

Chapter 4

Foundations

R401.3 Drainage. Surface drainage shall be diverted to a storm sewer conveyance or other approved point of collection so as to not create a hazard. Lots shall be graded to drain surface water away from foundation walls. The grade shall fall a minimum of 6 inches (152 mm) within the first 10 feet (3048 mm).

Exception: Where lot lines, walls, slopes or other physical barriers prohibit 6 inches (152 mm) of fall within 10 feet (3048 mm), the final grade shall slope away from the foundation at a minimum slope of 5 percent and the water shall be directed to drains or swales or other means shall be provided to ensure drainage away from the structure. Swales shall be sloped a minimum of 2 percent when located within 10 feet (3048 mm) of the building foundation. Impervious surfaces within 10 feet (3048 mm) of the building foundation shall be sloped a minimum of 2 percent away from the building.

R402.2 Concrete. Concrete shall have a minimum specified compressive strength of f'_c , as shown in Table R402.2. Concrete subject to moderate or severe weathering as indicated in Table R301.2(1) shall be air entrained as specified in Table R402.2. The maximum weight of fly ash, other pozzolans, silica fume, slag or blended cements that is included in concrete mixtures for garage floor slabs and for exterior porches, carport slabs and steps that will be exposed to deicing chemicals shall not exceed the percentages of the total weight of cementitious materials specified in Section 4.2.3 of ACI 318. Materials used to produce concrete and testing thereof shall comply with the applicable standards listed in Chapter 3 of ACI 318. In addition to the cements permitted by ACI 318, cements complying with ASTM C1157 is permitted.

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,f}	3,500 ^{d,e,f}

For SI: 1 pound per square inch = 6.895 kPa.

a. At 28 days psi.

b. See Table R301.2(1) for weathering potential.

c. Concrete in these locations that may be subject to freezing and thawing during construction shall be air-entrained concrete in accordance with Footnote d.

d. Concrete shall be air entrained. Total air content (percent by volume of concrete) shall not be less than 5 percent or more than 7 percent.

e. See Section R402.2 for minimum cement content.

f. For garage floors with steel troweled finish, reduction of the total air content (percent by volume of concrete) to not less than 3 percent is permitted if the specified compressive strength of the concrete is increased to not less than 4,000 psi.

R403.1.8.1 Foundation anchorage in Seismic Design Categories C, D₁ and D₂. In addition to the requirements of Section R403.1.8, the following requirements shall apply to wood light-frame structures in Seismic Design Categories D₁ and D₂ and wood light-frame townhouses in Seismic Design Category C.

1. Plate washers conforming to Section R602.11.1 shall be ~~used on each provided for all anchor bolts over the full length of required braced wall lines. Properly sized cut washers shall be permitted for anchor bolts in wall lines not containing braced wall panels.~~
2. Interior braced wall plates shall have anchor bolts spaced at not more than 6 feet (1829 mm) on center and located within 12 inches (305 mm) of the ends of each plate section when supported on a continuous foundation required by Section R602.10.9.
3. In Seismic Design Category D₂, the maximum anchor bolt spacing shall be 4 feet (1219 mm) for buildings over two stories in height.
4. Stepped cripple walls shall conform to Section R602.11.3.
5. Where continuous wood foundations in accordance with Section R404.2 are used, the force transfer shall have a capacity equal to or greater than the connections required by Section R602.11.1 or the braced wall panel shall be connected to the wood foundations in accordance with the braced wall panel-to-floor fastening requirements of Table R602.3(1).

R404.1.4 Seismic Design Categories D₁ and D₂. In addition to the requirements of Tables R404.1.1(1) and R404.1.1(5), plain concrete and plain masonry foundation walls located in Seismic Design Categories D₁ and D₂, as established in Table R301.2(1), shall comply with the following.

1. Wall height shall not exceed 8 feet (2438 mm).
2. ~~Height of Unbalanced backfill height~~ shall not exceed 4 feet (1219 mm).
3. Minimum reinforcement for plain concrete foundation walls shall consist of one No. 4 (No. 13) horizontal bar located in the upper 12 inches (305 mm) of the wall.
4. Minimum thickness for plain concrete foundation walls shall be of 7.5 inches (191 mm) is required for plain concrete foundation walls except that a minimum thickness of 6 inches (152 mm) is shall be permitted for plain concrete foundation walls when the with a maximum height is 4 feet, 6 inches (1372 mm).
5. Minimum nominal thickness for plain masonry foundation walls shall be 8 inches (203 mm).
6. Masonry stem walls shall have a minimum vertical reinforcement of one No. 3 (No. 10) bar located a maximum of 4 feet (1220 mm) on center in grouted cells. Vertical reinforcement shall be tied to the horizontal reinforcement in the footings. Vertical reinforcement for masonry stem walls shall be tied to the horizontal reinforcement in the footings. Masonry stem walls located in Seismic Design Categories D₁ and D₂ shall have a minimum vertical reinforcement of one No. 3 bar located a maximum of 4 feet (1220 mm) on center in grouted cells.

Foundation walls located in Seismic Design Categories D₁ and D₂, as established in Table R301.2(1), supporting more than 4 feet (1219 mm) of unbalanced backfill or exceeding 8 feet (2438 mm) in height shall be constructed in accordance with Table R404.1.1(2), R404.1.1(3) or R404.1.1(4) and for masonry, or Table R404.1.1(5) for concrete. Where Table R404.1.1(5) permits plain concrete walls, not less than No. 4 (No. 13) vertical bars at a spacing not exceeding 48 inches (1219 mm) shall be provided. Insulating concrete form foundation walls shall be reinforced as required in Table R404.4(1), R404.4(2), R404.4(3), R404.4(4) or R404.4(5). Where no vertical reinforcement is required by Table R404.4(2), R404.4(3) or R404.4(4) there shall be a minimum of one No. 4 (No. 13) bar at 48 inches (1220 mm) on center. All concrete and masonry foundation walls shall have two No. 4 (No. 13) horizontal bars located in the upper 12 inches (305 mm) of the wall.

