

Don't Lose Your Footings In Saturated Soil

by Michael Lennon

A walk in the wet sand at the beach can demonstrate how the spread footings of a building distribute the loads they carry. It can also show what role water plays in soil.

Footprints are made when your body weight presses down and displaces the water in the sand under your feet. This allows the sand beneath your feet to sink. Also, the displaced water increases the moisture content of the sand alongside your footprints. This is why the sand changes color.

Your feet are like building footings in the way they affect the soil both directly beneath and alongside of them when they carry weight. Footings, too, affect the soil all around them and the moisture content in the soil under footings can affect the footing's ability to support. More important, changes in soil moisture content can cause buildings to settle. Serious damage or even collapse can occur when these principles are misunderstood or ignored.

Surveying the Damage

A recent emergency inspection I made drove this point home and left a lasting impression. The owner of the building was acting as her own general contractor on this job. She had been renovating an inner-city brick row house when part of the building collapsed. The building was typical for the area. It was an 18-foot wide, two-story structure with a full basement under two thirds of the building. The rear third of the building was 12 feet wide and sat over a crawl space. The front facade was handsome with intricate brick work above the windows and doors and along the soffit.

When I first saw the building it looked like a bomb had gone off inside. Bricks were all over the ground, and what was left of the roof dangled in the open air, two stories above. The double-course masonry walls of the right side and the rear had collapsed. The fire-cut joists for the second floor stabbed out into open space where the sidewall had been.

Looking at the house from the front, it struck me as odd that there was not much brick debris on the right side of the house. The answer to that riddle came soon.

Not Backfilling Led to Problems

The owner/general contractor told me that she was in the process of installing a full bathroom in the basement of the house. The new sewer had already been roughed in. The plumbing contractor had excavated alongside the rear portion of the building (alongside and deeper than the footings) and installed piping. But he walked off the job over a dispute before he backfilled the excavation. No shoring had ever been used. It turns out that the bricks I'd expected to see piled up on that side of the house were there all right. But they were filling the excavated hole.

Rainwater had run off the roof and collected in the excavated area because gutters had not yet been installed. Later, the shallow crawl-space footings for the two-story rear portion of the building had slipped laterally and then down into the excavated hole. Everything above collapsed when the footings moved.

Saturated Soil Caused Collapse

The weight of the sidewall, the floor, and the roof would normally have been carried not just by the soil beneath the footings, but by the soil around them as well. Such loads would normally transfer down and outward at an angle of approximately 45 degrees to the surrounding soil beneath the footings. Excavating the soil from the outside of the footing had left it supported only on the inside. The remaining soil under the bottom of the full basement. This weakened the outside support, and the footings slipped out and into the excavated hole. Most of the rest of the building crashed down and filled up the hole.

The collapse would undoubtedly cost someone dearly in an upcoming court case. Surely, the plumbing contractor would be sued. The cost might run to much more than the repair of the collapsed building. The potential for serious injury was very real. I recommended that the woman call her attorney immediately. I doubt the plumbing contractor understood how his excavation of the footings con-

I doubt the plumber understood how excavation of the footings contributed to the collapse.

tributed to the collapse. However, I also doubt a jury would be sympathetic to him.

I saw another similar case where an entire masonry building collapsed into the adjoining site. In this case, the vibrations set up by heavy machinery allowed the footings to slip into an excavated area. This reaffirmed my feeling that many contractors either don't understand how soil surrounding the footings functions or are too cavalier about the entire issue.

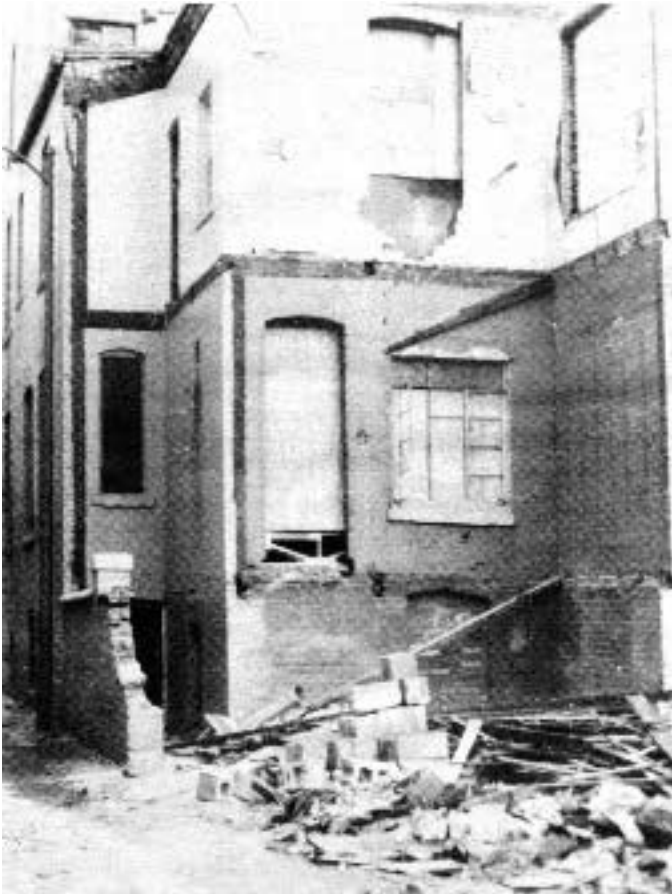
Carefully Watch Sloped Lots

I've talked briefly about two cases where poor attention to excavated areas caused problems. It is also my experience that split-level houses built on sloped lots with crawl spaces beneath the uphill portion of the house and full basements on the downhill portion are prone to settle due to soil conditions. In this case, poor surface drainage around the uphill portion of the house can cause soil saturation. This puts pressure on the more deeply excavated area where the crawl space butts to the full basement. The water promotes soil consolidation or erodes soil from beneath the footings. This allows settlement to occur.

More dramatic settlement can occur when an aquifer recedes. This can happen when a stream or a spring is diverted, or even when surface drainage is piped within storm drains. (On a grand scale, it is the same principle that caused the Florida sinkholes to swallow whole blocks).

It's important to note that the soil under the footings and the supporting soils around the footings are both equally important. Pay careful attention to the role of soil as a footing support. And take note of the drastic consequences that can occur when the soil's moisture content changes. ■

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Part of this inner-city row house collapsed when a plumber didn't backfill a trench and rainwater saturated the excavated ground around the footings.



This masonry building collapsed when vibrations from heavy machinery caused the footings to slip into an excavated area.