



#12 - Foundation Requirements

General

Footings and foundations shall be constructed of reinforced concrete and shall extend below the frost line. Foundations supporting wood shall extend at least 6" above the adjacent finish grade. Footings and foundation walls shall have a minimum depth, size and reinforcement as indicated in Figure 1 or in accordance with IRC Sections R403 and R404 or as designed by an engineer in accordance with ACI 318.

All bearing walls shall be supported on continuous reinforced concrete foundations or other approved foundation systems that shall be of sufficient size to support all loads. If the soil contains a lot of sand, clay or organic material, the design may require geotechnical and possibly foundation engineering. Where an engineered design is not provided, the minimum foundation requirements for stud-bearing walls shall be as shown in Figure 1.

Exception: The support of buildings by posts embedded in earth (such as pole barns) shall be designed as specified in IBC Section 1805.7. Wood posts or poles embedded in earth shall be pressure treated with an approved preservative (in accordance with AWWA C2 or C4).

Stepped Foundations

Foundations for all buildings shall be level or shall be stepped so that both top and bottom of such foundation are level. Required reinforcement shall be continuous throughout the entire footing and foundation walls. (Note: Wood cripple walls in excess of 48" constitute an additional story in Seismic Design Category D₂.)

Post Footings

Individual pier footings for the support of bearing posts shall have reinforcement bars at least 12" on center in both directions if the depth of the footing is less than half its width (1:2 ratio). Pier footings shall have positive connections such as metal brackets or post bases connecting the footings to the posts they support.

Footings on or Adjacent to Slopes

The placement of buildings and structures adjacent to (either above or below) slopes steeper than one unit vertical in three units horizontal (33.3% slope) shall be set back from the slope in accordance with the following: (Also, see handout #6 - Clearance from Slopes)

Building Clearance from Ascending Slopes

In general, buildings below slopes shall be set a sufficient distance from the slope to provide protection from slope drainage, erosion and shallow failures. Where the existing slope is steeper than one unit vertical in one unit horizontal (100% slope), the toe of the slope shall be assumed to be at the intersection of a horizontal plane drawn from the top of the foundation and a plane drawn tangent to the slope at an angle of 45° to the horizontal.

Footing Setback from Descending Slope Surface

Footing on or adjacent to slope surfaces shall be founded in firm material with an embedment and setback from the slope surface sufficient to provide vertical and lateral support for the footing without detrimental settlement. Where the slope is steeper than one unit vertical in one unit horizontal (100% slope), the required setback shall be measured from an imaginary plane 45° to the horizontal, projected upward from the toe of the slope.

Alternate Setback and Clearance

The building official may approve alternate setbacks and clearances upon evidence from a geotechnical report and recommendation of a qualified engineer. The geotechnical report shall include consideration of material, height of slope, slope gradient, load intensity and erosion characteristics of slope material. Such alternative setbacks shall be justified by an engineered analysis and shall contain full foundation construction and placement requirements.

Foundation Plates or Sills

Wood plates or sills shall be bolted to the foundation or foundation wall. Steel bolts with a minimum nominal diameter of ½ inch shall be embedded at least 7" into the concrete and shall be spaced not more than 6' apart (4' if over 2 stories). There shall be a minimum of two bolts per piece with one bolt located not more than 12" nor less than seven bolt diameters (3.5" with .5" bolt) from each end of the piece. A properly sized nut and 3" x 3" x 1/4" thick, hot-dipped galvanized plate washer shall be tightened on each bolt to the plate. Alternately, foundation anchor straps may be used instead of anchor bolts provided they are not spaced more than 4' apart, or 3' apart if over 2 stories.

Foundation plates and sills shall be of pressure-treated wood or foundation redwood. (Note: All fasteners used in pressure treated lumber (except bolts ½" or larger) shall be hot-dipped galvanized, stainless steel, bronze or copper.)

