlap by 6 inches (152 mm) and be sealed or taped. The edges of the vapor retarder shall extend at least 6 inches (152 mm) up the stem wall and shall be attached to the stem wall.*

1105.2.2.10 Masonry veneer. *Insulation shall not be required on the horizontal portion of the foundation that supports a masonry veneer.*

1105.2.2.11 Thermally isolated sunroom insulation. *The minimum ceiling insulation R-values shall be R-24. The minimum wall R-value shall be R-13. New wall(s) separating the sunroom from conditioned space shall meet the building thermal envelope requirements.*

1105.2.3 Fenestration.

1105.2.3.1 U-factor. *An area-weighted average of fenestration products shall be permitted to satisfy the U-factor requirements.*

1105.2.3.2 Glazed fenestration SHGC. *An area-weighted average of fenestration products more than 50 percent glazed shall be permitted to satisfy the solar heat gain coefficient (SHGC) requirements.*

1105.2.3.3 Glazed fenestration exemption. *Up to 15 square feet (1.4 m²) of glazed fenestration per dwelling unit shall be permitted to be exempt from U-factor and SHGC requirements in Section 1105.2.1. This exemption shall not apply to the U-factor alternative approach in Section 1105.2.1.2 and the Total UA alternative in Section 1105.2.1.3.*

1105.2.3.4 Opaque door exemption. *One side-hinged opaque door assembly up to 24 square feet (2.22 m²) in area is exempted from the U-factor requirement in Section 1105.2.1. This exemption shall not apply to the U-factor alternative approach in Section 1105.2.1.2 and the Total UA alternative in Section 1105.2.1.3.*

1105.2.3.5 Thermally isolated sunroom U-factor. *The maximum fenestration U-factor shall be 0.50 and the maximum skylight U-factor*

shall be 0.75. New windows and doors separating the sunroom from conditioned space shall meet the building thermal envelope requirements.

1105.2.3.6 Replacement fenestration. *Where some or all of an existing fenestration unit is replaced with a new fenestration product, including sash and glazing, the replacement fenestration unit shall meet the applicable requirements for U-factor and solar heat gain coefficient (SHGC) in Table 1105.2.1*

1105.2.4 Air leakage.

1105.2.4.1 Building thermal envelope. *The building thermal envelope shall be durably sealed to limit infiltration. The sealing methods between dissimilar materials shall allow for differential expansion and contraction. The following shall be caulked, gasketed, weatherstripped or otherwise sealed with an air barrier material, suitable film or solid material.*

1. *All joints, seams and penetrations.*
2. *Site-built windows, doors and skylights.*
3. *Openings between window and door assemblies and their respective jambs and framing*
4. *Utility penetrations.*
5. *Dropped ceilings or chases adjacent to the thermal envelope.*
6. *Knee walls.*
7. *Walls and ceilings separating the garage from conditioned spaces.*
8. *Behind tubs and showers on exterior walls.*
9. *Common walls between dwelling units.*
10. *Attic access openings.*
11. *Rim joists junction.*
12. *Other sources of infiltration.*

1105.2.4.2 Air sealing and insulation. *Building envelope air tightness and insulation installation shall be demonstrated to comply with Section 1105.2.4.2.1.*

1105.2.4.2.1 Testing. *Tested air leakage is less than 6 ACH when tested with a blower door at a pressure of 50 pascals (0.007 psi). Testing shall occur after rough in and after installation of penetrations of the building envelope, including penetrations for utilities, plumbing, electrical, ventilation and combustion appliances.*

During testing:

- 1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed;*
- 2. Dampers shall be closed, but not sealed; including exhaust, intake, makeup air, back draft, and flue dampers;*
- 3. Interior doors shall be open;*
- 4. Exterior openings for continuous ventilation systems and heat recovery ventilators shall be closed and sealed;*
- 5. Heating and cooling system(s) shall be turned off;*
- 6. HVAC ducts shall not be sealed; and*
- 7. Supply and return registers shall not be sealed.*

This requirement will take effect one year after the effective date of this rule.

1105.2.4.2.1.1 Sampling. *Where groups of seven or more buildings of similar design and construction are completed and are issued occupancy permits during a 120 day period, testing of less than 100 percent, but not less than 1 in 7 or 15 percent, of the buildings from a specific builder and/or contractor or of dwelling units to be tested shall be selected by the code official. If any tested building fails to comply with the maximum air leakage requirement in Section 1105.2.4.2.1 then all buildings shall be tested until a minimum of three consecutive buildings comply from that specific builder and/or contractor before the code official may permit sampling to resume.*

1105.2.4.3 Fireplaces. *New wood-burning fireplaces shall have ~~gasketed~~ doors or tight-fitting flue dampers and outdoor combustion air. If using tight-fitting doors on UL 127 fireplaces, they must be tested and listed for the fireplace.*

1105.2.4.4 Fenestration air leakage. *Windows, skylights and sliding glass doors shall have an air infiltration rate of no more than 0.3 cubic foot per minute per square foot [1.5(L/s)/m²], and swinging doors no more than 0.5 cubic foot per minute per square foot [2.5(L/s)/m²], when tested according to NFRC 400 or AAMA/WDMA/CSA 101/I.S.2/ A440 by an approved agency, and listed and labeled by the manufacturer.*

Exception: *Site-built windows, skylights and doors.*

1105.2.4.5 Recessed lighting. *Recessed luminaires installed in the building thermal envelope shall be sealed to limit air leakage between conditioned and unconditioned spaces. All recessed luminaires shall be IC-rated and labeled as meeting ASTM E 283 when tested at 1.57 ~~psi~~ psf (75 Pa) pressure differential with no more than 2.0 cfm (0.944 L/s) of air movement from the conditioned space to the ceiling cavity. All recessed luminaires shall be sealed with a gasket or caulk between the housing and the interior wall or ceiling covering.*

1105.2.5 Maximum fenestration U-factor and SHGC. *The area-weighted average maximum fenestration U-factor permitted using trade-offs from Section 1105.2.1.3 shall be 0.48 for vertical fenestration, and 0.75 for skylights.*

1105.3 Systems.

1105.3.1 Controls. *At least one thermostat shall be installed for each separate heating and cooling system.*

1105.3.1.1 Programmable thermostat. *Where the primary heating system is a forced air furnace, at least one thermostat per dwelling unit shall be capable of controlling the heating and cooling system on a daily schedule to maintain different temperature set points at different times of the day. This thermostat shall include the capability to set back or temporarily operate the system to maintain zone temperatures down to 55°F (13°C) or up to 85°F (29°C). The thermostat shall initially be programmed with a heating temperature set point no higher than 70°F (21°C) and a cooling temperature set point no lower than 78°F (26°C).*

1105.3.1.2 Heat pump supplementary heat. Heat pumps having supplementary electric-resistance heat shall have controls that, except during defrost, prevent supplemental heat operation when the heat pump compressor can meet the heating load.

1105.3.2 Ducts.

1105.3.2.1 Insulation. Supply ducts in attics shall be insulated to a minimum of R-8. All other ducts shall be insulated to a minimum of R-6.

Exception: Ducts or portions thereof located completely inside the building thermal envelope.

1105.3.2.2 Sealing. Ducts, air handlers, filter boxes and building cavities used as ducts shall be sealed. Joints and seams shall comply with Section M1601.4. Duct tightness shall be verified by either of the following:

1. **Post-construction test:** Post-construction duct tightness shall be verified to meet the values prescribed in Table 1105.3.2.2(a) by testing either the “Leakage to Outdoors” or the “Total Leakage” in accordance with the chosen compliance path. Testing shall be conducted at a pressure differential of 0.1 inch w.g. (25 Pa) across the entire system, including the manufacturer’s air handler end closure. All register boots shall be taped or otherwise sealed during the test.

**TABLE 1105.3.2.2(a)
POST-CONSTRUCTION DUCT TIGHTNESS TESTING**

	Leakage to Outdoors (per 100 ft ² (9.29 m ²) of conditioned floor area)	Total Leakage (per 100 ft ² (9.29 m ²) of conditioned floor area)
Compliance Path #1	≤ 6 cfm (2.83 L/s)	≤ 9 cfm (4.24 L/s)
Compliance Path #2	≤ 4 cfm (1.89 L/s)	≤ 6 cfm (2.83 L/s)

2. **Rough-in test:** Rough-in duct tightness shall be verified to meet the values prescribed in Table 1105.3.2.2(b) by testing the “Total Leakage” in accordance with the chosen compliance path. Testing shall be conducted at a pressure differential of 0.1 inch w.g. (25 Pa) across the roughed in system, including the manufacturer’s air handler enclosure, if installed at the time of the test. All register boots shall be taped or otherwise sealed during the test.

**TABLE 1105.3.2.2(b)
ROUGH-IN DUCT TIGHTNESS TESTING**

	Total Leakage – with air handler installed (per 100 ft ² (9.29 m ²) of conditioned floor area)	Total Leakage – without air handler installed (per 100 ft ² (9.29 m ²) of conditioned floor area)
Compliance Path #1	≤ 6 cfm (2.83 L/s)	≤ 4 cfm (1.89 L/s)
Compliance Path #2	≤ 4 cfm (1.89 L/s)	≤ 3 cfm (1.41 L/s)

Exception: Duct tightness test is not required if the air handler and all ducts are located within conditioned space.

