

# Three Tier Vanishing Edge Pool

By Ryan Oakes

**M**ark Dorsey, owner and lead designer at Asheville, NC-based Medallion Pool Company, called us with a unique pool to shoot. As with most of their projects, unique isn't the only quality. Often, Medallion Pool Company sends us to some harrowing locations: on the side of a mountain, in a deep valley, or in some form or fashion a difficult job to get to. This one was easy to get to, though 250 miles (400 km) from our shop and slated to be larger than our volumetric batch trucks could carry in one trip. Thus, the first thing we had to do was to coordinate a local reload and batching point.

Dry-mix shotcrete materials are typically delivered in either pre-packaged bagged form or volumetric batch trucks. For swimming pools, using pre-packaged material is practically unheard of these days, though it was once considered a viable method. The beauty in the pre-packaged method is that quality control of the dry material is always dependable. The ugly is the cost. When just shooting a few cubic feet ( $m^3$ ), it works, but when delivering 80 yd<sup>3</sup> (60 m<sup>3</sup>) in a day is the goal, it becomes cost prohibitive, at least for the swimming pool industry.

This is where volumetric batching comes in. The downside of volumetric site batching is that it is hard to keep aggregate piles dry, which is essential to success in the dry-mix shotcrete process. Ideal aggregate moisture levels are in the 3 to 5% range. The upside is that we don't have to use pre-dampeners because the aggregate moisture is usually higher than 1%. Our approach has been to set up batching facilities across the state where we store our own aggregate under covered facilities for reloading, along with bulk cement reloading via storage silos, just like a concrete ready-mix plant would do.

This works great when we are working somewhere near one of our facilities, but occasionally, as in the case in Johnson City, TN, no such facility would be nearby. We have accordingly become rather adept at coordinating reloads with local ready-mix plants where we don't have a facility. We have samples of their aggregates shipped to us to ensure we can work with the materials and review the gradation reports to ensure they fall within the parameters of our mixture design. Shooting preconstruction test panels for a residential project to completely assure that the mixture design is adequate is not typical, so we aim for using concrete mixture designs producing higher strengths than most standard pools. Our base mixture design produces an average 28-day compressive strength of 5680 psi (39.2 MPa), so meeting the ASA-recommended

4000 psi (28 MPa) leaves a little room for error. We do like to shoot panels when on a job, particularly when using an aggregate that we haven't tested before. That way we can later test the panels to understand the variances in mixture design for those particular aggregates.

Once we had a ready-mix facility that would work with us, we coordinated the job with Medallion. Fortunately, on their last job, their superintendent had given us a set of plans so we would know that a complicated pool would be coming our way. This pool would take approximately 80 yd<sup>3</sup> (60 m<sup>3</sup>), but there was no way to shoot this one in a day. We weren't sure until we arrived, but we knew it was at least a 2-day shoot, if not more. If it were poured-in-place, it would have taken a week or more to pour. Therein lies the beauty of shotcrete, wet or dry—speed of project and reduced forming labor and materials. On a project like this, dry-mix really shines. The number of times we had to stop placement during the shoot was uncountable, and if using wet-mix, may have pushed the concrete dispatcher into a fit of fury. Trying to schedule loads of concrete for wet-mix would be tough on a project as broken up and with as much detail as this one.

The client wanted a vanishing edge pool, also called an infinity pool. The site is perched on a hill overlooking a lovely golf course near Johnson City. They wanted an edgy, modern design that was unique, as well as creating a pool for multiple purposes. This pool would have a swim jet system, 24 spa jets, contoured lounge seats, bar stools, a separate spa, and a shallow water lounging area all connected with three separate bodies of water and several troughs to carry water from one feature to the next. As pools go, this one is about as complicated as one can get in such a small space. Also included was a set of stairs and a planter adjacent to the pool, separated just enough to let water pass between the steps and the raised spa. Mark knew he had to transition the users from a raised area down to the main pool area, so he used the spa and sun shelf to do that.

Our job was shooting the shell. Fortunately, Mark is a seasoned builder with one of the best superintendents on the East Coast. His superintendent, Joe, had given us enough information to know that we needed to show up a day before the shoot to pull ground wires and walk through the project. Joe had a story pole ready and walked us through everything. Mark, being an engineer by profession, carefully designed the pool so that Joe could fabricate most of the pool forms and reinforcing bar in their shop, then bring them to the site for installation.

Joe stayed on the job for the entire shoot, aiding in stripping the forms and ensuring that the shell was built exactly to his plan. We believe any pool builder should do the same, especially when building such highly technical and detailed projects like this.

Rigid forming was used because this pool had a great deal of tile installed and the straight walls would minimize any rendering of the walls prior to tilework. The rigid formwork proves great for the shotcrete process (Fig. 1). It provides a sturdy form to shoot against so the plastic concrete is not vibrating and moving, as well as providing a rigid base for securing the reinforcing steel. Finally, our crew members could move around the project, climbing over forms without fear of collapse.

Some of the form supports were buried in the substrate, but in a manner that made it easy to remove them after the form had served its purpose. This was particularly true in the spa walls. Often, spa walls are shot by tying thin peg board to the reinforcing steel, stripping it after shooting onto it, then placing a flash coat on the side where the pegboard was removed after preparing the surface to receive new material. A preferred method is to set a rigid form such as Joe did for us and shoot to the desired finished surface. That form needs to be easily removed, so we left holes in the floor around the support jacks for the forms. Joe would later fill these holes with a non-shrink grout. On the vertical surfaces, we typically dig out a support hole wider at the surface and narrower at the base, then shoot it back in while using a blow pipe (air lance) to keep rebound out of the hole. On a horizontal surface such as a floor, filling the temporary support holes later with grout serves the dual purpose of allowing groundwater to escape during the construction process without putting hydrostatic pressure on the shell.

