# 2021 IRC - Plan Review

## Shums Coda Associates, Inc.

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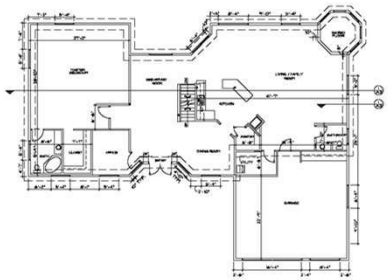
## Class Summary

- Plan Review Techniques
  - Personal Preparation
  - Tools/Equipment
  - Building
- Based on single family dwelling & townhouse review
- Basic light-frame wood construction
- Based on 2021 IRC
- Not a code introductory class



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## Professionalism

- Professional manner
- Courteous
- Prompt
- Good frame of mind
- Refrain from criticism
- Work to limit complaints

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## Develop a Reputation

- Tough
- Knowledgeable
- Fair
- Reasonable
- Understands construction

- A jerk
- Hard to work with
- Unreasonable
- Arrogant
- Doesn't know the code
- #&*@$@&#%

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## Public Relations

- Homeowners
  - Be patient
  - Expect to spend more time
  - Use opportunity to educate person about codes

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## Tools/Equipment

- Drafting Table
- Calculator
- Architect/Engineer Scale
- Red Pen
- Highlighters
- Sticky Notes
- Straight edge

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## Tools/Equipment

- Code Book!
- Reference Standards
- Resource Documents

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## Review Comments

- Succinct
- Adequately address problem
- Accurate
- Refer to sheet
- Refer to code section

B-2 The construction documents are not of sufficient clarity to determine code compliance. Please provide additional details to show compliance in the following areas (Section R106.1.1):

a. Flashing details for windows and copings (siding to stone). This applies Bowen designs. Eckalizzi have adequate details.
b. Wall water resistive barriers – need detailed section with opening flashing details. This applies Bowen designs. Eckalizzi have adequate details.
c. Stucco application information. 3 coat per R703.6? Other method that will require an ICC Evaluation Services ER Report? What type of paper and lath installation will be used?
d. Stair tread detail showing required nosing for treads with a depth of less than 11". This should also show closed risers (or those designed such that a 4" diameter sphere cannot pass through).
e. Plan locations and methodology for braced wall lines (IRC R602.10). I also need to know what alternate bracing method is intended to be employed at locations such as the garage wall containing the vehicle access door (and any other walls that contain braced lengths that are less than 4' in length). Provide locations of interior braced wall lines (houses exceed 35' in length). If the provisions of 602.10.5 are being employed, please provide details to address the wall panel lengths in relation to adjacent window and door openings (Table R602.10.5).
f. Update window schedules for all windows indicated. Some missing windows required safety glazing, etc.
g. Electrical plans should be updated for AFCI and revised GFCI requirements.
h. Ventilation details are lacking. The only reference to ventilation is the upper ridge vent. Are soffit vents intended to take advantage of the 1:300 exception? Please provide ventilation details for shed roof assemblies such as the ones indicated at A9 for 2369 Hecla.
i. Some of the submitted ResCheck compliance worksheets indicate that the 2000 IECC was used. These should be updated to the 2003 IRC or IECC. Go on-line to www.energycodes.gov and download a new version and provide revised compliance data.

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## Sample Comments

- The garage must comply with Section 309.
- The door between the garage and dwelling unit must be a minimum 1 3/8 inch thick solid wood, solid or honeycomb core steel door not less than 13/8 inches thick, or 20-minute fire-rated doors. (Section 309.1)

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## Sample Comments

- The stairs do not comply.
- Refer to sheet A-5. The minimum tread depth of the stairs are required to be 10 inches per Section R311.5.3.2

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## Sample Comments

- Construction, projections, openings and penetrations of exterior walls of dwellings and accessory buildings shall comply with Table R302.1. These provisions shall not apply to walls, projections, openings or penetrations in walls that are perpendicular to the line used to determine the fire separation distance. Projections beyond the exterior wall shall not extend more than 12 inches (305 mm) into the areas where openings are prohibited.

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## Sample Comments

- The east wall of the dwelling is located 4 feet from the property line and therefore must be a minimum one-hour fire-resistance rated construction. Please provide details of the construction of the wall to show that that the wall meets this requirement.

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## Submittal Documents R106.1

- Construction documents and other data shall be submitted in one or more sets with each application for a permit.
- The construction documents shall be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed.

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## Submittal Documents 106.1

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

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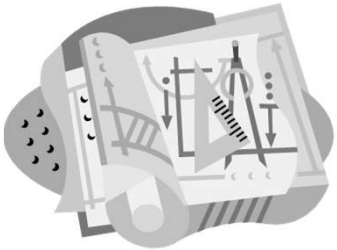
## Information On Construction Documents - 106.1.1

- Construction documents shall be of sufficient clarity to indicate the location, nature and extent of the work proposed and show in detail that it will conform to the provisions of this code and relevant laws, ordinances, rules and regulations, as determined by the building official.
- Drawn on Suitable material.
- Electronic media permitted when approved.



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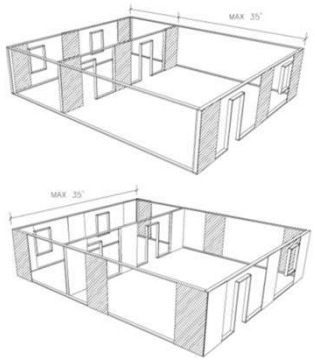
# R106.1.3 Braced Wall Lines

- Requirement for providing locations of braced wall lines and bracing elements
- IF required by the building official

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# Design Criteria Table R301.2(1)

TABLE R301.2
CLIMATIC AND GEOGRAPHIC DESIGN CRITERIA

| GROUND SNOW LOAD[a] | WIND DESIGN | | | | SEISMIC DESIGN CATEGORY[f] | SUBJECT TO DAMAGE FROM | | | ICE BARRIER UNDERLAYMENT REQUIRED[h] | FLOOD HAZARDS[g] | AIR FREEZING INDEX[i] | MEAN ANNUAL TEMP[j] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Speed[d] (mph) | Topographic effects[k] | Special wind region[l] | Windborne debris zone[m] | | Weathering[a] | Frost line depth[b] | Termite[c] | | | | |
| — | — | — | — | — | — | — | — | — | — | — | — | — |
| MANUAL J DESIGN CRITERIA[n] | | | | | | | | | | | | |
| Elevation | | Altitude correction factor[e] | Coincident wet bulb | Indoor winter design dry-bulb temperature | | Indoor winter design dry-bulb temperature | | | Outdoor winter design dry-bulb temperature | | Heating temperature difference | |
| — | | — | — | — | | — | | | — | | — | |
| Latitude | | Daily range | Indoor summer design relative humidity | Summer design gains | | Indoor summer design dry-bulb temperature | | | Outdoor summer design dry-bulb temperature | | Cooling temperature difference | |
| — | | — | — | — | | — | | | — | | — | |

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# Plan Review Process

- Develop personal/department style
  - Checklist
  - Page by page
  - Computer Programs
  - Other styles?

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# Review Process

- Site Plan
- Floor Plan
- Elevations
- Details
- Structural
- Mechanical
- Plumbing
- Electrical

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# Site Plan Review

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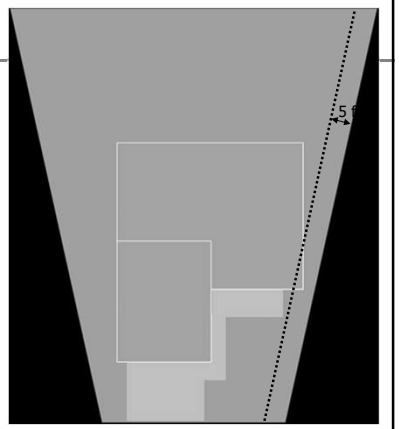
# R302.1 Exterior walls

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

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# Location on Lot

TABLE R302.1(2)
EXTERIOR WALLS—DWELLINGS WITH FIRE SPRINKLERS

| EXTERIOR WALL ELEMENT | | MINIMUM FIRE-RESISTANCE RATING | MINIMUM FIRE SEPARATION DISTANCE |
|---|---|---|---|
| Walls | Fire-resistance rated | 1 hour—tested in accordance with ASTM E119, UL 263 or Section 703.3 of the *International Building Code* with exposure from the outside | 0 feet |
| | Not fire-resistance rated | 0 hours | 3 feet[a] |
| Projections | Not allowed | NA | < 2 feet |
| | Fire-resistance rated | 1 hour on the underside, or heavy timber, or fire-retardant-treated wood[b, c] | 2 feet[a] |
| | Not fire-resistance rated | 0 hours | 3 feet |
| Openings in walls | Not allowed | NA | < 3 feet |
| | Unlimited | 0 hours | 3 feet[a] |
| Penetrations | All | Comply with Section R302.4 | < 3 feet |
| | | None required | 3 feet[a] |

For SI: 1 foot = 304.8 mm.
NA = Not Applicable.
a. For residential subdivisions where all dwellings are equipped throughout with an automatic sprinkler system installed in accordance with Section P2904, the fire separation distance for exterior walls not fire-resistance rated and for fire-resistance-rated projections shall be permitted to be reduced to 0 feet, and unlimited unprotected openings and penetrations shall be permitted, where the adjoining lot provides an open setback yard that is 6 feet or more in width on the opposite side of the property line.
b. The fire-resistance rating shall be permitted to be reduced to 0 hours on the underside of the eave overhang if fireblocking is provided from the wall top plate to the underside of the roof sheathing.
c. The fire-resistance rating shall be permitted to be reduced to 0 hours on the underside of the rake overhang where gable vent openings are not installed.

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# Application of R302.1

- "…shall not apply to walls, projections, openings, or penetrations in walls that are perpendicular to the line used to determine the FSD"

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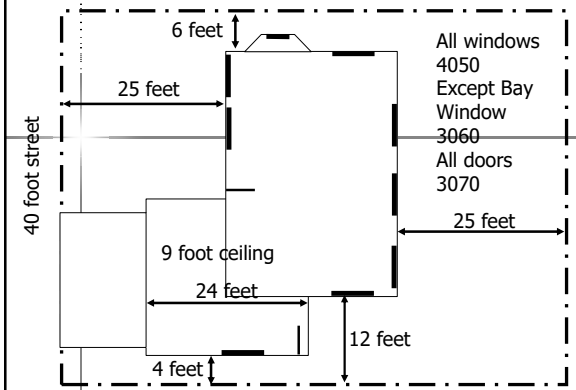


1. Evaluate the exterior wall requirements
2. Evaluate opening requirements
3. Evaluate projections
4. What is missing?

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## R302
## Fire Resistance Qualification

- All assemblies requiring fire resistance ratings are qualified by ASTM E119 or UL 263 or Section 703.3 of the IBC.

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## R302.2
## Townhouses

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

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## R302.2.1
## Double walls

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

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# R302.2.2
# Common walls

- Common walls separating townhouse units shall be assigned a fire-resistance rating in accordance with Item 1 or 2 and shall be rated for fire exposure from both sides.

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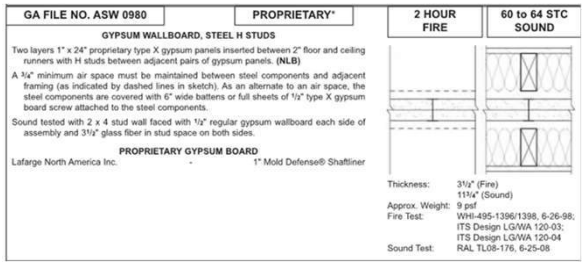
# R302.2.2
# Townhouse Common Wall

- Automatic Fire Sprinklers – 1-hour FRR
- No Fire Sprinklers – 2-hour FRR

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# R302.2.2
# Common walls

- Common walls shall extend to and be tight against the exterior sheathing of the exterior walls, or the inside face of exterior walls without stud cavities, and the underside of the roof sheathing.
- The common wall shared by two townhouse units shall be constructed without plumbing or mechanical equipment, ducts or vents, other than water-filled fire sprinkler piping in the cavity of the common wall.

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# Continuity
# R302.2.3

- Must be continuous from the foundation to the underside of the roof sheathing, deck or slab.
- Must extend the full length of the wall or assembly, including wall extensions through and separating attached enclosed accessory structures.

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# Parapet R302.2.4

- 1. Where roof surfaces adjacent to the wall or walls are at the same elevation, the parapet shall extend not less than 30 inches above the roof surfaces.

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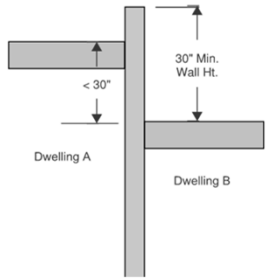
# Parapets R302.2.4

- 2. Where roof surfaces adjacent to the wall or walls are at different elevations and the higher roof is not more than 30 inches above the lower roof, the parapet shall extend not less than 30 inches above the lower roof surface.

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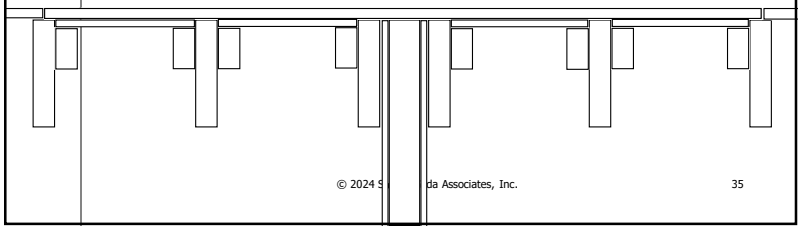
# Parapet R302.2.4, Item 2 Exc.

- A parapet is not required in previous two situations
  - Roof is covered with a minimum class C roof covering
  - Roof sheathing is noncombustible materials or approved fire-retardant-treated wood for a distance of 4 feet on each side of the wall or walls,
  - or one layer of 5 /8 -inch Type X gypsum board is installed directly beneath the roof sheathing for a distance of 4 feet on each side of the wall or walls.
  - No openings or penetrations within 4 feet of common walls.



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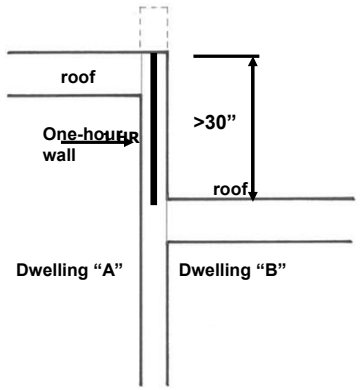
# Parapet R302.2.4

A parapet is not required:

- Different elevations and the higher roof is more than 30 inches above the lower roof.
- Common wall construction from the lower roof to the underside of the higher roof deck shall not have less than a 1-hour fire-resistive rating.

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## Parapet Construction R302.2.5

- Same fire resistance of supporting wall
- non-combustible faces at uppermost 18″
- >2:12 roof slope
  - extend to same height or roof 3′ away, not less than 30″

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## Structural Independence R302.2.6

- Each townhouse shall be structurally independent
- Exceptions:
  - foundations
  - roof & wall sheathing may fasten to common wall
  - nonstructural wall coverings
  - flashing
  - common 1- or 2-hour separation
  - Sprinklered townhouses



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## R302.3 Two-family dwellings

- Dwelling units in two-family dwellings shall be separated from each other by wall and floor assemblies having not less than a 1-hour fire-resistance rating where tested in accordance with ASTM E119, UL 263 or Section 703.2.2 of the International Building Code.
- Such separation shall be provided regardless of whether a lot line exists between the two dwelling units or not.

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## Dwelling Unit Separation R302.3

- Extend to and against exterior wall and to underside of roof sheathing
  - Exception: 1/2 hour permitted with NFPA 13 sprinkler system.
- Supporting construction same protection
- Exception:
  - 5/8″ ceiling, ½″ Support, Attic Draftstop

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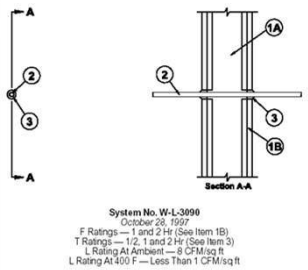
# Rated Penetrations R302.4




System No. W-L-3090
October 28, 1997
F Ratings — 1 and 2 Hr (See Item 1B)
T Ratings — 1/2, 1 and 2 Hr (See Item 3)
L Rating At Ambient — 6 CFM/sq ft
L Rating At 400 F — Less Than 1 CFM/sq ft

- Through penetrations of fire-resistance-rated assemblies
  - approved penetration fire stop system
  - F rating equal to separation rating
- Membrane penetrations
  - approved penetration fire stop system

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# Membrane Penetrations R302.4.2

- Recessed light fixtures to be installed so fire resistance not reduced
- Exceptions:
  - steel electrical boxes - total area not to exceed 100 sq. in. in 100 sq. ft.
  - separated from other boxes
    - 24" horizontally
    - Depth of wall cavity with insulation
    - Listed putty pads
    - Other listed materials & methods
  - rated nonmetallic boxes with above separations
  - sprinkler penetration with escutcheon

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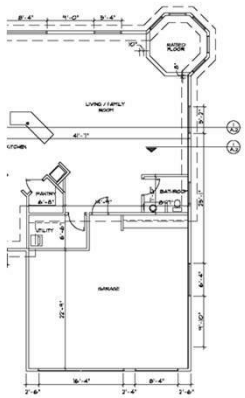
# Garages & Carports R302.5



- No openings into sleeping room
- Other openings
  - solid wood door 1 3/8"
  - honeycomb core steel door 1 3/8"
  - 20-minute fire-rated
  - Self-closing, Self-latching
- Ducts
  - 26 gauge or other approved material
- Penetrations through the separation required in Section R302.6 shall be protected by filling the opening around the penetrating item with approved material to resist the free passage of flame and products of combustion.

