

FOUNDATIONS

FOOTINGS

FOOTING LAYOUT

Footings can be larger than required dimensions, but should not be smaller. Footings should be straight and level to within 1/4 in. over 20 ft., and should be no more than 1/2-in. out of square in 20 ft.

Footing Layout

Footing Width

The bearing width of footings varies according to soil strengths and loading conditions (**below**).

FIGURE: MINIMUM WIDTH OF CONCRETE OR MASONRY FOOTINGS (IN.)

	Loadbearing Value of Soil (psf)					
	1,500	2,000	2,500	3,000	3,500	4,000
Conventional Wood Frame Construction						
1-story	16 in.	12 in.	10 in.	8 in.	7 in.	6 in.
2-story	19	15	12	10	8	7
3-story	22	17	14	11	10	9
4-in. Brick Veneer over Wood Frame or 8-in. Hollow Concrete Masonry						
1-story	19 in.	15 in.	12 in.	10 in.	8 in.	7 in.
2-story	25	19	15	13	11	10
3-story	31	23	19	16	13	12
8-in. Solid or Fully Grouted Masonry						
1-story	22 in.	17 in.	13 in.	11 in.	10 in.	9 in.
2-story	31	23	19	16	13	12
3-story	40	30	24	20	17	15

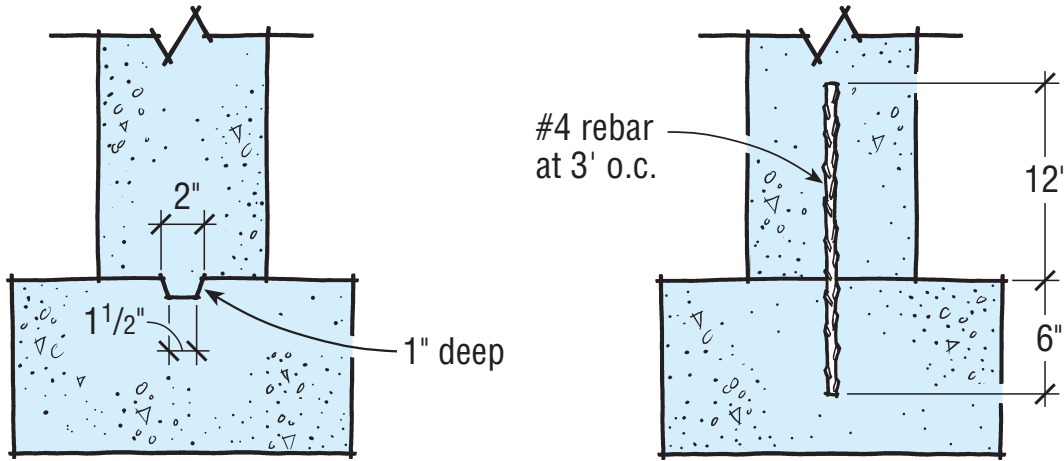
The width of a foundation footing is based on the loadbearing value of the soil. Load-values assume undisturbed, native soils of known type or tested values of compacted soils.

Footing Tie-In

Footings should be struck off level, but should never be troweled smooth. In addition, footings must be tied firmly to the wall above using either a keyway poured into the footing or reinforcing bar projecting from the footing into the concrete (**below**).

