



Keep it plumb. Because of soil obstructions and the way the machine's geometry changes as the boom lowers, the operator needs to make regular adjustments to plumb the pile.



It's Time to Consider Helical-Pile Footings

Steel piles screwed into the ground can support anything from mailboxes to houses

BY JEREMY HESS



After almost 20 years in construction, I became a dealer for Techno Metal Post (TMP), a helical-pile manufacturer. Helical piles can be driven almost anywhere, install in minutes, don't make a mess, and come in sizes that can support an enormous variety of structures. Since becoming a dealer, I've installed piles to support decks, porches, boardwalks across wetlands, industrial equipment, and business signs; to shore up failing house footings; and to underpin concrete slabs that were settling. Some of the machines used to drive the piles are small enough that they can be used inside a house—for example, to add a footing to a basement. It is not uncommon for my helper and me to pull up to a job site first thing in the morning, install 10 or 12 piles for a large deck, and leave by midafternoon with no evidence of our having been there besides the piles themselves.

Helical piles are essentially large steel screws that thread into the ground to serve as footings, and they have been in use since the early 1830s. The machines used to drive the modern versions come in many sizes, from the walk-behind machine I use to versions that are mounted on excavators. All of them work pretty much the same way. A gas or diesel engine drives a hydraulic pump that provides the power to spin the pile into the ground.

The first project I ever did—a 30-ft. by 80-ft. deck for a winery—exemplifies some advantages of helical piles. The original design called for concrete footings. However, because the deck was to be built over uncompacted fill, those footings needed to be 14 ft. deep to reach bearing soil. The owner almost abandoned the project after finding that concrete footings would cost \$20,000. I was able to save him \$8000 with helical piles. And even on the steep slope of that site, the installation took a couple of days instead of a week.

When you account for all the costs of conventional footings, helical piles are surprisingly affordable. Consider these costs: renting an auger or hiring an excavator, or the time it takes to dig by hand; removing spoils from the excavation; and repairing site damage from heavy equipment. If the concrete will come from a truck, how will it be moved to the hole? How do you know that the soil will support the structure? What if it rains between the time of the excavation and the footing inspection so that the hole has

NO MESS

The helix simply threads into the ground, leaving virtually no surface disturbance.



6 in. of water in the bottom? Helical piles overcome all of these concerns. Although pricing for piles can vary widely based on availability, contractor, and location, my company can install four piles for a typical residential deck for \$600 to \$900.

While there are other helical-pile installers, most don't focus on residential work like TMP does. That said, you may have a local contractor who does residential work using other manufacturer's products. Many of the advantages I discuss here are common among manufacturers.

What are helical piles?

A helical pile consists of three main parts. The shaft is either a hollow square bar, a solid square bar, or a hollow pipe. The helix is a deformed round plate resembling a section of screw thread that is welded to the bottom of the shaft. Once the pile is installed, a cap attached to the top of the shaft connects the structure to the pile.

The first section of shaft with the helix is referred to as the lead section. The length of the lead section varies by manufacturer and application, but it's typically between 5 ft. and 7 ft. For greater depths, extensions are added as necessary. Extensions are just shafts without a helix that are welded or bolted to the installed pile. In poor soils, additional lead sections with their helices sometimes are added to improve bearing.

The size of the helix used is determined by a number of factors, but the load to be carried and the soil type are the main considerations. In soft soils, a larger helix is needed to spread the load over a wider area. In rocky or very dense soils, a smaller helix is typically used. Most helical-pile manufacturers offer helix sizes ranging from 6 in. dia. to 24 in. dia. The helix sizes my company uses in residential work range from 6 in. to 12 in., but we've used helices as large as 18 in. when working in very soft ground. Larger sizes are available but are used typically in heavy commercial or industrial applications.

Every helical-pile manufacturer has its own selection of pile caps for attaching to wood, concrete, and steel. Typical pile-to-wood connections are made through U-brackets or flat plates. Usually called heads, they either are fixed, meaning there is no adjustment after installation, or are adjustable by means of a threaded stalk so that the elevation may be fine-tuned. Heads used to support slabs and grade beams are flat plates with short pieces

VERIFYING A PILE'S BEARING CAPACITY

There are two ways to verify bearing: a high-tech approach based on hydraulic pressure, and a low-tech approach that involves whacking the pile with a sledgehammer.

Hydraulic pressure equates to torque and bearing capacity.

The more torque needed to drive a pile, the greater its bearing capacity. Think of a wood screw. The harder it is to spin the screw into the wood, the harder it will be to pry the screw out or to hammer it farther in.



OR



An alternative test measures how far the pile sinks under impact loads. Slick soils such as wet clay don't require much torque to drive a pile, and when the pile is stopped by ledge rock, torque ceases to be a factor. In those cases, a benchmark is made on the shaft using a laser level and a permanent marker.