New Table

**TABLE R404.1.1(4)
 12-INCH MASONRY FOUNDATION WALLS WITH REINFORCING
 WHERE $d > 8.75$ INCHES^a**

WALL HEIGHT	HEIGHT OF UNBALANCE BACKFILL ^e	MINIMUM VERTICAL REINFORCEMENT ^{b, c}		
		Soil classes and lateral soil load ^d (psf per foot below grade)		
		GW, GP, SW and SP soils 30	GM, GC, SM, SM-SC and ML soils 45	SC, ML-CL and inorganic CL soils 60
6 feet 8 inches	4 feet (or less)	#4 at 72" o.c.	#4 at 72" o.c.	#4 at 72" o.c.
	5 feet	#4 at 72" o.c.	#4 at 72" o.c.	#4 at 72" o.c.
	6 feet 8 inches	#4 at 72" o.c.	#4 at 72" o.c.	#5 at 72" o.c.
7 feet 4 inches	4 feet (or less)	#4 at 72" o.c.	#4 at 72" o.c.	#4 at 72" o.c.
	5 feet	#4 at 72" o.c.	#4 at 72" o.c.	#4 at 72" o.c.
	6 feet	#4 at 72" o.c.	#4 at 72" o.c.	#5 at 72" o.c.
	7 feet 4 inches	#4 at 72" o.c.	#5 at 72" o.c.	#6 at 72" o.c.
8 feet	4 feet (or less)	#4 at 72" o.c.	#4 at 72" o.c.	#4 at 72" o.c.
	5 feet	#4 at 72" o.c.	#4 at 72" o.c.	#4 at 72" o.c.
	6 feet	#4 at 72" o.c.	#4 at 72" o.c.	#5 at 72" o.c.
	7 feet	#4 at 72" o.c.	#5 at 72" o.c.	#6 at 72" o.c.
8 feet 8 inches	8 feet	#5 at 72" o.c.	#6 at 72" o.c.	#6 at 64" o.c.
	4 feet (or less)	#4 at 72" o.c.	#4 at 72" o.c.	#4 at 72" o.c.
	5 feet	#4 at 72" o.c.	#4 at 72" o.c.	#4 at 72" o.c.
	6 feet	#4 at 72" o.c.	#4 at 72" o.c.	#5 at 72" o.c.
8 feet 8 inches	7 feet	#4 at 72" o.c.	#5 at 72" o.c.	#6 at 72" o.c.
	8 feet 8 inches	#5 at 72" o.c.	#7 at 72" o.c.	#6 at 48" o.c.
	4 feet (or less)	#4 at 72" o.c.	#4 at 72" o.c.	#4 at 72" o.c.
	5 feet	#4 at 72" o.c.	#4 at 72" o.c.	#4 at 72" o.c.
9 feet 4 inches	6 feet	#4 at 72" o.c.	#5 at 72" o.c.	#5 at 72" o.c.
	7 feet	#4 at 72" o.c.	#5 at 72" o.c.	#6 at 72" o.c.
	8 feet	#5 at 72" o.c.	#6 at 72" o.c.	#6 at 56" o.c.
	9 feet 4 inches	#6 at 72" o.c.	#6 at 48" o.c.	#6 at 40" o.c.
10 feet	4 feet (or less)	#4 at 72" o.c.	#4 at 72" o.c.	#4 at 72" o.c.
	5 feet	#4 at 72" o.c.	#4 at 72" o.c.	#4 at 72" o.c.
	6 feet	#4 at 72" o.c.	#5 at 72" o.c.	#5 at 72" o.c.
	7 feet	#4 at 72" o.c.	#6 at 72" o.c.	#6 at 72" o.c.
	8 feet	#5 at 72" o.c.	#6 at 72" o.c.	#6 at 48" o.c.
	9 feet	#6 at 72" o.c.	#6 at 56" o.c.	#6 at 40" o.c.
	10 feet	#6 at 64" o.c.	#6 at 40" o.c.	#6 at 32" o.c.

For SI: 1 inch= 25.4 mm, 1 foot= 304.8 mm, 1 pound per square foot per foot = 0.157 kPa/mm.

- a. Mortar shall be Type M or S and masonry shall be laid in running bond.
- b. Alternative reinforcing bar sizes and spacings having an equivalent cross-sectional area of reinforcement per lineal foot of wall shall be permitted provided the spacing of the reinforcement does not exceed 72 inches.
- c. Vertical reinforcement shall be Grade 60 minimum. The distance from the face of the soil side of the wall to the center of vertical reinforcement shall be at least 8.75 inches.
- d. Soil classes are in accordance with the Unified Soil Classification System and design lateral soil loads are for moist conditions without hydrostatic pressure. Refer to Table R405.1.
- e. Unbalanced backfill height is the difference in height between the exterior finish ground level and the lower of the top of the concrete footing that supports the foundation wall or the interior finish ground levels. Where an interior concrete slab-on-grade is provided and in contact with the interior surface of the foundation wall, measurement of the unbalanced backfill height is permitted to be measured from the exterior finish ground level to the top of the interior concrete slab is permitted.