This requirement will take effect one year after the effective date of this rule.

1105.3.2.3 Building cavities. Building framing cavities shall not be used as supply ducts.

1105.3.3 Circulating hot water systems. The first five feet of circulating service hot water piping shall be insulated to at least R-2. Circulating hot water systems shall include an automatic or readily accessible manual switch that can turn off the hot water circulating pump when the system is not in use.

1105.3.4 Mechanical ventilation. Outdoor air intakes and exhausts shall have automatic or gravity dampers that close when the ventilation system is not operating.

1105.3.5 Equipment sizing. Heating and cooling equipment shall be sized as specified in Section M1401.3.

1105.3.6 Snow melt system controls. Snow-and ice-melting systems supplied through energy service to the building shall include automatic controls capable of shutting off the system when the pavement temperature is above 50°F (10°C) and no precipitation is falling and an automatic or manual control that will allow shutoff when the outdoor temperature is above 40°F (5°C).

~~**1105.3.7 Pools.** Where regulations are adopted and enforced by the local jurisdiction, residential swimming pools shall be provided with energy conserving measures in accordance with Sections 1105.3.7.1 through 1105.3.7.3. Deleted.~~

~~**1105.3.7.1 Pool heaters.** All pool heaters shall be equipped with a readily accessible on-off switch to allow shutting off the heater without adjusting~~

~~the thermostat setting. Pool heaters fired by natural gas or LPG shall not have continuously burning pilot lights. Deleted.~~

~~1105.3.7.2 Time switches. Time switches that can automatically turn off and on heaters and pumps according to a preset schedule shall be installed on swimming pool heaters and pumps. Deleted.~~

~~**Exceptions:-**~~

- ~~1. Where public health standards require 24-hour pump operation.~~
- ~~2. Where pumps are required to operate solar and waste heat recovery pool heating systems.~~

~~1105.3.7.3 Pool covers. Heated pools shall be equipped with a vapor retardant pool cover on or at the water surface. Pools heated to more than 90°F (32°C) shall have a pool cover with a minimum insulation value of R-12. Deleted.~~

~~1105.4 lighting Lighting systems.~~

~~1105.4.1 Lighting equipment. A minimum of 75 percent of the lamps in permanently installed lighting fixtures shall be high-efficacy lamps.~~

Effective: 07/01/2014

R.C. 119.032 review dates: 01/01/2018

CERTIFIED ELECTRONICALLY

Certification

04/14/2014

Date

Promulgated Under: 119.03
Statutory Authority: 3781.10(A)
Rule Amplifies: 3781.01, 3781.06, 3781.10, 3781.11, 3791.04, 4740.14
Prior Effective Dates: 1/1/08, 1/1/09, 1/1/13

4101:8-15-01 Exhaust systems.

[Comment: When a reference is made within this rule to a federal statutory provision, an industry consensus standard, or any other technical publication, the specific date and title of the publication as well as the name and address of the promulgating agency are listed in rule 4101:8-44-01 of the Administrative Code. The application of the referenced standards shall be limited and as prescribed in section 102.5 of rule 4101:8-1-01 of the Administrative Code.]

**SECTION 1501
GENERAL**

1501.1 Outdoor discharge. The air removed by every mechanical exhaust system shall be discharged to the outdoors. Air shall not be exhausted into an attic, soffit, ridge vent or crawl space.

Exception: Whole-house ventilation-type attic fans that discharge into the attic space of dwelling units having private attics shall be permitted.

**SECTION 1502
CLOTHES DRYER EXHAUST**

1502.1 General. Clothes dryers shall be exhausted in accordance with the manufacturer's instructions.

1502.2 Independent exhaust systems. Dryer exhaust systems shall be independent of all other systems and shall convey the moisture to the outdoors.

Exception: This section shall not apply to listed and labeled condensing (ductless) clothes dryers.

1502.3 Duct termination. Exhaust ducts shall terminate on the outside of the building. Exhaust duct terminations shall be in accordance with the dryer manufacturer's installation instructions. If the manufacturer's instructions do not specify a termination location, the exhaust duct shall terminate not less than 3 feet (914 mm) in any direction from openings into buildings. Exhaust duct terminations shall be equipped with a backdraft damper. Screens shall not be installed at the duct termination.

1502.4 Dryer exhaust ducts. Dryer exhaust ducts shall conform to the requirements of Sections 1502.4.1 through 1502.4.6.

1502.4.1 Material and size. Exhaust ducts shall have a smooth interior finish and shall be constructed of metal a minimum 0.016-inch (0.4 mm) thick. The exhaust duct size shall be 4 inches (102 mm) nominal in diameter.

1502.4.2 Duct installation. Exhaust ducts shall be supported at 4 foot (1219 mm) intervals and secured in place. The insert end of the duct shall extend into the adjoining duct or fitting in the direction of airflow. Ducts shall not be joined with screws or similar fasteners that protrude into the inside of the duct.

1502.4.3 Transition duct. Transition ducts used to connect the dryer to the exhaust duct system shall be a single length that is listed and labeled in accordance with UL 2158A. Transition ducts shall be a maximum of 8 feet (2438 mm) in length. Transition ducts shall not be concealed within construction.

1502.4.4 Duct length. The maximum allowable exhaust duct length shall be determined by one of the methods specified in Section 1502.4.4.1 or 1502.4.4.2.

1502.4.4.1 Specified length. The maximum length of the exhaust duct shall be 25 feet (7620 mm) from the connection to the transition duct from the dryer to the outlet terminal. Where fittings are used, the maximum length of the exhaust duct shall be reduced in accordance with Table 1502.4.4.1.

1502.4.4.2 Manufacturer's instructions. The size and maximum length of the exhaust duct shall be determined by the dryer manufacturer's installation instructions. The *building* official shall be provided with a copy of the installation instructions for the make and model of the dryer at the concealment inspection. In the absence of fitting equivalent length calculations from the clothes dryer manufacturer, Table 1502.4.4.1 shall be used.

1502.4.5 Length identification. Where the exhaust duct is concealed within the building construction *and only if the equivalent length exceeds 25 feet (7620 mm)*, the equivalent length of the exhaust duct shall be identified on a permanent label or tag. The label or tag shall be located within 6 feet (1829 mm) of the exhaust duct connection *or at the electrical panel*.

**TABLE 1502.4.4.1
DRYER EXHAUST DUCT FITTING EQUIVALENT LENGTH**

DRYER EXHAUST DUCT FITTING TYPE	EQUIVALENT LENGTH
4 inch radius mitered 45 degree elbow	2 feet 6 inches
4 inch radius mitered 90 degree elbow	5 feet
6 inch radius smooth 45 degree elbow	1 foot
6 inch radius smooth 90 degree elbow	1 foot 9 inches
8 inch radius smooth 45 degree elbow	1 foot
8 inch radius smooth 90 degree elbow	1 foot 7 inches
10 inch radius smooth 45 degree elbow	9 inches
10 inch radius smooth 90 degree elbow	1 foot 6 inches

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 degree = 0.0175 rad.

1502.4.6 Exhaust duct required. Where space for a clothes dryer is provided, an exhaust duct system shall be installed. Where the clothes dryer is not installed at the time of occupancy the exhaust duct shall be capped or plugged in the space in which it originates and identified and marked “future use.”

Exception: Where a listed condensing clothes dryer is installed prior to occupancy of the structure.

1502.5 Protection required. Protective shield plates shall be placed where nails or screws from finish or other work are likely to penetrate the clothes dryer exhaust duct. Shield plates shall be placed on the finished face of all framing members where there is less than 1¼ inches (32 mm) between the duct and the finished face of the framing member. Protective shield plates shall be constructed of steel, shall have a minimum thickness of 0.062-inch (1.6 mm).

SECTION 1503 RANGE HOODS

1503.1 General. Range hoods shall discharge to the outdoors through a single-wall duct. The duct serving the hood shall have a smooth interior surface, shall be air tight and shall be equipped with a backdraft damper. Ducts serving range hoods shall not terminate in an attic or crawl space or areas inside the building.

Exception: Where installed in accordance with the manufacturer’s installation instructions, and where mechanical or natural ventilation is otherwise provided, listed and labeled ductless range hoods shall not be required to discharge to the outdoors.

1503.2 Duct material. Single-wall ducts serving range hoods shall be constructed of galvanized steel, stainless steel or copper.

Exception: Ducts for domestic kitchen cooking appliances equipped with down-draft exhaust systems shall be permitted to be constructed of schedule 40 PVC pipe and fittings provided that the installation complies with all of the following:

1. The duct is installed under a concrete slab poured on grade; and
2. The underfloor trench in which the duct is installed is completely backfilled with sand or gravel; and
3. The PVC duct extends not more than 1 inch (25 mm) above the indoor concrete floor surface; and
4. The PVC duct extends not more than 1 inch (25 mm) above grade outside of the building; and
5. The PVC ducts are solvent cemented.

