

Leakproof Basements

Standard materials, good sense, and careful detailing will keep out the water for good.

by Henri de Marne

Wet basements and crawl spaces are the most common problems I see as a consultant, followed by attic moisture problems. And sometimes the two are related. But there is no excuse for a wet foundation in a new house.

The marketplace is full of waterproofing systems, some adapted to residential housing from commercial applications. They come in a wide variety of materials, but have one thing in common: all are relatively expensive.

Yet, available to contractors and builders everywhere is a system that is inexpensive, easy to apply, and foolproof. It requires no special skills, and causes no delays in delivery. It's a wonder that all builders don't use it on all their jobs.

The Usual Way

The excavation hole is usually back-filled with loose, disturbed material that will settle over time as water puddles on it. But where is this water to go once it reaches the bottom of the excavation? It is trapped between undisturbed soil and concrete.

Even if a perimeter drain has been provided and run to daylight or to a sump, it will soon silt up and become useless. Water will build up against the walls. If the drain has no outlet—as is too often the case—water will build up that much faster. When it does, the water pressure often finds relief through joints and cracks in the walls.

If the walls are reasonably watertight, the weight of saturated soil can crack and buckle the foundation. In very cold climates, this process is aggravated by frost.

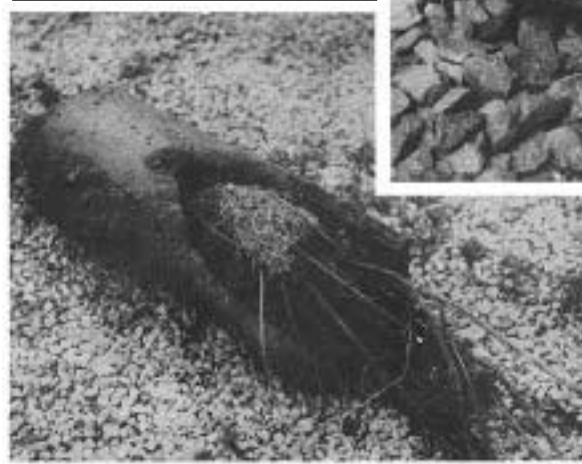
Those who build in areas with coarse and sandy soils have an easier life—but not necessarily without problems. I have been called a number of times to diagnose buckling foundation walls in sandy areas. Every single case was caused by rain or melting snow—with temperatures near the freezing point during the day and below freezing at night. The sandy soil did not have time to drain and the water froze, putting pressure on the foundation. Over the course of the winter, the situation got worse until finally the foundation gave way.

So how can these problems be prevented?

A Better Way

First, you need to build houses with foundations that stick up far enough above the natural grade to permit proper final grading that drops away from the house. For instance, if you now excavate about eight feet deep so that your houses hug the ground when completed, try going down only six and a half feet. You'll save on dozer time and won't have as much dirt to store and handle.

Next, if you build with poured founda-



Drain tile filled with roots (left) or silt (above) is worthless. Properly detailed gravel bed and filter fabric will keep out both.

tations, you must ensure that the concrete cures properly. And, finally, you must carefully follow a strict procedure to build and protect the foundation drain, backfill, and final grade.

As soon as the wall forms come off, knock off the ties and cover the foundation walls—inside and out—with 6-mil clear plastic. Don't use black plastic except in winter pours, as it can cause the concrete to overheat.

Keep the number of joints in the poly to a minimum, overlap them substantially, and tape them with duct tape. Let the plastic drape over and cover the footings, and hold it in place with shovelfuls of crushed stone. This will pre-

vent dehydration of the concrete and thus allow complete curing, which takes 28 days. The end result will be rock-hard walls that are less prone to shrinkage cracks or water penetration.

Leave the outside plastic on permanently; you may remove the inside plastic after a month.

