

Section R401 General

R401.1 Application. The provisions of this chapter shall control the design and construction of the foundation and foundation spaces for buildings. In addition to the provisions of this chapter, the design and construction of foundations in flood hazard areas as established by Table R301.2(1) shall meet the provisions of Section R322. Wood foundations shall be designed and installed in accordance with AWC PWF.

Exception: The provisions of the chapter shall be permitted to be used for wood foundations only in the following situations:

1. In buildings that have no more than two floors and a roof.
2. Where interior basement and foundations walls are constructed at intervals not exceeding 50 feet (15 240 mm).

Wood foundations in Seismic Design Category D₀₃ D₁ or D₂ shall be designed in accordance with accepted engineering practice.

R401.2 Requirements. Foundations construction shall be capable of accommodating all loads in accordance with Section R301 and of transmitting the resulting loads to the supporting soil. Fill soils that support footings and foundations shall be designed, installed and tested in accordance with accepted engineering practice. Gravel fill used as footings for wood and precast concrete foundations shall comply with Section R403.

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

Exception: Where lot lines, walls, slopes or other physical barriers prohibit 6 inches (152mm) of fall within 10 feet (3048mm), drains or swales shall be constructed to ensure drainage away from the structure. Impervious surfaces within 10 feet (3048 mm) of the building foundations shall be sloped a minimum of 2 percent away from the building.

R401.4 Soil Test. Where quantifiable data created by accepted soil science methodologies indicate expansive, compressible, shifting or other questionable soil characteristics are likely to be present, the building official 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.

R401.4.1 Geotechnical evaluation. In lieu of a complete geotechnical evaluation, the load-bearing values in Table R401.4.1 shall be assumed.

**Section R402
Materials**

R402.1 Wood foundations. Wood foundation systems shall be designed and installed in accordance with the provisions of this code.

R402.1.1 Fasteners. Fasteners used below grade to attach plywood to the exterior side of the exterior basement or crawlspace wall studs, or fasteners used in knee wall construction, shall be of Type 304 or 316 stainless steel. Fasteners used above grade to attach plywood and all lumber-to-lumber fasteners except those used in knee wall construction shall be of Type 304 or 316 stainless steel, silicon bronze, copper, hot-dipped galvanized (zinc coated) steel nails, or hot-tumbled galvanized (zinc coated) steel nails. Electro-galvanized steel nails and galvanized (zinc coated) steel staples shall not be permitted.

R402.1.2 Wood Treatment. All lumber and plywood shall be pressure-preservative treated and dried after treatment in accordance with AWPA U1 (Commodity Specification A, Use Category 4B and Section 5.2), and shall bear the label of an accredited agency. Where lumber and /or plywood is cut or drilled after treatment, the treated surface shall be field treated with copper naphthenate, the concentration of which shall contain a minimum of 2-percent copper metal, by repeated brushing, dipping or soaking until the wood absorbs no more preservative.

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

**Table R401.4.1
Presumptive Load-Bearing
Values of Foundation Materials**

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 silty clay (CL, ML, MH and CH)	1,500 ^b

For SI: 1 pound per square foot = 0.0479kPa.

- a. Where soil tests are required by Section R401.4, the allowable bearing capacities of the soil shall be part of the recommendations.
- b. Where the building official determines that in-place soils with allowable bearing capacity of less than 1,500 psf are likely to be present at the site, the allowable bearing capacity shall be determined by a soils investigation.

R401.4.2 Compressible or shifting soil. Instead of a complete geotechnical evaluation, where top of subsoils are compressible or shifting, they shall be removed to a depth and width sufficient to ensure stable moisture content in each active zone and shall not be used as fill or stabilized within each active zone by chemical, dewatering or presaturation.

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 percentage of the total weight of cementitious materials specified in Section 19.3.3.4 of ACI 318. Materials used to produce concrete and testing thereof shall comply with the applicable standards listed in Chapters 19 and 20 of ACI 318 or ACI 332.

R402.2.1 Materials for concrete.

Materials for concrete shall comply with the requirements of Section R608.5.1.

R402.3 Precast Concrete. Precast concrete foundations shall be designed in accordance with Section R404.5 and shall be installed in accordance with the provisions of this code and manufacturer's instructions.

R402.3.1 Precast Concrete

Foundation Materials. Materials used to produce precast concrete foundations shall meet the following requirements.

1. All concrete used in the manufacture of precast concrete foundations shall have a minimum compressive strength of 5,000 psi (34 470 kPa) at 28 days. Concrete exposed to freezing and thawing environment shall be air entrained with a minimum total air content of 5 percent.

2. Structural reinforcing steel shall meet the requirements of ASTM A615, A706 or A996. The minimum yield strength of reinforcing steel shall be 40,000 psi (Grade 40) (276 MPa). Steel reinforcement for precast concrete foundation walls shall have a minimum concrete cover of ¾ inch (19.1 mm).
3. Panel-to-panel connections shall be made with Grade II steel fasteners.
4. The use of nonstructural fibers shall conform to ASTM C1116
5. Grout used for bedding precast foundations placed upon concrete footings shall meet ASTM C1107.