FIGURE: FOOTING TIE-IN

Footing Layout



Keyway Tie-In

Steel Tie-In

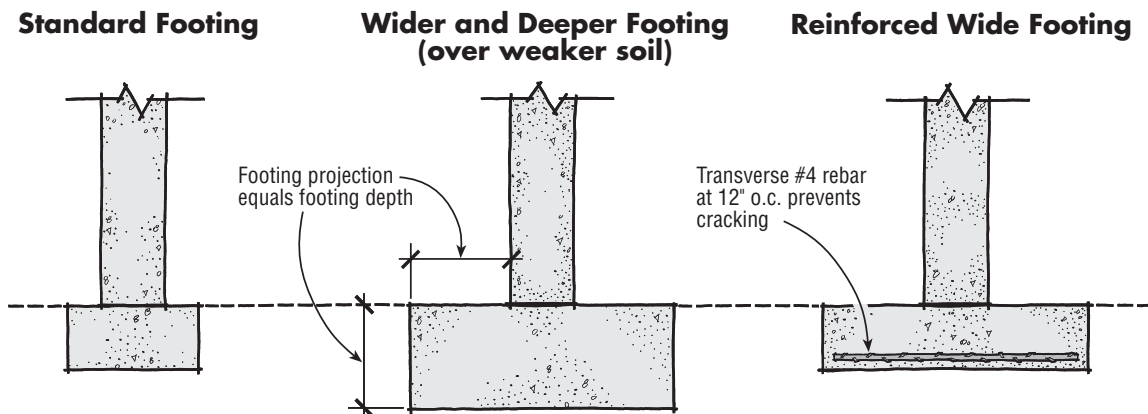
To tie a footing to the wall above, a keyway should be about 1 in. deep by 2 in. wide. When rebar is used, the typical rebar layout is one #4 bar every 3 ft. o.c.

Footing Thickness

Footing proportions for plain concrete (unreinforced) footings are set by code (**Footing Dimensions, left and center**). Generally, footings should be at least as deep as the thickness of the wall they support. The wall should be centered on the footing so that the projection of the footing on each side equals half the wall or footing thickness.

If a wider footing is required, the footing must be reinforced (**Footing Dimensions, right**). Typically, 1/2-in. or 5/8-in. rebar will be required on 1-ft. centers, set about 3 in. up from the bottom of the footing.

FIGURE: FOOTING DIMENSIONS



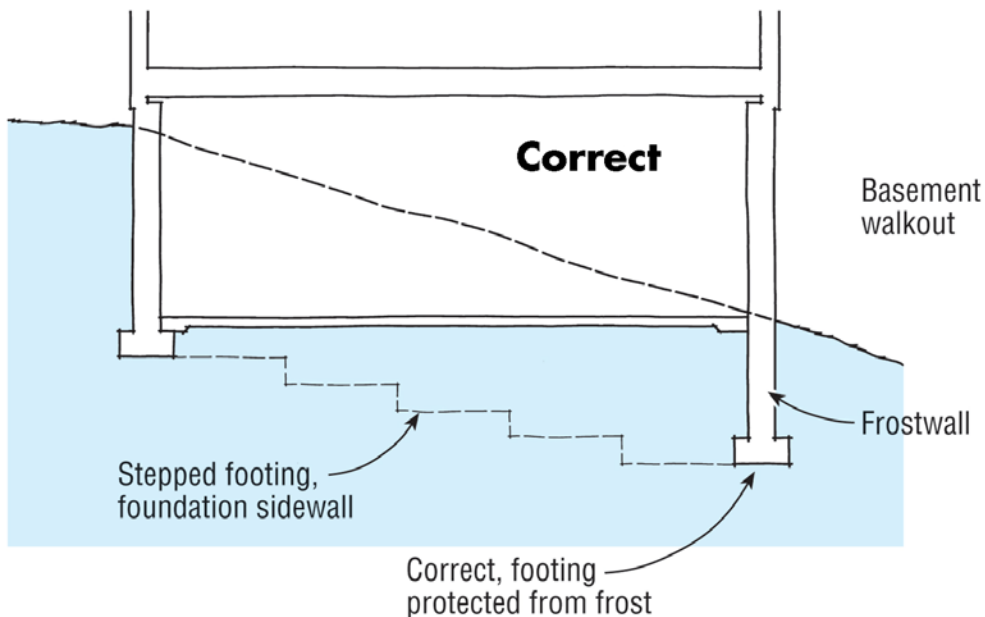
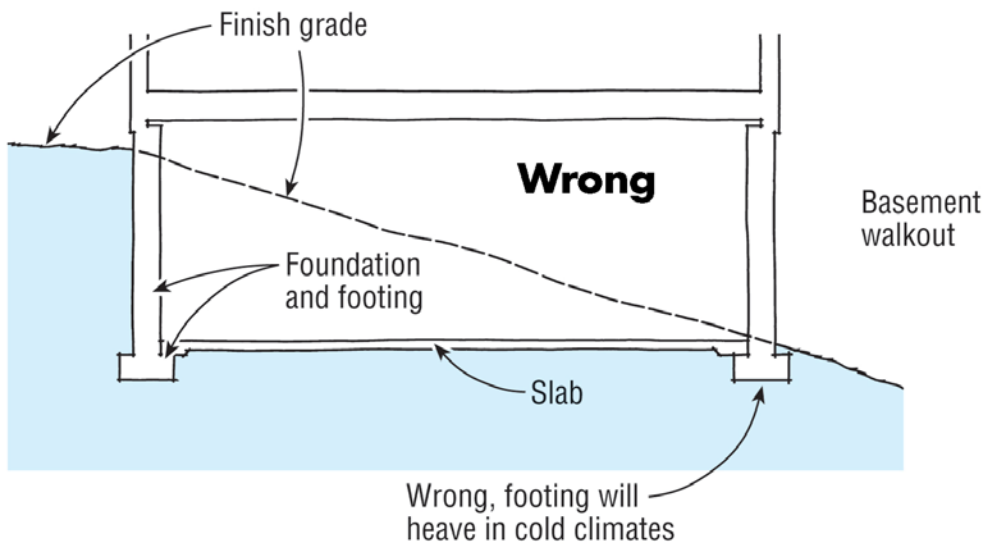
If a particular soil bearing capacity requires a wider footing, code allows the footing projection to increase, but the footing thickness must also be increased so that the footing depth equals the distance it projects from the wall (center). An alternative is to reinforce the wider footing (right), if local code allows.

