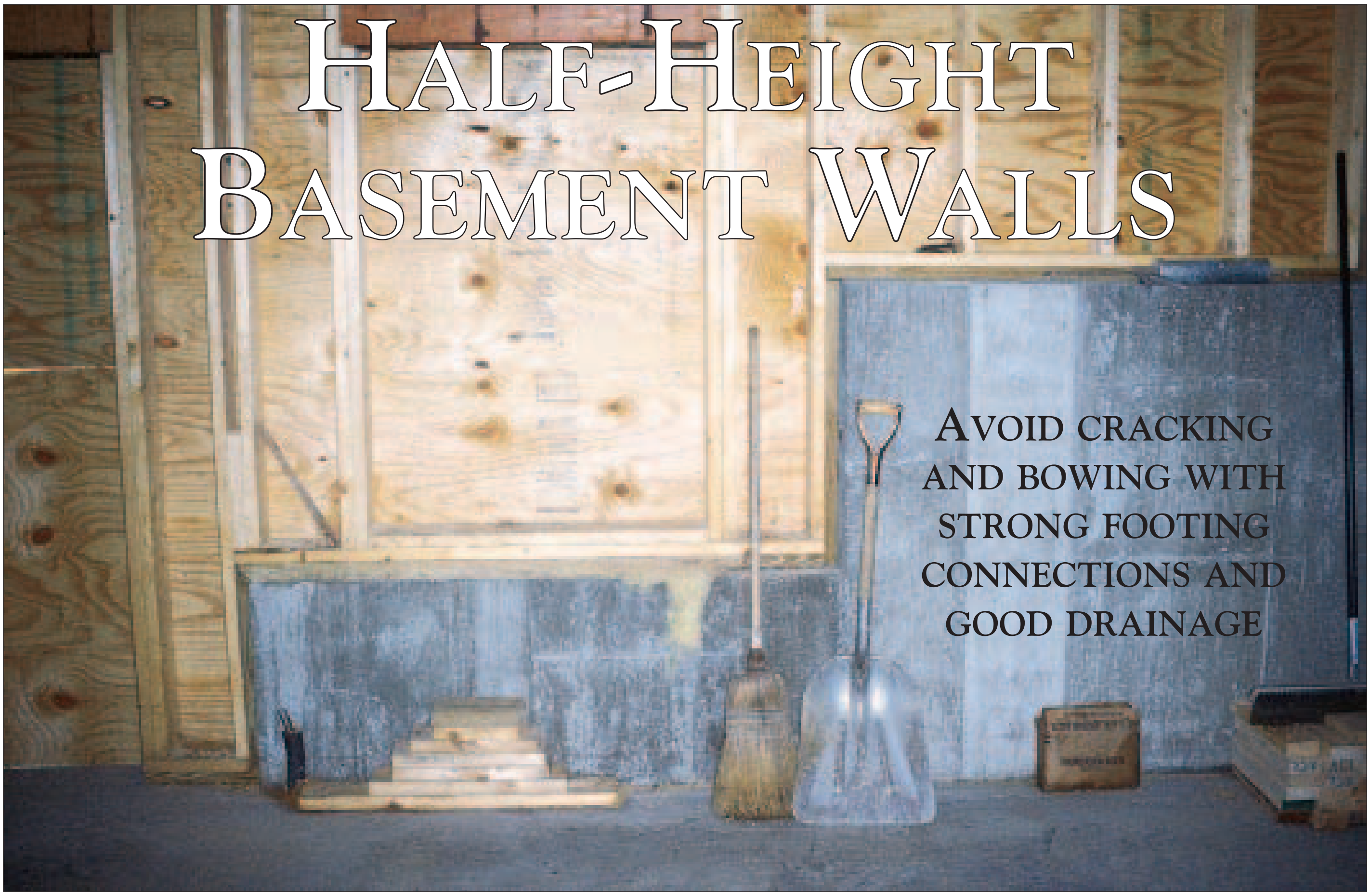
BY CHRISTOPHER F. DEBLOIS

Half-Height Basement Walls



Avoid cracking and bowing with strong footing connections and good drainage

When a foundation will be backfilled to just below the first floor, every builder puts in a full-height basement wall. That's because the wall must hold back the earth in addition to holding up the house. But present the same builder with a wall that will be backfilled only part of the way — a house bermed into a hill, for example — and the solution may be quite different. In such a case it seems sensible to step the wall up the slope, pouring a concrete wall or laying up a block wall to just above grade, then spanning the rest of the distance with a wood-framed wall. The durable, relatively waterproof concrete seems strong enough to hold back the earth; the framed wall, called a "cripple wall" (a cripple is any less-than-full-length framing member) is less expensive than concrete and easier to put siding on or windows through. Sounds good, right?