R402.4 Masonry. Masonry systems shall be designed and installed in accordance with this chapter and shall have a minimum specified compressive strength of 1,500 psi (10.3 MPa).

**Section R403
Footings**

R403.1 General. All exterior walls shall be supported on continuous solid or fully grouted masonry or concrete footing, crushed stone footing, wood foundations, or other *approved* structural systems which shall be sufficient design to accommodate all loads according to Section R301 and to transmit the resulting loads to the soil within the limitations as determined from the character of the soil. Footings shall be supported on undisturbed natural soils or engineered fill. Concreted footing shall be

designed and constructed in accordance with the provisions of Section R403 or in accordance with ACI 332.

R403.1.1 Minimum Size. The minimum width, W, and thickness, T, for concrete footings shall be in accordance with Tables R403.1(1) through R403.1(3) and Figure R403.1(1) or R403.1.3 as applicable. The footing width shall be based on the load-bearing value of the soil in accordance with Table R401.4.1. Footing projections, P, shall be not less than 2

inches (51mm) 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 footing supporting piers and columns shall be based on the tributary load and allowable soil pressure in accordance with Table R401.4.1. Footings for wood foundations shall be in accordance with the details set forth in Section R403.2. and Figures R403.1(2) and R403.1(3).

Table R402.2
Minimum Specified Compressive Strength of Concrete

Type or location of concrete construction	Minimum Specified Compressive Strength ^(f1)		
	Weathering Potential		
	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 ^c
Porches, carports slabs and steps exposed to the weather, and garage floor slabs	2,500	3,000 ^{d e f}	3,500 ^{d e f}

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

a. Strength at 28 days psi.

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

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

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

e. See Section R402.2 for maximum cementitious materials content.

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

Table R403.1(1)

Minimum width and thickness for concrete footings for light-frame construction (inches) ^{a b}

Snow Load or Roof Live Load	Story and Type of Structure with Light Frame	Load-Bearing Value of Soil (psf)					
		1500	2000	2500	3000	3500	4000
20 psf	1 Story – slab-on-grade	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	1 Story-w/ crawl space	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	1 Story – plus basement	18 x 6	14 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	2 Story – slab-on-grade	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	2 Story – w/ crawl space	16 x 6	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	2 Story – plus basement	22 x 6	16 x 6	13 x 6	12 x 6	12 x 6	12 x 6
	3 Story- slab-on-grade	14 x 6	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	3 Story –w/ crawl space	19 x 6	14 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	3 Story – plus basement	25 x 8	19 x 6	15 x 6	13 x 6	12 x 6	12 x 6
30 psf	1 Story – slab-on-grade	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	1 Story-w/ crawl space	13 x 6	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	1 Story – plus basement	19 x 6	14 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	2 Story – slab-on-grade	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	2 Story – w/ crawl space	17 x 6	13 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	2 Story – plus basement	23 x 6	17 x 6	14 x 6	12 x 6	12 x 6	12 x 6
	3 Story- slab-on-grade	15 x 6	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	3 Story –w/ crawl space	20 x 6	15 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	3 Story – plus basement	26 x 8	20 x 6	16 x 6	13 x 6	12 x 6	12 x 6
50 psf	1 Story – slab-on-grade	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	1 Story-w/ crawl space	16 x 6	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	1 Story – plus basement	21 x 6	16 x 6	13 x 6	12 x 6	12 x 6	12 x 6
	2 Story – slab-on-grade	14 x 6	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	2 Story – w/ crawl space	19 x 6	14 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	2 Story – plus basement	25 x 7	19 x 6	15 x 6	12 x 6	12 x 6	12 x 6
	3 Story- slab-on-grade	17 x 6	13 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	3 Story –w/ crawl space	22 x 6	17 x 6	13 x 6	12 x 6	12 x 6	12 x 6
	3 Story – plus basement	28 x 9	21 x 6	17 x 6	14 x 6	12 x 6	12 x 6
70 psf	1 Story – slab-on-grade	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	1 Story-w/ crawl space	18 x 6	13 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	1 Story – plus basement	24 x 7	18 x 6	14 x 6	12 x 6	12 x 6	12 x 6
	2 Story – slab-on-grade	16 x 6	12 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	2 Story – w/ crawl space	21 x 6	16 x 6	13 x 6	12 x 6	12 x 6	12 x 6
	2 Story – plus basement	27 x 9	20 x 6	16 x 6	14 x 6	12 x 6	12 x 6
	3 Story- slab-on-grade	19 x 6	14 x 6	12 x 6	12 x 6	12 x 6	12 x 6
	3 Story –w/ crawl space	25 x 7	18 x 6	15 x 6	12 x 6	12 x 6	12 x 6
	3 Story – plus basement	30x 10	23 x 6	18 x 6	15 x 6	13 x 6	12 x 6

For SI:1 inch = 25.4 mm, 1 plf = 14.6 N/m, 1 pound per square foot = 47.9 N/m2

- a. Interpolation allowed. Extrapolation is not allowed.
- b. Based on 32-foot-wide house with load-bearing center wall that carries half of the tributary attic, and floor framing. For every 2 feet of adjustment to the width of the house, add or subtract 2 inches of footing width and 1 inch of footing thickness (but not less than 6 inches thick).

