

Solving Structural Problems With Soil Screw Anchors

Everybody knows there is no such thing as the perfect house. As home and building inspectors, we devote quite a bit of time explaining this very fact to our nail-biting clients. Luckily, the majority of problems that can occur residentially can be solved relatively easily: furnaces can be replaced, roofs can be repaired or replaced, and electrical systems can be upgraded. In most cases, none of these problems will cost over about \$5,000.

Not so for structural concerns. Nothing can send a client screaming from a house faster than the discovery of a serious structural problem. For residential properties, the most common structural issues are foundation related.

Every house settles a little bit. Some settle quite a lot. Seldom is it something the owner or buyer has to worry about in the short term. Eventually, however, *somebody* is going to have to fix that wall that has been slowly settling for the past fifty years. Sometimes by the time one of our engineers gets to the house, the house has settled to the point of leaning. If your first clue is that the owner has one leg longer than the other, and she goes by the name Eileen, you can be sure something is afoot...with the footing. (Pun intended.)

The cause of most foundation movement is settlement of the footing. The footing is the wide pad that sits on the soil and supports the foundation wall. (insert picture A) When the footing settles, it is usually because the soil is doing something it's not supposed to do. Perhaps an underground stream is washing it away. This is commonly suspected in Toronto, where parts of some older neighborhoods were built by first filling in a stream or creek. The soil may also be compacting, or just shifting.

Whatever the reason, the time-honoured way of fixing a settling footing has been to dig under the footing, in alternate short sections, in order to pour more concrete to deepen and/or widen the footing. The goal is to get beyond the bad soil or to spread the weight of the house onto more area to ease the burden. This technique is referred to as underpinning (picture B), and it is disruptive to either large sections of the exterior yard or to long lengths of the basement floor.

It is also expensive. For very rough approximations, you can use \$400-600 per linear foot, minimum \$5,000, which explains the reaction of the client when the inspector starts throwing around numbers like \$10,000 and up. "Mr. Jones, are you alright? You must have fainted."

The good news is that there is another method that can be used to address structural movement, which in many cases is less disruptive and can be less expensive than underpinning. The technique will also solve problems in difficult sites where underpinning just won't work. The technique uses long screws drilled

into the soil, and is referred to by one manufacturer, Hubbell Chance, as the “Helical Pier Foundation System”.

It sounds new, but the technique has actually been used for about 100 years, in a large variety of construction installations including column supports for bridges and lights, seismic applications, retaining walls, dams, roadways and more.

For solving a house footing problem, the theory is simple: from the outside, install a few long, strong, non-corroding screws deep into good soil, and support the foundation wall on them instead of the non-performing footing. The advantages of this system are several: versatility, often lower cost, faster, limited excavation, no heavy equipment needed, installs in limited-access areas, and can be used for sites with unusually poor soil.

When the soil anchor technique is decided upon, a dealer certified by the manufacturer will send engineers and technicians to inspect the home in order to design a solution based on the damage, weight and soil conditions. The solution will specify the number, size and location of the soil anchors. For installation, the location of each anchor is excavated down to the footing. Each hole is only a few feet wide. The footing is notched to provide room for the L-shaped bracket that will support the wall. A special hydraulic drill screws the anchor into the soil to the prescribed depth. Then the L-bracket is installed and the anchor is adjusted to fit to the wall. The hole is then backfilled (Picture F).

For order of magnitude on costs, let’s take a case study. Assume one corner of an old brick house has settled. Step cracks can be seen on both walls, but not too far along the walls, indicating only the corner is affected (Picture C). The cracks are wide, about one-half inch, and/or can be seen to have been repeatedly patched with new mortar over the years. This really should be fixed at some point, especially if the cracks have moved both down and out. A smaller job like this may only require three to five anchors (Picture E). We have been advised that the cost per anchor can be in the \$1000-1500 range. The additional costs, like re-landscaping, will probably be less than those for the old technique. Obviously, this is meant for illustrative purposes only. Actual costs depend on site conditions.

Footing settlement is not the only type of foundation movement. The same anchors can also be used to hold back a bulging foundation wall (Picture D). This is one where it is not settling down, but the soil is pushing it in. The old solution would be, most often, to replace the wall. The anchor method is significantly less costly in this case. How about a leaning retaining wall? Anchors can be installed to pull it back and restrain it. For a large wall, restraining it will be much less costly than replacing it.

When does a home need structural remediation? This is best determined by an engineer, but it also needs some time data. In many cases, all the house needs

is for the owner to be aware of the problem, and to monitor the situation. That may mean measuring the cracks each year and charting their growth, if any.

Movement that seems to have stopped may never need addressing, but should always be monitored. Movement that continues or accelerates will at some point need fixing. While sooner is better, often these movements will be slow enough to allow the owner to decide when they have the chance to do it.

A one-time visit to a house will not allow the decision about *when* to fix a structural problem to be made, unless it's so bad the inspector is refusing to get out of her car. But the order of magnitude of the cost of the job can be discussed, if the inspector is qualified to both diagnose the problem and suggest a possible remedy. This is the role of an engineer. The screw anchor technique can help reduce these costs, and may keep the owner or potential owner from leaping out the nearest window.

*This article was submitted by Carson Dunlop, a Toronto based Consulting Engineering company that has specialized in **Home Inspection** since 1978. For more information, call 1-800-268-7070 or visit www.carsondunlop.com. Information and images provided by EBS Engineering (519-648-3613), Chance® Master Distributor, ebs@c3group.com; www.hubbell.com/abchance*