Wrong. This "solution" has a critical flaw. If I told you to make a horizontal saw cut through all your foundation walls at mid-height, you would toss me off the site. Yet the connection between a concrete wall and a framed cripple wall isn't much better. To understand why it's such a bad idea, you need to know what a basement wall does and how it does it.

Basement Wall Basics

A basement wall performs the same three structural functions as any other exterior wall. In addition to supporting gravity loads, it must also resist in-plane shear loads (parallel to the wall plane) without racking, and lateral loads (perpendicular to the wall) without flexing. What makes a basement wall unique, however, is that the lateral loads are not short-term wind loads, as with above-grade walls; instead, they're the permanent loads exerted by the soil. These loads can be huge. If the backfill isn't well drained, the force at the base of an 8-foot-high basement wall can easily exceed 500 pounds per square foot (psf). That makes a 20-psf wind load seem puny (see Figure 1, next page). The constant lateral force makes flexural strength more important in a basement wall than it is in a typical above-grade wall.

The Trouble With Cripple Walls

From a structural point of view, a concrete/cripple wall combination is inferior to a full-height concrete wall at resisting all three types of loads. A full-height, reinforced poured concrete or concrete block wall can handle in-plane shear, or racking forces, with no problem in any setting; a wood cripple wall, however, must be braced against shear just like any other framed wall. These bracing requirements range from shear panels at the corners to the full-bore coverage and nailing requirements needed in coastal or earthquake-prone regions.

The really fatal flaw in a concrete/cripple wall is the way it handles lateral, or flexing loads. Most full-height basement walls perform admirably, whether they consist of poured concrete, concrete block, or even treated lumber. The key to their success is the fact that they span uninterrupted from the footing to the first

