FOUNDATIONS
POURED WALLS

Concrete is a strong material and pouted foundation walls easily support downward compressive loads. It's the lateral loads that are the real controlling factor.

Concrete Wall Dimensions

Reinforcing Concrete Walls

CONCRETE WALL DIMENSIONS

By code, foundation walls must always extend above the finished grade at least 6 in. However, 18 in. is recommended to prevent splashback from deteriorating wood siding (see Board Siding). The height above grade may be lowered to 4 in. if a masonry cladding, such as brick veneer, is used.

Maximum heights of foundation walls should be based on the required wall thickness and reinforcement required, as specified below.

Concrete Wall Thickness

The design thickness of foundation walls depends on soil conditions, the amount of reinforcement in the wall, the height of the wall, and the height of unbalanced fill. *Unbalanced fill* refers to the difference in ground-level height between the inside and outside of the foundation wall.

While code will allow *plain*, or unreinforced, concrete and masonry block foundation walls (refer to Figure R404.1.1 (1), p. 67 of the 2000 International Residential Code), this is not recommended. Code sets minimums for safety, not necessarily for quality. To avoid the callback nightmare of a cracked foundation, all foundations should include reinforcing steel. An exception can be made for a plain concrete or masonry foundation wall less than 5 ft. tall with less than 4 ft. of unbalanced fill. In this case, use minimum 4,000-psi concrete (see Specifying Ready-Mix).

Typically, a foundation wall should be thicker than the wall it supports. An 8-in.-thick wall is standard for supporting wood-framed walls, but only if the unbalanced fill height is less than 6 ft., the foundation is located on a well-drained site, and the foundation is properly reinforced.

Where poor soils exist, in seismic zones, and on hillside sites, a thicker 10- or 12-in. poured concrete wall may be required. In each of these cases, an engineer's review is recommended and may be required by local code.

REINFORCING CONCRETE WALLS

Follow general guidelines for reinforcing foundations (see Rebar).

For appropriate sizing and spacing of rebar in concrete foundations, follow the minimum code requirements shown in **Figures** in Sizing and Spacing in Walls.

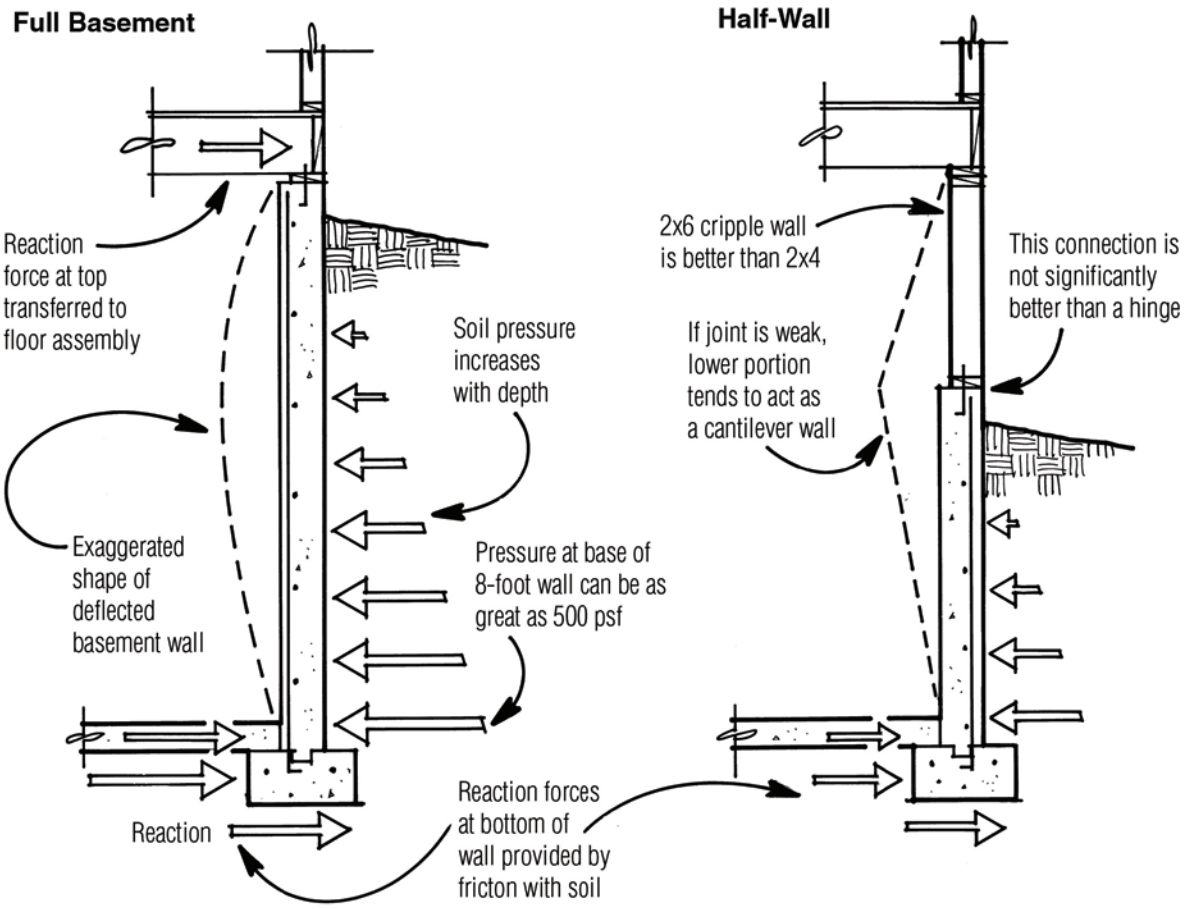
Rebar should always be placed near the tension side of the concrete (see Placing Foundation Rebar). On a full-height foundation wall, which is held in place by floor framing at the top and by the footing at the bottom, the tension side is toward the inside (Figure: Rebar for Poured Foundation Walls in Placing Foundation Rebar)