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# Separation Required R302.6

TABLE R302.6
DWELLING/GARAGE SEPARATION

| SEPARATION | MATERIAL |
|---|---|
| From the residence and attics | Not less than $^{1}/_{2}$-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 $^{1}/_{2}$-inch gypsum board or equivalent |
| Garages located less than 3 feet from a dwelling unit on the same lot | Not less than $^{1}/_{2}$-inch gypsum board or equivalent applied to the interior side of exterior walls that are within this area |

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## Under Stair Protection R302.7

- Enclosed space under stairs that is accessed by a door or access panel shall have walls, under-stair surface and any soffits protected on the enclosed side with 1/2-inch gypsum board.

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## R302.13 – Fire Protection of Floors

- Non FR floor assemblies:
- …shall be provided with
  - ½" Gypsum Board
  - 5/8" Wood Structural Panel
  - Or equivalent…
- …on the underside of the floor framing member

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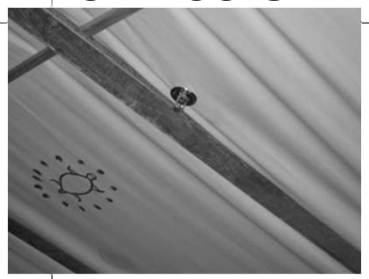
## R302.13 – Fire Protection of Floors



- Exception 1
- Floor assemblies located directly over a space protected by fire sprinklers
  - P2904
  - NFPA 13d

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## R302.13 – Fire Protection of Floors

- Exception 2
- Floor assemblies located directly over a crawl space not intended for storage or fuel-fired or electric-powered equipment

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## R302.13 – Fire Protection of Floors

- Exception 3
- Permits unprotected floor assemblies when:
  - 80sf area or less per story in aggregate
  - Fire blocking is provided in the cavity between the protected and unprotected portions

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## R302.13 – Fire Protection of Floors

- Exception 4
- Wood floor assemblies using 2x10 or greater dimension solid or composite lumber.
- Also permits testing for equivalency to these materials.

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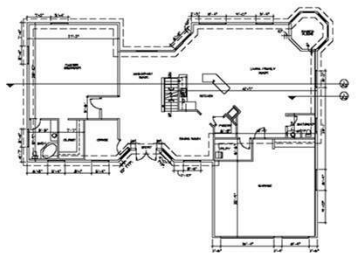
## Light, Ventilation & Heating R303

- Habitable Rooms
  - Aggregate glazing area of 8 percent of floor area of room
  - Natural ventilation via openings to the outdoor air shall be 4 percent of the floor area.



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## Bathrooms R303.3

- 3 square feet of glazing with 1/2 of window openable
- Exception:
  - artificial light & mechanical ventilation permitted
  - 50 cfm intermittent
  - 20 cfm continuous
  - exhausted outside



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# R303.7 Interior stairway illumination

- Interior stairways shall be provided with an artificial light source to illuminate the landings and treads. The light source shall be capable of illuminating treads and landings to levels of not less than 1 foot-candle as measured at the center of treads and landings. There shall be a wall switch at each floor level to control the light source where the stairway has six or more risers.

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# R303.8 Exterior stairway illumination

- Exterior stairways shall be provided with an artificial light source located at the top landing of the stairway.
- Exterior stairways providing access to a basement from the outdoor grade level shall be provided with an artificial light source located at the bottom landing of the stairway.

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# Required Heating R303.10

- Winter Design temperature is below 60 degrees F, dwelling shall be provided with heating facilities to maintain 68 degree F at a point 3 Ft. above floor and 2 Ft. from exterior wall

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# Minimum Room Areas R304


- Habitable rooms minimum 70 square feet
- Minimum 7 feet horizontal dimension
  - Exception: Kitchens
- Portions of a room with a sloping ceiling measuring less than 5 feet or a furred ceiling measuring less than 7 feet from the finished floor to the finished ceiling shall not be considered as contributing to the minimum required habitable area for that room.

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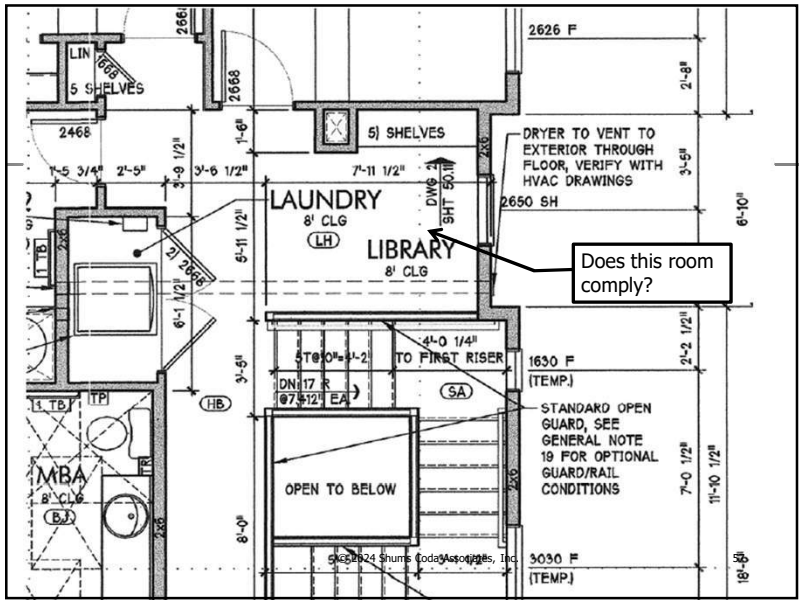


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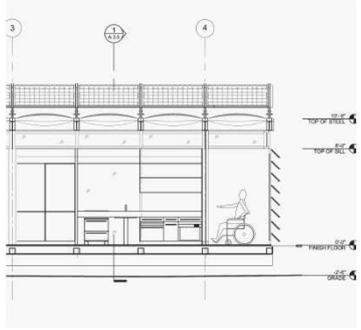
# Ceiling Height R305

- 7 Feet
  - Habitable rooms
  - hallways
  - corridors
  - bathrooms
  - toilet rooms
  - laundry rooms
  - basements
- measured to lowest projection



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# SECTION R306 SANITATION

- Every dwelling unit shall be provided with a water closet, lavatory, and a bathtub or shower.
- Each dwelling unit shall be provided with a kitchen area and every kitchen area shall be provided with a sink.

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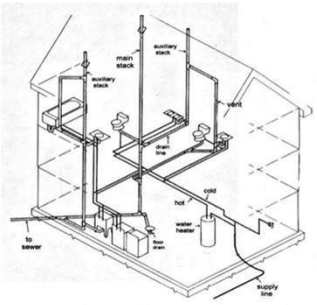
# SECTION R306 SANITATION

- Plumbing fixtures shall be connected to a sanitary sewer or to an approved private sewage disposal system.
- 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.



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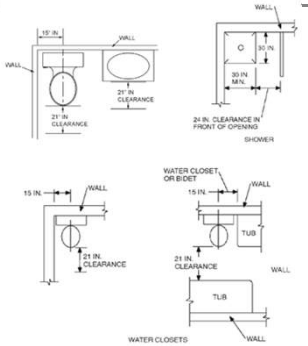
## Minimum Fixture Clearances Figure R307.1

- Fixtures shall be spaced in accordance with Figure R307.1, and in accordance with the requirements of Section P2705.1.

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## Safety Glazing Hazardous Locations - R308.4

- Side hinged doors except jalousies
- Sliding glass doors and panels in sliding & bifold closet door assemblies
- Storm doors
- Unframed swinging doors

Exceptions

- Openings in doors through which a 3-inch sphere is unable to pass.
- Decorative glass in side hinged doors

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## R308.4.2 Glazing adjacent to doors

- Glazing in an individual fixed or operable panel adjacent to a door shall be considered to be a hazardous location where the bottom exposed edge of the glazing is less than 60 inches above the floor or walking surface and it meets either of the following conditions:

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## R308.4.2 Glazing adjacent to doors

- 1. Where the glazing is within 24 inches of either side of the door in the plane of the door in a closed position.

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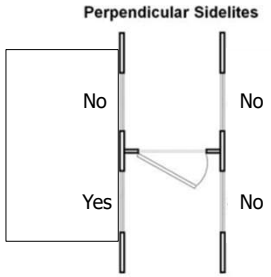
## R308.4.2 Glazing adjacent to doors

- 2.Where the glazing is on a wall less than 180 degrees from the plane of the door in a closed position and within 24 inches of the hinge side of an in-swinging door.

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## Hazardous Locations R308.4.3

- Fixed or operable panel
  - > 9 square feet, and
  - < 18 inches above floor, and
  - top edge >36 inches above floor, and
  - walking surface within 36 inches

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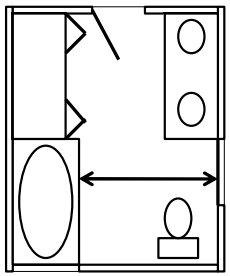
66

## R308.4.5 – Glazing and Wet Surfaces

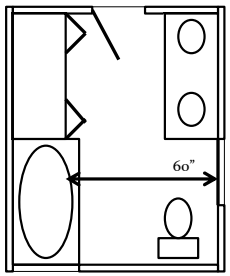


- Glazing in walls, enclosures, or fences containing OR FACING:
- Bathtubs
- Showers
- Whirlpools, saunas, steam rooms, indoor and outdoor pools
- Shall be safety glazing is less than 60”AFF

 67

67

## R308.4.5 – Glazing and Wet Surfaces




- Exception:
- “Glazing that is more than 60” measured horizontally and in a straight line from the water’s edge of a bathtub, hot tub, spa, whirlpool, or swimming pool.”
- Shower is NOT similarly exempted.

 68

68

## R308.4.6 – Glazing Adjacent to Stairs and Ramps

- Glazing where the bottom exposed edge of the glazing is less than 36 inches above the plane of the adjacent walking surface of stairways, landings between flights of stairs and ramps shall be considered a hazardous location.

 69

69

## R308.4.7 Glazing adjacent to the bottom stair landing

- Glazing adjacent to the landing at the bottom of a stairway where the glazing is less than 36 inches above the landing and within a 60-inch horizontal arc less than 180 degrees from the bottom tread nosing shall be considered to be a hazardous location.

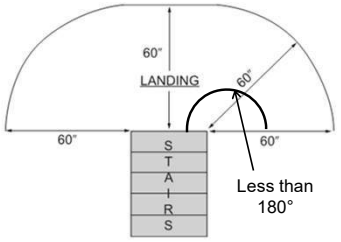



FIGURE R308.4.7
PROHIBITED GLAZING LOCATIONS AT BOTTOM STAIR LANDINGS

 70

70

## Garages & Carports R309

- 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.

 71

71

## R310.1 - Emergency escape and rescue opening required

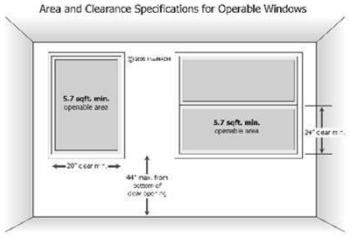
- Basements, habitable attics and every sleeping room shall have not less than one operable emergency escape and rescue opening.
- Where basements contain one or more sleeping rooms, an emergency escape and rescue opening shall be required in each sleeping room.
- Emergency escape and rescue openings shall open directly into a public way, or to a yard or court having a minimum width of 36 inches that opens to a public way.

 72

72

# R310.2.1
# EERO Minimum size

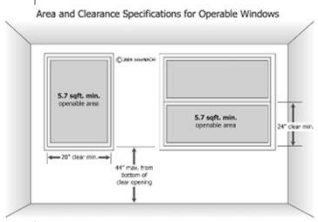
- Emergency escape and rescue openings shall have a net clear opening of not less than 5.7 square feet.
  - Exception: The minimum net clear opening for grade-floor emergency escape and rescue openings shall be 5 square feet




 73

73

# R310.2.2
# Minimum dimensions




- The minimum net clear opening height dimension shall be 24 inches.
- The minimum net clear opening width dimension shall be 20 inches.
- The net clear opening dimensions shall be the result of normal operation of the opening.

 74

74

# R310.2.3
# Maximum height from floor

- Emergency escape and rescue openings shall have the bottom of the **clear opening** not greater than 44 inches above the floor.

 75

75

## R310.2.4 - Emergency escape and rescue openings under decks, porches and cantilevers

- Emergency escape and rescue openings installed under decks, porches and cantilevers shall be fully openable and provide a path not less than 36 inches in height and 36 inches in width to a yard or court.

 76

76

# R310.4
# Area wells

- An emergency escape and rescue opening where the bottom of the clear opening is below the adjacent grade shall be provided with an area well in accordance with Sections R310.4.1 through R310.4.4.

 77

77

# R310.4.1
# Minimum size

- The horizontal area of the area well shall be not less than 9 square feet, with a horizontal projection and width of not less than 36 inches.
- The size of the area well shall allow the emergency escape and rescue opening to be fully opened.
  - Exception: The ladder or steps required by Section R310.4.2 shall be permitted to encroach not more than 6 inches into the required dimensions of the area well.

 78

78

# R310.4.2
# Ladder and steps

- Area wells with a vertical depth greater than 44 inches shall be equipped with an approved, permanently affixed ladder or steps.
- The ladder or steps shall not be obstructed by the emergency escape and rescue opening where the window or door is in the open position.
- Ladders or steps required by this section shall not be required to comply with Section R311.7.

 79

79

# R310.4.3
# Drainage

- Area wells shall be designed for proper drainage by connecting to the building's foundation drainage system required by Section R405.1.
  - Exception: A drainage system for area wells is not required where the foundation is on well-drained soil or sand-gravel mixture soils in accordance with the United Soil Classification System, Group I Soils, as detailed in Table R405.1.

 80

80

# R311.1
# Means of Egress

- Dwellings shall be provided with a means of egress as provided in this section.
- Must 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 going through a garage.

 81

81

# R311.2
# Egress door

- Not less than one exit door shall be provided for each dwelling unit.

 82

82

# R311.2
# Egress door

- The egress door shall be side-hinged, and shall provide a clear width of not less than 32 inches where measured between the face of the door and the stop, with the door open 90 degrees.
- The clear height of the door opening shall be not less than 78 inches 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.

 83

83

# R311.2
# Egress door

- Egress doors shall be readily openable from inside the dwelling without the use of a key or special knowledge or effort.

 84

84

## Floors and Landings at EXTERIOR Doors - R311.3

- There shall be a floor or landing on each side of each exterior door.

 85

85

## Floors and Landings at EXTERIOR Doors - R311.3

- The width of each landing shall not be less than the door served.
- Every landing shall have a minimum dimension of 36 inches measured in the direction of travel.


 86

86

## R311.3.1 Floor Elevation at REQUIRED EGRESS Doors

- Landings or finished floors at the required egress door shall not be more than 11/2 inches lower than the top of the threshold.

 87

87

## R311.3.1 Floor Elevation at REQUIRED EGRESS Doors

- The exterior landing at an exterior doorway shall not be more than 7¾ inches below the top of the threshold, provided the door, other than an exterior storm or screen door does not swing over the landing.

 88

88

## R311.3.1 Floor Elevation at REQUIRED EGRESS Doors

- 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 or a stairway.

 89

89

## Floor Elevations for OTHER Doors - R311.3.2

- Doors other than the required egress door shall be provided with landings or floors not more than 7 3/4 inches below the top of the threshold.

 90

90

## Floor Elevations for OTHER Doors - R311.3.2

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.

 91

91

## Hallways R311.6

- The minimum width of a hallway shall be not less than 3 feet.

 92

92

# R311.7 Stairways

- Where required by this code or provided, stairways shall comply with this section.
  - Exceptions:
  - 1. Stairways not within or serving a building, porch or deck.
  - 2. Stairways leading to nonhabitable attics.
  - 3. Stairways leading to crawl spaces.

 93

93

# Stairway Width R311.7.1


- 36 inches minimum width
  - above handrail
  - below headroom height
  - handrails permitted to project 4 1/2 inches on either side
- 31.5 inches minimum width
  - below one handrail
- 27 inches minimum width
  - below two handrails

 94

94

# Stairway Headroom R311.7.2

- Minimum 6′ 8″ headroom measured vertically from the sloped plane adjoining the tread nosing or from the floor surface of the landing or platform

 95

95

# Vertical Rise 311.7.3

- A flight of stairs shall not have a vertical rise greater than 12 feet 7 inches between floor levels or landings

 96

96

# R311.7.5.1 Risers

- The riser height shall be not more than 7¾ inches.
- 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 3/8 inch

 97

97

# R311.7.5.1 Risers

- Risers shall be vertical or sloped from the underside of the nosing of the tread above at an angle not more than 30 degrees from the vertical.
- Open risers are permitted provided that the openings located more than 30 inches, as measured vertically, to the floor or grade below do not permit the passage of a 4-inch-diameter sphere.

 98

98

# R311.7.5.2 Treads

- Minimum tread 10”
- leading edges of the foremost projection of adjacent tread’s leading edge
- greatest tread depth within any flight of stairs shall not exceed the smallest by more than 3/8 inch.

 99

99

# R311.7.5.2.1 Winder treads

- Minimum tread depth of 10 inches measured between the vertical planes of the foremost projection of adjacent treads at the intersections with the walkline (12” from from the side where the winders are narrower).
- Minimum tread depth of 6 inches 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 3/8 inch.
- 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 3/8 inch of the rectangular tread depth.

 100

100

## Landings for Stairways R311.7.6

- Top and bottom of stairs
  - except interior where door does not swing over
- As wide as stair
- Minimum of 36” in direction of travel

 101

101

## Handrails R311.7.8

- Handrails shall be provided on not less than one side of each flight of stairs with four or more risers.
- 34” - 38” above tread
- Continuous full length of stairs from top riser to bottom riser in the same flight
  - newel posts permitted
- Ends returned or terminate at newel post or safety rail
  - use of volute, turnout or starting easing allowed at lowest tread
- 1.5 inch space at wall

 102

102

## Ramps R311.8

- Ramps serving egress door
  - Maximum slope 1:12
- Other Ramps
  - Maximum slop 1:8
- Unless “technically infeasible”

 103

103

## R312 Guards

- Guards shall be provided for those portions of open-sided walking surfaces, including stairs, ramps and landings, that are located more than 30 inches measured vertically to the floor or grade below at any point within 36 inches horizontally to the edge of the open side.
- Insect screening shall not be considered as a guard.