Full-Height vs. Half-Height Foundation Wall

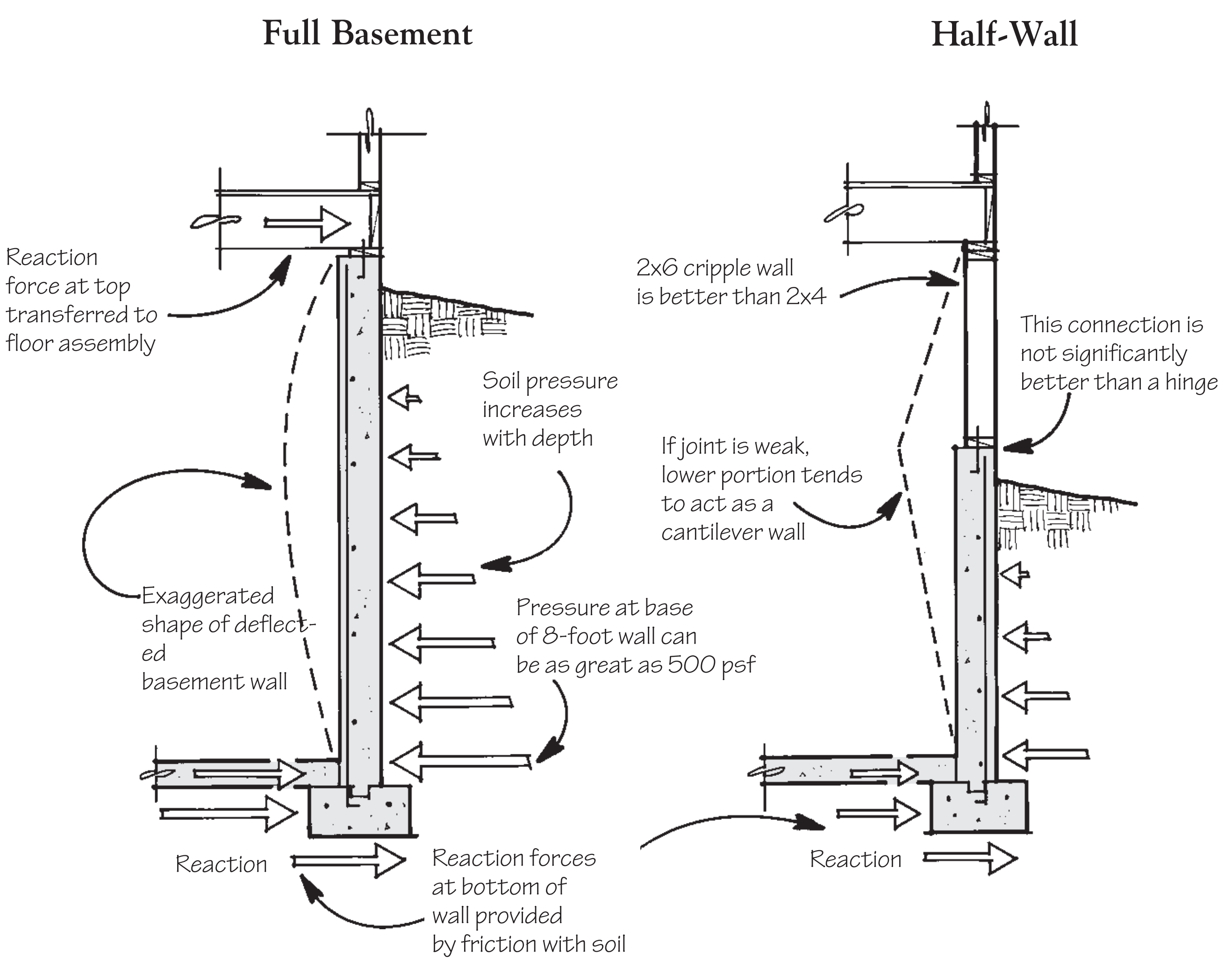


Figure 1. *The lateral force at the bottom of a full-height basement wall (left)can easily exceed 500 pounds per square foot. One reason the wall doesn't fail is that it's braced at the top by floor framing and at the bottom by the concrete footing. A concrete/cripple wall combination, however, is braced only at the bottom; thus the connection between the concrete and the wood wall is little more than a hinge (right). The result is that the top edge of the concrete wants to tip inward.*

floor. But the connection between the framed wall and the concrete wall is rarely much stronger than a hinge. You wouldn't platform-frame a two-story wall with a hinge at mid-height, so why do the same to a basement wall? (The normal "hinges" at the top and bottom of platform-framed walls seldom pose problems because they're braced by floors, ceilings, or roofs.)

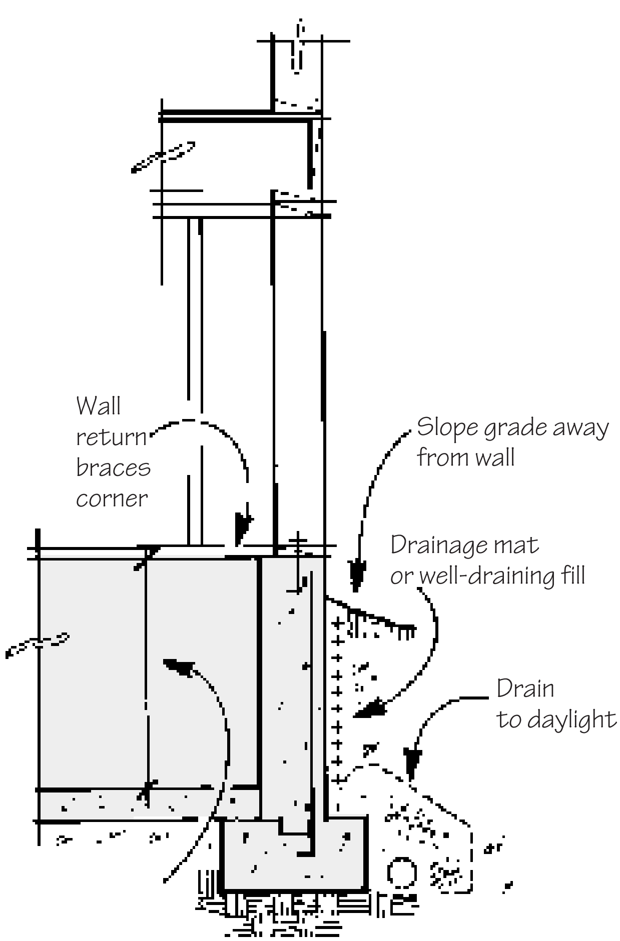
The problem is exacerbated by the weight of the house. If the soil pushes the hinge inward, the weight pushing down on the wall will force it in even further; and the more the wall bends, the more unstable it becomes. This instability is worst in earthquake-prone areas. When an earthquake hits, the soil starts moving back and forth. The extra force can lead to a catastrophic failure.