1503.3 Kitchen exhaust rates. Where domestic kitchen cooking appliances are equipped with ducted range hoods or down-draft exhaust systems, the fans shall be sized in accordance with Section 1507.3.

1503.4 Makeup air required. ~~Exhaust hood systems shall be provided with makeup air as required in the manufacturers installation guidelines.~~ Exhaust hood systems capable of exhausting in excess of 400 cubic feet per minute (0.19 m³/s) shall be provided with makeup air at a rate approximately equal to the exhaust air rate. Such makeup air systems shall be equipped with a means of closure and shall be automatically controlled to start and operate simultaneously with the exhaust system.

Exception: If an exhaust hood system's manufacturer's instructions and/or specifications differ from this requirement, the system shall be installed per the manufacturer's instructions and/or specifications.

SECTION 1504 INSTALLATION OF MICROWAVE OVENS

1504.1 Installation of a microwave oven over a cooking appliance. The installation of a listed and labeled cooking appliance or microwave oven over a listed and labeled cooking appliance shall conform to the terms of the upper appliance's listing and label and the manufacturer's installation instructions. The microwave oven shall conform to UL 923.

SECTION 1505 OVERHEAD EXHAUST HOODS

1505.1 General. Domestic open-top broiler units shall have a metal exhaust hood, having a minimum thickness of 0.0157-inch (0.3950 mm) (No. 28 gage) with ¼ inch (6.4 mm) clearance between the hood and the underside of combustible material or cabinets. A clearance of at least 24 inches (610 mm) shall be maintained between the cooking surface and the combustible material or cabinet. The hood shall be at least as wide as the broiler unit, extend over the entire unit, discharge to the outdoors and be equipped with a backdraft damper or other means to control infiltration/exfiltration when not in operation. Broiler units incorporating an integral exhaust system, and listed and labeled for use without an exhaust hood, need not have an exhaust hood.

SECTION 1506 EXHAUST DUCTS

1506.1 Ducts. Where exhaust duct construction is not specified in this chapter, construction shall comply with Chapter 16.

SECTION 1507 MECHANICAL VENTILATION

1507.1 General. Where toilet rooms and bathrooms are mechanically ventilated, the ventilation equipment shall be installed in accordance with this section.

1507.2 Recirculation of air. Exhaust air from bathrooms and toilet rooms shall not be recirculated within a residence or to another dwelling unit and shall be exhausted directly to the outdoors. Exhaust air from bathrooms and toilet rooms shall not discharge into an attic, crawl space or other areas inside the building.

1507.3 Ventilation rate. Ventilation systems shall be designed to have the capacity to exhaust the minimum air flow rate determined in accordance with Table 1507.3.

TABLE 1507.3
MINIMUM REQUIRED EXHAUST RATES FOR ONE-, TWO-, AND
THREE-FAMILY DWELLINGS

AREA TO BE VENTILATED	VENTILATION RATES
Kitchens	100 cfm intermittent or 25 cfm continuous
Bathrooms—Toilet Rooms	Mechanical exhaust capacity of 50 cfm intermittent or 20 cfm continuous

For SI: 1 cubic foot per minute = 0.4719 L/s.

Effective: 07/01/2014

R.C. 119.032 review dates: 01/01/2018

CERTIFIED ELECTRONICALLY

Certification

04/14/2014

Date

Promulgated Under: 119.03
Statutory Authority: 3781.10(A)
Rule Amplifies: 3781.01, 3781.06, 3781.10, 3781.11, 3791.04, 4740.14
Prior Effective Dates: 1/1/13

4101:8-20-01 Boilers and water heaters.

[Comment: When a reference is made within this rule to a federal statutory provision, an industry consensus standard, or any other technical publication, the specific date and title of the publication as well as the name and address of the promulgating agency are listed in rule 4101:8-44-01 of the Administrative Code. The application of the referenced standards shall be limited and as prescribed in section 102.5 of rule 4101:8-1-01 of the Administrative Code.]

**SECTION 2001
BOILERS**

2001.1 Installation. In addition to the requirements of this code, the installation of boilers shall conform to the manufacturer's instructions. The manufacturer's rating data, the nameplate and operating instructions of a permanent type shall be attached to the boiler. Boilers shall have all controls set, adjusted and tested by the installer. A complete control diagram together with complete boiler operating instructions shall be furnished by the installer. Solid-and liquid-fuel-burning boilers shall be provided with combustion air as required by Chapter 17.

2001.1.1 Standards. Oil-fired boilers and their control systems shall be listed and labeled in accordance with UL 726. Electric boilers and their control systems shall be listed in accordance with UL 834. Boilers shall be designed and constructed in accordance with the requirements of ASME CSD-1 and as applicable, the ASME Boiler and Pressure Vessel Code, Sections I and IV. Gas-fired boilers shall conform to the requirements listed in Chapter 24.

2001.2 Clearance. Boilers shall be installed in accordance with their listing and label.

2001.3 Valves. Every boiler or modular boiler shall have a shutoff valve in the supply and return piping. For multiple boiler or multiple modular boiler installations, each boiler or modular boiler shall have individual shutoff valves in the supply and return piping.

Exception: Shutoff valves are not required in a system having a single low-pressure steam boiler.

2001.4 Flood-resistant installation. In areas prone to flooding as established in Table 301.2(1), boilers, water heaters and their control systems shall be located or installed in accordance with Section 322.1.6.

SECTION 2002 OPERATING AND SAFETY CONTROLS

2002.1 Safety controls. Electrical and mechanical operating and safety controls for boilers shall be listed and labeled.

2002.2 Hot water boiler gauges. Every hot water boiler shall have a pressure gauge and a temperature gauge, or combination pressure and temperature gauge. The gauges shall indicate the temperature and pressure within the normal range of the system's operation.

2002.3 Steam boiler gauges. Every steam boiler shall have a water-gauge glass and a pressure gauge. The pressure gauge shall indicate the pressure within the normal range of the system's operation. The gauge glass shall be installed so that the midpoint is at the normal water level.

2002.4 Pressure-relief valve. Boilers shall be equipped with pressure-relief valves with minimum rated capacities for the equipment served. Pressure-relief valves shall be set at the maximum rating of the boiler. Discharge shall be piped to drains by gravity to within 18 inches (457 mm) of the floor or to an open receptor.

2002.5 Boiler low-water cutoff. All steam and hot water boilers shall be protected with a low-water cutoff control. The low-water cutoff shall automatically stop the combustion operation of the appliance when the water level drops below the lowest safe water level as established by the manufacturer.

SECTION 2003 EXPANSION TANKS

2003.1 General. Hot water boilers shall be provided with expansion tanks. Nonpressurized expansion tanks shall be securely fastened to the structure or boiler and supported to carry twice the weight of the tank filled with water. Provisions shall be made for draining nonpressurized tanks without emptying the system.

2003.1.1 Pressurized expansion tanks. Pressurized expansion tanks shall be consistent with the volume and capacity of the system. Tanks shall be capable of withstanding a hydrostatic test pressure of two and one-half times the allowable working pressure of the system.

2003.2 Minimum capacity. The minimum capacity of expansion tanks shall be determined from Table 2003.2.

SECTION 2004 WATER HEATERS USED FOR SPACE HEATING

2004.1 General. Water heaters used to supply both potable hot water and hot water for space heating shall be installed in accordance with this chapter, Chapter 24, Chapter 28 and the manufacturer's installation instructions.

SECTION 2005 WATER HEATERS

2005.1 General. Water heaters shall be installed in accordance with the manufacturer's installation instructions and the requirements of this code. Water heaters installed in an attic shall conform to the requirements of Section 1305.1.3. Gas-fired water heaters shall conform to the requirements in Chapter 24. Domestic electric water heaters shall conform to UL 174 or UL 1453. Commercial electric water heaters shall conform to UL 1453. Oiled-fired water heaters shall conform to UL 732.

2005.2 Prohibited locations. Fuel-fired water heaters shall not be installed in a room used as a storage closet. Water heaters located in a bedroom or bathroom shall be installed in a sealed enclosure so that combustion air will not be taken from the living space. Installation of direct-vent water heaters within an enclosure is not required.

**TABLE 2003.2
EXPANSION TANK MINIMUM CAPACITY^a FOR FORCED HOT-WATER SYSTEMS**

SYSTEM VOLUME^b (gallons)	PRESSURIZED DIAPHRAGM TYPE	NONPRESSURIZED TYPE
10	1.0	1.5
20	1.5	3.0
30	2.5	4.5
40	3.0	6.0
50	4.0	7.5
60	5.0	9.0
70	6.0	10.5
80	6.5	12.0
90	7.5	13.5
100	8.0	15.0

For SI: 1 gallon = 3.785 L, 1 pound per square inch gauge = 6.895 kPa, °C = [(°F)-32]/1.8.

- a. Based on average water temperature of 195°F, fill pressure of 12 psig and a maximum operating pressure of 30 psig.
- b. System volume includes volume of water in boiler, convectors and piping, not including the expansion tank.

2005.2.1 Water heater access. Access to water heaters that are located in an attic or underfloor crawl space is permitted to be through a closet located in a sleeping room or bathroom where ventilation of those spaces is in accordance with this code.

