2007 Outstanding Pool & Spa Project

Think Logical Technologies

by Bill Drakeley

Drakeley Swimming Pool Company LLC's recent award-winning pool, "Think Logical Technologies," was the most difficult watershape construction project that we have ever taken on. Some clientele heed warnings about areas or sites that are not the best for construction unless certain preparations are taken. To their credit, this particular client wanted their watershape in an area that had certain terrain issues that made placement difficult. We informed them that, when finished, it would be a fantastic addition to the back living area, but getting to the finish would be a challenge both structurally and economically. From this point on, we focused on solutions, not problems. We were given the task of building a structure that encompassed geotechnical problems, high tolerance levels of placement, and glass tile installations in an environment that had temperature variations from 0 to 100 °F (18 to 38 °C). On the far side, the current elevation placed the pool 20 ft (6 m) above original grade. When our team gathered around the drawing board, we knew two things for certain: this pool had the potential to raise the bar in the local pool industry and there could be no mishaps.

The first and most concerning issue was that the soil was unstable. It was expansive clay that held moisture. After every rain shower, the moisture never drained through and the soil always had movement. We also encountered fill areas from the house builder who dumped excess material in the pool site. Removing and hauling away the existing soil was the first priority. A geotechnical engineer was hired to conduct some testing on the load-carrying abilities of the sub soils after removing the clay. Once a stable base was established, we planned the substructure elevations.

At the bottom of the dig, we were 20 ft (6 m) below the top of the pool water level. To accommodate a structure with this elevation, we had to do two things: 1) form and pour soil retaining walls on the downhill side of the pool, and 2) haul in engineered approved fill material that would compact to support the weight and still have drainage capabilities. The construction crews and suppliers hauled in over 200 yd^3 (153 m^3) of engineered fill and 30 yd (27 m) of drainage rock

Rigid forming: 1 x 6 in. (24 x 152 mm) rough-sawn lumber with 1/2 in. (13 mm) steel and 6 in. (152 mm) on center

Removal of fill and installation of process material compacted in 6 in. (152 mm) lifts. Top of forms is the water height

Vanishing edge formed wall (outside) of wall

to build a plateau where none existed before. Once established and tested by the soils engineer, we were now ready to dig into this created plateau for the pool. This method allowed us to drive our forms into material that is conducive to sound forming without vibration, which helped eliminate shadowing or voids during the shotcrete application.

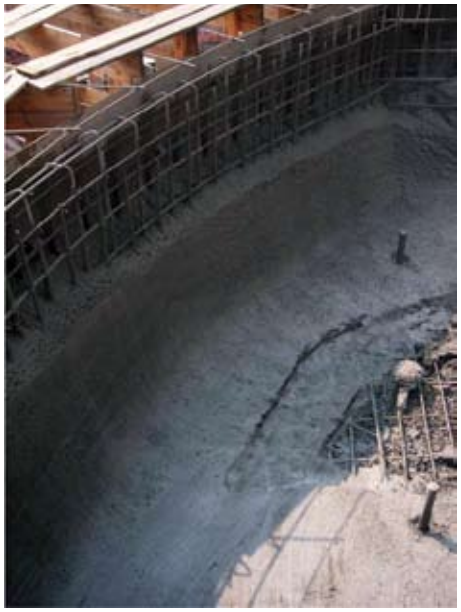
All forming was done with rough-sawn lumber (1 x 6 in. [24 x 152 mm] board, 2 x 4 in. [51 mm x 102 mm], 3/4 in. [19 mm] plywood). Design requirements called for two vanishing edges on the main pool and one raised circular spa with a 100% perimeter overflow into an adjacent trough. That trough spilled into the main pool. From the main pool, the water in transit spilled over the two vanishing edge walls into a lower pool. The main trough wall was 10 ft (3 m) in total height from the spillway on the vanishing edge to the floor of the lower pool. Both edge walls and total spa were to be given a glass tile finish so forming and tolerances of the forms were critical.

Next in line was the plumbing. All pools would be connected with a lower concrete subbunker to house all equipment. Because the vanishing edge systems are atmospheric, we did actually run our main lower pool suctions during the plateau construction being careful to continually test the piping. This piping must be level or have a slight pitch with no loops or traps. Piping runs were placed under the stone base or vertically in the walls. We never ran any trunk or supply lines in the ground around pools because of the freezing-and-thawing zone and the need for protection from other contractors.