 104

104

# R312.1.2 Height


- 36 inches high measured vertically above the adjacent walking surface or the line connecting the nosings.
  - Exceptions:
  - 34" along the side of stairs.
  - Serving as a handrail can be 34-38 inches along stairs.

 105

105

# Guard Opening Limitations R312.1.3


- Intermediate rails or ornamental closures cannot allow passage of a sphere 4 inches in diameter.
  - Exceptions:
    - 6 inch sphere permitted at riser/tread triangle
    - 4 3/8" on sides of stair treads

 106

106

# R312.2.1 Window opening height

- In dwelling units, where the bottom of the clear opening of an operable window opening is located less than 24 inches above the finished floor and greater than 72 inches above the finished grade or other surface below on the exterior of the building, the operable window shall comply with one of the following:

 107

107

# R312.2.1 Window opening height

- 1. Operable window openings will not allow a 4-inch-diameter sphere to pass through where the openings are in their largest opened position.
- 2. Operable windows are provided with window opening control devices or fall prevention devices that comply with ASTM F2090.

 108

108

## R312.2.2 - Emergency escape and rescue openings

- Where an operable window serves as an emergency escape and rescue opening, a window opening control device or fall prevention device, after operation to release the control device or fall prevention device allowing the window to fully open, shall not reduce the net clear opening area of the window unit to less than the area required by Sections R310.2.1 and R310.2.2.

 109

109

## R313 Mandatory Sprinklers

- Required in:
  - One Family Dwellings
  - Two Family Dwellings
  - Townhouses
  - Exception: Additions and alterations to existing nonsprinkled structures

 110

110

## Smoke Alarms R314.3

- Smoke alarms required:
  - Each sleeping room
  - Outside of each separate sleeping area
  - Each additional story including basements & habitable attics but not including crawl spaces and uninhabitable attics

 11

111

## R314.3 Smoke alarm location

- Not less than 3 feet horizontally from the door or opening of a bathroom that contains a bathtub or shower unless this would prevent placement of a smoke alarm required by this section.

 112

112

# R314.3
# Smoke alarm location

- In the hallway and in the room open to the hallway in dwelling units where the ceiling height of a room open to a hallway serving bedrooms exceeds that of the hallway by 24 inches or more.

 113

113

## R314.3.1
## Installation near cooking appliances

- 1. Ionization not less than 20 feet.
- 2. Ionization with an alarm-silencing switch shall not be installed less than 10 feet.
- 3. Photoelectric not be installed less than 6 feet.

 114

114

## R314.3.1
## Installation near cooking appliances

- 4. Smoke alarms listed and marked "helps reduce cooking nuisance alarms" shall not be installed less than 6 feet horizontally from a permanently installed cooking appliance.


 115

115

# R314.4
# Interconnection

- Where more than one smoke alarm is required to be installed within an individual dwelling unit in accordance with Section R314.3, 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 wireless alarms are installed and all alarms sound upon activation of one alarm.

 116

116

# R315.2.1
# Carbon Monoxide Alarms

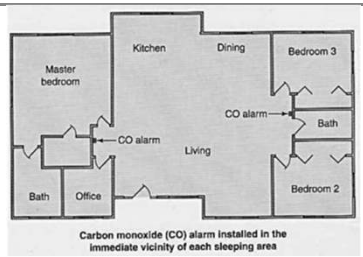
- For new construction, carbon monoxide alarms shall be provided in dwelling units where either or both of the following conditions exist.
  - 1. The dwelling unit contains a fuel-fired appliance.
  - 2. The dwelling unit has an attached garage with an opening that communicates with the dwelling unit.

 117

117

# R315.3 Location

- Carbon monoxide alarms in dwelling units shall be installed outside of each separate sleeping area in the immediate vicinity of the bedrooms.
- Where a fuel-burning appliance is located within a bedroom or its attached bathroom, a carbon monoxide alarm shall be installed within the bedroom.



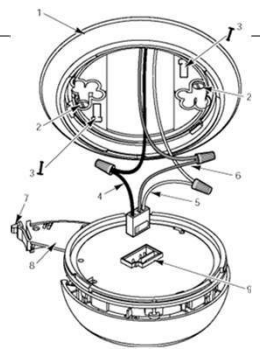
Carbon monoxide (CO) alarm installed in the immediate vicinity of each sleeping area

 118

118

# R315.5
# Power source

- Carbon monoxide alarms shall receive their primary power from the building wiring where such wiring is served from a commercial source and, where 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.



 119

119

# Foam Plastic
# R316

- Flame spread <75
- Smoke Development <450
- Thermal barrier required
  - 1/2 inch gypsum board mechanically fastened
  - 15 Minute E119 equivalent
    - adhesives prohibited



120

## Protection Against Decay R317.1

- Joists <18" to ground, beams <12" to ground
- All wood framing members on concrete/masonry exterior walls within 8" of exposed ground
- Sills/plates on concrete/masonry slab w/o impervious moisture barrier
- Girders entering masonry or concrete <1/2" air space

 121

121

## R317.1 Locations for Decay Protection

- Wood siding, sheathing and wall framing:
  - 6" from the ground
  - 2" from concrete steps and slabs and "similar horizontal surfaces"

 122

122

## Ground Contact R317.1.2

- 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



123

## Accessible Units R320

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

 124

124

## Flood Resistant Construction R322

- Buildings and structures constructed in flood hazard areas (including A or V Zones) as established in Table R301.2(1) shall be designed and constructed in accordance with the provisions contained in this section.
- Buildings and structures located in whole or in part in identified floodways shall be designed and constructed in accordance with ASCE 24.

 125

125

## R325 Mezzanines

- Mezzanines shall comply with Sections R325 through R325.5.

 126

126

## R326 Habitable attics

- Habitable attics shall comply with Sections R326.2 and R326.3.

 127

127

## FOUNDATIONS CHAPTER 4


128

128

# Drainage R401.3

- Diverted to a storm sewer conveyance or other approved point of collection.
- Drain away from foundation
- Grade shall fall 6” within first 10’
  - < 10’ drain or swale to ensure drainage away

 129

129

# Soils Tests R401.4

- Where quantifiable data created by accepted soil science methodologies indicate expansive soils, compressible soils, shifting soils or other questionable soil characteristics are likely to be present, the building official shall 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.



130

# Presumptive Load Bearing Values Table R401.4.1

- In lieu of test, Table R401.4.1 Load Bearing Values shall be assumed

TABLE R401.4.1
PRESUMPTIVE LOAD-BEARING VALUES OF FOUNDATION MATERIALS[a]

| CLASS OF MATERIAL | LOAD-BEARING PRESSURE (pounds per square foot) |
|---|---|
| Crystalline bedrock | 12,000 |
| Sedimentary and foliated rock | 4,000 |
| 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, silty clay, clayey silt, silt and sandy siltclay (CL, ML, MH and CH) | 1,500[b] |

 131

131

# Materials R402.2

- Concrete
  - Minimum compressive strength per table R402.2

TABLE R402.2
MINIMUM SPECIFIED COMPRESSIVE STRENGTH OF CONCRETE

| TYPE OR LOCATIONS 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] | 3,500[d,e] |

 132

132

# Footings
# R403

- All exterior walls shall be supported on continuous solid or fully grouted masonry or concrete footings, wood foundations, or other approved structural systems
- Sufficient design to accommodate all loads and to transmit the resulting loads to the soil
- Footings shall be supported on undisturbed natural soils or engineered fill.

 133

133

# R403.1.1
# Minimum footing size

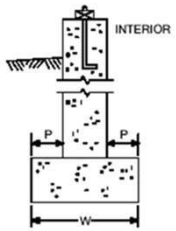
- The minimum width, W, and thickness, T, for concrete footings shall be in accordance with Tables R403.1(1) through R403.1(3) and Figure R403.1(1) or R403.1.3, as applicable, but not less than 12 inches in width and 6 inches in depth.
- The footing width shall be based on the load-bearing value of the soil in accordance with Table R401.4.1.

 134

134

# R403.1.1
# Minimum size

- Footing projections, P, shall be not less than 2 inches and shall not exceed the thickness of the footing.
- Footing thickness and projection for fireplaces shall be in accordance with Section R1001.2.
- The size of footings supporting piers and columns shall be based on the tributary load and allowable soil pressure in accordance with Table R401.4.1.




BASEMENT OR CRAWL SPACE WITH CONCRETE WALL AND SPREAD FOOTING

 135

135

# R403.1.1
# Minimum footing size

TABLE R403.1(1)
MINIMUM WIDTH AND THICKNESS FOR CONCRETE FOOTINGS FOR LIGHT-FRAME CONSTRUCTION (inches)[a, b, c, d]

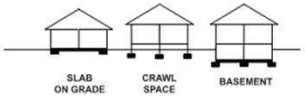
| GROUND SNOW LOAD OR ROOF LIVE LOAD | STORY AND TYPE OF STRUCTURE WITH LIGHT FRAME | LOAD-BEARING VALUE OF SOIL (psf) | | | | | |
|---|---|---|---|---|---|---|---|
| | | 1,500 | 2,000 | 2,500 | 3,000 | 3,500 | 4,000 |
| 20 psf roof live load or 25 psf ground snow load | 1 story—slab-on-grade | 12 × 6 | 12 × 6 | 12 × 6 | 12 × 6 | 12 × 6 | 12 × 6 |
| | 1 story—with crawl space | 12 × 6 | 12 × 6 | 12 × 6 | 12 × 6 | 12 × 6 | 12 × 6 |
| | 1 story—plus basement | 16 × 6 | 12 × 6 | 12 × 6 | 12 × 6 | 12 × 6 | 12 × 6 |
| | 2 story—slab-on-grade | 13 × 6 | 12 × 6 | 12 × 6 | 12 × 6 | 12 × 6 | 12 × 6 |
| | 2 story—with crawl space | 15 × 6 | 12 × 6 | 12 × 6 | 12 × 6 | 12 × 6 | 12 × 6 |
| | 2 story—plus basement | 19 × 6 | 14 × 6 | 12 × 6 | 12 × 6 | 12 × 6 | 12 × 6 |
| | 3 story—slab-on-grade | 16 × 6 | 12 × 6 | 12 × 6 | 12 × 6 | 12 × 6 | 12 × 6 |
| | 3 story—with crawl space | 18 × 6 | 14 × 6 | 12 × 6 | 12 × 6 | 12 × 6 | 12 × 6 |
| | 3 story—plus basement | 22 × 7 | 16 × 6 | 13 × 6 | 12 × 6 | 12 × 6 | 12 × 6 |
| 30 psf | 1 story—slab-on-grade | 12 × 6 | 12 × 6 | 12 × 6 | 12 × 6 | 12 × 6 | 12 × 6 |
| | 1 story—with crawl space | 13 × 6 | 12 × 6 | 12 × 6 | 12 × 6 | 12 × 6 | 12 × 6 |
| | 1 story—plus basement | 16 × 6 | 12 × 6 | 12 × 6 | 12 × 6 | 12 × 6 | 12 × 6 |
| | 2 story—slab-on-grade | 13 × 6 | 12 × 6 | 12 × 6 | 12 × 6 | 12 × 6 | 12 × 6 |
| | 2 story—with crawl space | 16 × 6 | 12 × 6 | 12 × 6 | 12 × 6 | 12 × 6 | 12 × 6 |
| | 2 story—plus basement | 19 × 6 | 14 × 6 | 12 × 6 | 12 × 6 | 12 × 6 | 12 × 6 |
| | 3 story—slab-on-grade | 16 × 6 | 14 × 6 | 12 × 6 | 12 × 6 | 12 × 6 | 12 × 6 |
| | 3 story—with crawl space | 19 × 6 | 14 × 6 | 12 × 6 | 12 × 6 | 12 × 6 | 12 × 6 |
| | 3 story—plus basement | 22 × 7 | 16 × 6 | 13 × 6 | 12 × 6 | 12 × 6 | 12 × 6 |

 136

136

# R403.1.1
# Minimum footing size

- Footnotes:
- a. Linear interpolation of footing width is permitted between the soil bearing pressures in the table. Extrapolation is not permitted.
- b. The table is based on the following conditions and loads: building width, 32 feet; wall height, 9 feet; basement wall height, 8 feet; dead loads, 15 psf roof and ceiling assembly, 10 psf floor assembly, 12 psf wall assembly; live loads, roof and ground snow loads as listed, 40 psf first floor, 30 psf second and third floors. Footing sizes are calculated assuming a clear span roof/ceiling assembly and an interior bearing wall or beam at each floor.




 137

137

# R403.1.1
# Minimum footing size

- c. Where the building width perpendicular to the wall footing is greater than 32 feet, the footing width shall be increased by 2 inches and footing depth shall be increased by 1 inch for every 4 feet of increase in building width.
- d. Where the building width perpendicular to the wall footing is less than 32 feet, a 2-inch decrease in footing width and 1-inch decrease in footing depth is permitted for every 4 feet of decrease in building width provided that the minimum width is 12 inches and minimum depth is 6 inches.

 138

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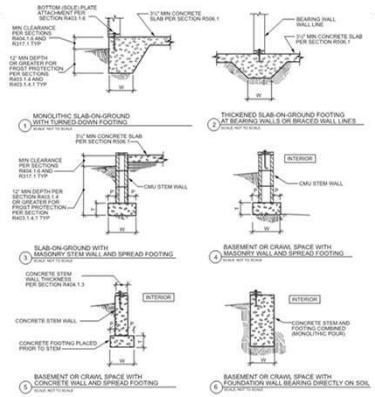
# Figure 403.1(1)
# SDC A, B &C




For SI: 1 inch = 25.4 mm.
W = Width of footing, T = Thickness of footing and P = Projection per Section R403.1.1

139

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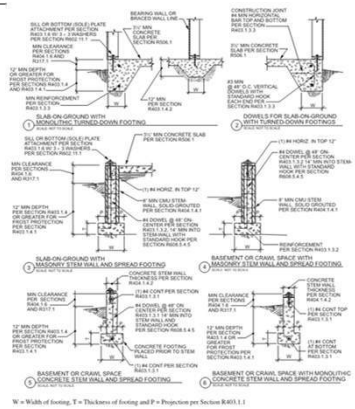
# Figure 403.1.3
# SDC D1, D2 & D3



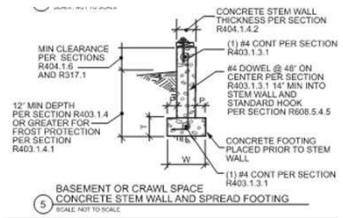

W = Width of footing, T = Thickness of footing and P = Projection per Section R403.1.1

140

140

# R403.1.3.1 - Concrete stem walls with concrete footings

- In Seismic Design Categories D0, D1 and D2 where a construction joint is created between a concrete footing and a concrete stem wall, not fewer than one No. 4 vertical bar shall be installed at not more than 4 feet on center.
- The vertical bar shall have a standard hook and extend to the bottom of the footing and shall have support and cover as specified in Section R403.1.3.5.3 and extend not less than 14 inches into the stem wall.
- Standard hooks shall comply with Section R608.5.4.5. Not fewer than one No. 4 horizontal bar shall be installed within 12 inches of the top of the stem wall and one No. 4 horizontal bar shall be located 3 to 4 inches from the bottom of the footing.




 141

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# R403.1.3.5 Reinforcement

- Footing and stem wall reinforcement shall comply with Sections R403.1.3.5.1 through R403.1.3.5.4.
  - ASTM A 615, A706, or A996
  - 40,000 psi (Grade 40)
  - Center of vertical reinforcement in stem walls shall be located at the centerline of the wall.

 142

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# Footing Minimum Depth R403.1.4

- Exterior footings shall be placed not less than 12 inches below the undisturbed ground surface.
- Where applicable, the depth of footings shall also conform to Section R403.1.4.1.
- Deck footings shall be in accordance with Section R507.3.

 143

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# Frost Protection R403.1.4.1

- 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:
  - Extend below the frost line
  - Frost Protected Shallow Foundations
  - Constructing per ASCE 32
  - Erected on solid rock

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## R403.1.4.1 Frost Protection

- Exceptions:
  - 600 sq. ft. light framed construction freestanding accessory structure, 10 feet eave height
  - 400 sq. ft. other than light framed, free standing accessory structure, 10 feet eave height

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## Footing Slope R403.1.5

- 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% slope).

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## Stepped Footings R403.1.5

- 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% slope).

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## R403.1.6 Foundation anchorage

- Wood sill plates and wood walls supported directly on continuous foundations shall be anchored to the foundation in accordance with this section.

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# Foundation Anchorage R403.1.6

- 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 on center.
- Bolts shall be at least 1/2 inch in diameter and shall extend a minimum of 7 inches into concrete or grouted cells of concrete masonry units.
- A nut and washer shall be tightened on each anchor bolt.

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# Foundation Anchorage R403.1.6

- There shall be a minimum of two bolts per plate section with one bolt located not more than 12 inches or less than seven bolt diameters from each end of the plate section.

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# Foundation Walls R404

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# R404.1.1 Design required

- Concrete or masonry foundation walls shall be designed in accordance with accepted engineering practice where either of the following conditions exists:
  - 1. Walls are subject to hydrostatic pressure from ground water.
  - 2. Walls supporting more than 48 inches of unbalanced backfill that do not have permanent lateral support at the top or bottom.

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# Concrete foundation walls R404.1.3

- 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 R611.2 shall be designed and constructed in accordance with the provisions of this section, ACI 318, ACI 332 or PCA 100.