New Table

TABLE R404.1.1(5)
CONCRETE FOUNDATION WALLS^{h,i,j,k}

MAXIMUM WALL HEIGHT (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT ^b (feet)	MINIMUM VERTICAL REINFORCEMENT SIZE AND SPACING ^{c, d, e, f, l}											
		Soil classes ^a and design lateral soil (psf per foot of depth)											
		GW, GP, SW and SP				GM, GC, SM, SM-SC and ML				SC, ML-CL and inorganic CL			
		30				45				60			
		Minimum wall thickness (inches)											
5.5	7.5	9.5	11.5	5.5	7.5	9.5	11.5	5.5	7.5	9.5	11.5		
5	4	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	
	5	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	
6	4	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	
	5	PC	PC	PC	PC	PC	PC ^e	PC	PC	#4@35"	PC ^e	PC	PC
7	6	PC	PC	PC	PC	#5@48"	PC	PC	PC	#5@36"	PC	PC	PC
	4	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC
	5	PC	PC	PC	PC	PC	PC	PC	PC	#5@47"	PC	PC	PC
	6	PC	PC	PC	PC	#5@42"	PC	PC	PC	#6@43"	#5@48"	PC ^e	PC
8	7	#5@46"	PC	PC	PC	#6@42"	#5@46"	PC ^e	PC	#6@34"	#6@48"	PC	PC
	4	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC
	5	PC	PC	PC	PC	#4@38"	PC ^e	PC	PC	#5@43"	PC	PC	PC
	6	#4@37"	PC ^e	PC	PC	#5@37"	PC	PC	PC	#6@37"	#5@43"	PC ^e	PC
	7	#5@40"	PC	PC	PC	#6@37"	#5@41"	PC	PC	#6@34"	#6@43"	PC	PC
9	8	#6@43"	#5@47"	PC ^e	PC	#6@34"	#6@43"	PC	PC	#6@27"	#6@32"	#6@44"	PC
	4	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC
	5	PC	PC	PC	PC	#4@35"	PC ^e	PC	PC	#5@40"	PC	PC ^e	PC
	6	#4@34"	PC ^e	PC	PC	#6@48"	PC	PC	PC	#6@36"	#5@39"	PC ^e	PC
	7	#5@36"	PC	PC	PC	#6@34"	#5@37"	PC	PC	#6@33"	#6@38"	#5@37"	PC ^g
	8	#6@38"	#5@41"	PC ^e	PC	#6@33"	#6@38"	#5@37"	PC ^e	#6@24"	#7@39"	#6@39"	#4@48" h
10	9	#6@34"	#6@46"	PC	PC	#6@26"	#7@41"	#6@41"	PC	#6@19"	#7@31"	#7@41"	#6@39"
	4	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC	PC
	5	PC	PC	PC	PC	#4@33"	PC ^e	PC	PC	#5@38"	PC	PC	PC
	6	#5@48"	PC ^e	PC	PC	#6@45"	PC	PC	PC	#6@34"	#5@37"	PC	PC
	7	#6@47"	PC	PC	PC	#6@34"	#6@48"	PC	PC	#6@30"	#6@35"	#6@48"	PC ^g
	8	#6@34"	#5@38"	PC	PC	#6@30"	#7@47"	#6@47"	PC ^e	#6@22"	#7@35"		#7 @ 4
	9	#6@34"	#6@41"	#4@48"	PC ^e	#6@23"	#7@37"	#7@48"	#4@48" h	DR	#6@22"	#7@37"	#7@47"
10	#6@28"	#7@45"	#6@45"	PC	DR	#7@31"	#7@40"	#6@38"	DR	#6@22"	#7@30"	#7@38"	

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa; 1 pound per square foot per foot = 0.157 kPa/mm.

- a. Soil classes are in accordance with the United Soil Classification System. Refer to Table R405.1
- b. Unbalanced backfill height is the difference in height of the exterior and interior finish ground levels. Where there is an interior concrete slab, the unbalanced back- fill height shall be measured from the exterior finish ground level to the top of the interior concrete slab.
- c. The size and spacing of vertical reinforcement shown in the table is based on the use of reinforcement with a minimum yield strength of 60,000 psi. Vertical reinforcement with a minimum yield strength of 40,000 psi or 50,000 psi is permitted, provided the same size bar is used and the spacing shown in the table is reduced by multiplying the spacing by 0.67 or 0.83, respectively.
- d. Vertical reinforcement, when required, shall be placed nearest the inside face of the wall a distance d from the outside face (soil side) of the wall. The distance d is equal to the wall thickness, t, minus 1.25 inches plus one-half the bar diameter, db ($d = t - (1.25 + db/2)$). The reinforcement shall be placed within a tolerance of $\pm 3/8$ inch where d is less than or equal to 8 inches, or $\pm 1/2$ inch where d is greater than 8 inches.
- e. In lieu of the reinforcement shown, smaller reinforcing bar sizes and closer spacings resulting in an equivalent cross-sectional area of reinforcement per linear foot of wall are permitted.
- f. Concrete cover for reinforcement measured from the inside face of the wall shall not be less than $3/4$ inch. Concrete cover for reinforcement measured from the outside face of the wall shall not be less than $1\frac{1}{2}$ inches for No. 5 bars and smaller, and not less than 2 inches for larger bars.
- g. The minimum thickness is permitted to be reduced 2 inches, provided the minimum specified compressive strength of concrete f'_c is 4,000 psi.
- h. A plain concrete wall with a minimum thickness of 11.5 inches is permitted, provided minimum specified compressive strength of concrete, f'_c is 3,500 psi.
- i. Concrete shall have a specified compressive strength of not less than 2,500 psi at 28 days, unless a higher strength is required by note g or h.
- j. “DR” means design is required in accordance with ACI 318 or ACI 332.
- k. “PC” means plain concrete.
- l. Where vertical reinforcement is required, horizontal reinforcement shall be provided in accordance with the requirements of Section R404.6.2.

R404.5 Retaining walls. Retaining walls that are not laterally supported at the top and that retain in excess of ~~24~~ 48 inches (610 1220 mm) of unbalanced fill shall be designed to ensure stability against overturning, sliding, excessive foundation pressure and water uplift. Retaining walls shall be designed for a safety factor of 1.5 against lateral sliding and overturning.

R406.1 Concrete and masonry foundation dampproofing. Except where required ~~to be waterproofed~~ by Section R406.2, foundation walls that retain earth and enclose ~~habitable or usable interior spaces and floors~~ below grade shall be dampproofed from the top of the footing to the finished grade. Masonry walls shall have not less than $3/8$ inch (9.5 mm) portland cement parging applied to the exterior of the wall. The parging shall be dampproofed in accordance with one of the following:

- 1. Bituminous coating.
- 2. 3 pounds per square yard (1.63 kg/m²) of acrylic modified cement.
- 3. $1/8$ -inch (3.2 mm) coat of surface-bonding cement complying with ASTM C 887.
- 4. Any material permitted for waterproofing in Section R406.2.
- 5. Other approved methods or materials.