After securing all shell piping and fittings, steel reinforcement began. Our steel cage was to incorporate No. 4, 1/2 in. (13 mm) and 6 in. (152 mm) reinforcing bar on center with No. 5, 5/8 in. (16 mm) reinforcing bar on the top horizontal bond beam. All steel was Grade 60 and required hydraulic benders on all curves and radius. Again, knowing that the ease of water in transit was critical to sophisticated edge designs such as this one, the steel had to be accurate. Encapsulation of all reinforcement with proper coverage of shotcrete and proper spacing was in our minds as we tied the steel together. Once the reinforcement was tied, guide rods and wires were placed for the assistance of the nozzlemen. Thicknesses, elevations, and details in the shotcrete process were achieved by the use of these guides. Every wall, corner, and interior step had some sort of guide to shoot by. In our opinion, no shotcrete pool should ever be attempted without them.

Completion of the steel placement was verified by the local inspector and our own engineer before shotcrete placement. Because of the degree of difficulty, we set our shooting schedule for 3 days. Each day of shooting would focus on detail, not yardage. After an edge wall was shot, we would strip the forming and shoot the adjacent sections of that edge wall the following day. Our shotcrete mixture was a 700 lb (318 kg) cement mixture that included the use of fly ash, water reducers, and high entrained-air content. This air content (10%) has two uses. One, it provides protection from freezing-and-thawing cycles, and two, it helps pumpability in getting the material to the nozzle. On impact, close to half of the entrained air will be squeezed out of the mixture and the shotcrete will regain its sticky texture and workability. Total material placed through the shotcrete process was 90 yd (82 m), which included all three levels of the edge designs. All shotcrete was placed by our certified nozzlemen.

After placement, forms were removed and soaker hoses were installed and kept on continuously for



4000 psi (28 MPa) shotcrete installed concrete

Back of vanishing edge wall that receives tile. Notice the wood grain mirroring on the concrete (high-velocity, good density)

28 days. Because we were building a structure out of original ground and had different operating levels, strength gained after placement was essential to future loading on the structure by water and connecting decking. As is typical for our pool vessels, water filled up the pool, and by the second week of curing, we shut off the hoses. This water-tight vessel was achieved through the knowledge gained in our training from the ACI Nozzleman Certification program. We shoot at a high velocity (375 ft^3/minute [11 m^3/minute]) for our wet-mix design. This dense, low permeability, high-tech shotcrete allows us to achieve the water tightness of the pool shell.

Start-up and different vanishing edge detail

Finished shot—water in transit

The finished project features an all-glass tile, perimeter overflow spa

The pool shell received glass tile to the spa, vanishing edge walls, and surge areas. Our masons did little surface prep and used no water sealers or damp proofing. (Because nothing can be completely impervious to water under pressure over infinite time, the term waterproofing should not be used). Having a tight tolerance in elevation levels and a high density allows tile and masonry installs a better bond ability to the shotcrete.

The significance of the shotcrete process in the pool industry is vast. Shotcrete continually defines high-end pool building across the country. Think Logical Technologies represents why shotcrete technology is so important to high-quality pool and watershape construction. The scope and location of the pool could not have been successful with other types of pool construction (that is, liner, fiberglass, etc.). Logistics required that the structure was built with the most dense and strongest quality material that would withstand a four-season calendar year. High-end watershapers must have an understanding of good techniques to satisfy long-term objectives of their clients and themselves. Some in the pool industry are constantly trying to raise the bar in building techniques, and shotcreting is a process that can continually adapt to these new parameters. Education and more education is what makes projects such as "Think Logical Technologies" possible. Fundamental concrete pool construction starts with the shotcrete process. Our industry needs to wrap its collective arms around its proper uses. The sky is the limit.

Outstanding Pool & Spa Project

Project Name
Think Logical Technologies

Project Location
Roxbury, CT

Shotcrete Contractor
Drakeley Swimming Pools*

Project Owner
Think Logical Technologies

Architect/Engineer
Drakeley Swimming Pools*

Material Supplier
O & G Industries

General Contractor
Drakeley Swimming Pools*

*Member of the American Shotcrete Association