Horizontal rebar is most effective along the top and bottom of the foundation elevation.

STEPPED FOUNDATION WALLS

Foundation walls on sloped sites are often built as a half-wall with a wood-frame cripple wall (**Figure A**). In a half-height foundation wall, the hinge joint between the concrete and the cripple, or pony, wall creates a structural weakness. The half-height portion of the wall must be treated as a retaining wall, and reinforced, buttressed, or otherwise supported to resist the lateral loading of unbalanced soil (see Retaining Walls)

FIGURE A: FULL-HEIGHT VS. HALF-HEIGHT FOUNDATION WALLS

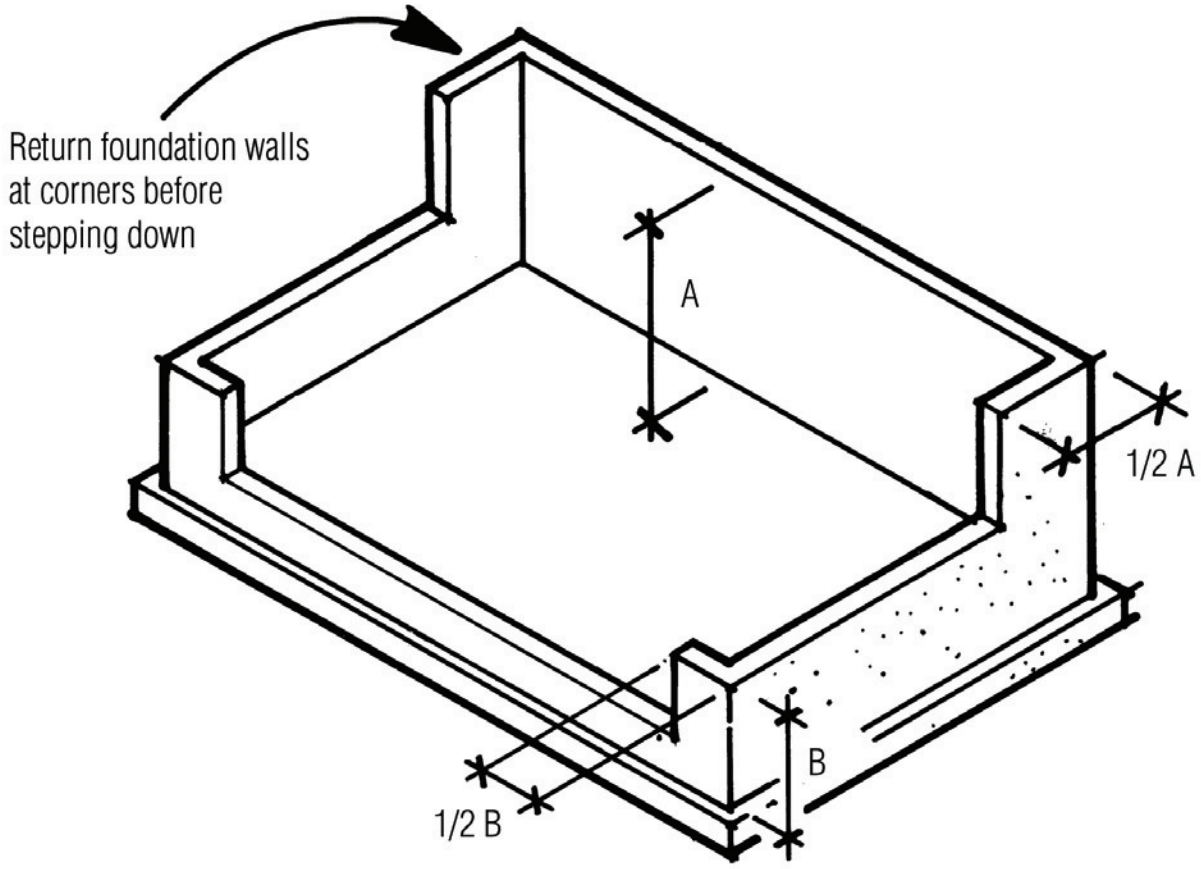


A full-height foundation wall is braced at the top by floor framing and at the bottom by the concrete footing and slab, so it is likely to bow inward. Reinforcement placed towards the inside face will resist cracking caused by this bowing (**left**). A concrete/cripple wall combination, however, is braced only at the bottom; the connection between the concrete and the wood wall is little more than a hinge (**right**). To resist toppling inward, the concrete wall must be detailed like a free-standing retaining wall, with rebar placed towards the outside face.

Stepped Foundation Corners

When any foundation wall turns a corner, maintain the height for a distance equal to half the height of the higher wall before stepping it down (**Figure B**).