Exception: Parging of unit masonry walls is not required where a material is approved for direct application to the masonry.

Concrete walls shall be dampproofed by applying any one of the above listed dampproofing materials or any one of the waterproofing materials listed in Section R406.2 to the exterior of the wall.

R406.2 Concrete and masonry foundation waterproofing. In areas where a high water table or other severe soil-water conditions are known to exist, exterior foundation walls that retain earth and enclose habitable or useable interior spaces and floors located below grade shall be waterproofed with a membrane extending from the top of the footing to the finished grade. The membrane shall consist of Walls shall be waterproofed in accordance with one of the following:

1. 2-ply hot-mopped felts.
2. 55 pound (25 kg) roll roofing.
3. 6-mil (0.15 mm) polyvinyl chloride.
4. 6-mil (0.15 mm) polyethylene.
5. 40-mil (1 mm) polymer-modified asphalt.
6. 60-mil (1.5 mm) flexible polymer cement.
7. 1/8 inch (3 mm) cement-based, fiber-reinforced, waterproof coating.
8. 60-mil (0.22 mm) solvent-free liquid-applied synthetic rubber.

Exception: Organic-solvent-based products such as hydrocarbons, chlorinated hydrocarbons, ketones and esters shall not be used for ICF walls with expanded polystyrene form material. Use of plastic roofing cements, acrylic coatings, latex coatings, mortars and pargings to seal ICF walls is permitted. Cold-setting asphalt or hot asphalt shall conform to type C of ASTM D 449. Hot asphalt shall be applied at a temperature of less than 200°F (93°C).

The All joints in membrane waterproofing shall be lapped and sealed with an adhesive compatible with the waterproofing membrane.

TABLE R404.4(3)
9.5-INCH-THICK FLAT ICF FOUNDATION WALLS ^{a,b,c,d,e}

HEIGHT OF BASEMENT WALL	MAXIMUM UNBALANCED BACKFILL HEIGHT ^f (feet)	MINIMUM VERTICAL REINFORCEMENT SIZE AND SPACING		
		Soil classes ^g and design lateral soil load (psf per foot of depth)		
		<u>GW, GP, SW and SP</u> 30	<u>GM, GC, SM, SM-SC and ML</u> 45	<u>SC, ML-CL and inorganic CL</u> 60
8	7	N/R	N/R	N/R
9	6	N/R	N/R	N/R
	7	N/R	N/R	#3 @6"; #4 @ 12"; #5@18"; #6@26"
10	8	N/R	#3@6"; #4@12"; #5@18"; #6@26"	#3@4"; #4@8"; #5@14"; #6@18"
	5	N/R	N/R	N/R
	6	N/R	N/R	N/R #3@10"; #4@18"; #5@26"; #6@36"
	7	N/R	N/R	#3 @6"; #4 @ 10"; #5@18"; #6@24"
	8	N/R	#3@6"; #4@12"; #5@16"; #6@24"	#3@4"; #4@8"; #5@12"; #6@16"
9	<u>#3 @ 4"; #4 @ 10"; #5 @ 14"; #6@20"</u>	#3@4"; #4@8"; #5 @ 12"; #6@ 18"	#3@4"; #4@6"; #5 @ 10"; #6 @ 12"	

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square inch = 6.895 kPa, 1 pound per square foot = 0.0479 kPa.

- a. This table is based on concrete with a minimum specified concrete strength of 2500 psi, reinforcing steel with a minimum yield strength of 40,000 psi. When reinforcing steel with a minimum yield strength of 60,000 psi is used, the spacing of the reinforcement shall be increased to 1.5 times the spacing value in the table.
- b. This table is not intended to prohibit the use of an ICF manufacturer's tables based on engineering analysis in accordance with ACI 318.
- c. N/R denotes "not required."
- d. Deflection criteria: $l/240$.
- e. Interpolation between rebar sizes and spacing is not permitted.
- f. Unbalanced backfill height is the difference in height of the exterior and interior finished ground. Where an interior concrete slab is provided, the unbalanced back- fill height shall be measured from the exterior finished ground level to the top of the interior concrete slab.
- g. Soil classes are in accordance with the Unified Soil Classification System. Refer to Table R405.1.

Chapter 5

Floors

R502.1.6 Structural log members. Stress grading of structural log members of nonrectangular shape, as typically used in log buildings, shall be in accordance with ASTM D 3957. Such structural log members shall be identified by the grade mark of an approved lumber grading or inspection agency. In lieu of a grade mark on the material, a certificate of inspection as to species and grade issued by a lumber-grading or inspection agency meeting the requirements of this section shall be permitted to be accepted.

R502.2 Design and construction. Floors shall be designed and constructed in accordance with the provisions of this chapter, Figure R502.2 and Sections R319 and R320 or in accordance with AF&PA/NDS.

R502.2.1 Framing at braced wall lines. A load path for lateral forces shall be provided between floor framing and braced wall panels located above or below a floor, as specified in Section R602.10.8.

R502.2.2 Decks. Where supported by attachment to an exterior wall, decks shall be positively anchored to the primary structure and designed for both vertical and lateral loads as applicable. Such attachment shall not be accomplished by the use of toenails or nails subject to withdrawal. Where positive connection to the primary building structure cannot be verified during inspection, decks shall be self-supporting. For decks with cantilevered framing members, connections to exterior walls or other framing members, shall be designed and constructed to resist uplift resulting from the full live load specified in Table R301.5 acting on the cantilevered portion of the deck.