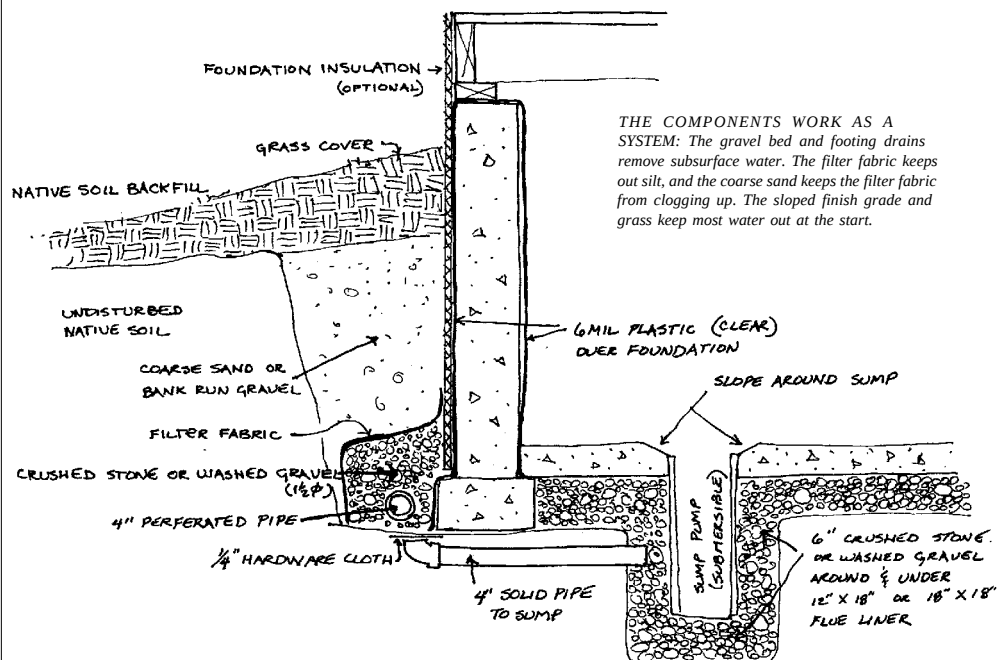
Footings Drains

If you plan on insulating the foundation from the outside—which I highly encourage—this is the time to do it. Then pin a strip of filter fabric (Tygar, Mirafi, etc.) to the bank of the excavation (see drawing). Make sure the strip is wide enough to cover the entire

perimeter drain that you are about to install.

The filter fabric must extend from the bottom of the trench all the way to the foundation wall with a few inches to spare. This will keep the footing drains from silting up. Don't be stingy; back-filling makes the fabric "shrink."

Spread a couple of inches of 1 1/2-inch crushed stone on the bottom of the trench outside the footings. Next, lay the perforated pipe (holes face down) around the perimeter on the crushed-stone bed. The pipe doesn't need to be sloped; sloping the pipe is impractical and could endanger the footing, since its lower end would have to be below



the footing. Water rarely runs in the pipe, anyway. Except in flood-like conditions, the two inches of stone below the pipe will handle the water. (Sites that need to use the perforated pipe regularly should probably not have been developed in the first place.)

Now cover the pipe with enough crushed stone to cover the entire footing plus the bottom four to six inches of the foundation wall. Drape the filter fabric over the stones and turn it up the foundation wall. Then proceed carefully with backfilling.

Backfilling

Backfilling should be done only with coarse material such as bank-run gravel or coarse sand. Do not use silty or clayey soils, because they will quickly plug up the pores of the filter fabric and render the drain useless.

I strongly recommend that you backfill up to, or almost to, natural grade with this coarse material. This not only provides excellent percolation for any water that penetrates the surface, but also gives good protection against frost pressure. Also, the bank-run gravel or coarse sand is dense enough that it won't silt up from the topsoil.

You will now have about two feet of foundation sticking out of the ground. Use the native soil to build the grade up to several inches below the siding. The slope of this final grading is necessary to shed water away from the building; shoot for a slope of about two inches per foot. Generally, you will use most of the native soil to accomplish this, and will have to haul away little or none.

There's another advantage to this system. In subdivisions—or where you build two or more houses on flat, contiguous lots—you can vary the grade and create interesting contours, while providing swales between houses that will conduct water to main disposal channels.