Frost Depth

The footing should be placed at least 1 ft. below the frost line so it will not heave when the soil freezes. Frost depth varies depending on local climate; check with local codes for the local frost depth. On a hillside foundation (such as a basement walkout), plan on building a frostwall on the downslope side (**below**).

Footing Layout

FIGURE: FROSTWALL FOR BASEMENT WALKOUT



On a hillside foundation, a frostwall should be added on the downslope side to extend the footing below the frostline.

As an alternative to building a frostwall, a walk-out basement may be insulated to protect against frost damage (see Insulation for Walkout Basements)

Footing Layout

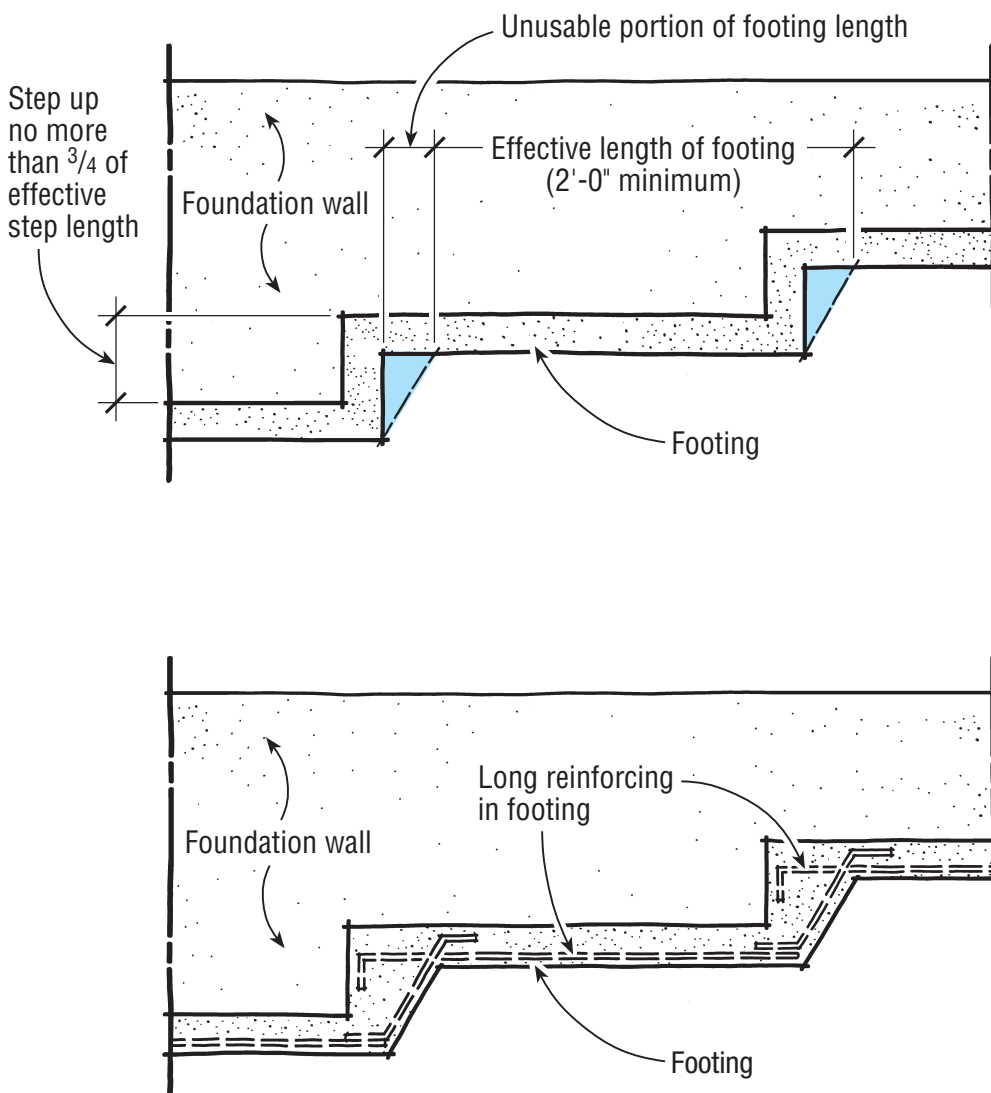
Shallow foundations may offer an alternative to deep excavations if properly insulated and detailed. See Insulation for Unheated Garage Slabs.

Stepped Footings

STEPPED FOOTINGS

On sloped sites, footings must be kept level, so the footings will have to be stepped. Step lengths must be at least 2 ft., step heights must be no greater than three-quarters of step length, and vertical footing sections must be at least 6 in. thick (**below**).

FIGURE: STEPPED FOOTINGS



The rise of a stepped footing should not exceed 2 ft., and the footing should run at least 2 ft. horizontally between steps (at top). Typically, the corners of a stepped excavation are unstable. The footing should be sloped and reinforced, so the effective horizontal length of the footing is supported on well-compacted soil (at bottom).

On slopes too steep for stepped footings of these dimensions, consider a pier-and-grade-beam foundation. See Pier Foundations.