~~**Exception:** Girders and posts supporting exterior decks not exceeding 18 inches (457 mm) in height are not required to be laterally braced or have gussets at post and girder connection.~~

R502.3.1 Sleeping areas and attic joists. Table R502.3.1(1) shall be used to determine the maximum allowable span of floor joists that support sleeping areas and attics that are accessed by means of a fixed stairway in accordance with Section R311.5 provided that the design live load does not exceed 30 psf (1.44 kPa) and the design dead load does not exceed ~~40~~ 20 psf (~~0.48~~ 0.96 kPa). The allowable span of ceiling joists that support attics used for limited storage or no storage shall be determined in accordance with Section R802.4.

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 all other areas of the building, other than sleeping rooms and attics, provided that the design live load does not exceed 40 psf (1.92 kPa) and the design dead load does not exceed ~~40~~ 20 psf (~~0.48~~ 0.96 kPa).

TABLE R502.3.1(1)
FLOOR JOIST SPANS FOR COMMON LUMBER SPECIES
(Residential sleeping areas, live load = 30 psf, L/ =360)^a
(New footnote^a)

a. Dead load limits for townhouses in Seismic Design Category C and all structures in Seismic Design Categories D₁ and D₂ shall be determined in accordance with Section R301.2.2.2.1.

TABLE R502.3.1(2)
FLOOR JOIST SPANS FOR COMMON LUMBER SPECIES
(Residential living areas, live load = 40 psf, L/ =360)^b
(New footnote^b)

- a. End bearing length shall be increased to 2 inches.
- b. Dead load limits for townhouses in Seismic Design Category C and all structures in Seismic Design Categories D₁ and D₂ shall be determined in accordance with Section R301.2.2.2.1.

TABLE R502.5(1)
GIRDER SPANS AND HEADER SPANS FOR EXTERIOR BEARING WALLS
(New column has been added to include a ground snow load of 70 psf)

R502.7 Lateral restraint at supports. Joists shall be supported laterally at their ends by full-depth solid blocking not less than 2 inches (51 mm) nominal thickness; or by attachment to a full-depth header, band or rim joist, or to an adjoining stud or shall be otherwise provided with lateral support to prevent rotation.

R502.8.2 Engineered wood products. Cuts, notches and holes bored in trusses, ~~laminated veneer lumber~~, structural composite lumber, structural glue-laminated members or I-joists are ~~not permitted unless~~ prohibited except where permitted by the manufacturer's recommendations or where the effects of such penetration alterations are specifically considered in the design of the member by a registered design professional.

TABLE R503.2.1.1(1)
(New column has been added for “Allowable live load”)

R505.1.1 Applicability limits. The provisions of this section shall control the construction of steel floor framing for buildings not greater than 60 feet (18,288 mm) in length perpendicular to the joist span, not greater than ~~36~~ 40 feet (12 192 mm) in width parallel to the joist span, and not greater than two stories in height. ~~each story not greater than 10 feet (3048 mm) high.~~ Steel floor framing constructed in accordance with the provisions of this section shall be limited to sites subjected to a maximum design wind speed of 110 miles per hour (49 m/s), Exposure A, B, or C, and a maximum ground snow load of 70 psf (3.35 kPa).

R505.1.3 Floor trusses. The design, quality assurance, installation and testing of cold-formed steel trusses shall be in accordance with the AISI Standard for Cold-formed Steel Framing-Truss Design (COFS/Truss). Truss members shall not be notched, cut or altered in any manner without an approved design.

R505.2 Structural framing. Load-bearing floor framing members shall comply with Figure R505.2(1) and with the dimensional and minimum thickness requirements specified in Tables R505.2(1) and R505.2(2). Tracks shall comply with Figure R505.2(2) and shall have a minimum flange width of 1¹/₄ inches (32 mm). The maximum inside bend radius for members shall be the larger of ³/₃₂ inch (2.4 mm) or twice the uncoated steel thickness. Holes in joist webs shall comply with all of the following conditions:

1. Holes shall conform to Figure R505.2(3);
2. Holes shall be permitted only along the centerline of the web of the framing member;
3. Holes shall have a center-to-center spacing of not less than 24 inches (61 mm);
4. Holes shall have a web hole width not greater than 0.5 times the member depth, or 2¹/₂ inches (64.5 mm);
5. Holes shall have a web hole length not exceeding 4¹/₂ inches (114 mm and
6. Holes shall have a minimum distance between the edge of the bearing surface and the edge of the web hole of not less than 10 inches (254 mm).

Framing members with web holes not conforming to the above requirements shall be patched in accordance with Section R505.3.6 or designed in accordance with accepted engineering practices.

R505.3.2 Allowable joist spans. The clear span of cold-formed steel floor joists shall not exceed the limits set forth in Tables [R505.3.2\(1\)](#), R505.3.2(2), [and R505.3.2\(3\)](#). Floor joists shall have a minimum bearing length of 1.5 inches (38 mm). When continuous joists are used, the interior bearing supports shall be located within 2 feet (610 mm) of mid span of the steel joists, and the individual spans shall not exceed the span in Tables R505.3.2(2) [and R505.3.2\(3\)](#). Bearing stiffeners shall be installed at each bearing location in accordance with Section R505.3.4 and as shown in Figure R505.3.

Blocking is not required for continuous back-to-back floor joists at bearing supports. Blocking shall be installed between the joists for single continuous floor joists across bearing supports. Blocking shall be spaced at a maximum of 12 feet (3660 mm) on center. Blocking shall consist of C-shape or track section with a minimum thickness of 33 mils (0.84 mm). Blocking shall be fastened to each adjacent joist through a 33-mil (0.84 mm) clip angle, bent web of blocking or flanges of web stiffeners with two No. 8 screws on each side. The minimum depth of the blocking shall be equal to the depth of the joist minus 2 inches (51 mm). The minimum length of the angle shall be equal to the depth of the joist minus 2 inches (51 mm).