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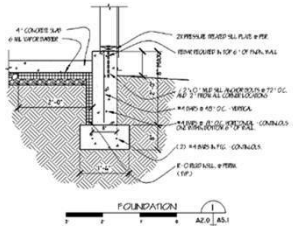
# Concrete foundation walls R404.1.3

- When ACI 318, ACI 332, PCA 100 or the provisions of this section are used to design concrete foundation walls, 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.

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# R404.1.3.1 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 R608.3.
- Other types of forming systems resulting in concrete walls not in compliance with this section and Table R608.3 shall be designed in accordance with ACI 318.

TABLE R608.3
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 |

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# R404.1.3.2 - 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 R404.1.2(1).

TABLE R404.1.2(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 |

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# R404.1.3.2 - Reinforcement for foundation walls

- Vertical reinforcement shall be provided in accordance with Tables R404.1.2(2), R404.1.2(3), R404.1.2(4), R404.1.2(5), R404.1.2(6), R404.1.2(7) or R404.1.2(8).

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TABLE R404.1.2(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 |

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TABLE R404.1.2(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 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 | | | |
| | | 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[j] | NR | NR | 4 @ 35 | NR[j] | 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[j] | NR |
| | 7 | 5 @ 46 | NR | NR | NR | 6 @ 42 | 5 @ 46 | NR[j] | 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[j] | NR | NR | 5 @ 43 | NR | NR | NR |
| | 6 | 4 @ 37 | NR[j] | NR | NR | 5 @ 37 | NR | NR | NR | 6 @ 37 | 5 @ 43 | NR[j] | NR |
| | 7 | 5 @ 40 | NR | NR | NR | 6 @ 37 | 5 @ 41 | NR[j] | NR | 6 @ 34 | 6 @ 43 | NR | NR |
| | 8 | 6 @ 43 | 5 @ 47 | NR[j] | 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[j] | NR | NR | 5 @ 40 | NR | NR | NR |
| | 6 | 4 @ 34 | NR[j] | NR | NR | 6 @ 48 | NR | NR | NR | 6 @ 36 | 6 @ 39 | NR[j] | NR |
| | 7 | 5 @ 36 | NR | NR | NR | 6 @ 34 | 5 @ 37 | NR | NR | 6 @ 33 | 6 @ 38 | 5 @ 37 | NR[j] |
| | 8 | 6 @ 38 | 5 @ 41 | NR[j] | NR | 6 @ 33 | 6 @ 38 | 5 @ 37 | NR[j] | 6 @ 24 | 6 @ 29 | 6 @ 39 | 4 @ 48[m] |
| | 9 | 6 @ 34 | 6 @ 46 | NR | NR | 6 @ 26 | 6 @ 30 | 6 @ 41 | NR | 6 @ 19 | 6 @ 23 | 6 @ 30 | 6 @ 39 |

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# R404.1.3.2 - Reinforcement for foundation walls

- Vertical reinforcement for flat basement walls retaining 4 feet or more of unbalanced backfill is permitted to be determined in accordance with Table R404.1.2(9).

TABLE R404.1.2(9)-continued
MINIMUM SPACING FOR ALTERNATE BAR SIZE AND/OR ALTERNATE GRADE OF STEEL[a, b, c]

| BAR SPACING FROM APPLICABLE TABLE IN SECTION R404.1.2.2 (inches) | BAR SIZE FROM APPLICABLE TABLE IN SECTION R404.1.2.2 | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | #4 | | | | | #5 | | | | | #6 | | | | |
| | Alternate bar size and/or alternate grade of steel desired to be used | | | | | | | | | | | | | | |
| | 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) | | | | | | | | | | | | | | |
| 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[z] | 31 | 48 | 21 | 32 | 45 | 22 | 34 | 15 | 23 | 32 |

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# R404.1.5.2 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.

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# R404.1.5.2 Concrete wall thickness

- 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 R404.1.2(8) and located in the wall as required by Section R404.1.3.3.7.2 where that table is used. Vertical reinforcement shall be based on the thickness of the thinner portion of the wall.

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# R404.1.6 - Height Above Finished Grade

- 4 inches for masonry veneer
- 6 inches elsewhere

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# R405.1 Foundation Drainage

- Drains shall be provided around 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 top of the footing or below the bottom of the slab and shall discharge by gravity or mechanical means into an approved drainage system.

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# R408.2 - Openings for under-floor ventilation

- Ventilation openings through foundation or exterior walls surrounding the under-floor space shall be provided in accordance with this section.
- The minimum net area of ventilation openings shall be not less than 1 square foot for each 150 square feet of under-floor area. One ventilation opening shall be within 3 feet of each external corner of the under-floor space.

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# R408.2 - Openings for under-floor ventilation

- Exceptions:
- 1. The total area of ventilation openings shall be permitted to be reduced to 1/1,500 of the under-floor area where the ground surface is covered with an approved Class I vapor retarder material.
- 2. Where the ground surface is covered with an approved Class 1 vapor retarder material, ventilation openings are not required to be within 3 feet of each external corner of the under-floor space provided that the openings are placed to provide cross ventilation of the space.

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# R408.3 Unvented crawl space

- For unvented under-floor spaces, the following items shall be provided:
  - 1. Exposed earth shall be covered with a continuous Class I vapor retarder. Joints of the vapor retarder shall overlap by 6 inches and shall be sealed or taped. The edges of the vapor retarder shall extend not less than 6 inches up the stem wall and shall be attached and sealed to the stem wall or insulation.

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# R408.3 Unvented crawl space

- 2. One of the following shall be provided for the under-floor space:
- 2.1.Continuously operated mechanical exhaust ventilation at a rate equal to 1 cubic foot per minute for each 50 square feet of crawl space floor area, including an air pathway to the common area (such as a duct or transfer grille), and perimeter walls insulated in accordance with Section N1102.2.10.1 of this code.
- 2.2. Conditioned air supply sized to deliver at a rate equal to 1 cubic foot per minute for each 50 square feet of under-floor area, including a return air pathway to the common area (such as a duct or transfer grille), and perimeter walls insulated in accordance with Section N1102.2.10.1 of this code.
- 2.3.Plenum in existing structures complying with Section M1601.5, if under-floor space is used as a plenum.
- 2.4.Dehumidification sized in accordance with manufacturer's specifications.

 168

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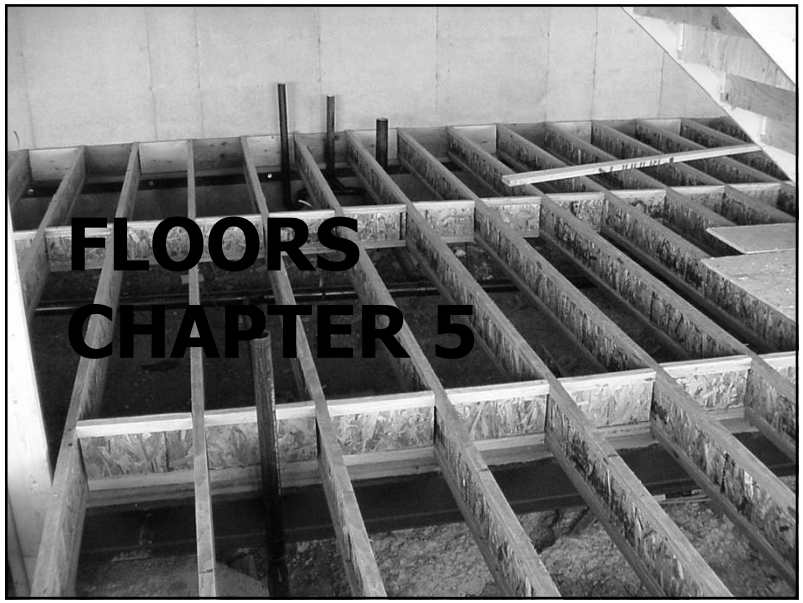


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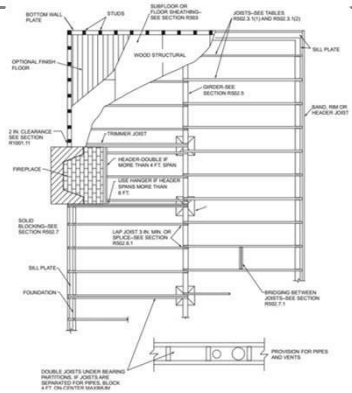
## R502.2
## Design and construction.

- Floors shall be designed and constructed in accordance with the provisions of this chapter, Figure R502.2 and Sections R317 and R318 or in accordance with ANSI AWC NDS.



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## Joist Span Tables
## Table R502.3.1(2)

TABLE R502.3.1(1)
FLOOR JOIST SPANS FOR COMMON LUMBER SPECIES
(Residential sleeping areas, live load = [illegible] L/Δ = 360)*

| JOIST SPACING (inches) | SPECIES AND GRADE | | DEAD LOAD = 10 psf | | | | DEAD LOAD = 20 psf | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2 × 6 | 2 × 8 | 2 × 10 | 2 × 12 | 2 × 6 | 2 × 8 | 2 × 10 | 2 × 12 |
| | | | Maximum floor joist spans | | | | | | | |
| | | | (ft. - in.) | (ft. - in.) | (ft. - in.) | (ft. - in.) | (ft. - in.) | (ft. - in.) | (ft. - in.) | (ft. - in.) |
| 12 | Douglas fir-larch | SS | 12-6 | 16-6 | 21-0 | 25-7 | 12-6 | 16-6 | 21-0 | 25-7 |
| | Douglas fir-larch | #1 | 12-0 | 15-10 | 20-3 | 24-8 | 12-0 | 15-7 | 19-0 | 22-0 |
| | Douglas fir-larch | #2 | 11-10 | 15-7 | 19-10 | 23-4 | 11-8 | 14-9 | 18-0 | 20-11 |
| | Douglas fir-larch | #3 | 9-11 | 12-7 | 15-5 | 17-10 | 8-11 | 11-3 | 13-9 | 16-0 |
| | Hem-fir | SS | 11-10 | 15-7 | 19-10 | 24-2 | 11-10 | 15-7 | 19-10 | 24-2 |
| | Hem-fir | #1 | 11-7 | 15-3 | 19-5 | 23-7 | 11-7 | 15-3 | 18-9 | 21-9 |
| | Hem-fir | #2 | 11-0 | 14-6 | 18-6 | 22-6 | 11-0 | 14-4 | 17-6 | 20-4 |
| | Hem-fir | #3 | 9-8 | 12-4 | 15-0 | 17-5 | 8-8 | 11-0 | 13-5 | 15-7 |
| | Southern pine | SS | 12-3 | 16-2 | 20-8 | 25-1 | 12-3 | 16-2 | 20-8 | 25-1 |
| | Southern pine | #1 | 11-10 | 15-7 | 19-10 | 24-2 | 11-10 | 15-7 | 18-7 | 22-0 |
| | Southern pine | #2 | 11-3 | 14-11 | 18-1 | 21-4 | 10-9 | 13-8 | 16-2 | 19-1 |
| | Southern pine | #3 | 9-2 | 11-6 | 14-0 | 16-6 | 8-2 | 10-3 | 12-6 | 14-9 |
| | Spruce-pine-fir | SS | 11-7 | 15-3 | 19-5 | 23-7 | 11-7 | 15-3 | 19-5 | 23-7 |
| | Spruce-pine-fir | #1 | 11-3 | 14-11 | 19-0 | 23-0 | 11-3 | 14-7 | 17-9 | 20-7 |
| | Spruce-pine-fir | #2 | 11-3 | 14-11 | 19-0 | 23-0 | 11-3 | 14-7 | 17-9 | 20-7 |
| | Spruce-pine-fir | #3 | 9-8 | 12-4 | 15-0 | 17-5 | 8-8 | 11-0 | 13-5 | 15-7 |

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## R502.3.2
## Other floor joists

- Table R502.3.1(2) shall be used to determine the maximum allowable span of floor joists that support other areas of the building, other than sleeping rooms and attics, provided that the design live load does not exceed 40 pounds per square foot and the design dead load does not exceed 20 pounds per square foot.

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TABLE R502.3.1(2)—continued
FLOOR JOIST SPANS FOR COMMON LUMBER SPECIES
(Residential living areas, live load = 40 psf, L/Δ = 360)[a]

| JOIST SPACING (inches) | SPECIES AND GRADE | | DEAD LOAD = 10 psf | | | | DEAD LOAD = 20 psf | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2 × 6 | 2 × 8 | 2 × 10 | 2 × 12 | 2 × 6 | 2 × 8 | 2 × 10 | 2 × 12 |
| | | | Maximum floor joist spans | | | | | | | |
| | | | (ft. - in.) | (ft. - in.) | (ft. - in.) | (ft. - in.) | (ft. - in.) | (ft. - in.) | (ft. - in.) | (ft. - in.) |
| 19.2 | Douglas fir-larch | SS | 9-8 | 12-10 | 16-4 | 19-10 | 9-8 | 12-10 | 16-4 | 19-6 |
| | Douglas fir-larch | #1 | 9-4 | 12-4 | 15-0 | 17-5 | 8-10 | 11-3 | 13-8 | 15-11 |
| | Douglas fir-larch | #2 | 9-2 | 11-8 | 14-3 | 16-6 | 8-5 | 10-8 | 13-0 | 15-1 |
| | Douglas fir-larch | #3 | 7-0 | 8-11 | 10-11 | 12-7 | 6-5 | 8-2 | 9-11 | 11-6 |
| | Hem-fir | SS | 9-2 | 12-1 | 15-5 | 18-9 | 9-2 | 12-1 | 15-5 | 18-9 |
| | Hem-fir | #1 | 9-0 | 11-10 | 14-10 | 17-2 | 8-9 | 11-1 | 13-6 | 15-8 |
| | Hem-fir | #2 | 8-7 | 11-3 | 13-10 | 16-1 | 8-2 | 10-4 | 12-8 | 14-8 |
| | Hem-fir | #3 | 6-10 | 8-8 | 10-7 | 12-4 | 6-3 | 7-11 | 9-8 | 11-3 |
| | Southern pine | SS | 9-6 | 12-7 | 16-0 | 19-6 | 9-6 | 12-7 | 16-0 | 19-6 |
| | Southern pine | #1 | 9-2 | 12-1 | 14-8 | 17-5 | 9-0 | 11-5 | 13-5 | 15-11 |
| | Southern pine | #2 | 8-6 | 10-10 | 12-10 | 15-1 | 7-9 | 9-10 | 11-8 | 13-9 |
| | Southern pine | #3 | 6-5 | 8-2 | 9-10 | 11-8 | 5-11 | 7-5 | 9-0 | 10-8 |
| | Spruce-pine-fir | SS | 9-0 | 11-10 | 15-1 | 18-4 | 9-0 | 11-10 | 15-1 | 17-9 |
| | Spruce-pine-fir | #1 | 8-9 | 11-6 | 14-1 | 16-3 | 8-3 | 10-6 | 12-10 | 14-10 |
| | Spruce-pine-fir | #2 | 8-9 | 11-6 | 14-1 | 16-3 | 8-3 | 10-6 | 12-10 | 14-10 |
| | Spruce-pine-fir | #3 | 6-10 | 8-8 | 10-7 | 12-4 | 6-3 | 7-11 | 9-8 | 11-3 |

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# Floor Cantilevers R502.3.3

- Floor cantilevers constructed in accordance with Table R502.3.3(1) shall be permitted when supporting a light-frame bearing wall and roof only.
- Floor cantilevers supporting an exterior balcony are permitted to be constructed in accordance with Table R502.3.3(2).

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# Floor Cantilevers R502.3.3

TABLE R502.3.3(1)
CANTILEVER SPANS FOR FLOOR JOISTS SUPPORTING LIGHT-FRAME EXTERIOR BEARING WALL AND ROOF ONLY[a, b, c, f, g, h]
(Floor Live Load ≤ 40 psf, Roof Live Load ≤ 20 psf)

| Member & Spacing | Maximum Cantilever Span (Uplift Force at Backspan Support in Lbs.)[d, e] | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Ground Snow Load | | | | | | | | | | | |
| | ≤ 20 psf | | | 30 psf | | | 50 psf | | | 70 psf | | |
| | Roof Width | | | Roof Width | | | Roof Width | | | Roof Width | | |
| | 24 ft. | 32 ft. | 40 ft. | 24 ft. | 32 ft. | 40 ft. | 24 ft. | 32 ft. | 40 ft. | 24 ft. | 32 ft. | 40 ft. |
| 2 × 8 @ 12″ | 20″ (177) | 15″ (227) | — | 18″ (209) | — | — | — | — | — | — | — | — |
| 2 × 10 @ 16″ | 29″ (228) | 21″ (297) | 16″ (364) | 26″ (271) | 18″ (354) | — | 20″ (375) | — | — | — | — | — |
| 2 × 10 @ 12″ | 36″ (166) | 26″ (219) | 20″ (270) | 34″ (198) | 22″ (263) | 16″ (324) | 26″ (277) | — | — | 19″ (356) | — | — |
| 2 × 12 @ 16″ | — | 32″ (287) | 25″ (356) | 36″ (263) | 29″ (345) | 21″ (428) | 29″ (367) | 20″ (484) | — | 23″ (471) | — | — |
| 2 × 12 @ 12″ | — | 42″ (209) | 31″ (263) | — | 37″ (253) | 27″ (317) | 36″ (271) | 27″ (358) | 17″ (447) | 31″ (348) | 19″ (462) | — |
| 2 × 12 @ 8″ | — | 48″ (136) | 45″ (169) | — | 48″ (164) | 38″ (206) | — | 40″ (233) | 26″ (294) | 36″ (230) | 29″ (304) | 18″ (379) |

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# Floor Cantilevers R502.3.3

TABLE R502.3.3(2)
CANTILEVER SPANS FOR FLOOR JOISTS SUPPORTING EXTERIOR BALCONY[a, b, e, f]

| Member Size | Spacing | Maximum Cantilever Span (Uplift Force at Backspan Support in Lbs.)[c, d] | | |
|---|---|---|---|---|
| | | Ground Snow Load | | |
| | | ≤30 psf | 50 psf | 70 psf |
| 2 × 8 | 12″ | 42″ (139) | 39″ (156) | 34″ (165) |
| 2 × 8 | 16″ | 36″ (151) | 34″ (171) | 29″ (180) |
| 2 × 10 | 12″ | 61″ (164) | 57″ (189) | 49″ (201) |
| 2 × 10 | 16″ | 53″ (180) | 49″ (208) | 42″ (220) |
| 2 × 10 | 24″ | 43″ (212) | 40″ (241) | 34″ (255) |
| 2 × 12 | 16″ | 72″ (228) | 67″ (260) | 57″ (268) |
| 2 × 12 | 24″ | 58″ (279) | 54″ (319) | 47″ (330) |

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# R502.5 - Allowable girder and header spans

- The allowable spans of girders and headers fabricated of dimension lumber shall not exceed the values set forth in Tables R602.7(1), R602.7(2) and R602.7(3).