Construction Methods

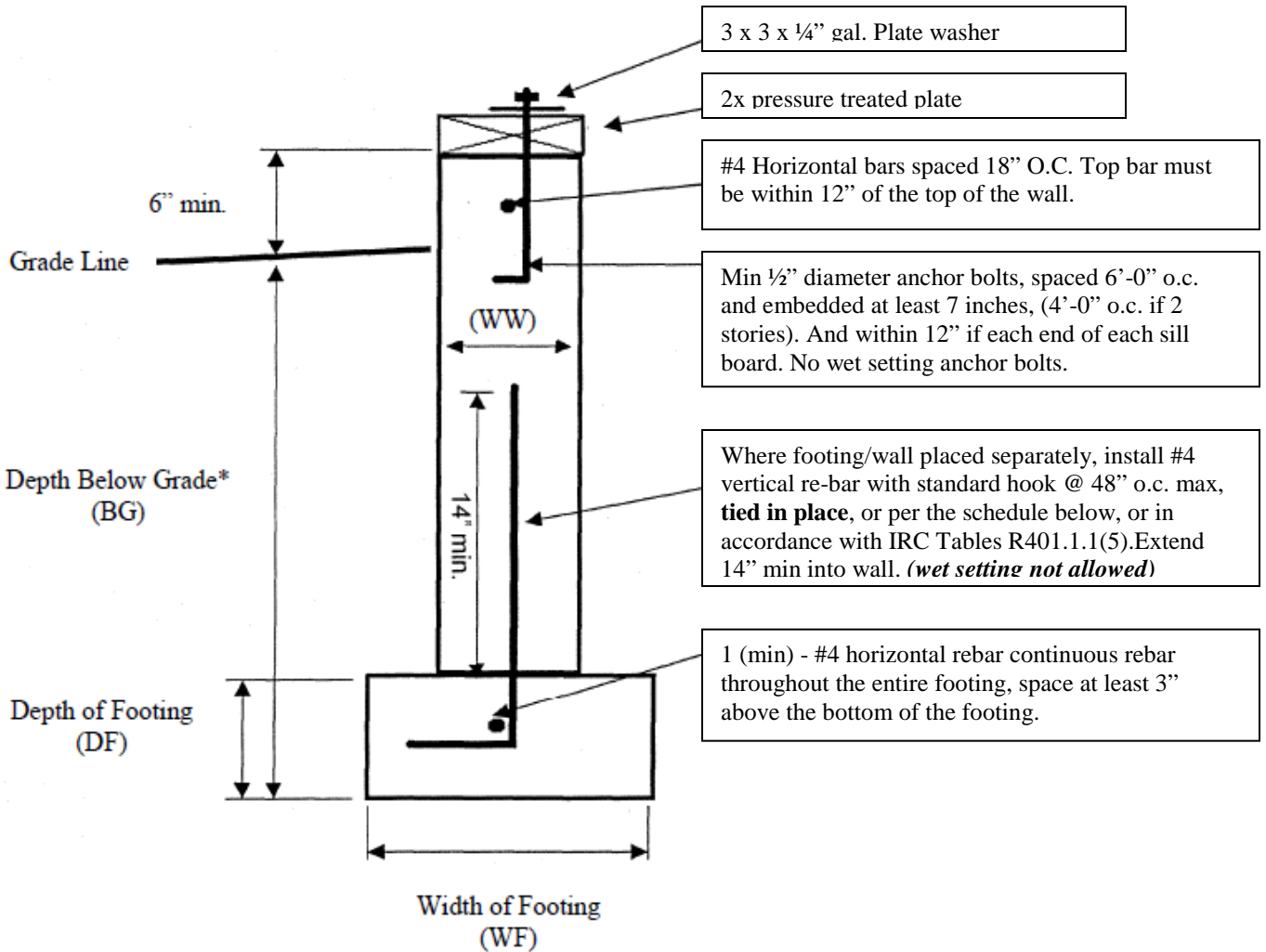
In Seismic Design Category D₂ (all of Cosmopolis), all footings and foundation walls shall be reinforced. Placement of reinforcement shall be in accordance with Figure 1, IRC Sections R403 and R404 or as designed by an engineer in accordance with ACI 318.

- All reinforcement bars must be accurately placed and adequately supported prior to the placement of concrete.
- All hooked bars shall have a 90° bend plus an extension at the free end of at least 12 times the bar diameter (6" for #4, 7 1/2" for #5).
- All reinforcement shall be placed such that there is at least 3" of concrete between the bars and the bottom of the concrete exposed to earth.
- All reinforcement bars where lapped to extend the length of the bars shall overlap the previous bar by a length at least 30 times the diameter of the bar (15" for #4, 19" for #5).
- All reinforcement bars shall be free of mud, oil, form release agents or other nonmetallic coatings that decrease bond.
- All footing pours shall be made in one continuous pour. All foundation wall pours shall be made in one continuous pour. If "cold joints" are planned, they must be made in accordance with an engineer's design and special inspection.