If you provide landscaping, don't stick shrubs or flower beds directly against the foundation. (Put them four to six feet away.) Advise your customers that these would trap water and could damage the waterproofing system. Instead, plant grass or lay sod around the foundation. Grass next to the foundation is one of the best insurance policies against water problems you can buy. It will shed a lot of water, and most of the rest will be caught in its deep root mat and re-evaporated.

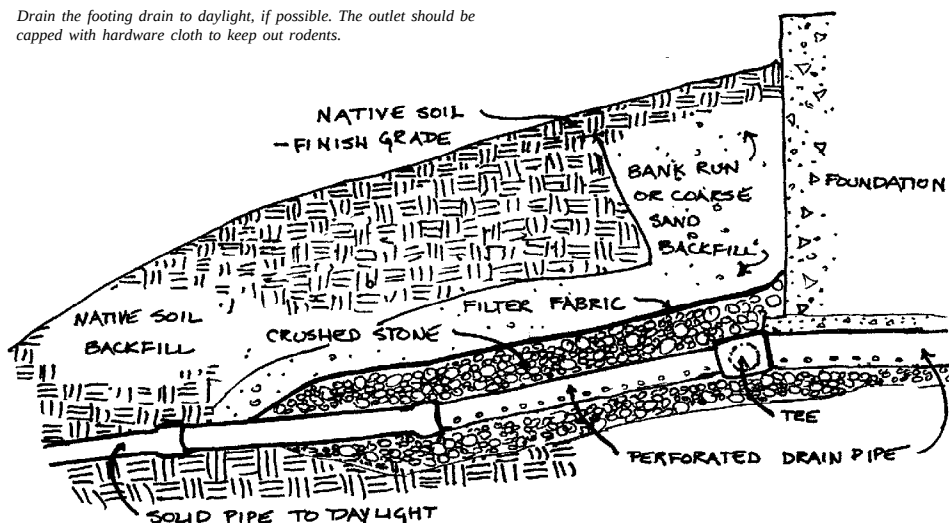
To Sump or Daylight

If these steps are carefully followed, surface water should never reach the perimeter drain. In many areas, however, *subsurface* water might be a problem. To function properly in either case, the drain must have an outlet.

If you are building on a lot that permits the footing drain to flow to daylight, the following procedure is recommended. At the point where you tee the drain into the outlet, excavate a sloping (minimum one inch per foot) shelf that extends from the footing drain to 10 feet away. Connect a 5- to 10-foot section of perforated pipe to the tee, and lay it in a heavy bed of crushed stone that is covered with filter fabric (see drawing). Connect solid pipe to the single section of perforated pipe, and run solid pipe to daylight. This will allow water to drain away from the foundation perimeter into this collection basin and be carried away, thereby keeping the soil under the footing dry.

Cap the daylight outlet with removable hardware cloth to keep rodents from nesting inside this secure shelter,

Drain the footing drain to daylight, if possible. The outlet should be capped with hardware cloth to keep out rodents.



and build a loose-stone culvert around it to keep grass and soil from closing it up.

When building on a flat site, connect the perimeter drain to a solid pipe that goes under the footing to a sump inside the basement or crawl space. The pipe should turn up and terminate level with the bottom of the footing, and be covered with hardware cloth to keep out the crushed stones.

To handle a rising water table under the slab, spread four to eight inches of crushed stone under it, and connect this stone layer to the exterior perimeter drain with a solid pipe that runs under the footing. In the case of a sump, surround the sump with crushed stones so the water can drain into it. I should mention that for a sump I always use—and recommend—a large clay flue-liner section that is set on and surrounded by six inches of crushed stone.

I use the term "crushed stone" for a reason. In some areas, gravel means washed round gravel, and it can be obtained in 1 1/2-inch-or-so diameter. But in other areas, gravel means bank or river gravel, which is not suitable for the fast movement of water. Crushed stone should go around the footing drains; bank-run gravel or coarse sand goes above.

Carefully follow this prescription and you'll have an inexpensive and effective—indeed, foolproof—foundation waterproofing system that will ensure crack-free walls and an unblemished reputation. ■

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