

The Versatile Nature of Shotcrete

By Laurel Mellett

There have been times when many of us have driven along the highway and seen soil nailing used to expand the lanes of the freeway, canals being rehabilitated during a dry-up period, or new buildings with below-grade walls used for parking. These are all examples where shotcrete was used. Shotcrete pervades the places we live and travel. The process of shotcrete is truly one of the most versatile processes available for either new construction or repairs.

Versatility is such a broad word. When applied to the application of shotcrete, however, it is about the most descriptive adjective one could use. For over a century, shotcrete has been used in many applications and on the most diverse projects. Whether you are an engineer, project owner, contractor, or tradesman, shotcrete can be applied in almost every project where concrete is being used. More often than not, shotcrete can save time and money.

Some people associate shotcrete with the underground mining industry but shotcrete is also used in projects such as swimming pools, soil nailing, arch culverts, subgrade walls, and architectural enhancements. The following highlights some of the ways wet-mix shotcrete is being used in today's projects.

Vista Verde—Rio Verde, AZ

This project consisted of eight multi-barrel arch culverts. The sizes ranged from a triple-barrel 20 x 6 ft (6.1 x 1.8 m) to a 10-barrel structure that consisted of eight 28 x 6.5 ft (8.5 x 2.0 m) barrels and two 20 x 6 ft (6.1 x 1.8 m) barrels. Each culvert was built on a skew with horizontal and vertical curves. At any given point in time, there were no

fewer than four culverts under construction. The original design for the Vista Verde project called for standard cast-in-place box culverts. The use of shotcrete arch culverts (the ProArch Shotcrete System) provided the owner a more aesthetically pleasing product, faster construction cycle, and an overall savings on the project that was close to \$750,000 on an overall project of \$2.3 million.

Shadow Hills—Indio, CA

Shadow Hills, a Del Webb Community, required a combination bridge/culvert/golf cart tunnel at the main entry of the project. The solution was two 48 x 10 x 190 ft (14.6 x 3.0 x 58 m) parallel arch structures. The aesthetically pleasing arch design represented a savings of \$275,000 on a total of \$650,000 and several weeks of construction time compared to other structural alternatives. The versatility and workability of shotcrete enabled the crew to hand-cut the unique “beveled” end



Bridge/culvert/golf cart tunnel combination at Shadow Hills in Indio, CA



Vista Verde eight-barrel arch culvert in Rio Verde, AZ

treatment. This effect was chosen by the owner to omit constructing conventional headwalls and wing walls. Adding to the challenge was the fact the structures were aligned with a 20-degree skew with the roadway. Shotcrete allowed craftsmen to cut and hand-shape the final product, similar to an artist working with clay.

Monolith at Green Valley Ranch & Resort—Henderson, NV

The spa at Green Valley Ranch Resort, when being built in 2002, was touted as one of the premier resort and spas in the Las Vegas area. In fact, when the resort was undergoing a renovation in 2004, the resort enjoyed even greater success due to the reality TV show on A&E called “American Casino,” which featured the day-to-day operations of the property. The resort elected to use a diagonal ellipse for its spa branding and wanted to reflect that symbol throughout the spa area. A divider wall in the spa pool was constructed separating the three swim lanes from the common area of the pool. This monolithic structure lent itself to shotcrete due to its 3 ft (915 mm) thickness, the ellipse in the middle of the structure, and the need for rounded edges. A foam insert was used for the elliptical shape in the structure. This structure is what catches the eye of the spa customer when entering in the pool area. Shotcrete was the most economical method due to the shape of the structure.

Smithsonian Patent Building— Washington, DC

The Patent Building was a remodeling project where the building needed more space and chose to dig up the courtyard in the front and create a basement. Shotcrete was chosen for the foundation structural walls as it was faster and less labor-



Smithsonian Patent Building below-grade wall retrofit project in Washington, DC



This monolithic structure is the main feature of the spa pool and cabana area at the Green Valley Ranch & Resort in Henderson, NV, and is made entirely out of shotcrete

Rio Vista Skatepark in Peoria, AZ, has many elements to its skatepark including two bowls; pipelines; ramps; and plaza elements, such as steps and railings, all of which were completed using shotcrete



This Peoria, AZ, municipal skatepark had to have an ultra-smooth finish for the safety and experience of the user

intensive than conventionally cast-in-place walls. After completion of the walls, the area was made back into a courtyard with the new basement hidden from the naked eye until entrance into the building and new basement area.

Rio Vista Skatepark—Peoria, AZ

Skateparks have very discriminating users and this city in the Phoenix metro area did its homework and asked for a lot of community input from its users. Out of all of our projects, we have found that skateparks tend to evoke the most passion among its users and its designers. This 26,000 ft² (2400 m²) skatepark was an ideal design for all skill levels due to its street plaza and bowl components. It consisted of almost 1000 yd³ (765 m³) of shotcrete with a trowel finish to provide a smooth finish. This finish could only be done with shotcrete due to its curvature and variety. Cast-in-place was not a valid option for the city of Peoria, as its constituents had stipulated a skatepark with specific elements and continuity.



View looking down into the atrium of the newest room tower at the Venetian Hotel in Las Vegas, NV

Venetian Hotel & Spa—Las Vegas, NV

When a new tower was being built at the Venetian Hotel in Las Vegas, the owner decided to build three luxury swimming pools on the 11th floor, which would be at the bottom of the atrium created by the four sides of rooms that towered above the pool area. The shotcrete had to be pumped 11 stories to complete this project. This is why shotcrete was the method of choice to complete the project. Not only is shotcrete commonly used in swimming pool construction for its imaginative design ability but also for its structural integrity. In this instance, these pools would be viewed by thousands of people each day: those staying at the hotel and those visiting for other reasons. The owner needed pizzazz to differentiate this property from others on the strip, and shotcrete was the key ingredient to achieve that goal.

Conclusions

Most backyard pools are constructed with shotcrete for the shell of the swimming pool, from a cookie-cutter shape such as the kidney or rectangle to Grecian-style corners and monuments with architectural rock designs, grottos, negative edges, raised spas, spillways, and swim-up bars. In the area of swimming pool construction, shotcrete makes all of these shapes, sizes, and bells and whistles possible due to the flexibility of shotcrete and infinite design possibilities. It is always interesting to have the homeowner watch the process and be in awe of how their “hole in the ground” comes to life when shotcrete is applied. It is like watching a child’s imaginative drawing turn into an artist’s architectural rendition—the possibilities are endless.

Many people have an idea of what shotcrete is and how it can be applied due to its inherent and versatile nature. These days, shotcrete can do wonders in terms of design and application. Industry contractors, engineers, owners, and tradesmen have just scratched the surface of the possibilities.



Laurel Mellett is the Operations Director for Fisher Shotcrete, Inc., Gilbert, AZ. She grew up in the shotcrete industry, starting her career by helping in the day-to-day operations of the family shotcrete business. She worked in the shotcrete business while attending Arizona State University, where she received a bachelor’s degree in both marketing and management and an International Business Certificate. While participating in a university exchange program, she received a Diploma of Management Studies from the University of Bradford in West Yorkshire, England. Mellett’s research interests include internal consulting and operations management. She has served on many ASA committees and ACI Committee 506, Shotcreting.

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