R505.3.6 Hole patching. Web holes not conforming to the requirements in Section R505.2 shall be designed in accordance with one of the following:

1. Framing members shall be replaced or designed in accordance with accepted engineering practices when web holes exceed the following size limits:

1.1. The depth of the hole, measured across the web, exceeds 70 percent of the flat width of the web; or

1.2. The length of the hole measured along the web, exceeds 10 inches (254 mm) or the depth of the web, whichever is greater.

2. Web holes not exceeding the dimensional requirements in Section R505.3.6, Item 1, shall be patched with a solid steel plate, stud section, or track section in accordance with Figure R505.3.6. The steel patch, shall be as a minimum thickness, be of the same thickness as the receiving member and shall extend at least 1 inch (25 mm) beyond all edges of the hole. The steel patch shall be fastened to the web of the receiving member with No. 8 screws spaced no greater than 1 inch (25 mm) center-to-center along the edges of the patch with minimum edge distance of ½ inch (13 mm)

R506.2.4 Reinforcement support. Where provided in slabs on ground, reinforcement shall be supported to remain in place from the center to upper one third of the slab for the duration of the concrete placement.

Exception: Welded wire fabric.

Chapter 6

Wall Construction

R602.1.3 Structural log members. Stress grading of structural log members of nonrectangular shape, as typically used in log buildings, shall be in accordance with ASTM D 3957. Such structural log members shall be identified by the grade mark of an approved lumber grading or inspection agency. In lieu of a grade mark on the material, a certificate of inspection as to species and grade issued by a lumber-grading or inspection agency meeting the requirements of this section shall be permitted to be accepted.

R602.3 Design and construction. Exterior walls of wood-frame construction shall be designed and constructed in accordance with the provisions of this chapter and Figures R602.3(1) and R602.3(2) or in accordance with AF&PA's NDS. Components of exterior walls shall be fastened in accordance with Tables R602.3(1) through R602.3(4). Exterior walls covered with foam plastic sheathing shall be braced in accordance with Section R602.10. Structural sheathing shall be fastened directly to structural framing members.

Studs shall be continuous from a support at the bottom to a support at the top to resist loads perpendicular to wall. The support shall be a foundation or floor, ceiling or roof diaphragm or other methods approved by the Building Official.

R602.3.2 Top plate. Wood stud walls shall be capped with a double top plate installed to provide overlapping at corners and intersections with bearing partitions. End joints in top plates shall be offset at least 24 inches (610 mm). Joints in plates need not occur over studs. Plates shall be not less than a nominal 2-inches (51 mm) in depth nominal thickness and have a width at least equal to the width of the studs.

**TABLE R602.3(1)
FASTENER SCHEDULE FOR STRUCTURAL MEMBERS**

<u>Collar tie to rafter, face nail, 1¼" x 20 gage ridge strap</u>		<u>3-10d (3" x 0.128")</u>	—
<u>½" regular cellulose fiberboard sheathing</u>	<u>1½ galvanized roofing nail; 6d common nail; staple 16-ga. 1½ long</u>	3	6

i. Spacing of fasteners on floor sheathing panel edges applies to panel edges supported by framing members and required blocking and at all floor perimeters only. Spacing of fasteners on roof sheathing panel edges applies to panel edges supported by framing members and required blocking and at all roof plane perimeters. Blocking of roof and or floor sheathing panel edges perpendicular to the framing members shall need not be required provided except as required by other provisions of this code at intersection of adjacent roof planes. Floor and roof perimeters shall be supported by framing members or solid blocking.

TABLE R602.3(2)
ALTERNATE ATTACHMENT

(This table has been modified on the model code level and a comparison of the new table with the old one, to establish the importance of the changes, will be needed. Since this is an alternate attachment schedule a detailed description of the changes is not provided here.)

R602.5 Interior nonbearing walls. Interior nonbearing walls shall be permitted to be constructed with 2-inch-by-3-inch (51 mm by 76 mm) studs spaced 24 inches (610 mm) on center or, when not part of a braced wall line, 2-inch-by-4-inch (51 mm by 102 mm) flat studs spaced at 16 inches (406 mm) on center. Interior nonbearing walls shall be capped with at least a single top plate. Interior nonbearing walls shall be fireblocked in accordance with Section R602.8.

Studs shall be supported at top and bottom by roof, floor or ceiling diaphragm to resist loads perpendicular to wall or shall be designed in accordance with accepted engineering practice.

Exception: Interior partial-height walls used as design features to separate spaces in kitchens and similar uses that are not used for stair guards, handrails or otherwise intended to support forces at the top of the wall.

R602.6 Drilling and notching—studs. Drilling and notching of studs shall be in accordance with the following:

1. Notching. Any stud in an exterior wall or bearing partition may be cut or notched to a depth not exceeding 25 percent of its width. Studs in nonbearing partitions may be notched to a depth not to exceed 40 percent of a single stud width.

2. Drilling. Any stud may be bored or drilled, provided that the diameter of the resulting hole is no ~~more greater~~ than ~~60~~ 40 percent of the stud width, the edge of the hole is no more than ⁵/₈ inch (16 mm) to the edge of the stud, and the hole is not located in the same section as a cut or notch. ~~Exception 1. A stud may be bored to a diameter not exceeding 60 percent of its width, provided that such~~ studs located in exterior walls or bearing partitions drilled over 40 percent and up to 60 percent shall also be ~~are~~ doubled with ~~and that~~ not more than two successive doubled studs ~~are~~ bored. See Figures R602.6(1) and R602.6(2).

Exception 2: Use of approved stud shoes may be used is permitted when they are installed in accordance with the manufacturer's recommendations.

R602.6.1 Drilling and notching of top plate. When piping or ductwork is placed in or partly in an exterior wall or interior load-bearing wall, necessitating cutting, drilling or notching of the top plate by more than 50 percent of its width, a galvanized metal tie of not less than 0.054 inch thick (1.37 mm) (16 ga) and 1½ inches (38 mm) wide shall be fastened across and to each the plate across-and-to at each side of the opening with not less than eight 16d nails at each side or equivalent. See Figure R602.6. 1.