2005.3 Electric water heaters. Electric water heaters shall also be installed in accordance with the applicable provisions of *NFPA 70*.

2005.4 Supplemental water-heating devices. Potable water heating devices that use refrigerant-to-water heat exchangers shall be approved and installed in accordance with the manufacturer's installation instructions.

SECTION 2006 POOL HEATERS

2006.1 General. ~~Where regulations are adopted and enforced by the local jurisdiction, heaters for residential swimming pools and spas shall be installed in accordance with the manufacturer's installation instructions. Oil fired pool heaters shall be tested in accordance with UL 726. Electric pool and spa heaters shall be tested in accordance UL 1261~~ *Deleted.*

2006.2 Clearances. ~~In no case shall the clearances interfere with combustion air, draft hood or flue terminal relief, or accessibility for servicing~~ *Deleted.*

2006.3 Temperature-limiting devices. ~~Pool heaters shall have temperature relief valves~~ *Deleted.*

2006.4 Bypass valves. ~~Where an integral bypass system is not provided as a part of the pool heater, a bypass line and valve shall be installed between the inlet and outlet piping for use in adjusting the flow of water through the heater~~ *Deleted.*

Effective: 07/01/2014

R.C. 119.032 review dates: 01/01/2018

CERTIFIED ELECTRONICALLY

Certification

04/14/2014

Date

Promulgated Under: 119.03
Statutory Authority: 3781.10(A)
Rule Amplifies: 3781.01, 3781.06, 3781.10, 3781.11, 3791.04, 4740.14
Prior Effective Dates: 1/1/13

4101:8-44-01 Referenced standards.

**SECTION 4401
REFERENCED STANDARDS**

4401.1 General. *This chapter lists the standards that are referenced in various sections of this code. The standards are listed herein by the promulgating agency of the standard, the standard identification, the effective date and title. The application of the referenced standards shall be as specified in Section 102.5.*

4401.2 Referenced codes. *When indicated in this code, the following codes refer to provisions in the listed chapters of the administrative code:*

<i>Referenced Code</i>	<i>Ohio Administrative Code Chapters</i>
<i>Ohio Building Code Fire Code Mechanical Code Plumbing Code</i>	<i>4101:1-1 to 4101:1-35 1301:7-1 to 1301:7-7 4101:2-1 to 4101:2-15 4101:3-1 to 4101:3-13, codified and published as the 2011 Ohio Plumbing Code, effective 11-1-2011 (including update effective 03-15-2012 03-01-2013), and as modified in Section 2501.1.1.</i>

4401.3 Referenced standard list.

American Architectural Manufacturers Association
1827 Walden Office Square, Suite 550
Schaumburg, IL 60173

**AAMA
Standard
reference
number**

Title

AAMA/WDMA/CSA 101/I.S.2/A440—08	North American Fenestration Standards/Specifications <u>Standard/Specification</u> for Windows, Doors, and Skylights
450—10	Voluntary Performance Rating Method for Muller Fenestration Assemblies
506—08	Voluntary Specifications for Hurricane Impact and Cycle Testing of Fenestration Products
711—07	Voluntary Specification for Self Adhering Flashing Used for Installation of Exterior Wall Fenestration Products.

Air Conditioning Contractors of America
2800 Shirlington Road, Suite 300
Arlington, VA 22206

ACCA
Standard
reference
number

Manual D—09	Title Residential Duct Systems
Manual J—04	Residential Load Calculation—Eighth Edition
Manual S—04	Residential Equipment Selection

American Concrete Institute
38800 Country Club Drive
Farmington Hills, MI 48331

ACE
Standard
reference
number

318—08	Title Building Code Requirements for Structural Concrete
332—08	Code Requirements for Residential Concrete Construction
530—08	Building Code Requirements for Masonry Structures
530.1—08	Specification for Masonry Structures

American Forest and Paper Association
1111 19th Street, NW, Suite 800
Washington, DC 20036

American Forest Products Association (Currently the American Wood Council)
 803 Sycolin Road, Suite 201
 Leesburg, VA 20175
<http://www.awc.org/index.html>

AFPA

**Standard
reference
number**

Title

NDS—05	National Design Specification (NDS) for Wood Construction—with 2005 Supplement
<i>WFCM-01</i>	Wood Frame Construction Manual for One- and Two-family Dwellings
AFPA—93	Span Tables for Joists and Rafters
PWF—07	Permanent Wood Foundation Design Specification

American Iron and Steel Institute
 1140 Connecticut Ave, Suite 705
 Washington, DC 20036

AISI

**Standard
reference
number**

Title

AISI S100—07	North American Specification for the Design of Cold-formed Steel Structural Members
AISI S230—07	Standard for Cold-formed Steel Framing-prescriptive Method for One- and Two-family Dwellings

American Institute of Timber Construction
 7012 S. Revere Parkway, Suite 140
 Centennial, CO 80112

AITC

**Standard
reference
number**

Title

ANSI/AITC A 190.1—07	Structural Glued Laminated Timber
----------------------	-----------------------------------

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

**ANSI
Standard
reference
number**

Title

A108.1A—09	Installation of Ceramic Tile in the Wet-set Method, with Portland Cement Mortar
A108.1B—09	Installation of Ceramic Tile, Quarry Tile on a Cured Portland Cement Mortar Setting Bed with Dry-set or Latex-Portland Mortar
A108.4—09	Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile-setting Epoxy Adhesive
A108.5—09	Installation of Ceramic Tile with Dry-set Portland Cement Mortar or Latex-Portland Cement Mortar
A108.6—09	Installation of Ceramic Tile with Chemical-resistant, Water-cleanable Tile-setting and -grouting Epoxy
A108.11—09	Interior Installation of Cementitious Backer Units
A118.1—10.1	American National Standard Specifications for Dry-set Portland Cement Mortar
A118.3—10.1	American National Standard Specifications for Chemical-resistant, Water-cleanable Tile-setting and Grouting Epoxy and Water-cleanable Tile-setting Epoxy Adhesive
A118.10—10.1	Specification for Load Bearing, Bonded, Waterproof Membranes for Thin-set Ceramic Tile and Dimension Stone Installation
A136.1—10.1	American National Standard Specifications for Organic Adhesives for Installation of Ceramic Tile
A137.1—08	American National Standard Specifications for Ceramic Tile
A208.1—09	Particleboard
LC1—05	Interior Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing
LC4—07	Press-connect Copper and Copper Alloy Fittings for use in Fuel Gas Distribution Systems
Z21.1—05	Household Cooking Gas Appliances

Z21.5.1—06	Gas Clothes Dryers—Volume I—Type I Clothes Dryers
Z21.8—94 (R2002)	Installation of Domestic Gas Conversion Burners
Z21.10.1—09	Gas Water Heaters—Volume I—Storage Water Heaters with Input Ratings of 75,000 Btu per hour or Less
Z21.10.3—07	Gas Water Heaters—Volume III—Storage Water Heaters with Input Ratings above 75,000 Btu per hour, Circulating and Instantaneous Water Heaters
Z21.11.2—07	Gas-fired Room Heaters—Volume II—Unvented Room Heaters
Z21.13—10	Gas-fired Low-Pressure Steam and Hot Water Boilers
Z21.15- 09	Manually Operated Gas Valves for Appliances, Appliance Connector Valves and Hose End Valves
Z21.24- 06	Connectors for Gas Appliances
Z21.40.1—96 (R2002)	Gas-fired, Heat-activated Air Conditioning and Heat Pump Appliances— with Z21.40.1a-97 (R2002)
Z21.40.2—96 (R2002)	Gas-fired, Work-activated Air Conditioning and Heat Pump Appliances (Internal Combustion) — with Z21.40.2a-1997 (R2002)
Z21.42—04	Gas-fired Illuminating Appliances
Z21.47—06	Gas-fired Central Furnaces
Z21.50—07	Vented Gas Fireplaces
Z21.56—06	Gas-fired Pool Heaters
Z21.58—08	Outdoor Cooking Gas Appliances
Z21.60—03	Decorative Gas Appliances for Installation in Solid Fuel Burning Fireplaces—with Addenda Z21.60a-2003
Z21.75/CSA6.27—07	Connectors for Outdoor Gas Appliances
Z21.80—03	Line Pressure Regulators
Z21.83—98	Fuel Cell Power Plants.
Z21.84—02	Manually Listed, Natural Gas Decorative Gas Appliances for Installation in Solid Fuel-burning Fireplaces—with Addenda Z21.84a -2003
Z21.86—08	Gas-fired Vented Space Heating Appliances
Z21.88—09	Vented Gas Fireplace Heaters
Z21.91—07	Ventless Firebox Enclosures for Gas-fired Unvented Decorative Room Heaters
Z83.6—90 (R1998)	Gas-fired Infrared Heaters

Z83.8—09 Gas-fired Unit Heaters and Gas-fired Duct Furnaces
 Z97.1—09 Safety Glazing Materials Used in Buildings—
 Safety Performance Specifications and Methods of
 Test