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# Wood Trusses R502.11

- Wood trusses shall be designed in accordance with approved engineering practice. The design and manufacture of metal-plate-connected wood trusses shall comply with ANSI/TPI 1. The truss design drawings shall be prepared by a registered professional where required by the statutes of the jurisdiction in which the project is to be constructed in accordance with Section R106.1.

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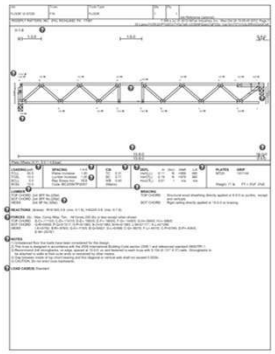
# R502.11.4 Truss design drawings

- Truss design drawings, prepared in compliance with Section R502.11.1, shall be submitted to the building official and approved prior to installation.
- Truss design drawings shall be provided with the shipment of trusses delivered to the job site.



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# R502.1.2 Prefabricated wood I-joists

- Structural capacities and design provisions for prefabricated wood I-joists shall be established and monitored in accordance with ASTM D5055.


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L/480 Live Load Deflection

| Depth | TJI® | 40 PSF Live Load / 10 PSF Dead Load | | | | 40 PSF Live Load / 20 PSF Dead Load | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 12" o.c. | 16" o.c. | 19.2" o.c. | 24" o.c. | 12" o.c. | 16" o.c. | 19.2" o.c. | 24" o.c. |
| 9½" | 110 | 16'-11" | 15'-6" | 14'-7" | 13'-7" | 16'-11" | 15'-6" | 14'-3" | 12'-9" |
| | 210 | 17'-9" | 16'-3" | 15'-4" | 14'-3" | 17'-9" | 16'-3" | 15'-4" | 14'-0" |
| | 230 | 18'-3" | 16'-8" | 15'-9" | 14'-8" | 18'-3" | 16'-8" | 15'-9" | 14'-8" |
| 11⅞" | 110 | 20'-2" | 18'-5" | 17'-4" | 15'-9"(1) | 20'-2" | 17'-8" | 16'-1"(1) | 14'-4"(1) |
| | 210 | 21'-1" | 19'-3" | 18'-2" | 16'-11" | 21'-1" | 19'-3" | 17'-8" | 15'-9"(1) |
| | 230 | 21'-8" | 19'-10" | 18'-8" | 17'-5" | 21'-8" | 19'-10" | 18'-2" | 16'-2"(1) |
| | 360 | 22'-11" | 20'-11" | 19'-8" | 18'-4" | 22'-11" | 20'-11" | 19'-8" | 17'-10"(1) |
| | 560 | 26'-1" | 23'-8" | 22'-4" | 20'-9" | 26'-1" | 23'-8" | 22'-4" | 20'-9"(1) |
| 14" | 110 | 22'-10" | 20'-11" | 19'-2" | 17'-2"(1) | 22'-2" | 19'-2" | 17'-6"(1) | 15'-0"(1) |
| | 210 | 23'-11" | 21'-10" | 20'-8" | 18'-10"(1) | 23'-11" | 21'-1" | 19'-2"(1) | 16'-7"(1) |
| | 230 | 24'-8" | 22'-6" | 21'-2" | 19'-9"(1) | 24'-8" | 22'-2" | 20'-3"(1) | 17'-6"(1) |
| | 360 | 26'-0" | 23'-8" | 22'-4" | 20'-9"(1) | 26'-0" | 23'-8" | 22'-4"(1) | 17'-10"(1) |
| | 560 | 29'-6" | 26'-10" | 25'-4" | 23'-6" | ***29'-6"*** | ***26'-10"*** | 25'-4"(1) | 20'-11"(1) |
| 16" | 210 | 26'-6" | 24'-3" | 22'-6"(1) | 19'-11"(1) | 26'-0" | 22'-6"(1) | 20'-7"(1) | 16'-7"(1) |
| | 230 | 27'-3" | 24'-10" | 23'-6" | 21'-1"(1) | ***27'-3"*** | 23'-9" | 21'-8"(1) | 17'-5"(1) |
| | 360 | 28'-9" | 26'-3" | 24'-8"(1) | 21'-5"(1) | ***28'-9"*** | 26'-3"(1) | 22'-4"(1) | 17'-10"(1) |
| | 560 | 32'-8" | 29'-8" | 28'-0" | 25'-2"(1) | ***32'-8"*** | ***29'-8"*** | 26'-3"(1) | 20'-11"(1) |

L/360 Live Load Deflection (Minimum Criteria per Code)

| Depth | TJI® | 40 PSF Live Load / 10 PSF Dead Load | | | | 40 PSF Live Load / 20 PSF Dead Load | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 12" o.c. | 16" o.c. | 19.2" o.c. | 24" o.c. | 12" o.c. | 16" o.c. | 19.2" o.c. | 24" o.c. |
| 9½" | 110 | 18'-9" | 17'-2" | 15'-8" | 14'-0" | 18'-1" | 15'-8" | 14'-3" | 12'-9" |
| | 210 | 19'-8" | 18'-0" | 17'-0" | 15'-4" | 19'-8" | 17'-2" | 15'-8" | 14'-0" |
| | 230 | 20'-3" | 18'-6" | 17'-5" | 16'-2" | ***20'-3"*** | 18'-1" | 16'-6" | 14'-9" |
| 11⅞" | 110 | 22'-3" | 19'-4" | 17'-8" | 15'-9"(1) | 20'-5" | 17'-8" | 16'-1"(1) | 14'-4"(1) |
| | 210 | 23'-4" | 21'-2" | 19'-4" | 17'-3"(1) | ***22'-4"*** | 19'-4" | 17'-8" | 15'-9"(1) |
| | 230 | 24'-0" | 21'-11" | 20'-5" | 18'-3" | ***23'-7"*** | 20'-5" | 18'-7" | 16'-7"(1) |
| | 360 | 25'-4" | 23'-2" | 21'-10" | 20'-4"(1) | ***25'-4"*** | ***23'-2"*** | ***21'-10"***(1) | 17'-10"(1) |
| | 560 | 28'-10" | 26'-3" | 24'-9" | 23'-0" | ***28'-10"*** | ***26'-3"*** | ***24'-9"*** | 20'-11"(1) |
| 14" | 110 | 24'-4" | 21'-0" | 19'-2" | 17'-2"(1) | 22'-2" | 19'-2" | 17'-6"(1) | 15'-0"(1) |
| | 210 | 26'-6" | 23'-1" | 21'-1" | 18'-10"(1) | 24'-4" | 21'-1" | 19'-2"(1) | 16'-7"(1) |
| | 230 | 27'-3" | 24'-4" | 22'-2" | 19'-10"(1) | ***25'-8"*** | 22'-2" | 20'-3"(1) | 17'-6"(1) |
| | 360 | 28'-9" | 26'-3" | 24'-9"(1) | 21'-5"(1) | ***28'-9"*** | ***26'-3"***(1) | 22'-4"(1) | 17'-10"(1) |
| | 560 | 32'-8" | 29'-9" | 28'-0" | 25'-2"(1) | ***32'-8"*** | ***29'-9"*** | ***26'-3"***(1) | 20'-11"(1) |
| 16" | 210 | 28'-6" | 24'-8" | 22'-6"(1) | 19'-11"(1) | 26'-0" | 22'-6"(1) | 20'-7"(1) | 16'-7"(1) |
| | 230 | 30'-1" | 26'-0" | 23'-9" | 21'-1"(1) | ***27'-5"*** | 23'-9" | 21'-8"(1) | 17'-6"(1) |
| | 360 | 31'-10" | 29'-0" | 26'-10"(1) | 21'-5"(1) | ***31'-10"*** | ***28'-10"***(1) | 22'-4"(1) | 17'-10"(1) |
| | 560 | 36'-1" | 32'-11" | 31'-0"(1) | 25'-2"(1) | ***36'-1"*** | ***31'-6"***(1) | 26'-3"(1) | 20'-11"(1) |

(1) Web stiffeners are required at intermediate supports of continuous-span joists when the intermediate bearing length is *less* than 5½" and the span on either side of the intermediate bearing is greater than the following spans:



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# TJI ForteWeb

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# Table R503.2.1.1(1) Wood Structural Panels

TABLE R503.2.1.1(1)
ALLOWABLE SPANS AND LOADS FOR WOOD STRUCTURAL PANELS FOR ROOF AND SUBFLOOR SHEATHING AND COMBINATION SUBFLOOR UNDERLAYMENT[a, b, c]

| SPAN RATING | MINIMUM NOMINAL PANEL THICKNESS (inch) | ALLOWABLE LIVE LOAD (psf)[h, i] | | MAXIMUM SPAN (inches) | | LOAD (pounds per square foot, at maximum span) | | MAXIMUM SPAN (inches) |
|---|---|---|---|---|---|---|---|---|
| | | SPAN @ 16" o.c. | SPAN @ 24" o.c. | With edge support[d] | Without edge support | Total load | Live load | |
| Sheathing[e] | | | | Roof[f] | | | | Subfloor[j] |
| 16/0 | 3/8 | 30 | — | 16 | 16 | 40 | 30 | 0 |
| 20/0 | 3/8 | 50 | — | 20 | 20 | 40 | 30 | 0 |
| 24/0 | 3/8 | 100 | 30 | 24 | 20[g] | 40 | 30 | 0 |
| 24/16 | 7/16 | 100 | 40 | 24 | 24 | 50 | 40 | 16 |
| 32/16 | 15/32, 1/2 | 180 | 70 | 32 | 28 | 40 | 30 | 16[h] |
| 40/20 | 19/32, 5/8 | 305 | 130 | 40 | 32 | 40 | 30 | 20[h, i] |
| 48/24 | 23/32, 3/4 | — | 175 | 48 | 36 | 45 | 35 | 24 |
| 60/32 | 7/8 | — | 305 | 60 | 48 | 45 | 35 | 32 |
| Underlayment, C-C plugged, single floor[e] | | | | Roof[f] | | | | Combination subfloor underlayment[k] |
| 16 o.c. | 19/32, 5/8 | 100 | 40 | 24 | 24 | 50 | 40 | 16[i] |
| 20 o.c. | 19/32, 5/8 | 150 | 60 | 32 | 32 | 40 | 30 | 20[i, j] |
| 24 o.c. | 23/32, 3/4 | 240 | 100 | 48 | 36 | 35 | 25 | 24 |
| 32 o.c. | 7/8 | — | 185 | 48 | 40 | 50 | 40 | 32 |
| 48 o.c. | 1 3/32, 1 1/8 | — | 415 | 72 | 56 | 50 | 40 | 48 |



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# R506.2.3 Vapor retarder

- A minimum 10-mil vapor retarder conforming to ASTM E1745 Class A requirements with joints lapped not less than 6 inches shall be placed between the concrete floor slab and the base course or the prepared subgrade where a base course does not exist.
- Exception: The vapor retarder is not required for the following:
  - 1. Garages, utility buildings and other unheated accessory structures.
  - 2. For unheated storage rooms having an area of less than 70 square feet and carports.
  - 3. Driveways, walks, patios and other flatwork not likely to be enclosed and heated at a later date.
  - 4. Where approved by the building official, based on local site conditions.



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# R507.1 Decks

- Wood-framed decks shall be in accordance with this section. Decks shall be designed for the live load required in Section R301.5 or the ground snow load indicated in Table R301.2, whichever is greater.
- For decks using materials and conditions not prescribed in this section, refer to Section R301.

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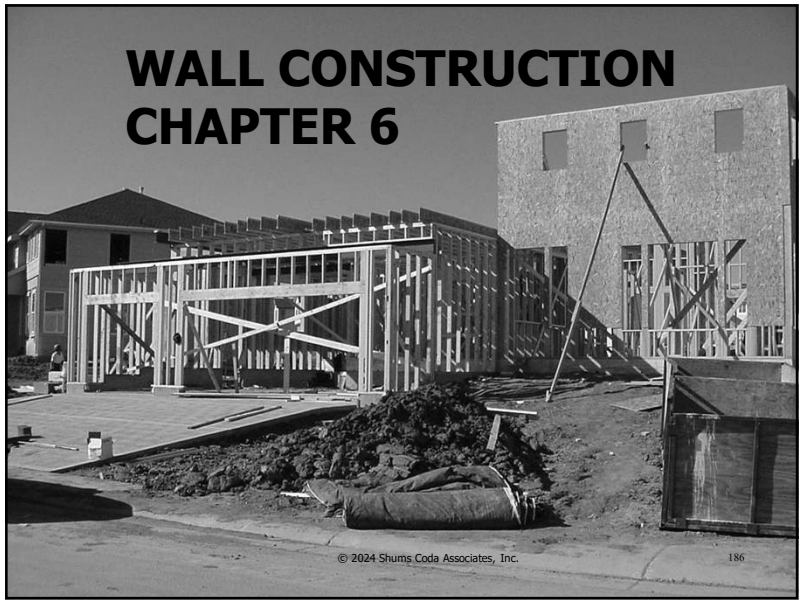


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# R601.2 Requirements

- Wall construction shall be capable of accommodating all loads imposed in accordance with Section R301 and of transmitting the resulting loads to the supporting structural elements.

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# Stud Size, Height and Spacing - R602.3.1

- The size, height and spacing of studs shall be in accordance with Table R602.3.(5).
- Exceptions!

TABLE R602.3(5)
SIZE, HEIGHT AND SPACING OF WOOD STUDS[a]

| 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] (inches) | 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 |

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# Interior Walls R602.4 & R602.5

- Load bearing walls same as exterior walls
- Nonbearing
  - 2X3 24”
  - 2X4 16” OC flat when not part of braced wall lines
  - Single top plate

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# Headers R602.7

- For header spans, see Tables R602.7(1-3)

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# Header/Girder Spans Table 602.7(1)

TABLE R602.7(1)
GIRDER SP[illegible]S[a] AND HEADER SPANS[a] FOR EXTERIOR BEARING WALLS
(Maximum spans for Douglas fir-[illegible], hem-fir, Southern pine and spruce-pine-fir[b] and required number of jack studs)

| GIRDERS AND HEADERS SUPPORTING | SIZE | GROUND SNOW LOAD (psf)[c] | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 30 | | | | | | 50 | | | | | | 70 | | | | | |
| | | Building width[c] (feet) | | | | | | | | | | | | | | | | | |
| | | 12 | | 24 | | 36 | | 12 | | 24 | | 36 | | 12 | | 24 | | 36 | |
| | | Span[f] | NJ[g] | Span[f] | NJ[g] | Span[f] | NJ[g] | Span[f] | NJ[g] | Span[f] | NJ[g] | Span[f] | NJ[g] | Span[f] | NJ[g] | Span[f] | NJ[g] | Span[f] | NJ[g] |
| Roof and ceiling | 1-2 × 6 | 4-0 | 1 | 3-1 | 2 | 2-7 | 2 | 3-5 | 1 | 2-8 | 2 | 2-4 | 2 | 3-2 | 1 | 2-5 | 2 | 2-2 | 2 |
| | 1-2 × 8 | 5-1 | 2 | 3-11 | 2 | 3-3 | 2 | 4-4 | 2 | 3-4 | 2 | 2-11 | 2 | 4-0 | 2 | 3-1 | 2 | 2-8 | 2 |
| | 1-2 × 10 | 6-0 | 2 | 4-8 | 2 | 3-11 | 2 | 5-2 | 2 | 4-0 | 2 | 3-6 | 2 | 4-9 | 2 | 3-8 | 2 | 3-3 | 2 |
| | 1-2 × 12 | 7-1 | 2 | 5-5 | 2 | 4-7 | 3 | 6-1 | 2 | 4-8 | 2 | 4-1 | 2 | 5-6 | 2 | 4-3 | 2 | 3-9 | 2 |
| | 2-2 × 4 | 4-0 | 1 | 3-1 | 1 | 2-7 | 1 | 3-5 | 1 | 2-7 | 1 | 2-3 | 1 | 3-2 | 1 | 2-5 | 1 | 2-2 | 1 |
| | 2-2 × 6 | 6-0 | 1 | 4-7 | 1 | 3-10 | 1 | 5-1 | 1 | 3-11 | 1 | 3-4 | 1 | 4-8 | 1 | 3-7 | 1 | 3-2 | 1 |
| | 2-2 × 8 | 7-7 | 1 | 5-9 | 1 | 4-10 | 2 | 6-5 | 1 | 5-0 | 1 | 4-3 | 1 | 5-11 | 1 | 4-6 | 1 | 4-0 | 1 |
| | 2-2 × 10 | 9-0 | 1 | 6-10 | 2 | 5-9 | 2 | 7-8 | 2 | 5-11 | 2 | 5-1 | 2 | 7-1 | 1 | 5-5 | 2 | 4-9 | 2 |
| | 2-2 × 12 | 10-7 | 2 | 8-1 | 2 | 6-10 | 2 | 9-0 | 2 | 6-11 | 2 | 6-0 | 2 | 8-4 | 2 | 6-5 | 2 | 5-8 | 2 |
| | 3-2 × 8 | 9-5 | 1 | 7-3 | 1 | 6-1 | 1 | 8-1 | 1 | 6-3 | 1 | 5-3 | 2 | 7-2 | 1 | 5-6 | 2 | 4-8 | 2 |
| | 3-2 × 10 | 11-3 | 1 | 8-7 | 1 | 7-3 | 2 | 9-7 | 1 | 7-4 | 2 | 6-2 | 2 | 8-6 | 1 | 6-7 | 2 | 5-6 | 2 |
| | 3-2 × 12 | [illegible] | [illegible] | [illegible] | [illegible] | 8-6 | 2 | 11-3 | 2 | 8-8 | 2 | 7-4 | 2 | 10-0 | 2 | 7-9 | 2 | 6-6 | 2 |
| | 4-2 × 8 | 10-11 | 1 | 8-4 | 1 | 7-0 | 1 | 9-4 | 1 | 7-2 | 1 | 6-0 | 1 | 8-3 | 1 | 6-4 | 1 | 5-4 | 2 |
| | 4-2 × 10 | 12-11 | 1 | 9-11 | 1 | 8-4 | 1 | 11-1 | 1 | 8-6 | 1 | 7-2 | 2 | 9-10 | 1 | 7-7 | 2 | 6-4 | 2 |
| | 4-2 × 12 | 15-3 | 1 | 11-8 | 1 | 9-10 | 2 | 13-0 | 1 | 10-0 | 2 | 8-5 | 2 | 11-7 | 1 | 8-11 | 2 | 7-6 | 2 |

Exterior girder/header for 7’6” opening supporting roof/ceiling 30psf snow load, 36’ building width

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# Nonbearing Walls R602.7.4

- Load bearing headers not required
  - single flat 2X4 up to 8 feet in width
  - less than 24 inches vertical distance from header to plate
  - cripples/blocking not required

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# R602.7.5 Supports for headers

- Headers shall be supported on each end with one or more jack studs or with approved framing anchors in accordance with Table R602.7(1) or R602.7(2).
- The full-height stud adjacent to each end of the header shall be end nailed to each end of the header with four-16d nails.
- The minimum number of full-height studs at each end of a header shall be in accordance with Table R602.7.5.