Stepped Footings

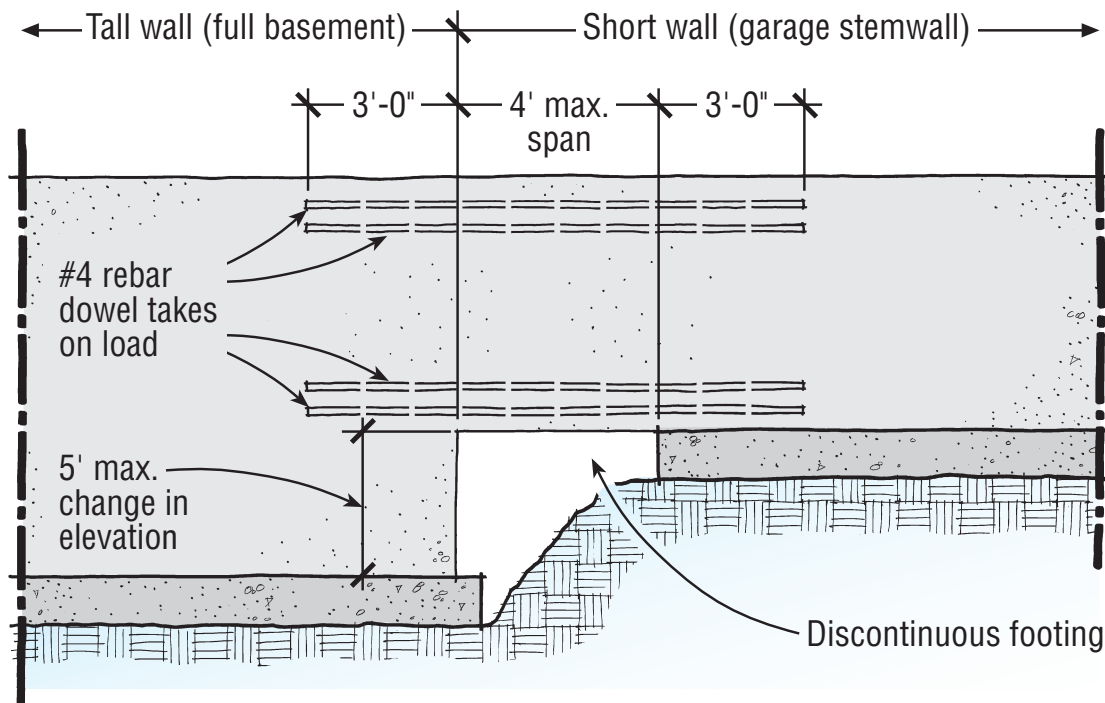
JUMP FOOTINGS

When a short foundation wall ties into a tall wall (such as where a house with a full basement jumps to a stem wall for the garage), the footing can be interrupted and the foundation wall tied together with a reinforced foundation wall section. Masonry foundation walls have no real spanning capability, so the footing must be stepped down when elevations change, but poured concrete walls can be reinforced with steel to span openings (**Jump Footings**, below). Check with a local code official first; the code on the books may have been written for masonry foundations.

Jump Footings

Footing Problems