Slabs-on-Ground with Turned-Down Footings

Slabs-on-ground with turned-down footings shall have a minimum of two #4 bars at the bottom, and one #4 bar at the top. The bottom of the slab edge shall be at least 12" wide and at least 12" below grade (see Figure 2).

**FIGURE 1:
PRESCRIPTIVE FOUNDATION DETAILS
For Typical Light Frame Constructed Buildings**



- Assumptions for this detail:**
 Conventional Light-frame construction
 Wood or other light siding
 1500 psf soli bearing cap
 Group 1, 2, or 3 soils (IRC R405.1)
 Backfill no closer than 6" to top of wall
 Walls must be laterally restrained at the top and bottom of wall

	WF	DF	BG*	WW
One Story	12"	6"	12"	6"
Two Story	15"	6"	12"	6"
Three Story	23"	8"	12"	8"

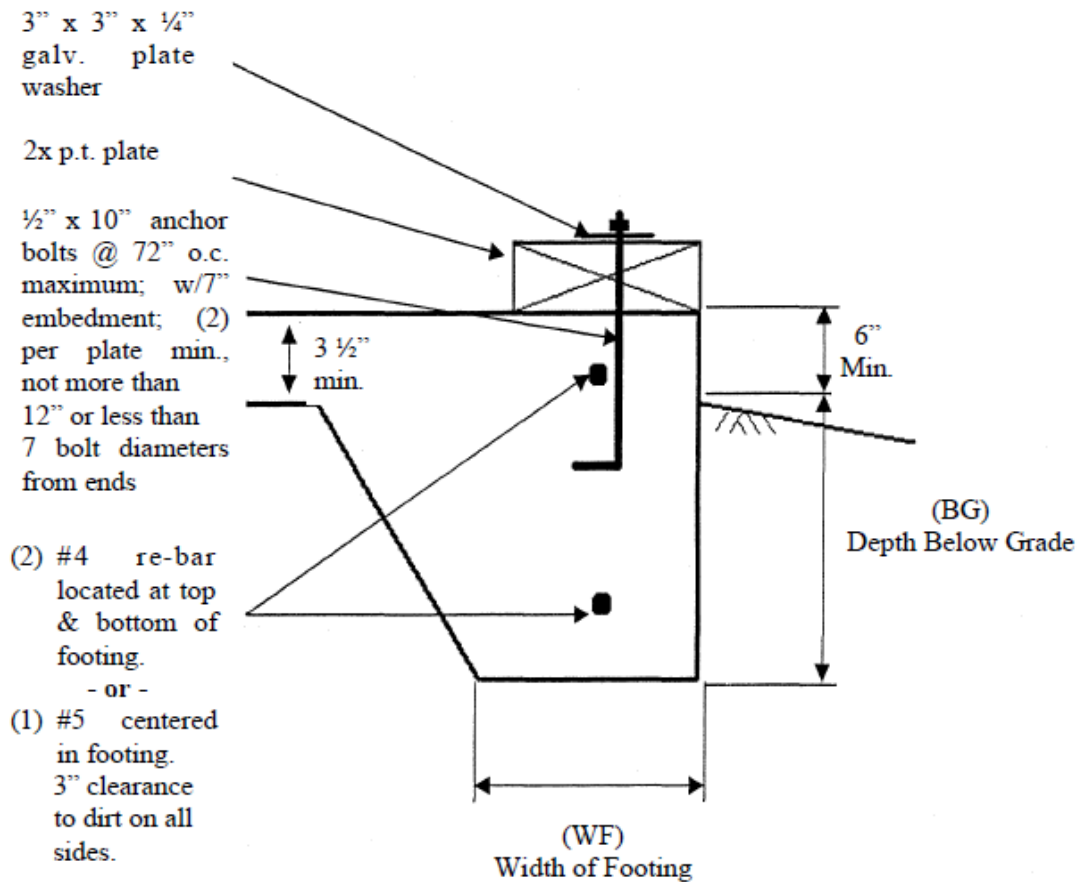
* Unbalanced Backfill not to exceed 48" in depth.