**TABLE R602.7.5**
**MINIMUM NUMBER OF FULL-HEIGHT STUDS AT EACH END OF HEADERS IN EXTERIOR WALLS[a]**

| MAXIMUM HEADER SPAN (feet) | ULTIMATE DESIGN WIND SPEED AND EXPOSURE CATEGORY | |
|---|---|---|
| | < 140 mph, Exposure B or < 130 mph, Exposure C | ≤ 115 mph, Exposure B[b] |
| 4 | 1 | 1 |
| 6 | 2 | 1 |
| 8 | 2 | 1 |
| 10 | 3 | 2 |
| 12 | 3 | 2 |
| 14 | 3 | 2 |
| 16 | 4 | 2 |
| 18 | 4 | 2 |

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

a. For header spans between those given, use the minimum number of full-height studs associated with the larger header span.

b. The tabulated minimum number of full-height studs is applicable where jack studs are provided to support the header at each end in accordance with Table R602.7(1). Where a framing anchor is used to support the header in lieu of a jack stud in accordance with Note d of Table R602.7(1), the minimum number of full-height studs at each end of a header shall be in accordance with requirements for wind speed < 140 mph, Exposure B.

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# R602.10 Wall bracing

- Buildings shall be braced in accordance with this section or, when applicable, Section R602.12.
- Where a building, or portion thereof, does not comply with one or more of the bracing requirements in this section, those portions shall be designed and constructed in accordance with Section R301.1.

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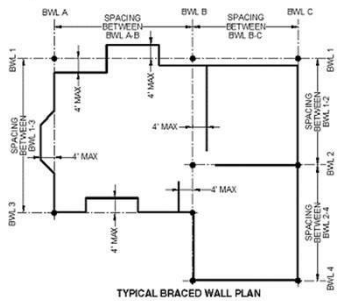
# R602.10.1 Braced wall lines



TYPICAL BRACED WALL PLAN

- 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.

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**TABLE R602.10.1.3**
**BRACED WALL LINE SPACING**

| APPLICATION | CONDITION | BUILDING TYPE | BRACED WALL LINE SPACING CRITERIA | |
|---|---|---|---|---|
| | | | Maximum Spacing | Exception to Maximum Spacing |
| Wind bracing | Ultimate design wind speed 100 mph to < 140 mph | Detached, townhouse | 60 feet | None |
| Seismic bracing | SDC A – C | Detached | Use wind bracing | |
| | SDC A – B | Townhouse | Use wind bracing | |
| | SDC C | Townhouse | 35 feet | Up to 50 feet when length of required bracing per Table R602.10.3(3) is adjusted in accordance with Table R602.10.3(4). |
| | SDC $D_0$, $D_1$, $D_2$ | Detached, townhouses, one- and two-story only | 25 feet | Up to 35 feet to allow for a single room not to exceed 900 square feet. Spacing of all other braced wall lines shall not exceed 25 feet. |
| | SDC $D_0$, $D_1$, $D_2$ | Detached, townhouse | 25 feet | Up to 35 feet when length of required bracing per Table R602.10.3(3) is adjusted in accordance with Table R602.10.3(4). |

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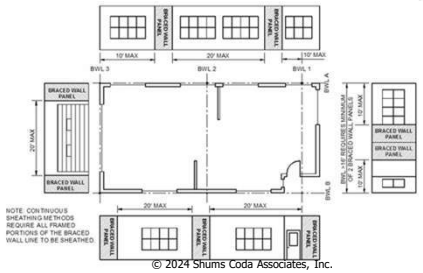
# Locations of braced wall panels - R602.10.2.2

- A braced wall panel shall begin within 10 feet from each end of a braced wall line
- The distance between adjacent edges of braced wall panels along a braced wall line shall be not greater than 20 feet



 197

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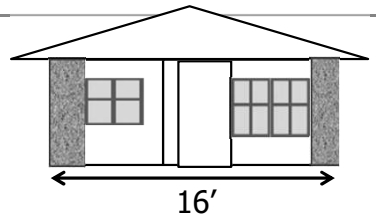
# R602.10.2.3 Minimum number of braced wall panels



16′

- Minimum bracing panel numbers:
- If wall line is 16′ long or less:
  - Two panels of any length
  - One panel of 48″ or more.

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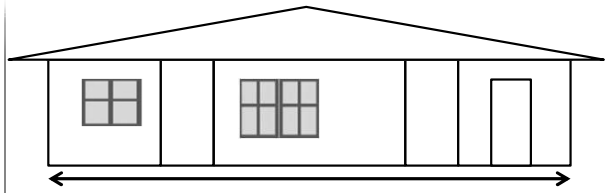
# R602.10.2.3 Minimum number of braced wall panels



>16′

- A braced wall line having a distance greater than 16 feet shall have a minimum of two braced wall panels.

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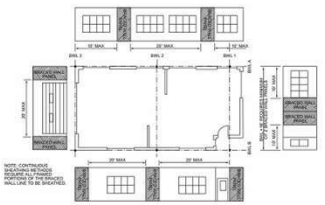
# R602.10.3 Required length of bracing

- Only braced wall panels parallel to the braced wall line shall contribute toward the required length of bracing of that braced wall line.
- Braced wall panels along an angled wall meeting the minimum length requirements of Tables R602.10.5 and R602.10.5.2 shall be permitted to contribute its projected length toward the minimum required length of bracing for the braced wall line as shown in Figure R602.10.1.4.
- Any braced wall panel on an angled wall at the end of a braced wall line shall contribute its projected length for only one of the braced wall lines at the projected corner.



 200

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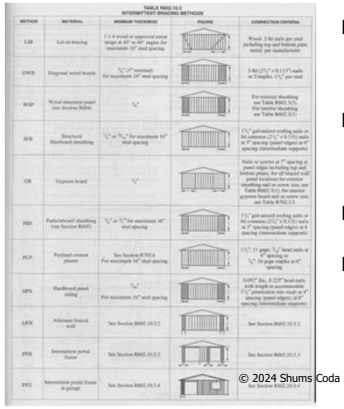
# Wall bracing methods



- Provides 3 letter designation
- Description of construction
- Figure
- Installation criteria

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TABLE R602.10.4—continued
BRACING METHODS

| | METHODS, MATERIAL | MINIMUM THICKNESS | FIGURE | CONNECTION CRITERIA[a] | |
|---|---|---|---|---|---|
| | | | | Fasteners | Spacing |
| Intermittent Bracing Methods | **PFH** Portal frame with hold-downs | $^3/_8$" | | See Section R602.10.6.2 | See Section R602.10.6.2 |
| | **PFG** Portal frame at garage | $^7/_{16}$" | | See Section R602.10.6.3 | See Section R602.10.6.3 |
| Continuous Sheathing Methods | **CS-WSP** Continuously sheathed wood structural panel | $^3/_8$" | | Exterior sheathing per Table R602.3(3) | 6" edges 12" field |
| | | | | Interior sheathing per Table R602.3(1) or R602.3(2) | Varies by fastener |
| | **CS-G**[b,c] Continuously sheathed wood structural panel adjacent to garage openings | $^3/_8$" | | See Method CS-WSP | See Method CS-WSP |
| | **CS-PF** Continuously sheathed portal frame | $^7/_{16}$" | | See Section R602.10.6.4 | See Section R602.10.6.4 |
| | **CS-SFB**[d] Continuously sheathed structural fiberboard | $^1/_2$" or $^{25}/_{32}$" for maximum 16" stud spacing | | $1^1/_2$" long × 0.12" dia. (for $^1/_2$" thick sheathing) $1^3/_4$" long × 0.12" dia. (for $^{25}/_{32}$" thick sheathing) galvanized roofing nails | 3" edges 6" field |

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# R602.10.3 Braced Wall Length

TABLE R602.10.3(1)
BRACING REQUIREMENTS BASED ON WIND SPEED

| • EXPOSURE CATEGORY B<br>• 30-FOOT MEAN ROOF HEIGHT<br>• 10-FOOT WALL HEIGHT<br>• 2 BRACED WALL LINES | | | MINIMUM TOTAL LENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE[a] | | | |
|---|---|---|---|---|---|---|
| Ultimate Design Wind Speed (mph) | Story Location | Braced Wall Line Spacing[f] (feet) | Method LIB[b] | Method GB | Methods DWB, WSP, SFB, PBS, PCP, HPS, BV-WSP, ABW, PFH, PFC, CS-SFB | Methods CS-WSP, CS-G, CS-PF |
| ≤ 110 |  | 10 | 3.5 | 3.5 | 2.0 | 1.5 |
| | | 20 | 6.0 | 6.0 | 3.5 | 3.0 |
| | | 30 | 8.5 | 8.5 | 5.0 | 4.5 |
| | | 40 | 11.5 | 11.5 | 6.5 | 5.5 |
| | | 50 | 14.0 | 14.0 | 8.0 | 7.0 |
| | | 60 | 16.5 | 16.5 | 9.5 | 8.0 |
| |  | 10 | 6.5 | 6.5 | 3.5 | 3.0 |
| | | 20 | 11.5 | 11.5 | 6.5 | 5.5 |
| | | 30 | 16.5 | 16.5 | 9.5 | 8.0 |
| | | 40 | 21.5 | 21.5 | 12.5 | 10.5 |
| | | 50 | 26.5 | 26.5 | 15.5 | 13.0 |
| | | 60 | 31.5 | 31.5 | 18.0 | 15.5 |
| |  | 10 | NP | 9.5 | 5.5 | 4.5 |
| | | 20 | NP | 17.0 | 10.0 | 8.5 |
| | | 30 | NP | 24.5 | 14.0 | 12.0 |
| | | 40 | NP | 32.0 | 18.5 | 15.5 |
| | | 50 | NP | 39.5 | 22.5 | 19.0 |
| | | 60 | NP | 46.5 | 26.5 | 23.0 |

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TABLE R602.10.3(2)
WIND ADJUSTMENT FACTORS TO THE REQUIRED LENGTH OF WALL BRACING

| ITEM NUMBER | ADJUSTMENT BASED ON | STORY/SUPPORTING | CONDITION | ADJUSTMENT FACTOR[a,b] [multiply length from Table R602.10.3(1) by this factor] | APPLICABLE METHODS |
|---|---|---|---|---|---|
| 1 | Exposure category[c] | One-story structure | B | 1.00 | All methods |
| | | | C | 1.20 | |
| | | | D | 1.50 | |
| | | Two-story structure | B | 1.00 | |
| | | | C | 1.30 | |
| | | | D | 1.60 | |
| | | Three-story structure | B | 1.00 | |
| | | | C | 1.40 | |
| | | | D | 1.70 | |
| 2 | Roof eave-to-ridge height | Roof only | ≤ 5 feet | 0.70 | |
| | | | 10 feet | 1.00 | |
| | | | 15 feet | 1.30 | |
| | | | 20 feet | 1.60 | |
| | | Roof + 1 floor | ≤ 5 feet | 0.85 | |
| | | | 10 feet | 1.00 | |
| | | | 15 feet | 1.15 | |
| | | | 20 feet | 1.30 | |
| | | Roof + 2 floors | ≤ 5 feet | 0.90 | |
| | | | 10 feet | 1.00 | |
| | | | 15 feet | 1.10 | |
| | | | 20 feet | Not permitted | |
| 3 | Story height (Section R301.3) | Any story | 8 feet | 0.90 | |
| | | | 9 feet | 0.95 | |
| | | | 10 feet | 1.00 | |
| | | | 11 feet | 1.05 | |
| | | | 12 feet | 1.10 | |
| 4 | Number of braced wall lines (per plan direction)[f] | Any story | 2 | 1.00 | |
| | | | 3 | 1.30 | |
| | | | 4 | 1.45 | |
| | | | ≥ 5 | 1.60 | |
| 5 | Additional 800-pound hold-down device | Top story only | Fastened to the end studs of each braced wall panel and to the foundation or framing below | 0.80 | DWB, WSP, SFB, PBS, PCP, HPS |
| 6 | Interior gypsum board finish (or equivalent) | Any story | Omitted from inside face of braced wall panels | 1.40 | DWB, WSP, SFB, PBS, PCP, HPS, CS-WSP, CS-G, CS-SFB |
| 7 | Gypsum board fastening | Any story | 4 inches o.c. at panel edges, including top and bottom plates, and all horizontal joints blocked | 0.7 | GB |
| 8 | Horizontal blocking | Any story | Horizontal block is omitted | 2.0 | WSP, CS-WSP |

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# R602.10.3 – Braced Wall Length

TABLE R602.10.3(3)
BRACING REQUIREMENTS BASED ON SEISMIC DESIGN CATEGORY

| · SOIL CLASS D[b]<br>· WALL HEIGHT = 10 FEET<br>· 10 PSF FLOOR DEAD LOAD<br>· 15 PSF ROOF/CEILING DEAD LOAD<br>· BRACED WALL LINE SPACING ≤ 25 FEET | | | MINIMUM TOTAL LENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE[a] | | | | |
|---|---|---|---|---|---|---|---|
| Seismic Design Category | Story Location | Braced Wall Line Length (feet)[c] | Method LIB[d] | Method GB | Methods DWB, SFB, PBS, PCP, HPS, CS-SFB[e] | Method WSP | Methods CS-WSP, CS-G |
| C (townhouses only) | 1 story | 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 |
| | 2 stories | 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 |
| | 3 stories | 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 |

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# R602.10.3 – Braced Wall Length

TABLE R602.10.3(4)
SEISMIC ADJUSTMENT FACTORS TO THE REQUIRED LENGTH OF WALL BRACING

| ITEM NUMBER | ADJUSTMENT BASED ON: | STORY | CONDITION | ADJUSTMENT FACTOR[a, b] [Multiply length from Table R602.10.3(3) by this factor] | APPLICABLE METHODS |
|---|---|---|---|---|---|
| 6 | Walls with stone or masonry veneer, townhouses in SDC C[d, e] | 1 story | 1.0 | | All methods |
| | | 2 stories | 1.5 | | |
| | | 3 stories | 1.5 | | |
| 7 | Walls with stone or masonry veneer, detached one- and two-family dwellings in SDC $D_0 - D_2$[f] | Any story | See Table R602.10.6.5 | | BV-WSP |
| 8 | Interior gypsum board finish (or equivalent) | Any story | Omitted from inside face of braced wall panels | 1.5 | DWB, WSP, SFB, PBS, PCP, HPS, CS-WSP, CS-G, CS-SFB |

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# WALL COVERING Chapter 7

 207

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# R702.4.2 Backer boards

- Materials used as backers for wall tile in tub and shower areas and wall panels in shower areas shall be of materials listed in Table R702.4.2, and installed in accordance with the manufacturer's recommendations.

TABLE R702.4.2
BACKER BOARD MATERIALS

| MATERIAL | STANDARD |
|---|---|
| Glass mat gypsum backing panel | ASTM C1178 |
| Fiber-reinforced gypsum panels | ASTM C1278 |
| Nonasbestos fiber-cement backer board | ASTM C1288 or ISO 8336, Category C |
| Nonasbestos fiber mat-reinforced cementitious backer units | ASTM C1325 |

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# R702.7
# Vapor retarders

- Vapor retarder materials shall be classified in accordance with Table R702.7(1).
- A vapor retarder shall be provided on the interior side of frame walls of the class indicated in Table R702.7(2), including compliance with Table R702.7(3) or R702.7(4) where applicable.
- An approved design using accepted engineering practice for hygrothermal analysis shall be permitted as an alternative.
- The climate zone shall be determined in accordance with Section N1101.7.

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# R702.7
# Vapor retarders

- Exceptions:
- 1. Basement walls.
- 2. Below-grade portion of any wall.
- 3. Construction where accumulation, condensation or freezing of moisture will not damage the materials.
- 4. A vapor retarder shall not be required in Climate Zones 1, 2 and 3.