Exception: When the entire side of the wall with the notch or cut is covered by wood structural panel sheathing.

R602.10.3 Braced wall panel construction methods. The construction of braced wall panels shall be in accordance with one of the following methods:

1.
2.
3.
4.
5. Gypsum board with minimum ½-inch (12.7 mm) thickness placed on studs spaced a maximum of 24 inches (610 mm) on center and fastened at the edge of the panel at 7 inches (178 mm) on center with the size of nails specified in Table R602.3(1) for sheathing and Table R702.3.5 for interior gypsum board.
6.
7.
8.

Exception: Alternate braced wall panels constructed in accordance with Section R602.10.6.1 or Section R602.10.6.2 shall be permitted to replace any of the above methods of braced wall panels.

R602.10.5 Continuous wood structural panel sheathing. When continuous wood structural panel sheathing is provided in accordance with Method 3 of Section R602.10.3 on all sheathable areas of all exterior walls, and interior braced wall lines, where required, including areas above and below openings, bracing wall panel lengths shall be in accordance with Table R602.10.5. All vertical and horizontal panel edges, regardless of location along a given braced wall line, shall be blocked and edges nailed. When this methodology is utilized, the minimum length to be considered a qualifying braced panel shall comply with Table R602.10.5. Wood structural panel sheathing at corners shall be installed in accordance with Figure R602.10.5. The bracing amounts in Table R602.10.3(1) for Method 3 shall be permitted to be multiplied by a factor of 0.9 for walls with a maximum opening height that does not exceed 85 percent of the wall height or a factor of 0.8 for walls with a maximum opening height that does not exceed 67 percent of the wall height as per Table R602.10.3(2).

R602.10.6 Alternate braced wall panel construction methods. Alternate braced wall panels shall be constructed in accordance with Sections R602.10.6.1 and R602.10.6.2

R602.10.6.1 Alternate braced wall panels.

R602.10.6.2 Alternate braced wall panel adjacent to a door or window opening. Alternate braced wall panels constructed in accordance with one of the following provisions are also permitted to replace each 4 feet (1219 mm) of braced wall panel as required by Section R602.10.4 for use adjacent to a window or door opening with a full-length header:

1. In one-story buildings, each panel shall have a length of not less than 16 inches (406 mm) and a height of not more than 10 feet (3048 mm). Each panel shall be sheathed on one face with a single layer of $3/8$ -inch-minimum-thickness (10 mm) wood structural panel sheathing nailed with 8d common or galvanized box nails in accordance with Figure R602.10.6.2. The wood structural panel sheathing shall extend up over the solid sawn or glued-laminated header and shall be nailed in accordance with Figure R602.10.6.2. Use of a built-up header consisting of at least two 2 x 12s and fastened in accordance with Table R602.3(1) shall be permitted. A spacer, if used, shall be placed on the side of the built-up beam opposite the wood structural panel sheathing. The header shall extend between the inside faces of the first full-length outer studs of each panel. The clear span of the header between the inner studs of each panel shall be not less than 6 feet (1829 mm) and not more than 18 feet (5486 mm) in length. A strap with an uplift capacity of not less than 1000 pounds (4448 N) shall fasten the header to the side of the inner studs opposite the sheathing. One anchor bolt not less than $5/8$ -inch-diameter (16 mm) and installed in accordance with Section R403.1.6 shall be installed in the center of each sill plate. The studs at each end of the panel shall have a tie-down device fastened to the foundation with an uplift capacity of not less than 4,200 pounds (18 683 N).

Where a panel is located on one side of the opening, the header shall extend between the inside face of the first full-length stud of the panel and the bearing studs at the other end of the opening. A strap with an uplift capacity of not less than 1000 pounds (4448 N) shall fasten the header to the bearing studs. The bearing studs shall also have a tie-down device fastened to the foundation with an uplift capacity of not less than 1000 pounds (4448 N).

The tie-down devices shall be an embedded-strap type, installed in accordance with the manufacturer's recommendations. The panels shall be supported directly on a foundation which is continuous across the entire length of the braced wall line. The foundation shall be reinforced with not less than one No. 4 bar top and bottom.

Where the continuous foundation is required to have a depth greater than 12 inches (305 mm), a minimum 12-inch-by-12-inch (305 mm by 305 mm) continuous footing or turned down slab edge is permitted at door openings in the braced wall line. This continuous footing or turned down slab edge shall be reinforced with not less than one No. 4 bar top and bottom. This reinforcement shall be lapped not less than 15 inches (381 mm) with the reinforcement required in the continuous foundation located directly under the braced wall line.

2. In the first story of two-story buildings, each wall panel shall be braced in accordance with Item 1 above, except that each panel shall have a length of not less than 24 inches (610 mm).

