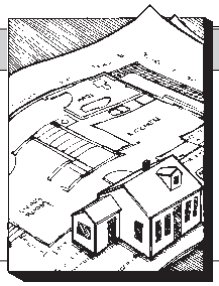


Tricky Details

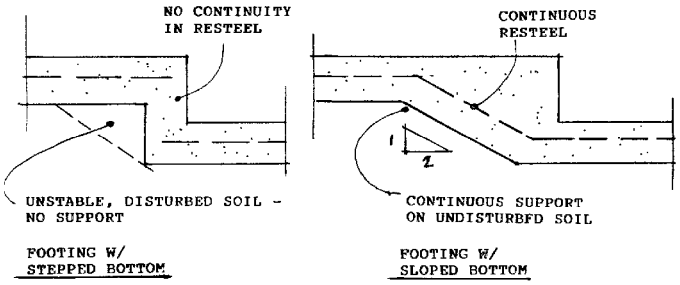
by Gordon F. Tully

Stepped Footings

Don't step the bottom of a footing unless you construct the step in two pours (see diagram). Each type of soil has a natural "angle of repose." When you dig down, any soil inside the angle of repose will loosen or collapse. If a footing needs to step up, its bottom should rise along the angle of repose.

The proper way to step a footing is to pour the lower footing, then backfill to the level of the higher footing, compacting the fill in small lifts so that it will carry the load. Also, be sure the steps overlap enough to allow longitudinal reinforcing to continue through the steps.

Why, you might ask, do so many foundations have footings with stepped bottoms and no cracks? Because, I would answer, most houses are overdesigned most of the time. It's just hard to know when "some of the time" occurs, and I—and my insurance company—prefer not to guess.



Maximum Headroom

Don't let standard 8-foot forms determine the ceiling height of a basement. You build a house only once, but the users have to duck under beams, piping, and ductwork for the next 100 years. It's not worth the few dollars saved by using 8-foot forms.

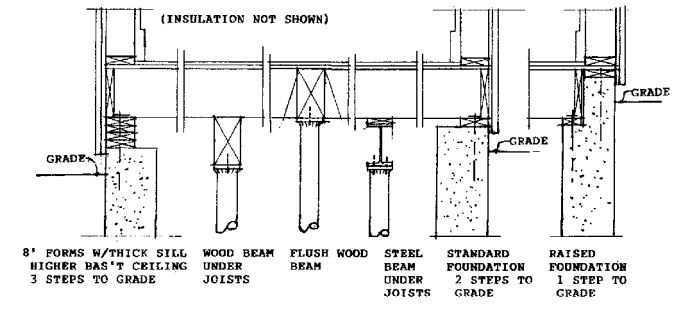
The options are to use taller forms, add blocking to the top of the forms, or increase the thickness of the sill to 6 or 8 inches (see diagram).

Using a 6- or 8-inch-deep sill has a minor advantage in houses where the first-floor joists sit on a wood carrying beam. With a standard 2-inch-deep sill, the middle wall will settle more than the outside walls due to cross-grain shrinkage (especially if the middle beam is a solid timber, which is usually not kiln-dried).

A deep sill, though, might raise the first floor higher above the ground than you like. In that case, a higher concrete wall would be a better solution.

Stoops and Porches

This raises the question of stoops and porches at entries. A neat way to meet grade at entries is to raise the foundation nearly to the level of the subfloor, and to create a seat for the joists on walls perpendicular to the joists. (See diagram).



It is probably a good idea to use this detail only with a concrete foundation, and to use treated wood for the band joists as well as the sill. If the raised foundation is brick or block, or if drainage around the house is inadequate, water can enter above the joists and cause rot.

Another problem related to shrinkage is that the outside wall will rest on only 2 or 3 inches of wood in cross grain, while the interior walls might rest on 20 inches (assuming an 8- or 10-inch wood carrying beam). Even if the beam is kiln-dried, any major changes in the house's relative humidity will cause noticeable differential movement. It's a good idea to use steel carrying beams with this entry detail, thereby reducing the differential in cross-grain wood to 7 or 8 inches.