FIGURE B: STEPPED FOUNDATION CORNERS



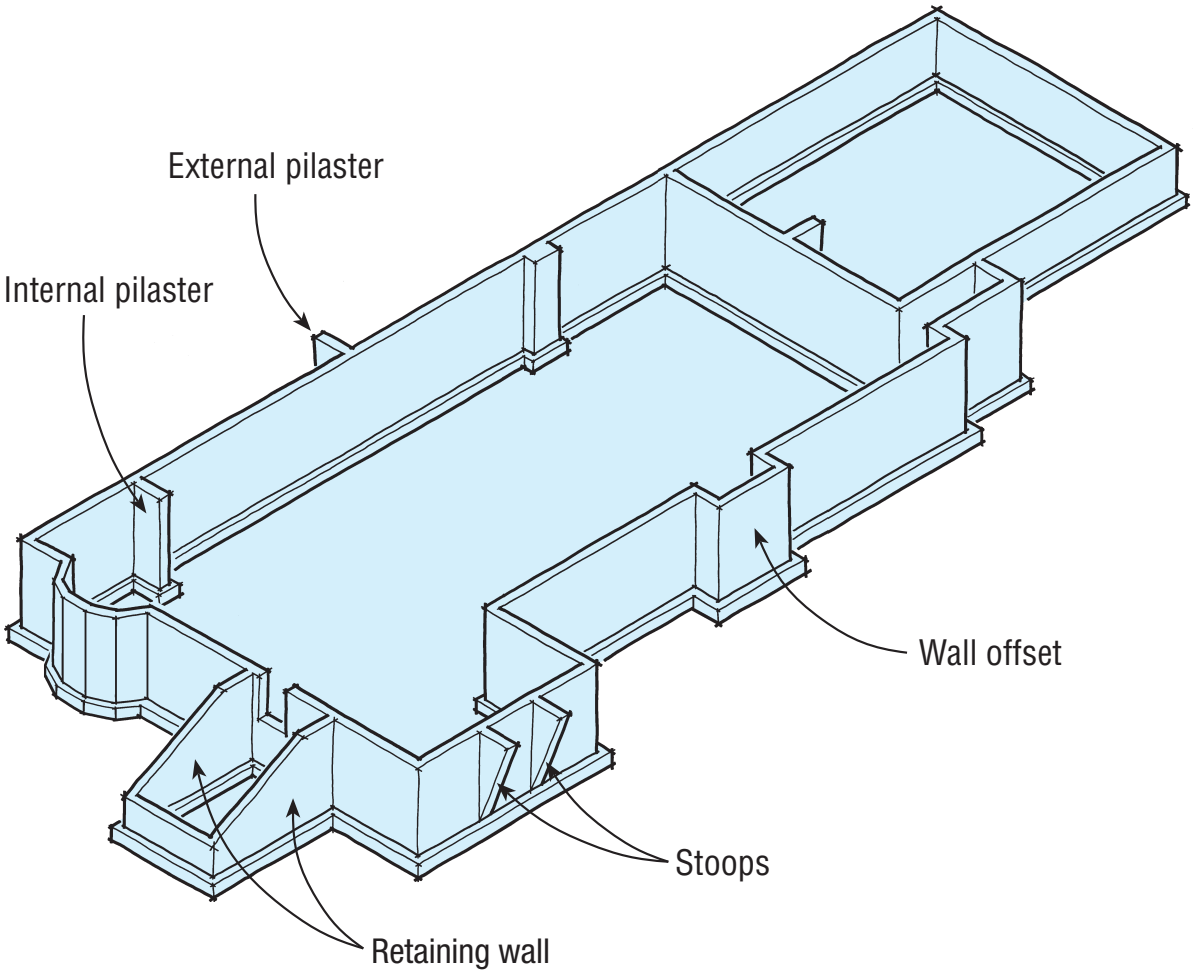
Regardless of height, every concrete wall should be braced at each corner. Maintain the higher wall height for a distance equal to half that wall height.

STRUCTURAL BRACING

Always frame the floor deck before placing backfill. If this is not possible, install temporary bracing before placing backfill (see Bracing Before Backfill).

Where soils impose an excessive lateral load, additional intermediate structural support for foundation walls can be provided by the cast foundation elements (**Figure C**).