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TABLE R702.7(1)
VAPOR RETARDER MATERIALS AND CLASSES

| CLASS | ACCEPTABLE MATERIALS |
|---|---|
| I | Sheet polyethylene, nonperforated aluminum foil or other approved materials with a perm rating less than or equal to 0.1. |
| II | Kraft-faced fiberglass batts, vapor retarder paint or other approved materials applied in accordance with the manufacturer's installation instructions for a perm rating greater than 0.1 and less than or equal to 1.0. |
| III | Latex paint, enamel paint or other approved materials applied in accordance with the manufacturer's installation instructions for a perm rating greater than 1.0 and less than or equal to 10.0. |

TABLE R702.7(2)
VAPOR RETARDER OPTIONS

| CLIMATE ZONE | VAPOR RETARDER CLASS | | |
|---|---|---|---|
| | CLASS I[a] | CLASS II[a] | CLASS III |
| 1, 2 | Not Permitted | Not Permitted | Permitted |
| 3, 4 (except Marine 4) | Not Permitted | Permitted[c] | Permitted |
| Marine 4, 5, 6, 7, 8 | Permitted[b] | Permitted[c] | See Table R702.7(3) |

a. Class I and II vapor retarders with vapor permeance greater than 1 perm when measured by ASTM E96 water method (Procedure B) shall be allowed on the interior side of any frame wall in all climate zones.
b. Use of a Class I interior vapor retarder in frame walls with a Class I vapor retarder on the exterior side shall require an approved design.
c. Where a Class II vapor retarder is used in combination with foam plastic insulating sheathing installed as continuous insulation on the exterior side of frame walls, the continuous insulation shall comply with Table R702.7(4) and the Class II vapor retarder shall have a vapor permeance greater than 1 perm when measured by ASTM E96 water method (Procedure B).

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## R702.7.1 Spray foam plastic insulation for moisture control with Class II and III vapor retarders

- For purposes of compliance with Tables R702.7(3) and R702.7(4), spray foam with a maximum permeance of 1.5 perms at the installed thickness applied to the interior side of wood structural panels, fiberboard, insulating sheathing or gypsum shall be deemed to meet the continuous insulation moisture control requirement in accordance with one of the following conditions:
  - 1. The spray foam R-value is equal to or greater than the specified continuous insulation R-value.
  - 2. The combined R-value of the spray foam and continuous insulation is equal to or greater than the specified continuous insulation R-value.

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**TABLE R702.7(3)**
**CLASS III VAPOR RETARDERS**

| CLIMATE ZONE | CLASS III VAPOR RETARDERS PERMITTED FOR:[a,b] |
|---|---|
| Marine 4 | Vented cladding over wood structural panels. |
| | Vented cladding over fiberboard. |
| | Vented cladding over gypsum. |
| | Continuous insulation with *R*-value ≥ 2.5 over 2 × 4 wall. |
| | Continuous insulation with *R*-value ≥ 3.75 over 2 × 6 wall. |
| 5 | Vented cladding over wood structural panels. |
| | Vented cladding over fiberboard. |
| | Vented cladding over gypsum. |
| | Continuous insulation with *R*-value ≥ 5 over 2 × 4 wall. |
| | Continuous insulation with *R*-value ≥ 7.5 over 2 × 6 wall. |
| 6 | Vented cladding over fiberboard. |
| | Vented cladding over gypsum. |
| | Continuous insulation with *R*-value ≥ 7.5 over 2 × 4 wall. |
| | Continuous insulation with *R*-value ≥ 11.25 over 2 × 6 wall. |
| 7 | Continuous insulation with *R*-value ≥ 10 over 2 × 4 wall. |
| | Continuous insulation with *R*-value ≥ 15 over 2 × 6 wall. |
| 8 | Continuous insulation with *R*-value ≥ 12.5 over 2 × 4 wall. |
| | Continuous insulation with *R*-value ≥ 20 over 2 × 6 wall. |

a. Vented cladding shall include vinyl, polypropylene, or horizontal aluminum siding, brick veneer with a clear airspace as specified in Table R703.8.4(1), and other approved vented claddings.
b. The requirements in this table apply only to insulation used to control moisture in order to permit the use of Class III vapor retarders. The insulation materials used to satisfy this option also contribute to but do not supersede the thermal envelope requirements of Chapter 11.

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**TABLE R702.7(4)**
**CONTINUOUS INSULATION WITH CLASS II VAPOR RETARDER**

| CLIMATE ZONE | CLASS II VAPOR RETARDERS PERMITTED FOR:[a] |
|---|---|
| 3 | Continuous insulation with *R*-value ≥ 2. |
| 4, 5 and 6 | Continuous insulation with *R*-value ≥ 3 over 2 × 4 wall. |
| | Continuous insulation with *R*-value ≥ 5 over 2 × 6 wall. |
| 7 | Continuous insulation with *R*-value ≥ 5 over 2 × 4 wall. |
| | Continuous insulation with *R*-value ≥ 7.5 over 2 × 6 wall. |
| 8 | Continuous insulation with *R*-value ≥ 7.5 over 2 × 4 wall. |
| | Continuous insulation with *R*-value ≥ 10 over 2 × 6 wall. |

a. The requirements in this table apply only to insulation used to control moisture in order to permit the use of Class II vapor retarders. The insulation materials used to satisfy this option also contribute to but do not supersede the thermal envelope requirements of Chapter 11.

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# R703.2 Water-resistive barrier

- Not fewer than one layer of water-resistive barrier shall be applied over studs or sheathing of all exterior walls with flashing as indicated in Section R703.4, in such a manner as to provide a continuous water-resistive barrier behind the exterior wall veneer.
- The water-resistive barrier material shall be continuous to the top of walls and terminated at penetrations and building appendages in a manner to meet the requirements of the exterior wall envelope as described in Section R703.1.
- Water-resistive barrier materials shall comply with one of the following:
  - 1. No. 15 felt complying with ASTM D226, Type 1.
  - 2. ASTM E2568, Type 1 or 2.
  - 3. ASTM E331 in accordance with Section R703.1.1.
  - 4. Other approved materials in accordance with the manufacturer's installation instructions.
- No.15 asphalt felt and water-resistive barriers complying with ASTM E2556 shall be applied horizontally, with the upper layer lapped over the lower layer not less than 2 inches, and where joints occur, shall be lapped not less than 6 inches

 215

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## R703.4.1 Flashing installation at exterior window and door openings

- Flashing at exterior window and door openings shall extend to the surface of the exterior wall finish or to a water-resistive barrier complying with Section 703.2 for subsequent drainage.
- Air sealing shall be installed around all window and door openings on the interior side of the rough opening gap.

 216

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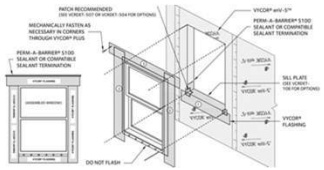
## R703.4.1 Flashing installation at exterior window and door openings

- Mechanically attached flexible flashings shall comply with AAMA 712.
- Flashing at exterior window and door openings shall be installed in accordance with one or more of the following:



 217

217

## R703.4.1 Flashing installation at exterior window and door openings

- 1. The fenestration manufacturer's installation and flashing instructions, or for applications not addressed in the fenestration manufacturer's instructions, in accordance with the flashing manufacturer's instructions.
- Where flashing instructions or details are not provided, pan flashing shall be installed at the sill of exterior window and door openings.
- Pan flashing shall be sealed or sloped in such a manner as to direct water to the surface of the exterior wall finish or to the water-resistive barrier for subsequent drainage.
- Openings using pan flashing shall incorporate flashing or protection at the head and sides.

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## R703.4.1 Flashing installation at exterior window and door openings

- 2. In accordance with the flashing design or method of a registered design professional.
- 3. In accordance with other approved methods

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## ROOF-CEILING CONSTRUCTION Chapter 8

 220

220

# Roof Drainage R801.3

- In areas where expansive or collapsible soils are known to exist, all dwellings shall have a controlled method of water disposal from roofs that will collect and discharge all roof drainage to the ground surface at least 5 feet from foundation walls or to an approved drainage system.

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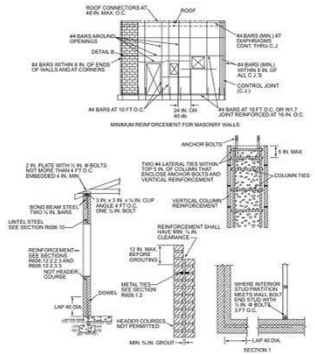
# R802.2 Design and construction

- The roof and ceiling assembly shall provide continuous ties across the structure to prevent roof thrust from being applied to the supporting walls.
- The assembly shall be designed and constructed in accordance with the provisions of this chapter and Figures R606.11(1), R606.11(2) and R606.11(3) or in accordance with AWC NDS.



 222

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# R802.3 Ridge

- A ridge board used to connect opposing rafters shall be not less than 1 inch nominal thickness and not less in depth than the cut end of the rafter.
- Where ceiling joist or rafter ties do not provide continuous ties across the structure as required by Section R802.5.2, the ridge shall be supported by a wall or ridge beam designed in accordance with accepted engineering practice and supported on each end by a wall or column.

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# Rafter Spans Table R802.4.1 (1-8)

TABLE R802.4.1(1)—continued
RAFTER SPANS FOR COMMON LUMBER SPECIES
(Roof live load = 20 psf, ceiling not attached to rafters, L/Δ = 180)

| RAFTER SPACING (inches) | SPECIES AND GRADE | | DEAD LOAD = 10 psf | | | | | DEAD LOAD = 20 psf | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2 × 4 | 2 × 6 | 2 × 8 | 2 × 10 | 2 × 12 | 2 × 4 | 2 × 6 | 2 × 8 | 2 × 10 | 2 × 12 |
| | | | Maximum rafter spans[a] | | | | | | | | | |
| | | | (feet - inches) | (feet - inches) | (feet - inches) | (feet - inches) | (feet - inches) | (feet - inches) | (feet - inches) | (feet - inches) | (feet - inches) | (feet - inches) |
| 24 | Douglas fir-larch | SS | 9-1 | 14-4 | 18-10 | 23-9 | Note b | 9-1 | 13-3 | 16-10 | 20-7 | 23-10 |
| | Douglas fir-larch | #1 | 8-7 | 12-6 | 15-10 | 19-3 | 22-6 | 7-5 | 10-10 | 13-9 | 16-9 | 19-6 |
| | Douglas fir-larch | #2 | 8-2 | 11-11 | 15-1 | 18-4 | 21-4 | 7-0 | 10-4 | 13-0 | 15-11 | 18-6 |
| | Douglas fir-larch | #3 | 6-2 | 9-1 | 11-6 | 14-0 | 16-3 | 5-4 | 7-10 | 10-0 | 12-2 | 14-1 |
| | Hem-fir | SS | 8-7 | 13-6 | 17-10 | 21-9 | Note b | 8-7 | 12-10 | 16-3 | 19-10 | 23-0 |
| | Hem-fir | #1 | 8-5 | 12-4 | 15-8 | 19-2 | 22-2 | 7-4 | 10-9 | 13-7 | 16-7 | 19-3 |
| | Hem-fir | #2 | 7-11 | 11-7 | 14-8 | 17-10 | 20-9 | 6-10 | 10-0 | 12-8 | 15-6 | 17-11 |
| | Hem-fir | #3 | 6-1 | 8-10 | 11-3 | 13-8 | 15-11 | 5-3 | 7-8 | 9-9 | 11-10 | 13-9 |
| | Southern pine | SS | 8-11 | 14-1 | 18-6 | 23-8 | Note b | 8-11 | 13-10 | 17-6 | 20-10 | 24-8 |
| | Southern pine | #1 | 8-7 | 12-9 | 16-2 | 18-11 | 22-6 | 7-5 | 11-1 | 14-0 | 16-5 | 19-6 |
| | Southern pine | #2 | 7-4 | 11-0 | 13-11 | 16-6 | 19-6 | 6-4 | 9-6 | 12-1 | 14-4 | 16-10 |
| | Southern pine | #3 | 5-8 | 8-4 | 10-6 | 12-9 | 15-1 | 4-11 | 7-3 | 9-1 | 11-0 | 13-1 |
| | Spruce-pine-fir | SS | 8-5 | 13-3 | 17-5 | 21-8 | 25-2 | 8-4 | 12-2 | 15-4 | 18-9 | 21-9 |
| | Spruce-pine-fir | #1 | 8-0 | 11-9 | 14-10 | 18-2 | 21-0 | 6-11 | 10-2 | 12-10 | 15-8 | 18-3 |
| | Spruce-pine-fir | #2 | 8-0 | 11-9 | 14-10 | 18-2 | 21-0 | 6-11 | 10-2 | 12-10 | 15-8 | 18-3 |
| | Spruce-pine-fir | #3 | 6-1 | 8-10 | 11-3 | 13-8 | 15-11 | 5-3 | 7-8 | 9-9 | 11-10 | 13-9 |

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# Rafter Spans
# Table R802.4.1 (1-8)

- Footnote a
- The tabulated rafter spans assume that ceiling joists are located at the bottom of the attic space or that some other method of resisting the outward push of the rafters on the bearing walls, such as rafter ties, is provided at that location. Where ceiling joists or rafter ties are located higher in the attic space, the rafter spans shall be multiplied by the adjustment factors in Table R802.4.1(9).

TABLE R802.4.1(9)
RAFTER SPAN ADJUSTMENT FACTOR

| $H_c/H_R$[a] | RAFTER SPAN ADJUSTMENT FACTOR |
|---|---|
| 1/3 | 0.67 |
| 1/4 | 0.76 |
| 1/5 | 0.83 |
| 1/6 | 0.90 |
| 1/7.5 or less | 1.00 |

a. $H_c$ = Height of ceiling joists or rafter ties measured vertically above the top of the rafter support walls; $H_R$ = Height of roof ridge measured vertically above the top of the rafter support walls.

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# R802.4.2
# Framing details

- Rafters shall be framed opposite from each other to a ridge board, shall not be offset more than 1½ inches from each other and shall be connected with a collar tie or ridge strap in accordance with Section R802.4.6 or directly opposite from each other to a gusset plate in accordance with Table R602.3(1).
- Rafters shall be nailed to the top wall plates in accordance with Table R602.3(1) unless the roof assembly is required to comply with the uplift requirements of Section R802.11.

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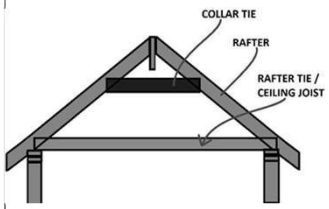
# R802.5
# Ceiling joists




- Ceiling joists shall be continuous across the structure or securely joined where they meet over interior partitions in accordance with Table R802.5.2.
- Ceiling joists shall be sized based on the joist spans in Tables R802.5.1(1) and R802.5.1(2).
- For other grades and species and for other loading conditions, refer to the AWC STJR.

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# Ceiling Joist Spans
# Tables R802.5 (1&2)

TABLE R802.5.1(1)—continued
CEILING JOIST SPANS FOR COMMON LUMBER SPECIES
(Uninhabitable attics without storage, live load = 10 psf, L/Δ = 240)

| CEILING JOIST SPACING (inches) | SPECIES AND GRADE | | DEAD LOAD = 5 psf | | | |
|---|---|---|---|---|---|---|
| | | | 2 × 4 | 2 × 6 | 2 × 8 | 2 × 10 |
| | | | Maximum ceiling joist spans | | | |
| | | | (feet - inches) | (feet - inches) | (feet - inches) | (feet - inches) |
| 19.2 | Douglas fir-larch | SS | 11-3 | 17-8 | 23-3 | Note a |
| | Douglas fir-larch | #1 | 10-10 | 17-0 | 22-5 | Note a |
| | Douglas fir-larch | #2 | 10-7 | 16-8 | 21-4 | 26-0 |
| | Douglas fir-larch | #3 | 8-9 | 12-10 | 16-3 | 19-10 |
| | Hem-fir | SS | 10-7 | 16-8 | 21-11 | Note a |
| | Hem-fir | #1 | 10-4 | 16-4 | 21-6 | Note a |
| | Hem-fir | #2 | 9-11 | 15-7 | 20-6 | 25-3 |
| | Hem-fir | #3 | 8-7 | 12-6 | 15-10 | 19-5 |
| | Southern -pine | SS | 11-0 | 17-4 | 22-10 | Note a |
| | Southern pine | #1 | 10-7 | 16-8 | 22-0 | Note a |
| | Southern pine | #2 | 10-2 | 15-7 | 19-8 | 23-5 |
| | Southern pine | #3 | 8-0 | 11-9 | 14-10 | 18-0 |
| | Spruce-pine-fir | SS | 10-4 | 16-4 | 21-6 | Note a |
| | Spruce-pine-fir | #1 | 10-2 | 15-11 | 21-0 | 25-8 |
| | Spruce-pine-fir | #2 | 10-2 | 15-11 | 21-0 | 25-8 |
| | Spruce-pine-fir | #3 | 10-2 | 15-11 | 15-10 | 19-5 |

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# R802.5.2 Ceiling joist and rafter connections

- Where ceiling joists run parallel to rafters and are located in the bottom third of the rafter height, they shall be installed in accordance with Figure R802.4.5 and fastened to rafters in accordance with Table R802.5.2(1).
- Where the ceiling joists are installed above the bottom third of the rafter height, the ridge shall be designed as a beam in accordance with Section R802.3.
- Where ceiling joists do not run parallel to rafters, rafters shall be tied across the structure with a rafter tie in accordance with Section R802.5.2.2, or the ridge shall be designed as a beam in accordance with Section R802.3.