FIGURE: JUMP FOOTINGS



For poured concrete wall only: Where a garage stemwall abuts a main basement wall, the short section of wall can be reinforced to span the gap. Use two #4 bars at the top and bottom of the short wall, extending 3 ft. into each adjoining section of wall above the footings. This solution is limited to a 4-ft. maximum span and a 5-ft. maximum change in elevation. If the walls are at right angles, the rebar can be bent accordingly.

FOOTING PROBLEMS

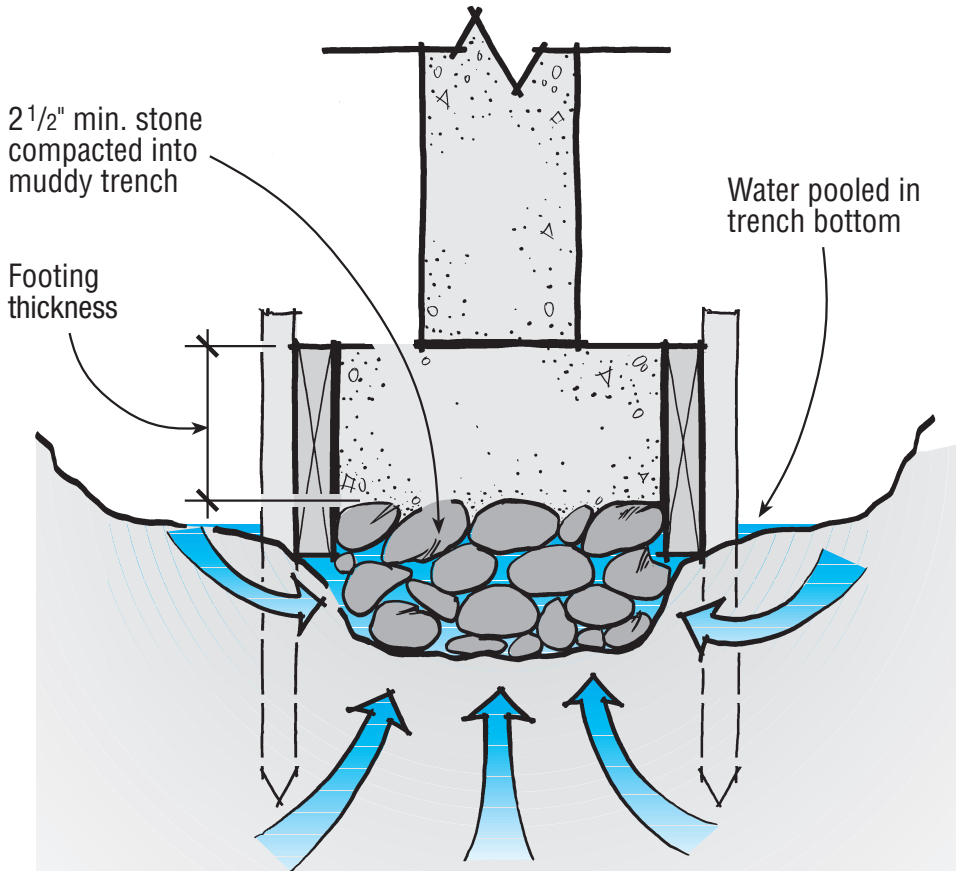
Foundation walls should be centered on the footing. In the event of a layout mistake, the footing can be repaired. The repair depends on the soil conditions.

