Outstanding Pool & Spa Project Award Recipient—Canterbury High School

The Canterbury school project is a high school competitive swimming facility in the western hills of Connecticut, MA. Our company was asked to submit a shotcrete structure for bidding purposes against and compared to a poured in place typical architectural specification. We leapt at the chance to show off why our concrete monolithic pool shell constructed with the shotcrete process was superior in many ways to the typical poured pool.

History has shown many times in the commercial pool industry that cast concrete pools have expansion joint and water tightness issues that sooner or later produce a water loss that can never fully be repaired. Our aim was to prove to the specification writers that shotcrete is a viable solution to cast concrete in terms of water tightness and longevity of the structure, as well as the finished surface bond ability.

Almost always there is a failure in the applied surface (tile or plaster) that started from a bond delamination, which was kick started by water penetrations. A question arose from the engineering team regarding how or what we were going to use for a expansion or movement joint. Our response was “what joint?” We had to sit down and explain one of the best advantages in the shotcrete process is that there is not an expansion joint or even a bonding adhesive between days of placement.

We explained that finishing an application from one day to the next included prepping the concrete in a construction joint format on a 45-degree angle and a gun or broom finish. All exposed steel would be clean of overspray and the previous days shoot would be in an saturated surface-dry (SSD) condition so no moisture or chemistry would change from the new material. We elaborated on the bonding capabilities of the cement paste. By using the shotcrete process, we explained, you drive this cementitious product into the pours of the previous day’s shoot and that makes for a tremendous physical and chemical bond.

A second question or concern raised was how or what we were going to add to the concrete surface for a water-proofing or dampproofing agent against leaks and finish materials. Our answer was “what agent?” My team’s response was that if the shotcrete process is done correctly there would be no scenarios that would call for a waterproofing or dampproofing agent. We would be installing high-density concrete that has very low permeability and very low porosity. Concrete with porosity issues call out for water proofing. Shotcrete done right eliminates the need for a membrane designed to make the shell hold water.

Once the arguments were made, the design team awarded our company the job. Our construction sequencing started with the excavation, drainage, and then forming. All forms were solid, nonvibrating forms that would ensure no shadowing or voids behind the steel reinforcement. Once forming was complete, we installed the steel reinforcement. The walls and floor were to be 12 in. (300 mm) thick with double matting of No. 5 and No. 4 bars, Grade 60, 12 in. (300 mm) on centers offset between cages. The crew inserted PVC chairs and wheel spacers to keep the reinforcing bar properly spaced, which would allow the necessary concrete coverage of each reinforcing bar. Guide wires were set for elevations and shooting depicting slopes of the floor and radius for the walls as well as the multiple levels of the bond beam. Wet shotcrete applications took 7 days to complete over a total span of 10 days. We started in the radius sections where the wall and floor met to establish the critical transition points. From there we shot the floor in sections.

The wet process was chosen over the dry process because our environment was somewhat controlled and we could easily apply a high-volume output with no strain on our finishers and reach the designed minimum of 4000 psi (27 MPa). Once on the floor we consolidated and leveled off each shoot with a power screed and then a very light broom finish. Tolerances were critical and everyone on the crew knew that the finish surface was all 1 x 1 in. (25 x 25 mm) tile.

After each shoot, we set up soaker hoses and kept the concrete in a saturated condition. This allowed the mixing water to stay in the concrete for optimal strength gain and no surface evaporation. As mentioned previously, each construction joint was in an SSD condition prior to receiving new concrete. Scaffolding was set up to do the walls.

We kept an excavator with a long reach-around to remove all excess concrete after cutting and trimming and some rebound. Because it was a competition pool, the depths were very deep (12 and 7 ft [3.6 m and 2.1 m], respectively) and we needed equipment to help lift out unusable material with those the elevation depths.

The pool shoots encompassed 350 yd^2 (293 m^2) of our special mix design over a 7-day period. The applicators were all ACI Certified Nozzleman. We cured the concrete for a 28-day period. The shell filled with water and remained water tight. There is not one expansion joint in the pool and not one area that a chemical bonding agent was used.

After the mechanical systems were installed, we applied the tile interior with its setting bed directly to the shot product. Because of the low-permeability, high-density concrete, we did not have any issues with bleed water or bond ability to this shot surface. It was always understood that, if done properly, our watertight surface formed an excellent bond with the tile and its setting bed. Our specification for the pool structure is now being used by this design team on other commercial projects around the New England area.

The significance of the shotcrete construction of the pool at Canterbury High School cannot be overstated. The shotcrete process in this case has opened a specification door with engineers and architects involved with these types of commercial school projects. Successful installations against cast-in-place pool projects are paramount to having the design team look first to shotcrete. We need to have everyone involved keep shotcrete as the established train of thought regarding building techniques and not look back.

Canterbury successfully showed the academia involved that, yes, we can shoot and bond to previous placed concrete without expansion on bonding issues. We also showed that we can shoot a product that will accept tight tolerances and intricate tile finishes. Our installation presented a seamless monolithic structure that satisfied uneducated concerns about the process. With equal focus we concentrated on the benefits of the process that make watertight shotcrete applications a reality, and necessity, for the pool industry.