APA—The Engineered Wood Association
 7011 South 19th
 Tacoma, WA 98466

**APA
 Standard
 reference
 number**

Title

APA E30—07 Engineered Wood Construction Guide

American Society of Civil Engineers Structural Engineering Institute
 1801 Alexander Bell Drive
 Reston, VA 20191

**ASCE/SEI
 Standard
 reference
 number**

Title

5—08 Building Code Requirements for Masonry Structures
 6—08 Specification for Masonry Structures
 7—05 Minimum Design Loads for Buildings and Other Structures
 24—05 Flood-resistant Design and Construction.
 32—01 Design and Construction of Frost-protected Shallow
 Foundations

American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
 1791 Tullie Circle, NE
 Atlanta, GA 30329

**ASHRAE
 Standard
 reference
 number**

Title

34—10 Designation and Safety Classification of Refrigerants
 ASHRAE—09 ASHRAE Fundamentals Handbook—2009

American Society of Mechanical Engineers
 Three Park Avenue
 New York, NY 10016-5990

**ASME
 Standard
 reference
 number**

A17.1/CSA B44—~~04~~ 2010
 A18.1—~~03~~ 2008

B1.20.1—1983 (R2006)
 B16.33—2002 (R2007)

B16.44—02

B36.10M—2004
 BPVC—2004 2010
 CSD-1—09

Title

Safety Code for Elevators and Escalators
 Safety Standard for Platforms and Stairway
 Chair Lifts
 Pipe Threads, General Purpose (Inch)
 Manually Operated Metallic Gas Valves for
 Use in Gas Piping Systems up to 125 psig
 (Sizes ½ through 2)
 Manually Operated Metallic Gas Valves For
 Use in Above-ground Piping Systems up to
 5 psi.
 Welded and Seamless Wrought-steel Pipe
 ASME Boiler and Pressure Vessel Code
 Controls and Safety Devices for
 Automatically Fired Boilers

American Society of Sanitary Engineering
 901 Canterbury, Suite A
 Westlake, OH 44145

ASTM International
 100 Barr Harbor Drive
 West Conshohocken, PA 19428

**ASTM
 Standard
 reference
 number**

A 36/A 36M—08
 A 53/A 53M—10a

Title

Specification for Carbon Structural Steel
 Specification for Pipe, Steel, Black and Hot-dipped,
 Zinc-coated Welded and Seamless

A 82/A 82M—07	Specification for Steel Wire, Plain, for Concrete Reinforcement
A 106/A 106M—10	Specification for Seamless Carbon Steel Pipe for High Temperature Service
A 153/A 153M—09	Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware
A 167—09	Specification for Stainless and Heat-resisting Chromium-nickel Steel Plate, Sheet and Strip
A 240/A 240M—10a	Standard Specification for Chromium and Chromium-nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels and for General Applications
A 254—9707	Specification for Copper Brazed Steel Tubing
A 307—07b	Specification for Carbon Steel Bolts and Studs, 6000 psi Tensile Strength
A 463/A 463M—09a	Standard Specification for Steel Sheet, Aluminum-coated by the Hot-dip Process.
A 510—08	Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel
A 539—99	Specification for Electric-resistance-welded Coiled Steel Tubing for Gas and Fuel Oil Lines
A 615/A 615M—09b	Specification for Deformed and Plain Billet-steel Bars for Concrete Reinforcement
A 641/A 641M—09b	Specification for Zinc-coated (Galvanized) Carbon Steel Wire
A 653/A 653M—09a	Specification for Steel Sheet, Zinc-coated (Galvanized) or Zinc-iron Alloy-coated (Galvanized) by the Hot-dip Process
A 706/A 706M—09b	Specification for Low-alloy Steel Deformed and Plain Bars for Concrete Reinforcement
A 755/A 755M—03 (2008)	Specification for Steel Sheet, Metallic Coated by the Hot-dip Process and Prepainted by the Coil-coating Process for Exterior Exposed Building Products
A 778—01 (2009)e1	Specification for Welded Unannealed Austenitic Stainless Steel Tubular Products
A 792/A 792M—09a	Specification for Steel Sheet, 55% Aluminum-zinc Alloy-coated by the Hot-dip Process
A 875/A 875M—09a	Specification for Steel Sheet, Zinc-5%, Aluminum Alloy-coated by the Hot-dip Process

A 924/A 924M—10	Standard Specification for General Requirements for Steel Sheet, Metallic-coated by the Hot-Dip Process
A 951—06	Specification for Steel Wire Masonry Joint Reinforcement
A 996/A 996M—09b	Specifications for Rail-steel and Axle-steel Deformed Bars for Concrete Reinforcement
A 1003/A 1003M—10	Standard Specification for Steel Sheet, Carbon, Metallic and Nonmetallic-coated for Cold-formed Framing Members
B 42—10	Specification for Seamless Copper Pipe, Standard Sizes
B 43—09	Specification for Seamless Red Brass Pipe, Standard Sizes
B 75—02	Specification for Seamless Copper Tube
B 88—09	Specification for Seamless Copper Water Tube
B 101—07	Specification for Lead-coated Copper Sheet and Strip for Building Construction.
B 135—10	Specification for Seamless Brass Tube
B 209—07	Specification for Aluminum and Aluminum-alloy Sheet and Plate
B 227—10	Specification for Hard-drawn Copper-clad Steel Wire
B 251—10	Specification for General Requirements for Wrought Seamless Copper and Copper-alloy Tube
B 302—07	Specification for Threadless Copper Pipe, Standard Sizes
B 306—09	Specification for Copper Drainage Tube (DWV)
B 370—09	Specification for Copper Sheet and Strip for Building Construction
B 447—07	Specification for Welded Copper Tube
B 695—04 (2009)	Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel
B 813—10	Specification for Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube
C 5—10	Specification for Quicklime for Structural Purposes
C 27—98 (2008)	Specification for Standard Classification of Fireclay and High-alumina Refractory Brick
C 28/C 28M—10	Specification for Gypsum Plasters
C 33—08	Specification for Concrete Aggregates

C 34—08	Specification for Structural Clay Load-bearing Wall Tile
C 35—01(2005)	Specification for Inorganic Aggregates for Use in Gypsum Plaster
C 36/C 36M—03	Specification for Gypsum Wallboard
C 37/C 37M—01	Specification for Gypsum Lath
C 55—09	Specification for Concrete Building Brick
C 59/C 59M—00 (2006)	Specification for Gypsum Casting and Molding Plaster
C 61/C 61M—00 (2006)	Specification for Gypsum Keene's Cement
C 62—10	Specification for Building Brick (Solid Masonry Units Made from Clay or Shale)
C 73—05	Specification for Calcium Silicate Face Brick (Sand Lime Brick)
C 79—04a	Specification for Treated Core and Nontreated Core Gypsum Sheathing Board
C 90—09	Specification for Load-bearing Concrete Masonry Units
C 91—05	Specification for Masonry Cement
C 94/C 94M—10	Specification for Ready-mixed Concrete
C 129—06	Specification for Nonload-bearing Concrete Masonry Units
C 143/C 143M—10a	Test Method for Slump or Hydraulic Cement Concrete
C 145—85	Specification for Solid Load-bearing Concrete Masonry Units
C 150—09	Specification for Portland Cement
C 199—84 (2005)	Test Method for Pier Test for Refractory Mortar
C 203—05a	Standard Test Methods for Breaking Load and Flexural Properties of Block-type Thermal Insulation
C 207—06	Specification for Hydrated Lime for Masonry Purposes
C 208—08a	Specification for Cellulosic Fiber Insulating Board
C 216—10	Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale)
C 270—10	Specification for Mortar for Unit Masonry
C 272—01 (2007)	Standard Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions
C 273—07a	Standard Test Method for Shear Properties of Sandwich Core Materials

C 315—07	Specification for Clay Flue Liners and Chimney Pots
C 406—10	Specifications for Roofing Slate
C 411—05	Test Method for Hot-surface Performance of High-temperature Thermal Insulation
C 475/C 475—02(2007)	Specification for Joint Compound and Joint Tape for Finishing Gypsum Wallboard
C 476—10	Specification for Grout for Masonry
C 514—04 (2009) <i>e1</i>	Specification for Nails for the Application of Gypsum Wallboard
C 552—07	Standard Specification for Cellular Glass Thermal Insulation
C 557—03 (2009) <i>e1</i>	Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing
C 578—10	Specification for Rigid, Cellular Polystyrene Thermal Insulation
C 587—04 (2009)	Specification for Gypsum Veneer Plaster
C 588/C 588M—03 <i>e1</i>	Specification for Gypsum Base for Veneer Plasters
C 595—10	Specification for Blended Hydraulic Cements
C 630/C 630M—03	Specification for Water-resistant Gypsum Backing Board
C 631—09	Specification for Bonding Compounds for Interior Gypsum Plastering
C 645—09 <i>a</i>	Specification for Nonstructural Steel Framing Members
C 652—10	Specification for Hollow Brick (Hollow Masonry Units Made from Clay or Shale)
C 685—10	Specification for Concrete Made by Volumetric Batching and Continuous Mixing
C 728—05 (2010)	Standard Specification for Perlite Thermal Insulation Board
C 836/C836M-10	Specification for High Solids Content, Cold Liquid-applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course
C 843—99 (2006)	Specification for Application of Gypsum Veneer Plaster
C 844—10	Specification for Application of Gypsum Base to Receive Gypsum Veneer Plaster
C 847—10 <i>a</i>	Specification for Metal Lath