A well-compacted gravel support may be allowed, but usually must be based on a good soil analysis and engineer's approval. Otherwise, an augmented footing must be poured using rebar dowels epoxied into the existing footing (**Pouring Footings in a Wet Drench**, below).

When footing trenches fill up with water in wet conditions, place a layer of well-tamped 3- to 4-in. cobbles (**Repairing Off-Center Footings**, below) and use a stiff concrete mix when casting the footings.

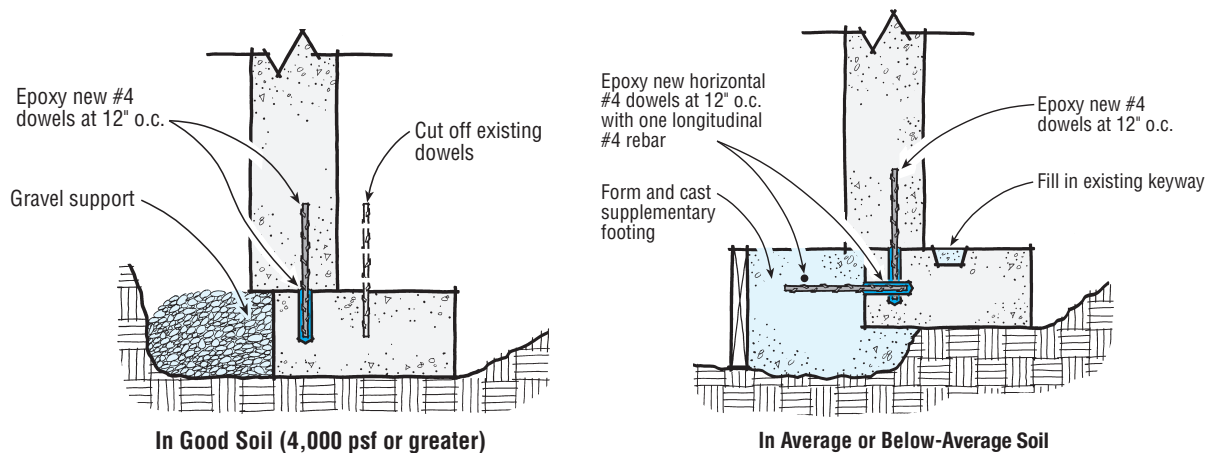
FIGURE: POURING FOOTINGS IN A WET TRENCH

Footings Problems



When water pools in a footing trench, place large cobbles in the bottom of the form, compacting them down into the mud. Muck and water may fill the spaces between the stones, but contact between stones will provide bearing. Use a stiff concrete mix when casting the footings.

FIGURE: REPAIRING OFF-CENTER FOOTINGS



A mistake in footing layout can be corrected in strong soils by placing compacted gravel to support the wall (at left). In weaker soils, an augmented footing will need to be cast alongside the existing footing (at right).