FIGURE C: CAST-IN BRACING FOR FOUNDATION WALLS



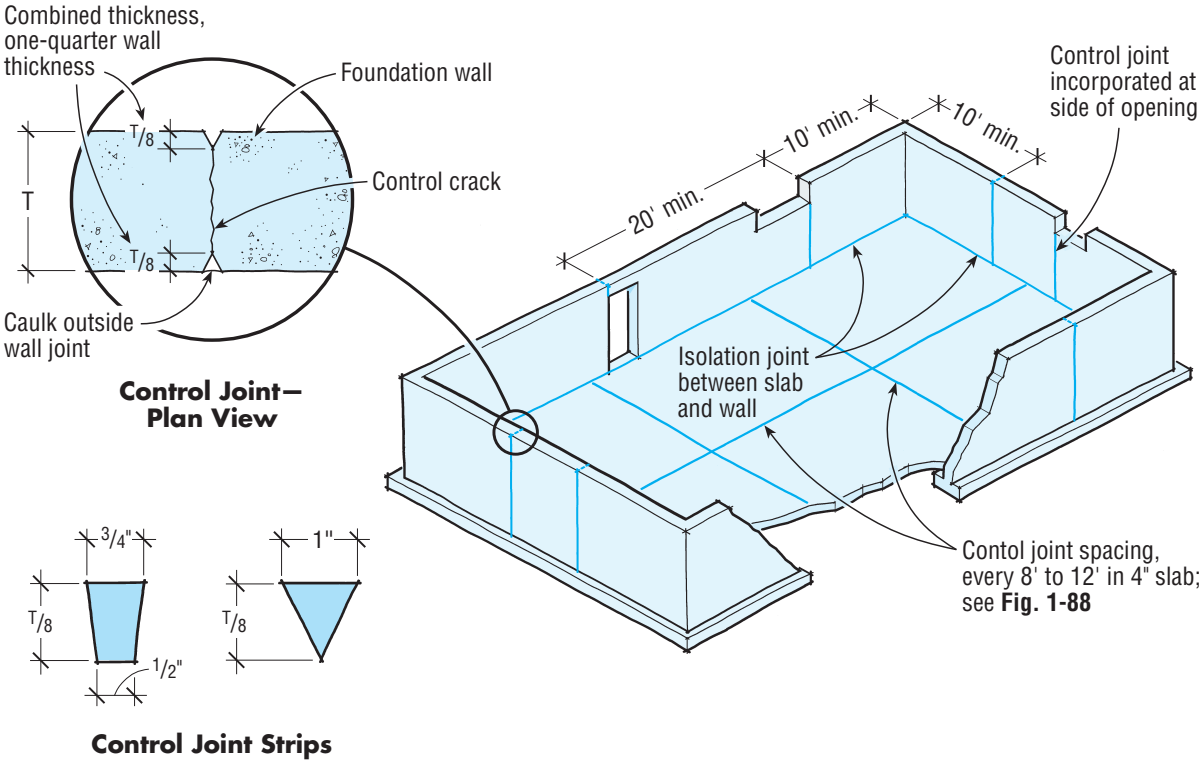
Any of the pop-outs or cast elements of a foundation wall will add lateral support, and they can be engineered to provide critical bracing of foundations in marginal soils.

CONTROL JOINTS FOR CONCRETE WALLS

Some surface cracking is inevitable in the face of concrete walls. Rebar and wire mesh are placed to keep cracks from widening but will not prevent them from occurring. If minor, random cracking is unacceptable, use control joints to confine cracks to intended locations.

Place control joints no more than 20 ft. apart, and within 10 ft. from corners. Locate control joints at natural points of weakness, such as door and window openings, corners, and changes in elevation or section (**Figure D**). In a stepped foundation, control joints should also be placed along a vertical in line with the point where the foundation changes elevations.

FIGURE D: CONTROL JOINTS FOR CONCRETE WALLS AND SLABS



Control joints are formed into the concrete using triangular or keystone-shaped strips attached to the inside faces of the form (both sides). To be effective, the combined thickness of the strips should equal one-quarter the wall thickness. So, for an 8-in.-thick foundation wall, use 1-in.-deep strips. Place strips at minimum distances shown, at door and window openings.