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TABLE R802.5.2(1)
RAFTER/CEILING JOIST HEEL JOINT CONNECTIONS[a]

| RAFTER SLOPE | RAFTER SPACING (inches) | GROUND SNOW LOAD (psf) 20° Roof span (feet) 12 | 24 | 36 | 30° 12 | 24 | 36 | 50 12 | 24 | 36 | 70 12 | 24 | 36 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Required number of 16d common nails per heel joint splices [b,c,d,e,f] | | | | | | | | | | | |
| 3:12 | 12 | 3 | 5 | 8 | 3 | 6 | 9 | 5 | 9 | 13 | 6 | 12 | 17 |
| | 16 | 4 | 7 | 10 | 4 | 8 | 12 | 6 | 12 | 17 | 8 | 15 | 23 |
| | 19.2 | 4 | 8 | 12 | 5 | 10 | 14 | 7 | 14 | 21 | 9 | 18 | 27 |
| | 24 | 5 | 10 | 15 | 6 | 12 | 18 | 9 | 17 | 26 | 12 | 23 | 34 |
| 4:12 | 12 | 3 | 4 | 6 | 3 | 5 | 7 | 4 | 7 | 10 | 5 | 9 | 13 |
| | 16 | 3 | 5 | 8 | 3 | 6 | 9 | 5 | 9 | 13 | 6 | 12 | 17 |
| | 19.2 | 3 | 6 | 9 | 4 | 7 | 11 | 6 | 11 | 16 | 7 | 14 | 21 |
| | 24 | 4 | 8 | 11 | 5 | 9 | 13 | 7 | 13 | 19 | 9 | 17 | 26 |
| 5:12 | 12 | 3 | 3 | 5 | 3 | 4 | 6 | 3 | 6 | 8 | 4 | 7 | 11 |
| | 16 | 3 | 4 | 6 | 3 | 5 | 7 | 4 | 7 | 11 | 5 | 9 | 14 |
| | 19.2 | 3 | 5 | 7 | 3 | 6 | 9 | 5 | 9 | 13 | 6 | 11 | 17 |
| | 24 | 3 | 6 | 9 | 4 | 7 | 11 | 6 | 11 | 16 | 7 | 14 | 21 |

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# Table 802.5.2 Footnote f

- Tabulated heel joint connection requirements assume that ceiling joists or rafter ties are located at the bottom of the attic space.
- Where ceiling joists or rafter ties are located higher in the attic, heel joint connection requirements shall be increased by the adjustment factors in Table 802.5.2(2).

TABLE R802.5.2(2)
HEEL JOINT CONNECTION ADJUSTMENT FACTORS

| $H_c/H_d$[a,b] | HEEL JOINT CONNECTION ADJUSTMENT FACTOR |
|---|---|
| 1/3 | 1.5 |
| 1/4 | 1.33 |
| 1/5 | 1.25 |
| 1/6 | 1.2 |
| 1/10 or less | 1.11 |

a. $H_c$ = Height of ceiling joists or rafter ties measured vertically from the top of the rafter support walls to the bottom of the ceiling joists or rafter ties; $H_d$ = Height of roof ridge measured vertically from the top of the rafter support walls to the bottom of the roof ridge.
b. Where $H_c/H_d$ exceeds 1/3, connections shall be designed in accordance with accepted engineering practice.

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# Wood Truss Design Drawings R802.10.1

- Slope, depth, span, spacing
- Location of joints
- Required bearing widths
- Design loads
- Adjustments to lumber & joint connectors design values for conditions of use
- Each reaction force and direction
- Joint connector type and description and dimensioned location of each connector
- Lumber size, species and grade for each member
- Connection requirements
- Calculated deflection ratio and/or maximum description for live & total load
- Maximum axial compression forces in the truss members
- Required permanent truss member bracing location

Designed to ANSI/TPI 1

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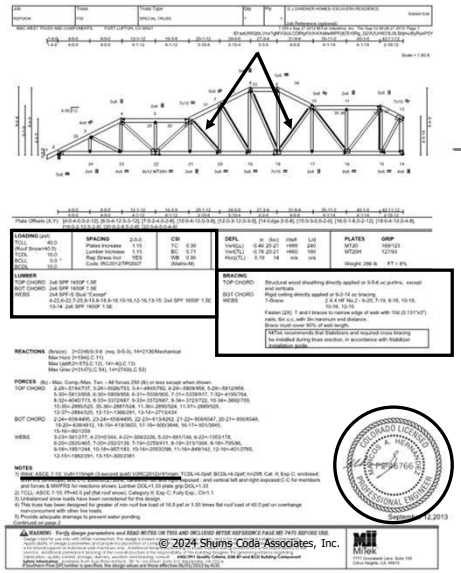



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# R802.11
# Uplift resistance

- Roof assemblies shall have uplift resistance in accordance with Sections R802.11.1.1 and R802.11.1.2.



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# R802.11
# Uplift resistance

- Exceptions: Rafters or trusses shall be permitted to be attached to their supporting wall assemblies in accordance with Table R602.3(1) where either of the following occur:
  - 1. Where the uplift force per rafter or truss does not exceed 200 pounds as determined by Table R802.11.
  - 2. Where the basic wind speed does not exceed 115 miles per hour, the wind exposure category is B, the roof pitch is 5 units vertical in 12 units horizontal or greater, the roof span is 32 feet or less, and rafters and trusses are spaced not more than 24 inches on center.



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**TABLE R802.11**
**RAFTER OR TRUSS UPLIFT CONNECTION FORCES FROM WIND (ASD) (POUNDS PER CONNECTION)[a, b, c, d, e, f, g, h]**

| RAFTER OR TRUSS SPACING | ROOF SPAN (feet) | EXPOSURE B Ultimate Design Wind Speed $V_{ULT}$ (mph) 110 | | 115 | | 120 | | 130 | | 140 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Roof Pitch | | Roof Pitch | | Roof Pitch | | Roof Pitch | | Roof Pitch | |
| | | < 5:12 | ≥ 5:12 | < 5:12 | ≥ 5:12 | < 5:12 | ≥ 5:12 | < 5:12 | ≥ 5:12 | < 5:12 | ≥ 5:12 |
| 12" o.c. | 12 | 48 | 43 | 59 | 53 | 70 | 64 | 95 | 88 | 122 | 113 |
| | 18 | 59 | 52 | 74 | 66 | 89 | 81 | 122 | 112 | 157 | 146 |
| | 24 | 71 | 62 | 89 | 79 | 108 | 98 | 149 | 137 | 192 | 178 |
| | 28 | 79 | 69 | 99 | 88 | 121 | 109 | 167 | 153 | 216 | 200 |
| | 32 | 86 | 75 | 109 | 97 | 134 | 120 | 185 | 170 | 240 | 222 |
| | 36 | 94 | 82 | 120 | 106 | 146 | 132 | 203 | 186 | 264 | 244 |
| | 42 | 106 | 92 | 135 | 120 | 166 | 149 | 230 | 211 | 300 | 278 |
| | 48 | 118 | 102 | 151 | 134 | 185 | 166 | 258 | 236 | 336 | 311 |
| 16" o.c. | 12 | 64 | 57 | 78 | 70 | 93 | 85 | 126 | 117 | 162 | 150 |
| | 18 | 78 | 69 | 98 | 88 | 118 | 108 | 162 | 149 | 209 | 194 |
| | 24 | 94 | 82 | 118 | 105 | 144 | 130 | 198 | 182 | 255 | 237 |
| | 28 | 105 | 92 | 132 | 117 | 161 | 145 | 222 | 203 | 287 | 266 |
| | 32 | 114 | 100 | 145 | 129 | 178 | 160 | 246 | 226 | 319 | 295 |
| | 36 | 125 | 109 | 160 | 141 | 194 | 176 | 270 | 247 | 351 | 325 |
| | 42 | 141 | 122 | 180 | 160 | 221 | 198 | 306 | 281 | 399 | 370 |
| | 48 | 157 | 136 | 201 | 178 | 246 | 221 | 343 | 314 | 447 | 414 |
| 24" o.c. | 12 | 96 | 86 | 118 | 106 | 140 | 128 | 190 | 176 | 244 | 226 |
| | 18 | 118 | 104 | 148 | 132 | 178 | 162 | 244 | 224 | 314 | 292 |
| | 24 | 142 | 124 | 178 | 158 | 216 | 196 | 298 | 274 | 384 | 356 |
| | 28 | 158 | 138 | 198 | 176 | 242 | 218 | 334 | 306 | 432 | 400 |
| | 32 | 172 | 150 | 218 | 194 | 268 | 240 | 370 | 340 | 480 | 444 |
| | 36 | 188 | 164 | 240 | 212 | 292 | 264 | 406 | 372 | 528 | 488 |
| | 42 | 212 | 184 | 270 | 240 | 332 | 298 | 460 | 422 | 600 | 556 |
| | 48 | 236 | 204 | 302 | 268 | 370 | 332 | 516 | 472 | 672 | 622 |



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# R802.11.1 – Truss Uplift Resistance

- Trusses shall be attached to the supporting wall assemblies by connections capable of resisting uplift forces
  - Per truss drawings
  - Construction drawings
  - Table 802.11
  - Accepted engineering practice

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# R802.11.1.2 Rafter uplift resistance

- Individual rafters shall be attached to supporting wall assemblies by connections capable of resisting uplift forces as determined by Table R802.11 or as determined by accepted engineering practice.
- Connections for beams used in a roof system shall be designed in accordance with accepted engineering practice.

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# R803.2.2 Allowable spans

TABLE R503.2.1.1(1)
ALLOWABLE SPANS AND LOADS FOR WOOD STRUCTURAL PANELS FOR ROOF AND SUBFLOOR SHEATHING AND COMBINATION SUBFLOOR UNDERLAYMENT[1, 2, 3]

| SPAN RATING | MINIMUM NOMINAL PANEL THICKNESS (inch) | ALLOWABLE LIVE LOAD (psf)[4, 5] | | MAXIMUM SPAN (inches) | | LOAD (pounds per square foot, at maximum span) | | MAXIMUM SPAN (inches) |
|---|---|---|---|---|---|---|---|---|
| | | SPAN @ 16" o.c. | SPAN @ 24" o.c. | With edge support[6] | Without edge support | Total load | Live load | |
| Sheathing[7] | | | | Roof | | | | Subfloor[8] |
| 16/0 | 5/16 | 30 | — | 16 | 16 | 40 | 30 | 0 |
| 20/0 | 3/8 | 50 | — | 20 | 20 | 40 | 30 | 0 |
| 24/0 | 7/16 | 100 | 30 | 24 | 20[9] | 40 | 30 | 0 |
| 24/16 | 7/16 | 100 | 40 | 24 | 24 | 50 | 40 | 16 |
| 32/16 | 15/32, 1/2 | 180 | 70 | 32 | 28 | 40 | 30 | 16[9] |
| 40/20 | 15/32, 1/2 | 305 | 130 | 40 | 32 | 40 | 30 | 20[9] |
| 48/24 | 19/32, 5/8 | — | 175 | 48 | 36 | 45 | 35 | 24 |
| 60/32 | 7/8 | — | 305 | 60 | 48 | 45 | 35 | 32 |
| Underlayment, C-C plugged, single floor[8] | | | | Roof | | | | Combination subfloor underlayment[8] |
| 16 o.c. | 15/32, 1/2 | 100 | 40 | 24 | 24 | 50 | 40 | 16 |
| 20 o.c. | 19/32, 5/8 | 150 | 60 | 32 | 32 | 40 | 30 | 20[9] |
| 24 o.c. | 19/32, 5/8 | 240 | 100 | 48 | 36 | 35 | 25 | 24 |
| 32 o.c. | 7/8 | — | 185 | 48 | 40 | 50 | 40 | 32 |
| 48 o.c. | 1 1/8, 1 1/4 | — | 290 | 60 | 48 | 50 | 40 | 48 |

- The maximum allowable spans for wood structural panel roof sheathing shall not exceed the values set forth in Table R503.2.1.1(1), or APA E30.

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# R806.2 Roof Ventilation

- 1:150 of the area
- 1:300 with Class I or II vapor retarder in warm side of ceiling in Climate Zones 6, 7, and 8.
- AND…

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# R806.2
# Roof Ventilation

- 40-50% of ventilation at upper portion of attic.
- Upper ventilation no more than 3′ below the ridge
  - More than 3′ if wall or roof framing will not permit the opening to be within the 3′
- Remainder at eave or cornice.

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# R806.5
# Conditioned attic assemblies

- Unvented conditioned attic assemblies (spaces between the ceiling joists of top story and the roof rafters) are permitted under specific conditions.

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# R806.5
# Conditioned attic assemblies

1. Must be within the building thermal envelope.
2. No interior vapor barriers on ceiling side
3. Wood shingles/shakes – ¼ inch air between sheathing
4. Air-impermeable insulation on underside of roof deck (Climate Zones 5, 6, 7, and 8)
   1. Or vapor retarder coating applied.

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# R806.5
# Conditioned attic assemblies

- Either Items 5.1, 5.2 or 5.3 shall be met, depending on the air permeability of the insulation directly under the structural roof sheathing.

TABLE R806.5
INSULATION FOR CONDENSATION CONTROL

| CLIMATE ZONE | MINIMUM RIGID BOARD ON AIR-IMPERMEABLE INSULATION *R*-VALUE[a] |
|---|---|
| 2B and 3B tile roof only | 0 (none required) |
| 1, 2A, 2B, 3A, 3B, 3C | R-5 |
| 4C | R-10 |
| 4A, 4B | R-15 |
| 5 | R-20 |
| 6 | R-25 |
| 7 | R-30 |
| 8 | R-35 |

a. Contributes to but does not supersede the requirements in Section N1103.2.1.

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## Attic Access R807

- Combustible ceiling or roof construction
- 22”X30” opening
  - hallway or readily accessible location
  - M1305.1.3 mechanical access

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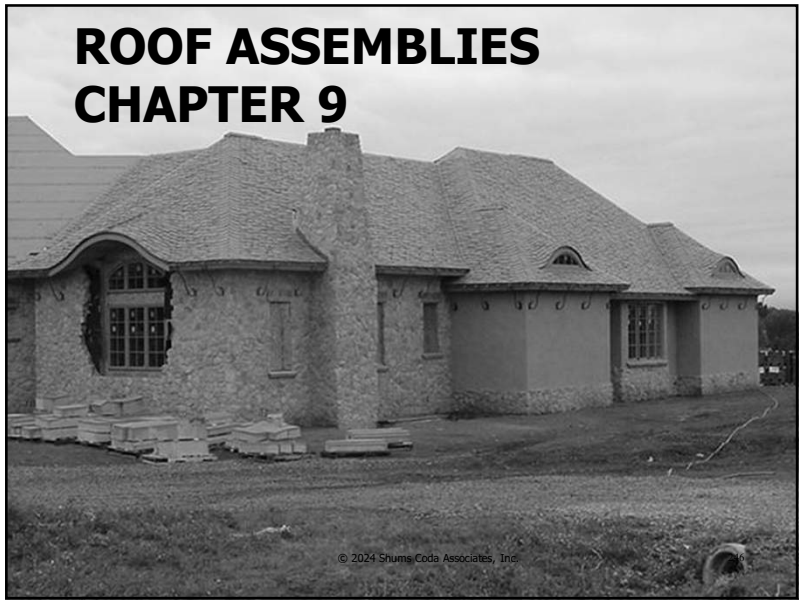
## ROOF ASSEMBLIES CHAPTER 9





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## Roof Classification R902

- Class A, B, C required
  - less than 3’ to property line
  - designated by law

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## Roof Drainage R903.4

- Unless roofs are sloped to drain over roof edges, roof drains shall be installed at each low point of the roof.

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## Roof Coverings R905

- Asphalt Shingles
- Clay & concrete tiles
- Metal roof shingles
- Mineral-surfaced roll roofing
- Slate shingles
- Wood shingles/shakes
- Built-up roofs
- Modified Bitumen
- Single-ply roofing
- Sprayed foam roofing
- Liquid-applied coatings

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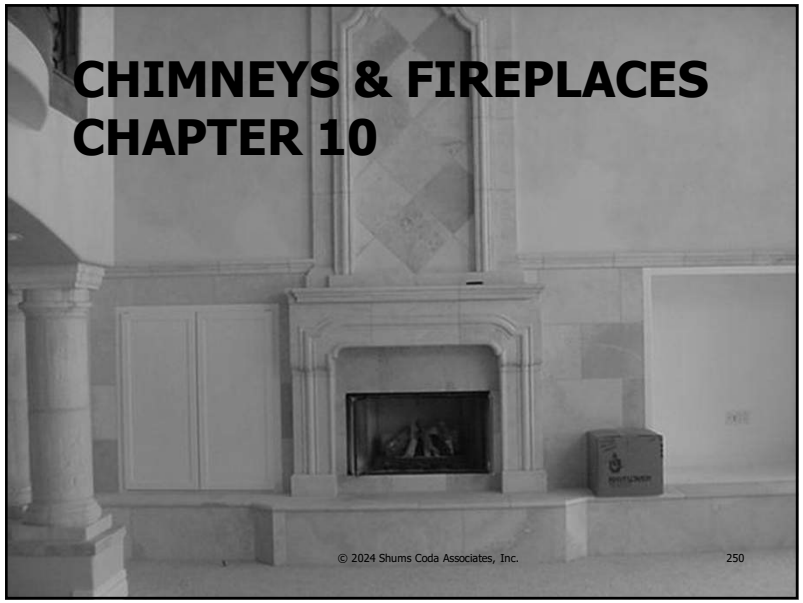
## CHIMNEYS & FIREPLACES CHAPTER 10



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## Factory-Built Fireplaces R1004

- Must be listed & labeled
  - UL 127
- Hearth extension per listing
- Unlisted decorative shrouds not permitted
- Unvented gas log not permitted unless fireplace specifically tested to UL 127



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## Factory Built Chimneys R1005

- Factory-built chimneys shall be listed and labeled and shall be installed and terminated in accordance with the manufacturer's installation instructions.

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# Exterior Air Supply R1006.1

- Exterior air required for factory-built or masonry fireplaces unless room is mechanically ventilated so indoor pressure is neutral or positive
  - Factory built fireplaces follow manufacturers listing
  - Masonry fireplaces may use listed combustion air ducts installed per listing

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