Pilings solve tank settl

Helical piling technology meant that this B.C. shop was able to repair settlement problems without shutting down.

With only two plants left in British Columbia that still do hot-dipped zinc galvanizing, it's important for the local economy that they stay in business. Because of the high environmental risks of running a hot-dip galvanizing plant – the possibility of pickling acids leaching into the groundwater or the risk of a spill, for example – it would be almost impossible to acquire a permit to open a new plant in that province.

That's why fixing a settling problem at Ebco Metal Finishing of Richmond, B.C. – the bigger of the two plants – was crucial. The repair didn't have to be permanent, since an expansion of the facility was on the drawing boards. However, the work needed to be done quickly.

Ebco's management started to notice some problems at the plant shortly after the high-water table at their site was lowered to repair two leaks in the 400,000-lb. galvanizing tank. When their overhead crane started giving them problems, they brought in surveyors and engineers, who finally determined that the crane rails were being affected by some of the settlement taking place in their building as a result of the lowering of the water table.

The tank is sizeable. At about 5 ft. 6 in. deep by 4 ft. wide by 42 ft. long, it can coat pieces of steel up to about 11 ft. wide. Ebco needed a repair that would allow them to keep the plant operational until the later, planned shutdown took place to increase the depth of the tank by an additional two ft. This extension will allow them to galvanize pieces up to 14 ft. wide. As a result of the evaluation, the engineers recommended that Ebco install helical pilings.

Six holes had to be hand-excavated and shored around the perimeter of the tank.

Vickars Development Co. Ltd. from Burnaby, B.C. was selected for the project. "The major advantage of this type of anchoring is that it allows the client to maintain their production schedules. We schedule the repairs around their needs," says Bob Vickars, the firm's president.

In the late 1990s, Vickars developed a process to install "Pulldown Piles." The pull-down pile is useful for installation in confined areas where there are very soft soils, peat and/or silts. Using this method of installation, the anchor can be founded in the denser, underlying material that is some depth below the soft layer.

A large screw or helix is set in a smaller pit at the bottom of the excavation. It is advanced down to firm soil by turning the shaft with a rotary drive head that, in this case, was mounted on a small excavator.

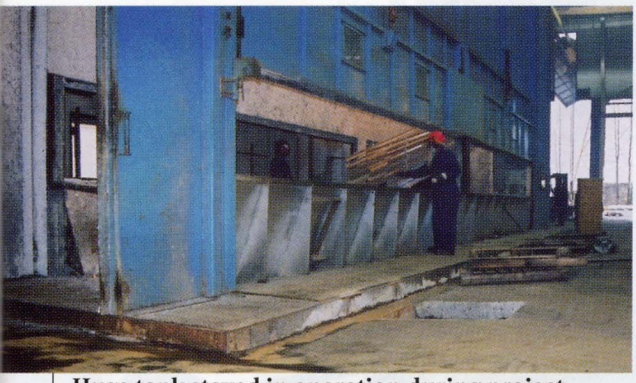
Since a cylinder of soil is displaced while the screw is advanced, a PVC sleeve was placed over the stem to keep the hole open and ensure that the soft soil didn't squeeze in around the stem. The displaced soil was replaced by a poly-reinforced grout that was fed manually down the hole. The grout gives the system additional strength in bending and compression and it also adds corrosion resistance to the system. The design load for this job was 30,000 lb. per pile, with an ultimate load capacity of 60,000 lb.

The piles were then mechanically attached with lifting brackets to the bottom of the tank footing, which is about six ft. below the floor of the plant. A total of six holes had to be hand-excavated and shored along the perimeter of the tank. The holes were four ft. sq. by about six ft. deep.

One challenge was the very high ambient temperatures. The zinc is kept at about 450 deg. C. "We measured the temperature of the groundwater in our excavations at about 80 deg. C., so you don't want to leave tools lying around in the hole for too long or you can't pick them up," says Sheridan Empey, the site foreman. "It also made it tricky to place the grout, because with these high temperatures, there is a risk that the grout can set too early and form a plug in the cylinder, which would prevent us from getting the system completely encased," he said. They used a set-retarder in the grout, but they still had to work quick-

ing problems

By Tonia Jurbin



Huge tank stayed in operation during project.

ly once the grout work started.

For the temporary repairs, two piles were installed in each of the holes at the four corners of the tank and one pile was installed in the holes along the sides of the tank. The loads on these piles were locked off at 30,000 lb. since some of the support still had to come from the soil underneath the tank. Otherwise, the underlying slab of the tank could fail in shear or bending. The loads are locked off with galvanized locking devices on the thread bars of the lifting brackets.

The piles reached denser material at about 27 to 32 ft. The crew can estimate the density of the soil the pile is entering since there is a well-established correlation between the applied torque used to advance the pile and the bearing capacity of the target soils. A gauge will tell them the exact torque. Generally the shaft of the pile will start to twist at about 5,000 ft.-lb.

The temporary repairs cost Ebco about $15,000 and took about eight days. The holes that were hand-excavated for the piles took a day each. The rest of the work went quickly, because each pile only takes about 40 min. to install.

During the permanent repair, the tank will be emptied so it will be possible to install piles in the middle of the tank. Pilings for the permanent repair will cost about $30,000, depending on the final dimensions of the tank. ◆

Located in B.C., Tonia Jurbin has a special interest in engineering. See www.toniajurbin.com

See page 61 for instructions on how to obtain free information on products and services featured in this issue.