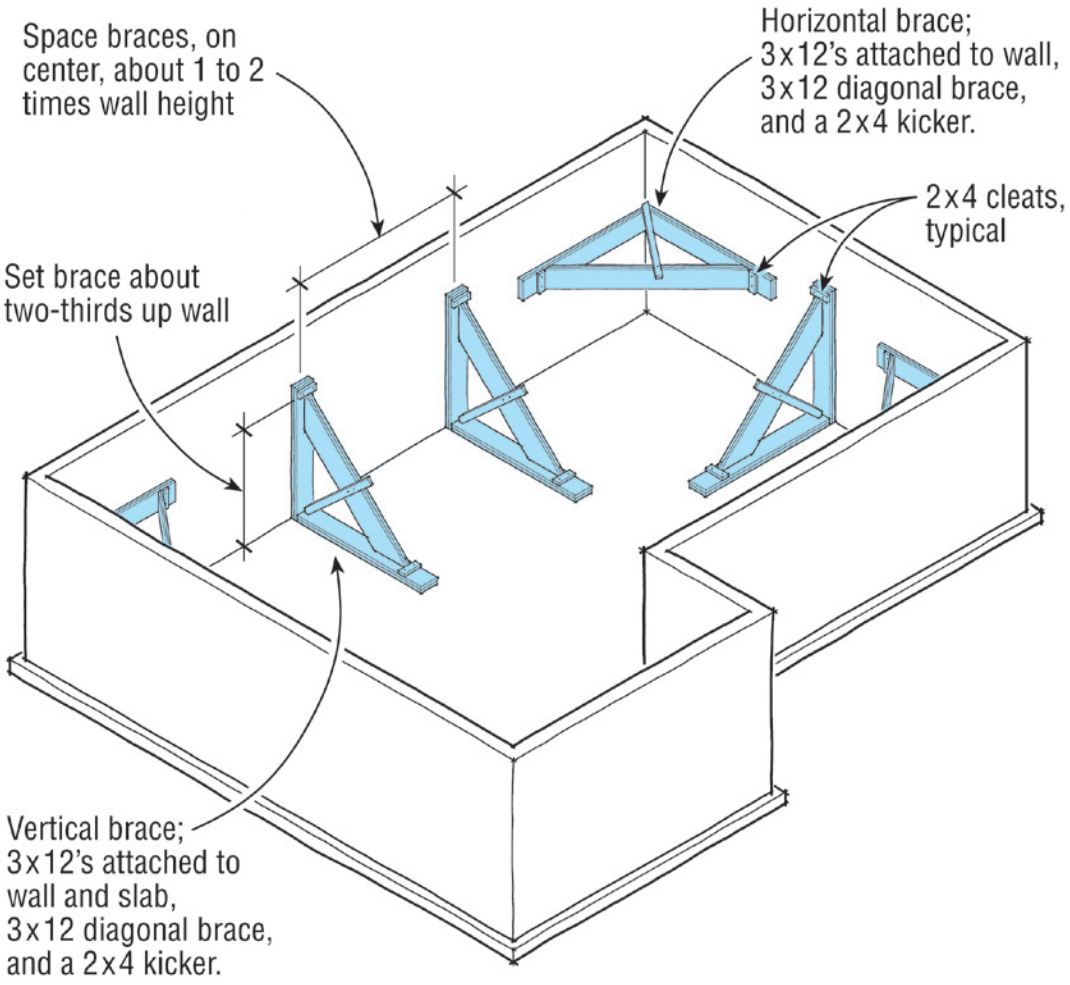
BRACING BEFORE BACKFILL

Backfill should be placed only after the floor framing has been completed to brace the top of the foundation wall against the backfill load. If this is not possible, provide temporary foundation bracing, as shown in **Figure E.**

Bracing Before Backfill

Placing Backfill

FIGURE E: TEMPORARY FOUNDATION BRACING



If backfilling must be done before the floor deck has been framed, install temporary foundation bracing. Set braces at about two-thirds the wall height and space braces apart about one to two times the wall height.