Problems typically appear at the joint. You may see the wall bowing in toward you, creating a substantial crack between the concrete and the mud sill or between the sill and the studs. These are signs that the wall has begun a slow but steady inward march. Correcting the flaw is usually impractical — you would have to remove the backfill and repair or replace the wall. At this point, you're better off bracing the wall from inside. You can do this by adding steel or concrete pilasters from slab to subfloor at intervals of several feet, or by framing a 2x6 or thicker studwall that's designed to handle the lateral loads. Your structural engineer can give you specifics on these remedies.

Why Do So Many Cripple Walls Survive?

Still, plenty of partial-height basement walls have been built, and most are still chugging along. A number of factors keep these walls from collapsing:

Building a Strong Half-Wall



Bracing Corners

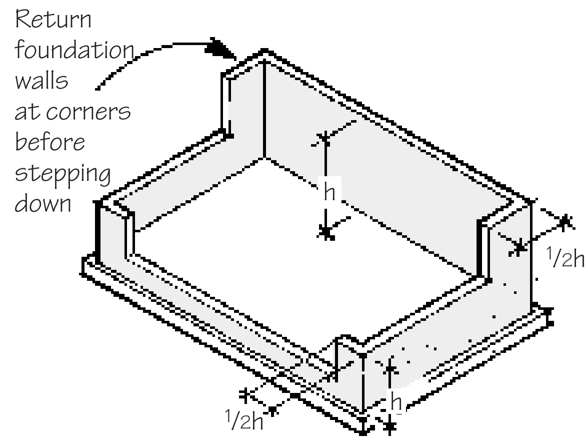


Figure 2. *When a concrete half-wall is no more than 3 feet high, the forces exerted by the soil are usually low enough that tipping isn't a problem (left). Good drainage is also important to relieve the soil stress on the wall. Regardless of height, every concrete wall should be braced at its end by turning the corner for a distance equal to half the wall height (above).*

- A concrete half-wall can to some extent cantilever from the footing. While a typical 8-inch concrete wall on a 2-foot-wide footing can't effectively resist a full 6 feet of backfill, it can handle some lateral loads.
- Usually, the cripple wall is attached to the half-height concrete wall with anchor bolts or mud sill straps. These provide limited strength to resist lateral forces. But structurally the wall is still closer to a hinge than to a continuous wall section.
- Half-height foundation walls are often found on the gable end walls of a house. These are not as long as the eaves walls, so less force is placed on them. Also, cripple walls are often built on the side of a house where the grade slopes away, meaning there is less soil pressure against the foundation than where the grade slopes toward the house.
- When foundation walls are poured, the excavation trench is often backfilled with a well-draining, granular fill material. Well-compacted, well-drained soil is more stable and puts less force on a wall than loose, poorly drained fill.
- I have seen concrete half-walls that have leaned inward slightly, then stopped moving. In such cases, the soil backfill was probably not compacted properly and stressed the foundation wall as it settled. After it settles, though, the soil stabilizes and the stress on the wall drops.

Because of these mitigating factors, the choice of a partial-height basement wall instead of a full-height one is rarely a choice between disaster and perfection — it's usually more a question of cutting corners instead of doing the job right.

Recommendations

There are some guidelines that can help you make smart decisions about half-height foundation walls. The shorter the wood-framed cripple wall gets, the more likely it will have problems. In my experience, most problems occur in cripple walls that are shorter than 3 feet. If this doesn't deter you, be aware that the CABO *One & Two Family Dwelling Code* severely limits the options for cripple walls with stud heights of less than 14 inches, requiring that all stud bays be filled with solid blocking. The cost of installing the blocking will easily exceed any savings on concrete.

There is one situation when a partial-height concrete basement wall is fine. I've found that you can build a conventional 8-inch-thick concrete wall on a 2-foot-wide footing up to 3 feet high without problems (Figure 2). In such a case, the forces exerted by the soil are low enough and the concrete wall and footing strong enough that the hinge doesn't cause problems.

Regardless of height, you should return the concrete wall at the corners before stepping the wall down farther — to a walk-out entrance, for example. This buttress section should be the same height as the main wall and at least half as long as it is tall (1 1/2 feet long for a 3-foot-high wall). And don't forget drainage — just as good drainage will help relieve soil stresses on a full-height basement wall, the same is true for concrete half-wall/cripple wall combinations. ■

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