Swing like John Henry. A steel bumper placed in the shaft is hit hard with a sledge, and the benchmark is checked against the level to see if the pile went down. Depending on how far it sinks, up to 5000 lb. of bearing can be assumed.

of rebar attached. Custom heads can be made for attaching almost anything imaginable.

Piles can last a lifetime or longer

Helical piles are made of either black steel or hot-dipped galvanized steel. Used properly, both should last several lifetimes. I generally install galvanized piles for decks, boardwalks, light posts, or other applications where the shaft is exposed. (People don't like to see rust.) For grade beams, foundation repairs, and other applications where the pile will be encased in concrete or buried deeply, I typically use black steel. When the piles are buried or encased in concrete, air can't get to them as easily, so corrosion isn't as much of a concern. However, some local codes require all steel in the ground to be galvanized.

Additional corrosion-protection systems can be used if clients request it. In places where piles are to support a whole building, the extra peace of mind from the corrosion protection can be considered cheap. There are both passive and active systems. Passive systems use magnesium anodes that attach to the piles and work the same way a sacrificial anode does on a boat or buried propane tank—that is, the anode corrodes first, leaving the steel intact. Eventually, though, oxidation will consume a sacrificial anode. An active kind of corrosion-protection system known as an impressed-current system works by connecting all the piles in a foundation and passing a small electrical current through them to prevent corrosion.

Verifiable bearing capacity

The capacity of an installed pile depends on its size and on the soil. Dense, gravelly soils generally have a much higher bearing capacity than clay or sand. To carry greater loads, piles may need to have additional lengths of shaft so that they can be driven deeper to reach better soils. Helical piles have excellent uplift resistance because the soil above the helix is not disturbed. As a rule of thumb, uplift resistance is one-half of compression resistance.

One of the chief benefits of helical piles is that the installer can verify the capacity of the installed pile. Building codes cover helical piles, but most inspectors haven't dealt with them in person. Inspectors may be skeptical, but once they learn about the product and see engineer-stamped documentation of the bearing capacity, they become receptive. When a building department requires

Weld the head to the pile. A welded connection transfers lateral and uplift loads from the structure to the pile.



WHERE THE METAL HITS THE WOOD

Providing bearing and uplift resistance is only half the battle. You also need to attach the helical pile to the structure, and that requires some kind of cap.



Saddle up. This U-shaped bracket makes a stout attachment for a deck beam.



Adjustable height. In some jurisdictions, a threaded stalk can be used to fine-tune the height of column bases.



Hold the house down. Steel plates are lined up and welded to the piles. The vertical legs provide attachment for perimeter beams.

GO-ANYWHERE MACHINES

Helical piles are versatile, and the smaller machines can even retrofit footings inside an existing house.



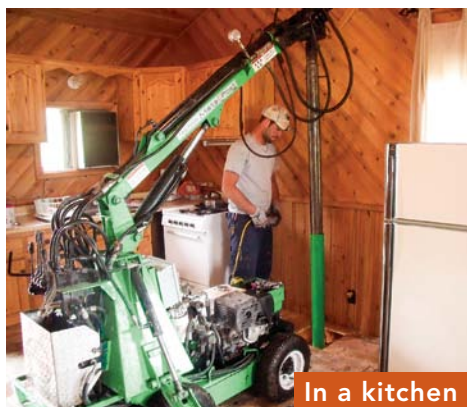
Stabilizing house footings



Jacking up a house



On lake ice



In a kitchen



Over a bank



In wetlands

SOURCES

Most helical-pile installers are regional, but you can find links to multiple contractors at these websites.

helicalpileworld.com
myfoundationsolutions.com

an installation report, I submit a sketch of the footprint of the structure, the pile layout, and the installation data for each pile to our engineer. He reviews the building loads and the pile data to verify that the pile will support the design weight. He then stamps and signs this report and submits it to the building department.

Accurate placement

Rocks did not prevent the installation of any of the hundreds of piles my company did last year, although they made a few of them difficult. Except for in very rocky soils, a pile can be installed within ¼ in. of its designed location and made plumb in all directions.

A skilled installer can manipulate the pile around rocks the size of a basketball. Smaller rocks are no more than an inconvenience.

In soils with larger rocks, helical piles are a little more challenging to place accurately. A boulder may have to be removed with a backhoe, or the pile may need to be relocated. Sometimes, though, I've been able to attach a cable winch between the boom of the pile machine and a stationary object to steer a pile through very rocky soils.

If a pile lands on ledge or on a large rock that is below the frost line, and if lateral stability is achieved through the framing of the structure and not the soil's resistance to pile movement, it may be fine to rest the pile on

top of the rock. This situation requires hammer testing the pile to be sure it won't sink once the structure is built and is generally only an option for light structures such as decks and sunrooms.

Winter doesn't have to halt construction. Helical piles can be installed in frozen ground. To do that, I drill a hole through the frost with an electric demolition hammer. Then I insert a 3000w electric heater into the hole. It takes 10 to 15 minutes to thaw enough ground to install a pile. □

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