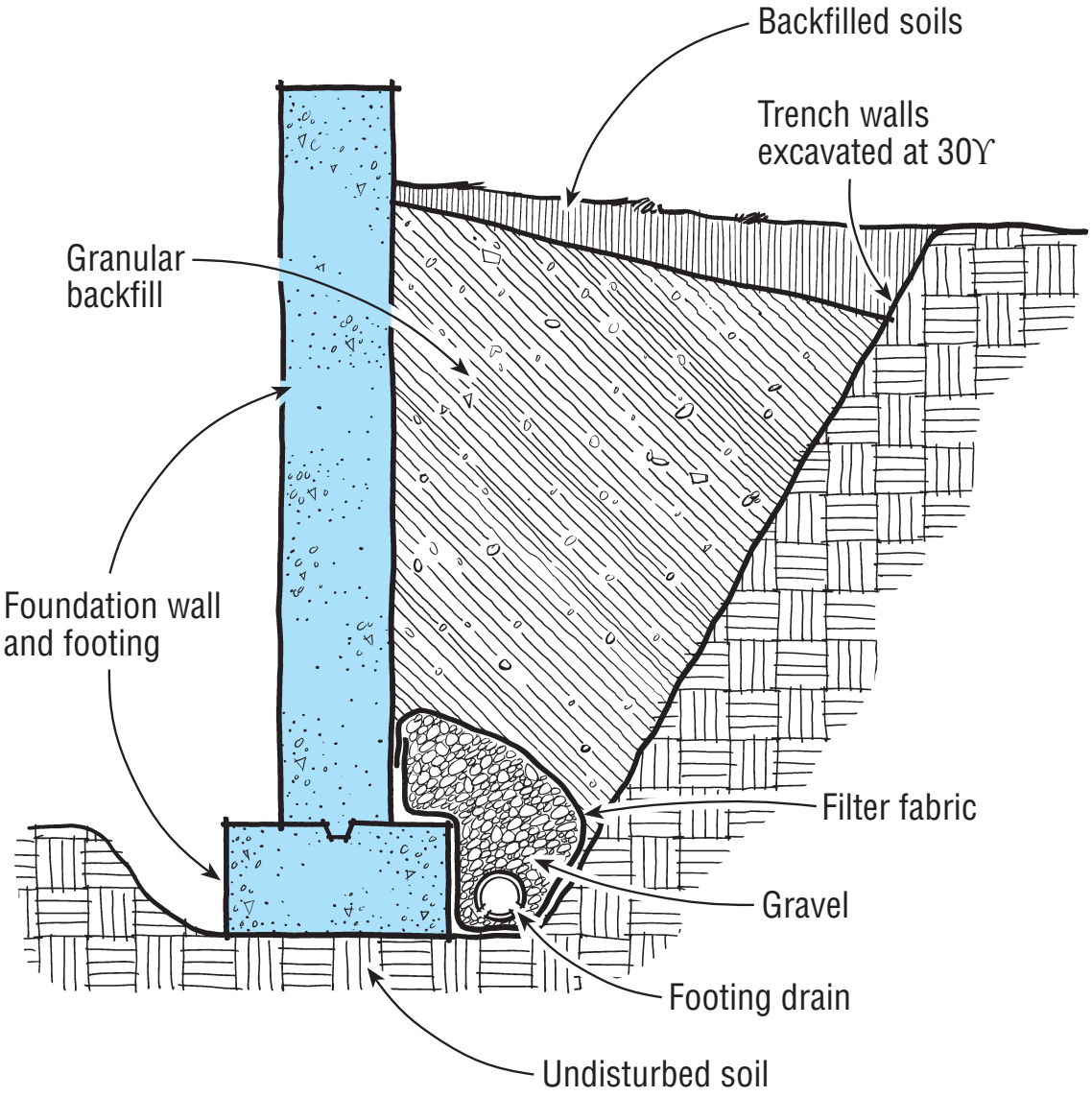
PLACING BACKFILL

Careful backfilling helps prevent foundation damage and soil settlement. Backfill only with well-draining granular fill (see Drainage).

Minimum Backfill Amount

Place the granular backfill in the zone from footing to near grade, widening to a minimum 30-degree angle from the footing up (**Figure F**).

FIGURE F: BACKFILLING FOUNDATION WALLS



If a foundation has not been excavated at least 3- to 4-ft. beyond the footing (see Excavating Foundation Holes), widen the cut to at least 30 degrees from the base of the footing before placing backfill.

Foundation Backfill Checklist

- **Use coarse granular material.** Sandy or gravelly soils make the best backfill.
- **Compact the backfill.** Place and compact the backfill in 6-in. lifts. Use hand compactors near the foundation, not machinery (see Compacting Soil). Uniform-graded gravel is largely self-compacting, but sandy, silty, or clay soils will settle if not compacted.
- **Slope final grade away from foundation.** A minimum pitch of 6 in. in 10 ft. will direct surface water away from the foundation. For added insurance against settling, build final grade up deeper and at a steeper slope so it will still slope away from foundation after settlement. For additional drainage details, see Drainage.