Backfilling

You should never backfill a basement wall until it has been braced across the building at both the top (by the floor framing) and at the bottom (by the floor slab), or by perpendicular walls. Most contractors wait until the top of the wall is braced before backfilling, but few worry about the bottom.

If the backfill is kept dry, it is unlikely that the footing will move. But if for some reason the fill becomes saturated, the footings can easily kick in and cause a wall failure. A foundation failure is expensive and serious, so extra precautions are appropriate.

Hillsides

A house built into a hillside can have special problems. First, if the uphill wall is exceptionally high, earth pressure there can overcome the resistance from the slab and frost wall downhill, and cause the entire basement to slide.

Second, the top of one basement wall is not braced to the opposite wall as in a normal basement. The thrust at the top of the uphill wall has to be led through the floor diaphragm and into the sidewall. This works well in a building with long sidewalls and a short uphill wall, but one with a long uphill wall and short sidewalls will need intermediate buttresses to keep the uphill wall from tipping in.

In either case, problems can arise if the uphill wall is backfilled before the structure is framed in. In these cases, we build the uphill wall as a freestanding retaining wall. This is expensive, but often it's the only solution.

For all hillside foundations, it's wise to get advice from a structural engineer, since experience is required to judge whether there will be a problem.

Half-High Walls

It is often desirable to have a half-high basement wall, perhaps as a transition from a full basement to a walkout. Such a wall is unstable, as it is unbraced at the top.

The solution is to extend the wall as far below the slab as it extends above, and reinforce it like a beam cantilevered out of the ground. But notice that the wall will not resist backfilling unless it is braced at grade by the slab, which acts as a pivot.

Insulation

We have never used exterior foundation insulation because:

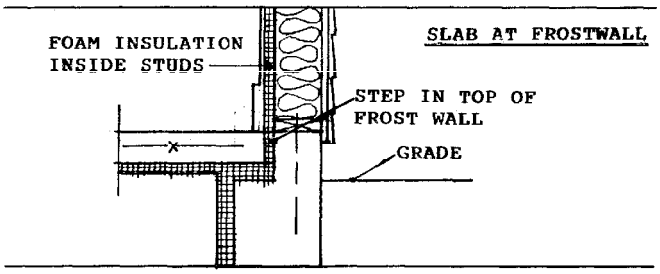
1. We cannot figure out how to protect it properly.
2. We are worried about the path it creates for carpenter ants and other vermin to reach the house framing.
3. The detail works only with one inch of insulation, since that is the usual maximum thickness of board insulation over studs, and we feel that one inch is not enough.
4. Putting the insulation inside is logical when the basement will be finished, since the studs are there, anyway, to hold up the interior finish. (In unfinished spaces, high-density fiberglass boards can be glued or pinned to the wall.)

But interior insulation has some problems of its own:

1. Bracing walls create an unsolvable cold bridge.
2. A vapor barrier can trap the moisture that initially escapes from the curing wall, thereby wetting the framing and insulation. (Eliminating the vapor barrier is probably the right solution.)
3. Compared with an unfinished interior wall, the studs use up floor space (but, as I noted, finished basement interiors usually have studs anyway).

Slabs

To prevent a serious cold bridge in a slab on grade, it is essential to insulate either outside the frost wall, or between the frost wall and the slab. Since I don't like exterior basement insulation, I take the latter approach. In this detail, the top of the frost wall is blocked out enough so that the baseboard will cover the top of the insulation (see diagram). Sometimes a builder leaves a thin layer of concrete above the insulation, but this can crack and should be covered.



A client brought to our attention the possibility that this detail, like exterior insulation, might provide a path for termites (the house is near Boston), so we now treat the soil adjacent to the insulation with an insecticide.

In cases such as a half-high foundation, where the slab braces the wall, the insulation should be interrupted for 6 inches every 4 feet to create tabs in the slab that will push directly against the wall.

It pays to be careful with foundations, because foundation problems are almost impossible to repair later on. If you are committed to quality construction, there is no better place to start than at the bottom, and these hints may help get you off on the right foot(ing). ■

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