This project had so much forming detail and tight plumbing to shoot around that we found it necessary to remove some of the previous day's shotcrete due to trapped rebound. Being prepared with chipping hammers that run off air from the compressor truck for the dry-mix machine serves well for this purpose. We made quick work



*Fig. 1: Rigid and easily removable forms allow for sturdy steel work and shotcrete placement while being able to strip the forms and shoot the other side*

of the previously shot areas, then the substrate was cleaned and brought to a saturated surface-dry (SSD) moisture condition before shooting the repairs back in with fresh shotcrete. The dry-mix process is great for this because we can use high-volume air flow, 825 ft<sup>3</sup>/min (24 m<sup>3</sup>/min) in this case, along with the water from the nozzle before sending the dry concrete materials down the line. On a multi-day project like this, we can also clean and wet the surrounding surfaces from the previous day's shoot periodically during the day to aid in wet-curing the green concrete shell.

Thirteen different sets of plumbing lines were maintained under pressure during the shoot so that if any line were compromised, we would know it instantly. Shooting around this much plumbing is difficult and the use of a blow pipe makes for better placement of material. Typical swimming pools have pipe sizes anywhere between 1.5 and 2.5 in. (38 and 64 mm), but more complicated pools like this one have larger pipes ranging from 2.5 to 6 in. (64 to 150 mm) or more. This makes for particularly difficult shooting to provide full encapsulation around such large obstructions and again, the use of a blow pipe is beneficial to move rebound out of the work space.

Shooting steps next to the spa was tricky work. The solution was simple, however. Joe formed out the spa with two



*Fig. 2: The enormous amount of hand carved detail in the benches and stairs can be seen in this photo*

sides and set the formwork for us. Attaching sheet foam and splitting the form allowed us to shoot the channel underneath that would carry the water back to the pool. When using the shotcrete process, forming requires a different line of thinking than the pour-in-place method.

The spa benches and benches in the pool were also unique items to shoot (Fig. 2). These would be contoured to match the shape of a fiberglass spa. This is a detail that Medallion uses a lot, so we were familiar with the process to pull this off. Joe provided us with a handheld plywood template that Mark had designed so there would be no error in communication when trying to explain the exact shape of the benches. The nozzleman would eyeball the shoot, then check it with the template. Once he shot the finished surface, the finishers used the template again to



*Fig. 3: Spectacular view with top two infinity tiers of pool*

rough cut the shape as a screed rather than their finishing rods. Wood floats from there would finish the surface to the desired texture. A good nozzleman can shoot close to the final shape and makes this aspect of the work go quickly.

No great job like this is complete without something going wrong. We ran into a mechanical difficulty when a mix auger on one of our batch trucks snapped. Fortunately, we were close enough to the reload facility that we could get by on the remaining volumetric batch trucks and even had enough capacity to shoot some fountains in nearby Asheville, NC, on the way home. Had we not sent an extra batch truck, this would not have been possible, so preplanning really saved the day.

In the end, a strong understanding of the shotcrete method, good planning from both Medallion and ourselves, and great support from Medallion's on-site superintendent allowed us to show up and shoot the job in 2 days outside of



Fig. 4: Second layer flowing into third and bottom tier of pool

travel time. Medallion knew how to form the pool properly and all the reinforcing steel was well placed, so no corrections were needed on our part. Medallion's ability to visualize a complicated project with a wide variety of specialized details made it easier for us to identify where we needed to start and finish our work. The guidelines for shotcreting, as



Fig. 5: View of top tiers showing the spa and built-in benches within the pools

established by ASA and ACI, can sometimes seem routine and appear as simple as walking down the street, but when tasked to do a high-quality job that is very technical in nature, having practiced those guidelines daily really makes the difference in completing a great project (Fig. 3, 4, 5).

## 2017 OUTSTANDING POOL & RECREATIONAL PROJECT

*Project Name*  
**Three Tier Vanishing Edge Pool**

*Project Location*  
**Johnson City, TN**

*Shotcrete Contractor*  
**Revolution Gunite\***

*General Contractor*  
**Medallion Pool Company**

*Architect/Engineer*  
**Mark Dorsey/Medallion Pool Company**

*Material Supplier/Manufacturer*  
**Revolution Gunite\***

*Equipment Manufacturer*  
**Gunite Supply\***

*Project Owner*  
**Chad and Cindy Thomas**

\*Corporate Member of the American Shotcrete Association



**Ryan Oakes** is a Managing Partner at Revolution Gunite and is a licensed pool contractor in North Carolina and Virginia. Oakes has been designing and building watershapes in the United States and abroad, from swimming pools to art pieces and even aquaculture systems, for the past 20 years. With a mission to change the way

gunite is perceived and applied, Oakes started down a path of education for himself as well as their staff. He is an active member in the Genesis Design Group, which educates contractors around the world in various aspects of the pool building process, including the shotcrete process. Oakes is SWD Registered (Society of Watershape Designers) and an Allied member of the American Institute of Architects and member of the American Pool & Spa Association. In 2017, Oakes was appointed by the ACI Technical Activities Committee as a member of ACI Subcommittee 506-H, Shotcrete for Pools, and a member of ACI Committee 506, Shotcrete. He was recently appointed to the Board of Directors for ASA while also serving as Vice Chair of the ASA Contractors Qualification Committee and a member of the ASA Pool & Recreational Shotcrete Committee.

**Revolution Gunite**, a Corporate Member of ASA and ACI, has a mission to not only educate and train its staff but to also educate its builders so that they, too, play their role in a quality shotcrete product. Revolution Gunite provides dry-mix shotcrete services to pool builders and other contractors in North Carolina and Florida, as well as parts of South Carolina, Virginia, and Tennessee.