C 887—05 (2010)	Specification for Packaged, Dry, Combined Materials for Surface Bonding Mortar
C 897—05 (2009)	Specification for Aggregate for Job-mixed Portland Cement-based Plasters
C 920—10	Standard Specification for Elastomeric Joint Sealants
C 926—06	Specification for Application of Portland Cement-based Plaster
C 931/C 931M—04	Specification for Exterior Gypsum Soffit Board
C 933—09	Specification for Welded Wire Lath
C 954—10	Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness
C 955—09a	Specification for Load-bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases
C 957—10	Specification for High-solids Content, Cold Liquid-applied Elastomeric Waterproofing Membrane for Use with Integral Wearing Surface
C 960—04	Specification for Predecorated Gypsum Board
C 1002—07	Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases
C 1029—10	Specification for Spray-applied Rigid Cellular Polyurethane Thermal Insulation
C 1032—06	Specification for Woven Wire Plaster Base
C 1047—10a	Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base
C 1063—08	Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-based Plaster.
C 1107—08	Standard Specification for Packaged Dry, Hydraulic-cement Grout (Nonshrink)
C 1116—10	Standard Specification for Fiber-reinforced Concrete and Shotcrete
C 1167—03 (2009)	Specification for Clay Roof Tiles
C 1177/C 1177M—08	Specification for Glass Mat Gypsum Substrate for Use as Sheathing

C 1178/C 1178M—08	Specification for Glass Mat Water-resistant Gypsum Backing Panel
C 1186—08	Specification for Flat Nonasbestos Fiber Cement Sheets
C 1261—10	Specification for Firebox Brick for Residential Fireplaces
C 1278/C 1278M—07a	Specification for Fiber-reinforced Gypsum Panels
C 1283—07a	Practice for Installing Clay Flue Lining
C 1288—99(2010)	Standard Specification for Discrete Nonasbestos Fiber-cement Interior Substrate Sheets
C 1289—10	Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
C 1325—08b	Standard Specification for Nonasbestos Fiber-mat Reinforced Cement Interior Substrate Sheets.
C 1328—05	Specification for Plastic (Stucco) Cement.
C 1395/C 1395M—06a	Specification for Gypsum Ceiling Board
C 1396/C 1396M—09a	Specification for Gypsum Board.
C 1492—03(2009)	Specification for Concrete Roof Tile
C 1513—10	Standard Specification for Steel Tapping Screws for Cold-formed Steel Framing Connections
C 1658/C 1658M—06	Standard Specification for Glass Mat Gypsum Panels
D 41—05 (2010)	Specification for Asphalt Primer Used in Roofing, Dampproofing and Waterproofing
D 43—00(2006)	Specification for Coal Tar Primer Used in Roofing, Dampproofing and Waterproofing
D 225—07	Specification for Asphalt Shingles (Organic Felt) Surfaced with Mineral Granules
D 226/D 226M—09	Specification for Asphalt-saturated (Organic Felt) Used in Roofing and Waterproofing
D 227—03	Specification for Coal Tar Saturated (Organic Felt) Used in Roofing and Waterproofing
D 312—00(2006)	Specification for Asphalt Used in Roofing.
D 422—63 (2007)	Test Method for Particle-size Analysis of Soils
D 449—03 (2008)	Specification for Asphalt Used in Dampproofing and Waterproofing.
D 450—07	Specification for Coal-tar Pitch Used in Roofing, Dampproofing and Waterproofing
D 1227—95(2007)	Specification for Emulsified Asphalt Used as a Protective Coating for Roofing

D 1248—05	Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable
D 1622—08	Standard Test Method for Apparent Density of Rigid Cellular Plastics
D 1623—09	Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics
D 1693—08	Test Method for Environmental Stress-cracking of Ethylene Plastics
D 1784—08	Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
D 1863—05	Specification for Mineral Aggregate Used in Built-up Roofs
D 1970—09	Specification for Self-adhering Polymer Modified Bitumen Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
D 2126—09	Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging
D 2178—04	Specification for Asphalt Glass Felt Used in Roofing and Waterproofing
D 2412—10	Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-plate Loading
D 2447—03	Specification for Polyethylene (PE) Plastic Pipe Schedules 40 and 80, Based on Outside Diameter
D 2513—09a	Specification for Thermoplastic Gas Pressure Pipe, Tubing and Fittings
D 2559—10a	Standard Specification for Adhesives for Structural Laminated Wood Products for Use Under Exterior (West Use) Exposure Conditions
D 2626—04	Specification for Asphalt-saturated and Coated Organic Felt Base Sheet Used in Roofing
D 2683—10	Specification for Socket-type Polyethylene Fittings for Outside Diameter-controlled Polyethylene Pipe and Tubing
D 2822—05	Specification for Asphalt Roof Cement
D 2823—05	Specification for Asphalt Roof Coatings
D 2824—06	Specification for Aluminum-pigmented Asphalt Roof Coatings, Nonfibered, Asbestos Fibered and Fibered without Asbestos

D 2837—08	Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products
D 2846/D 2846M—09b	Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot- and Cold-water Distribution Systems
D 2898—10	Test Methods for Accelerated Weathering of Fire-retardant-treated Wood for Fire Testing
D 3019—08	Specification for Lap Cement Used with Asphalt Roll Roofing, Nonfibered, Asbestos Fibered and Nonasbestos Fibered.
D 3035—08	Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based On Controlled Outside Diameter
D 3161—09	Test Method for Wind Resistance of Asphalt Shingles (Fan Induced Method)
D 3201—08ae1	Test Method for Hygroscopic Properties of Fire-retardant Wood and Wood-base Products
D 3309—96a (2002)	Specification for Polybutylene (PB) Plastic Hot-and Code-water Distribution System
D 3350—10	Specification for Polyethylene Plastic Pipe and Fitting Materials
D 3462/D 3462M—10a	Specification for Asphalt Shingles Made From Glass Felt and Surfaced with Mineral Granules.
D 3468—99 (2006)e01	Specification for Liquid-applied Neoprene and Chlorosulfanated Polyethylene Used in Roofing and Waterproofing
D 3679—09a	Specification for Rigid Poly (Vinyl Chloride) (PVC) Siding
D 3737—09	Practice for Establishing Allowable Properties for Structural Glued Laminated Timber (Glulam)
D 3747—79 (2007)	Specification for Emulsified Asphalt Adhesive for Adhering Roof Insulation
D 3909—97b (2004)e01	Specification for Asphalt Roll Roofing (Glass Felt) Surfaced with Mineral Granules
D 3957—09	Standard Practices for Establishing Stress Grades for Structural Members Used in Log Buildings
D 4022—07	Specification for Coal Tar Roof Cement, Asbestos Containing
D 4318—10	Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils

D 4434/D 4434—09	Specification for Poly (Vinyl Chloride) Sheet Roofing
D 4479—07	Specification for Asphalt Roof Coatings-asbestos-free
D 4586—07	Specification for Asphalt Roof Cement-asbestos-free
D 4601—04	Specification for Asphalt-coated Glass Fiber Base Sheet Used in Roofing
D 4637/D 4637M—10	Specification for EPDM Sheet Used in Single-ply Roof Membrane
D 4829—08a	Test Method for Expansion Index of Soils
D 4869—05e01	Specification for Asphalt-saturated (Organic Felt) Underlayment Used in Steep Slope Roofing
D 4897/D 4897M—01(2009)	Specification for Asphalt Coated Glass-fiber Venting Base Sheet Used in Roofing
D 4990—97a (2005)e01	Specification for Coal Tar Glass Felt Used in Roofing and Waterproofing
D 5019—07a	Specification for Reinforced Nonvulcanized Polymeric Sheet Used in Roofing Membrane
D 5055—10	Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-joists
D 5516—09	Test Method for Evaluating the Flexural Properties of Fire-retardant-treated Softwood Plywood Exposed to the Elevated Temperatures
D 5643—06	Specification for Coal Tar Roof Cement Asbestos-free
D 5664—10	Test Methods For Evaluating the Effects of Fire-retardant Treatments and Elevated Temperatures on Strength Properties of Fire-retardant-treated Lumber
D 5665—99a(2006)	Specification for Thermoplastic Fabrics Used in Cold-applied Roofing and Waterproofing
D 5726—98(2005)	Specification for Thermoplastic Fabrics Used in Hot-applied Roofing and Waterproofing
D 6083—05e01	Specification for Liquid-applied Acrylic Coating Used in Roofing
D 6162—08	Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements

D 6163—00 (2008)	Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements
D 6164—05 <i>e1</i>	Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements
D 6222—08	Specification for Atactic Polypropelene (APP) Modified Bituminous Sheet Materials Using Polyester Reinforcement.
D 6223/D 6223M—02(2009) <i>e01</i>	Specification for Atactic Polypropelene (APP) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcement
D 6298—05 <i>e1</i>	Specification for Fiberglass-reinforced Styrene Butadiene Styrene (SBS) Modified Bituminous Sheets with a Factory Applied Metal Surface
D 6305—08	Practice for Calculating Bending Strength Design Adjustment Factors for Fire-retardant-treated Plywood Roof Sheathing
D 6380—03(2008)	Standard Specification for Asphalt Roll Roofing (Organic Felt)
D 6694—08	Standard Specification Liquid-applied Silicone Coating Used in Spray Polurethane Foam Roofing
D 6754/D 6754M—10	Standard Specification for Ketone-ethylene-ester-based Sheet Roofing ²
D 6757—07	Standard Specification for Inorganic Underlayment for Use with Steep Slope Roofing Products.
D 6841—08	Standard Practice for Calculating Design Value Treatment Adjustment Factors for Fire-retardant-treated Lumber
D 6878—08 <i>e1</i>	Standard Specification for Thermoplastic-polyolefin-based Sheet Roofing.
D 6947—07	Standard Specification for Liquid Applied Moisture Cured Polyurethane Coating Used in Spray Polyurethane Foam Roofing System
D 7032—10 <i>a</i>	Standard Specification for Establishing Performance Ratings for Wood-plastic Composite Deck Boards and Guardrail Systems (Guards or Handrails).
D 7158—08 <i>d</i>	Standard Test Method for Wind Resistance of Sealed Asphalt Shingles (Uplift Force/ Uplift Resistance Method)

E 84—10 <i>b</i>	Test Method for Surface Burning Characteristics of Building Materials
E 90—04	Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
E 96/E 96M—05	Test Method for Water Vapor Transmission of Materials
E 108—10 <i>a</i>	Test Methods for Fire Tests of Roof Coverings
E 119—10 <i>b</i>	Test Methods for Fire Tests of Building Construction and Materials
E 136—09 <i>b</i>	Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C
E 283—04	Test Method for Determining the Rate of Air Leakage through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen
E 330—02 (2010)	Test Method for Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference
E 331—00 (2009)	Test Method for Water Penetration of Exterior Windows, Skylights, Doors and Curtain Walls by Uniform Static Air Pressure Difference
E 492—09	Specification for Laboratory Measurement of Impact Sound Transmission through Floor-ceiling Assemblies Using the Tapping Machine
E 814—10	Test Method for Fire Tests of Through-penetration Firestops
E 970—10	Test Method for Critical Radiant Flux of Exposed Attic Floor Insulation Using a Radiant Heat Energy Source
E 1509—04	Standard Specification for Room Heaters, Pellet Fuel-burning Type
E 1602—03(2010) <i>e1</i>	Guide for Construction of Solid Fuel Burning Masonry Heaters
E 1886—05	Test Method for Performance of Exterior Windows, Curtain Walls, Doors and Storm Shutters Impacted by Missiles and Exposed to Cyclic Pressure Differentials
E 1996—09	Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors and Impact

	Protective Systems Impacted by Windborne Debris in Hurricanes
E 2178—03	Standard Test Method for Air Permeance of Building Materials
E 2231—09	Standard Practice for Specimen Preparation and Mounting of Pipe and Duct Insulation Materials to Assess Surface Burning Characteristics
E 2273—03	Standard Test Method for Determining the Drainage Efficiency of Exterior Insulation and Finish Systems (EIFS) Clad Wall Assemblies
E 2568—09 <i>e1</i>	Standard Specification for PB Exterior Insulation and Finish Systems (EIFS)
E 2570—07	Standard Test Methods for Evaluating Water-resistant Barrier (WRB) Coatings Used Under Exterior Insulation and Finish Systems (EIFS) or EIFS with Drainage
F 876—10	Specification for Cross-linked Polyethylene (PEX) Tubing
F 877—07	Specification for Cross-linked Polyethylene (PEX) Plastic Hot-and Cold-water Distribution Systems
F 1055—98(2006)	Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Fittings
F 1281—07	Specification for Cross-linked Polyethylene/Aluminum/Cross-linked Polyethylene (PEX-AL-PEX) Pressure Pipe
F 1282—10	Specification for Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure Pipe
F 1554—07 <i>a</i>	Specification for Anchor Bolts, Steel, 36, 55 and 105-ksi Yield Strength
F 1667—10	Specification for Driven Fasteners, Nails, Spikes and Staples
F 1807—10 <i>e1</i>	Specification for Metal Insert Fittings Utilizing a Copper Crimp Ring for SDR9 Cross-linked Polyethylene (PEX) Tubing
F 1960—10	Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) Tubing
F 1973—08	Standard Specification for Factory Assembled Anodeless Risers and Transition Fittings in

	Polyethylene (PE) and Polyamide 11 (PA 11) Fuel Gas Distribution Systems
F 2090—10	Specification for Window Fall Prevention Devices—with Emergency Escape (Egress) Release Mechanisms
F 2098—08	Standard Specification for Stainless Steel Clamps for SDR9 PEX Tubing to Metal Insert Fittings
F 2389—10	Standard for Pressure-rated Polypropylene (PP) Piping Systems
F 2623—08	Standard Specification for Polyethylene of Raised Temperature (PE-RT) SDRG Tubing

American Wood Protection Association
P.O. Box 361784
Birmingham, AL 35236-1784

AWPA
Standard
reference
number

	Title
C1—03	All Timber Products—Preservative Treatment by Pressure Processes
M4—06	Standard for the Care of Preservative-treated Wood Products
U1—10	USE CATEGORY SYSTEM: User Specification for Treated Wood Except Section 6 Commodity Specification H

Canadian General Standards Board
Place du Portage 111, 6B1 11 Laurier Street
Gatineau, Quebec, Canada KIA 1G6

CGSB
Standard
reference
number

	Title
37-GP—52M—(1984)	Roofing and Waterproofing Membrane, Sheet Applied, Elastomeric
37-GP—56M—(1985)	Membrane, Modified Bituminous, Prefabricated and Reinforced for Roofing—with December 1985 Amendment
CAN/CGSB-37.54—95	Polyvinyl Chloride Roofing and Waterproofing Membrane

Composite Panel Association
19465 Deerfield Avenue, Suite 306
Leesburg, VA 20176

CPA

**Standard
reference**

number

ANSI A135.4—04

ANSI A135.5—04

ANSI A135.6—06

Title

Basic Hardboard

Prefinished Hardboard Paneling

Hardboard Siding

Consumer Product Safety Commission
4330 East West Highway
Bethesda, MD 20814-4408

CPSC

**Standard
reference**

number

16 CFR Part 1201—(1977)

16 CFR Part 1209—(1979)

16 CFR Part 1404—(1979)

Title

Safety Standard for Architectural Glazing

Interim Safety Standard for Cellulose
Insulation

Cellulose Insulation

Canadian Standards Association
5060 Spectrum Way
Mississauga, Ontario, Canada L4N 5N6

CSA

**Standard
reference**

number

CSA Requirement 3—88

CSA 8-93

O325—07

Title

Manually Operated Gas Valves for Use in House
Piping Systems

Requirements for Gas Fired Log Lighters for Wood
Burning Fireplaces—with Revisions through
January 1999

Construction Sheathing

O437-Series—93	Standards on OSB and Waferboard (Reaffirmed 2006)
101/I.S.2/A440—08	Specifications for Windows, Doors and Unit Skylights
CAN/CSA B137.10M—09	Cross-linked Polyethylene/Aluminum/Polyethylene Composite Pressure Pipe Systems

Cedar Shake & Shingle Bureau
P. O. Box 1178
Sumas, WA 98295-1178

CSSB

**Standard
reference
number**

Title

CSSB—97	Grading and Packing Rules for Western Red Cedar Shakes and Western Red Shingles of the Cedar Shake and Shingle Bureau
---------	---

Door and Access Systems Manufacturers Association International
1300 Summer Avenue
Cleveland, OH 44115-2851

DASMA

**Standard
reference
number**

Title

108—05	Standard Method for Testing Garage Doors: Determination of Structural Performance Under Uniform Static Air Pressure Difference
--------	--

United States Department of Commerce
1401 Constitution Avenue, NW
Washington, DC 20230

DOC

**Standard
reference
number**

Title

PS 1—07	Structural Plywood
---------	--------------------

PS 2—04 Performance Standard for Wood-based Structural-use Panels

R803.2.1/ PS 20—05 American Softwood Lumber Standard

Department of Transportation
1200 New Jersey Avenue SE East Building, 2nd floor
Washington, DC 20590

DOTn

Standard reference number

Title

49 CFR, Parts 192.281(e) &
192.283 (b)

Transportation of Natural and Other Gas by
Pipeline: Minimum Federal Safety
Standards

Federal Emergency Management Agency
500 C Street, SW
Washington, DC 20472

FEMA

Standard reference number

Title

TB-2—08

Flood Damage-Resistant Materials Requirements

FIA-TB-11—01

Crawlspace Construction for Buildings Located in Special
Flood Hazard Area

Factory Mutual Global Research Standards Laboratories
Department 1301 Atwood Avenue, P. O. Box 7500
Johnson, RI 02919

FM

Standard reference number

Title

4450—(1989)

Approval Standard for Class 1 Insulated Steel Deck
Roofs—with Supplements through July 1992