Minimum Wall Reinforcement (Grade 60 reinforcement steel)

Minimum Wall Thickness - (E)	Maximum Wall Height - (D)	Horizontal Reinforcement Steel	Vertical Reinforcement Steel*
6"	24"	1 - #4 Bar	#4 bars @ 48" oc
6"	36"	2 - #4 Bars @ 18" on center	#4 bars @ 48" oc
6"	60"	4 - #4 Bars @ 18" on center	#4 bars @ 24" oc
8"	48"	3 - #4 Bars @ 18" on center	#4 bars @ 48" oc
8"	72"	4 - #4 Bars @ 18" on center	#4 bars @ 48" oc
8"	108"	6 - #4 bars @ 18" on center	#7 bars @ 36" oc
10"	108"	6 - #4 bars @ 18" on center	#6 bars @ 36" oc

Figure 2. Slabs-on-Ground with Turned-Down Footings.

Monolithic Slab Foundation



	WF	BG
One Story	12"	12"
Two Story	15"	12"
Three Story	23"	12"

TABLE R404.1.1(5)
REINFORCED CONCRETE FOUNDATION WALLS^{1,2}

MAXIMUM WALL HEIGHT ^{7,8} (FEET)	MAXIMUM UNBALANCED BACKFILL HEIGHT ⁶ (FEET)	MINIMUM VERTICAL REINFORCEMENT SIZE AND SPACING ^{3,4}			
		ALL GROUP I, II AND III SOILS ⁵			
		MINIMUM WALL THICKNESS (INCHES)			
		5.5	7.5	9.5	11.5
5	4	#4@48"	#4@48"	#4@48"	#4@48"
	5	#4@48"	#4@48"	#4@48"	#4@48"
6	4	#4@48"	#4@48"	#4@48"	#4@48"
	5	#4@24"	#4@48"	#4@48"	#4@48"
	6	#5@24"	#4@48"	#4@48"	#4@48"
7	4	#4@36"	#4@36"	#4@48"	#4@48"
	5	#5@36"	#4@36"	#4@48"	#4@48"
	6	#6@36"	#5@36"	#4@36"	#4@48"
	7	#6@24"	#6@36"	#4@36"	#4@48"
8	4	#4@36"	#4@36"	#4@36"	#4@36"
	5	#5@36"	#4@36"	#4@36"	#4@36"
	6	#6@36"	#5@36"	#4@36"	#4@36"
	7	#6@24"	#6@36"	#5@36"	#4@36"
	8	DR	#6@24"	#6@36"	#4@36"
9	4	DR	#5@36"	#5@36"	#5@36"
	5	DR	#5@36"	#5@36"	#5@36"
	6	DR	#5@36"	#5@36"	#5@36"
	7	DR	#6@36"	#5@36"	#5@36"
	8	DR	#7@36"	#6@36"	#5@36"
	9	DR	DR	DR	DR
10	4	DR	DR	#5@36"	#5@36"
	5	DR	DR	#5@36"	#5@36"
	6	DR	DR	#5@36"	#5@36"
	7	DR	DR	#6@36"	#5@36"
	8	DR	DR	#7@36"	#6@36"
	9	DR	DR	DR	DR
	10	DR	DR	DR	DR

¹ Concrete shall have a specified compressive strength of not less than 2,500 psi at 28 days.
² "DR" means a design is required in accordance with ACI 318 or ACI 332.
³ Reinforcement bars shall have a minimum yield strength of 60,000 psi. (Grade 60)
⁴ Vertical reinforcement shall be placed nearest the inside face of the wall a distance d from the outside face (soil side) of the wall where d equals 4" for a 5.5" wall, 5.5" for a 7.5" wall, 7" for a 9.5" wall and 9" for a 11.5" wall. The reinforcement shall be placed within a tolerance of +/- 1/2 inch. In no instance shall concrete cover for reinforcement be less than 1 inch from the inside face of the wall, nor less than 3 inches from the outside face of the wall.
⁵ Soil classes are in accordance with the United Soil Classification System. Refer to Table R405.1. Group IV soils require a design prepared by a registered design professional.
⁶ 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 backfill height shall be measured from the exterior finish ground level to the top of the interior concrete slab.
⁷ Concrete stem walls not exceeding 5 feet in height, supporting less than 4 feet of unbalanced backfill, are exempt from the lateral bracing requirements of Section R404.1.
⁸ Concrete stem walls exceeding 5 feet in height, or supporting more than 4 feet of unbalanced backfill, shall comply with the lateral bracing requirements of Section R404.1. (All 10 foot high walls shall be braced in accordance with Table R404.1(1) as shown for 9' walls with 9' of unbalanced backfill.)