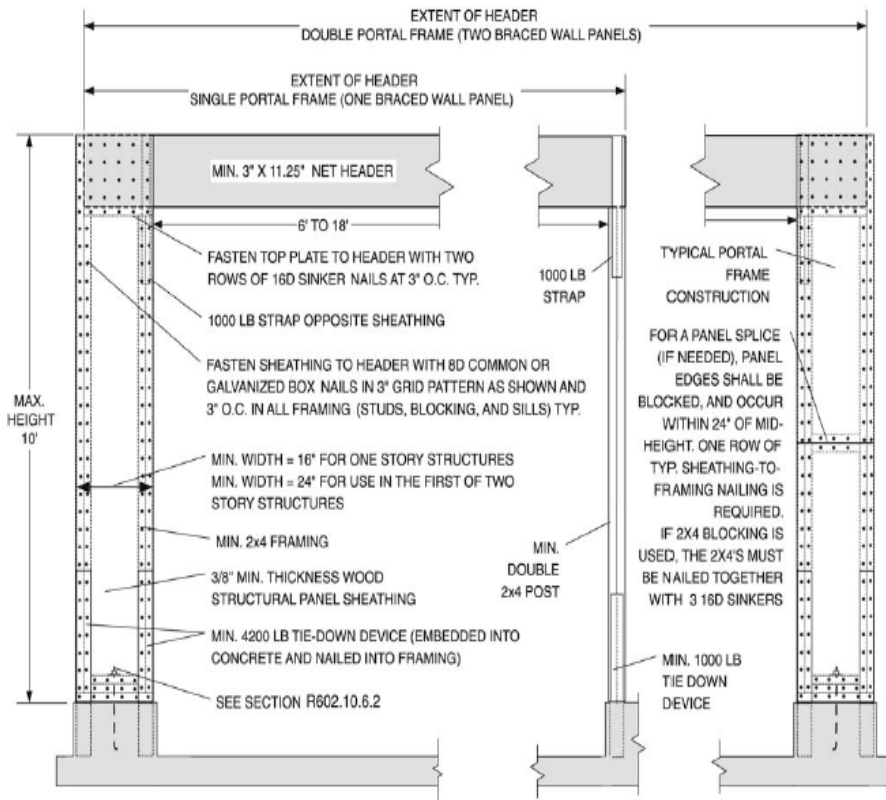


FIGURE R602.10.6.2
ALTERNATE BRACED WALL PANEL ADJACENT TO A DOOR OR WINDOW OPENING

R602.10.8 Connections. Braced wall panels shall be connected at wall top and bottom in accordance with the provisions of this section.

R602.10.8.1 Sole plate connections. Braced wall panel sole plates shall be fastened to the floor framing in accordance with Table R602.3(1). Where floor framing members are perpendicular to the braced wall lines above, a continuous rim joist or full height blocking between framing members shall be provided under and in line with the wall line. Where floor framing members are parallel to braced wall lines above, a rim joist or other parallel framing member shall be provided at the wall to permit fastening per Table R602.3(1).

R602.10.8.2 Foundation sill plate connections. Braced wall panel foundation sill plates shall be fastened to the foundation or slab in accordance with Sections R403.1.6 and R602.11.

R602.10.8.3 Top plate connections. Exterior braced wall panel top plates shall be connected to floor or roof framing above. Where the floor or roof framing members above are parallel to the braced wall lines, a full height parallel framing member shall be provided at the wall line. Where the roof or floor framing members above are perpendicular to the braced wall line, a continuous rim joist, header or full height blocking between the framing members shall be provided in line with the wall line below. Roof or floor sheathing above shall be attached to the full height framing or blocking and the full height framing or blocking shall be attached to top of the wall per Table R602.3(1).

Exceptions:

1. Where the height of the blocking required for top plate connection is over 9¼ inches (235 mm) solid, full height blocking is not required provided that the exterior braced wall panel top plates are connected in accordance with one of the following methods:

1.1. Figure R602.10.8.3(1) or Figure R602.10.8.3(2).

1.2. With full height engineered blocking panels designed for values listed in American Forest and Paper Association (AF&PA) *Wood Frame Construction Manual for One- and Two-Family Dwellings* (WFCM). Roof or floor sheathing above shall be attached to the blocking panels and the blocking panels shall be attached to top of wall in accordance with Table R602.3(1).

1.3. Designed in accordance with accepted engineering methods.

2. In Seismic Design Category C and wind speed zones less than 100 mph, where the framing members are perpendicular to the wall line below and the height of the roof or floor diaphragm is less than 9¼ inches (235 mm) from the top plate of the wall line, solid, full-height blocking need not be provided when the perpendicular framing members or a parallel member such as a continuous rim joist or header is attached to the wall line per Table R602.3(1).

Interior braced wall panel top plates shall be connected to floor or ceiling framing above and fastened in accordance with Table R602.3(1). Where the framing members above are parallel to braced wall lines, a parallel framing member shall be provided at the wall. Where the framing members are perpendicular to the braced wall line, blocking shall be provided in line with the braced wall panels.

R602.10.11.3 Collectors. A designed collector shall be provided if ~~the bracing a braced wall panel~~ is not located at each end of a braced wall line as indicated ~~above or~~ in Section R602.10.11.2, or, when using the Section R602.10.11.2 exception, if a braced wall panel is more than 8 feet (2438 mm) from each end of a braced wall line ~~as indicated in the exception.~~

R613.1 General. This section prescribes performance and construction requirements for exterior window and sliding door systems installed in wall systems. Windows and sliding doors shall be installed ~~and flashed~~ in accordance with the fenestration manufacturer's written installation instructions. Window and sliding door openings shall be flashed in accordance with Section R703.8.

R613.2 Window sills. Not adopted by the State of Oregon.

R613.4 Testing and labeling. Exterior ~~doors~~ windows and glass sliding doors shall be tested by an approved independent laboratory, and bear a label identifying manufacturer, performance characteristics and approved inspection agency to indicate compliance with the requirements of one of the following specifications:

1. AAMA/WDMA/CSA 101/1.S.2/A440 or
2. ANSI/AAMA/NWDA101/I.S.2-97 or
3. 101/I.S.2/NAFS-02

Exterior side-hinged doors shall comply with Section R613.6.

R613.4.1 Comparative analysis. Structural wind load design pressures for window and door units smaller than the size tested in accordance with Section R613.4 shall be permitted to be higher than the design value of the tested unit provided such higher pressures are determined by accepted engineering analysis. All components of the small unit shall be the same as those of the tested unit. Where such calculated design pressures are used, they shall be validated by an additional test of the window or door unit having the highest allowable design pressure.

R613.5 Vehicular access doors. Not adopted by the State of Oregon.

R613.9.1 Mullions. Mullions shall be tested by an approved testing laboratory in accordance with AAMA 450, or be engineered in accordance with accepted engineering practice. ~~Both methods~~ Mullions tested as stand-alone units or qualified by engineering shall use performance criteria cited in Sections R613.9.2, R613.9.3 and R613.9.4. Mullions qualified by an actual test of an entire assembly shall comply with Sections R613.9.2 and R613.9.4.