4880—(2010)

American National Standard for Evaluating Insulated Wall
or Wall and Roof/Ceiling Assemblies, Plastic Interior
Finish Materials, Plastic Exterior Building Panels,

Wall/Ceiling Coating Systems, Interior or Exterior Finish
Systems

Gypsum Association
810 First Street, Northeast, Suite 510
Washington, DC 20002-4268

GA

**Standard
reference
number**

Title

GA-253—07

Application of Gypsum Sheathing

Hardwood Plywood & Veneer Association
1825 Michael Faraday Drive
Reston, Virginia 20190-5350

HPVA

**Standard
reference
number**

Title

HP-1—2009

The American National Standard for Hardwood and
Decorative Plywood

International Code Council, Inc.
500 New Jersey Avenue, NW 6th Floor
Washington, DC 20001

ICC

**Standard
reference
number**

Title

ICC/ANSI A117.1 - 09

Accessible and Usable Buildings and Facilities

ICC 400 - 07

Standard on the Design and Construction of Log
Structures

ICC 500 - 08

ICC/NSSA Standard on the Design and
Construction of Storm Shelters

ICC 600 - 08

Standard for Residential Construction in High Wind
Regions

IEBC-09

International Existing Buildings Code

IECC - 09	International Energy Conservation Code (<i>adoption includes only section 101 of chapter 1 and chapters 2 through 6</i>)
IFGC - 09	International Fuel Gas Code (<i>including ICC Emergency Amendment changing section 406.7</i>)

International Organization for Standardization
1, ch. de la Voie -Creuse Case postale 56 CH-1211
Geneva 20, Switzerland

ISO

**Standard
reference
number**

Title

15874—03

Polypropylene Plastic Piping Systems for Hot and Cold Water Installations

Manufacturers Standardization Society of the Valve and Fittings Industry
127 Park Street, Northeast
Vienna, VA 22180

MSS

**Standard
reference
number**

Title

SP-58—09

Pipe Hangers and Supports—Materials, Design and Manufacture

North American Insulation Manufacturers Association
44 Canal Center Plaza, Suite 310
Alexandria, VA 22314

NAIMA

**Standard
reference
number**

Title

AH 116—02

Fibrous Glass Duct Construction Standards, Fifth Edition

National Concrete Masonry Association
13750 Sunrise Valley Drive
Herndon, VA 20171-4662

**NCMA
Standard
reference
number**

TR 68-A—75

Title

Design and Construction of Plain and Reinforced Concrete Masonry and Basement and Foundation Walls

National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02269

**NFPA
Standard
reference
number**

13—10

Title

Installation of Sprinkler Systems (*including TIA 10-2*)

13D—10

Standard for the Installation of Sprinkler Systems in One- and Two-family Dwellings and Manufactured Homes (*including TIA 10-2*)

13R-10

Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height (including TIA 10-2)

31—06

Installation of Oil-burning Equipment

58—11

Liquefied Petroleum Gas Code

70—11

National Electrical Code (*including TIA 11-1*)

72—10

National Fire Alarm *and Signaling* Code

85—07

Boiler and Construction Systems Hazards Code

211—10

Chimneys, Fireplaces, Vents and Solid Fuel Burning Appliances

259—08

Test Method for Potential Heat of Building Materials

286—06

Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth

501—05

Standard on Manufactured Housing

853—10

Standard for the Installation of Stationary Fuel Cell Power Systems

National Fenestration Rating Council Inc.
8484 Georgia Avenue, Suite 320
Silver Spring, MD 20910

**NFRC
Standard
reference
number**

100—10

200—10

400—10

Title

Procedure for Determining Fenestration Product U-factors

Procedure for Determining Fenestration Product Solar Heat Gain Coefficients and Visible Transmittance at Normal Incidence

Procedure for Determining Fenestration Product Air Leakage

Portland Cement Association
5420 Old Orchard Road
Skokie, IL 60077

**PCA
Standard
reference
number**

100—07

Title

Prescriptive Design of Exterior Concrete Walls for One- and Two-family Dwellings (Pub. No. EB241)

Sheet Metal & Air Conditioning Contractors National Assoc. Inc.
4021 Lafayette Center Road
Chantilly, VA 22021

**SMACNA
Standard
reference
number**

SMACNA—03

Title

Fibrous Glass Duct Construction Standards (2003)

The Masonry Society
3970 Broadway, Suite 201-D
Boulder, CO 80304

**TMS
Standard
reference
number**

Title

302—07	Standard Method for Determining the Sound Transmission Class Rating for Masonry Walls
402—08	Building Code Requirements for Masonry Structures
602—08	Specification for Masonry Structures

Truss Plate Institute
583 D'Onofrio Drive, Suite 200
Madison, WI 53719

TPI

Standard reference number

Title

TPI 1—2007	National Design Standard for Metal-plate-connected Wood Truss Construction
------------	--

Underwriters Laboratories, Inc.
333 Pfingsten Road
Northbrook, IL 60062

UL

Standard reference number

Title

17—08	Vent or Chimney Connector Dampers for Oil-fired Appliances
58—96	Steel Underground Tanks for Flammable and Combustible Liquids—with Revisions through July 1998
80—07	Steel Tanks for Oil-burner Fuel
103—10	Factory-built Chimneys for Residential Type and Building Heating Appliances
127—08	Factory-built Fireplaces
174—04	Household Electric Storage Tank Water Heaters—with Revisions through November 2005
181—05	Factory-made Air Ducts and Air Connectors
181A—05	Closure Systems for Use with Rigid Air Ducts and Air Connectors
181B—05	Closure Systems for Use with Flexible Air Ducts and Air Connectors
217—06	Single- and Multiple-station Smoke Alarms

263—03	Standards for Fire Test of Building Construction and Materials
325—02	Standard for Door, Drapery, Gate, Louver and Window Operations and Systems—with Revisions through February 2006
343—08	Pumps for Oil-burning Appliances
441—10	Gas Vents
508—99	Industrial Control Equipment—with Revisions through July 2005
536—97	Flexible Metallic Hose—with Revisions through June 2003
641—95	Type L, Low-temperature Venting Systems—with Revisions through August 2005
651—05	Schedule 40 and Schedule 80 Rigid PVC Conduit and Fittings
723—08	Standard for Test for Surface Burning Characteristics of Building Materials
726—95	Oil-fired Boiler Assemblies—with Revisions through March 2006
727—06	Oil-fired Central Furnaces
729—03	Oil-fired Floor Furnaces
730—03	Oil-fired Wall Furnaces
732—95	Oil-fired Storage Tank Water Heaters
737—07	Fireplaces Stoves
790—04	Standard Test Methods for Fire Tests of Roof Coverings
795—06	Commercial-industrial Gas Heating Equipment.
834—04	Heating, Water Supply and Power Boilers-Electric
896—93	Oil-burning Stoves—with Revisions through May 2004
923—08	Microwave Cooking Appliances-
959—01	Medium Heat Appliance Factory-built Chimneys—with Revisions through September 2006
1040—96	Fire Test of Insulated Wall Construction—with Revisions through June 2001
1256—02	Fire Test of Roof Deck Construction.
1261—01	Electric Water Heaters for Pools and Tubs—with Revisions through June 2004
1453—04	Electronic Booster and Commercial Storage Tank Water Heaters
1479—03	Fire Tests of Through-penetration Firestops
1482—10	Solid-fuel-type Room Heaters
1715—97	Fire Test of Interior Finish Material—with Revisions through March 2004

1738—10	Venting Systems for Gas-burning Appliances, Categories II, III and IV
1777—07	Standard for Chimney Liners
1995—05	Heating and Cooling Equipment.
2017—08	Standard for General-purpose Signaling Devices and Systems—with Revisions through June 2004
2034—08	Standard for Single- and Multiple-station Carbon Monoxide Alarms.
2158A—10	Outline of Investigation for Clothes Dryer Transition Duct

Underwriters' Laboratories of Canada
7 Underwriters Road Toronto,
Ontario, Canada M1R 3B4

ULC

Standard reference number

Title

CAN/ULC S 102—10	Standard Methods for Test for Surface Burning Characteristics of Building Materials and Assemblies
------------------	--

United States - Federal Trade Commission
600 Pennsylvania Avenue NW
Washington, DC 20580

US-FTC

Standard reference number

Title

CFR Title 16 Part 460	R-value Rule
-----------------------	--------------

Window & Door Manufacturers Association
1400 East Touhy Avenue, Suite 470
Des Plaines, IL 60018

WDMA

Standard reference number

Title

AAMA/WDMA/CSA	
---------------	--

101/I.S2/A440—08

Specifications for Windows, Doors and Skylights

Effective: 07/01/2014

R.C. 119.032 review dates: 01/01/2018

CERTIFIED ELECTRONICALLY

Certification

04/14/2014

Date

Promulgated Under: 119.03
Statutory Authority: 3781.10(A), 4104.43(A)(1)
Rule Amplifies: 3781.01, 3781.06, 3781.10, 3781.11, 3791.04, 4740.14
Prior Effective Dates: 5/27/06, 1/1/08, 3/31/08(Emer.), 6/24/08, 1/1/09,
1/1/13