

Outstanding Shotcrete Project Award Winner

2006 Outstanding Pool & Spa Project Contemporary Edge

by Bill Drakeley

Sergey and Katya Krayniy, our new clients, recently purchased a contemporary-style home situated on the highest peak in their town. The house was originally occupied by the builder, who constructed it on the edge of the hill, with 2-1/2-story windows throughout the living area that offer a spectacular view, particularly of sunrises.

Given the location, however, the builder thought a concrete pool would not work, or was too difficult to build, and opted for an aboveground liner pool. Upon installation, this eyesore was out of place and in disrepair when the Krayniys acquired the property. When one ventured outside, this broken-down water vessel immediately detracted from the overall theme of the property.

Knowing they had to do something, our clients began the interview process for the design and construction of a new pool. Drakeley Pools was the last company they interviewed. They looked into aboveground, liner, and traditional “gunite”

(their term, not mine) pool professionals to come and look at the site. Prior to our meeting with the Krayniys, not one company wanted to quote on the project or even return their phone calls. Apparently, no one contacted was capable of building on such difficult terrain or creating a functional watershape.

During our first visit, we immediately identified with our clients’ desire for a spectacular pool that blended into the surroundings. The location had to be on the cliff’s edge. There were no flat areas or plateaus, so our vision had to incorporate the changing contours and elevations. We also had to allow for well and utility setbacks that kept the pool structure closer to the hillside edge.

Our design and accepted proposal were for a vanishing-edge pool that would be built into the ledge using the shotcrete process and take advantage of the easterly view of New England during all four seasons. Other key design elements included the unique, very pronounced lines and angles of the house. I felt that even though our watershape would be in a natural setting, the proximity of the water to the house should highlight some of the contemporary lines of the existing architecture. The contemporary edge would also incorporate three levels of water in transit, with a vanishing-edge spa that spilled into the main pool, which, in turn, spilled into the lower surge pool. This tiered design would lend itself nicely to the contoured land.

The construction process for the wet-mix shotcrete installation began with a hydraulic hammer and earthmover. We hammered out the pool area and drilled reinforced holes into the ledge for our bracing points. The hammer also made a footing area at the farthest point of the cliff area. This footing would be our locking mechanism into the rock substrate to ensure stability for the new structure.

After excavation, we installed drainage stone and an underdrain dewatering system to allow groundwater to continuously flow or follow gravity. Typically, we will use a soil scientist or geotechnical engineer to assess the load-bearing capacity of the sub-soils. The overall weight of the shotcrete, in terms of loading capacity for the soil, was to be substantial. As we suspected, a soil scientist proved unnecessary because we were on 100% ledge rock.



Shooting for exact tolerances on walls and edges creates ease of movement for water in transit. Shooting in tight tolerances also reduces preparation for the installation of the finish material

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The pool and footing placed were thus unlikely to move at all.

All plumbing was rigid Schedule 80 and was pressure-tested after each construction phase. The forming was all rough-sawn lumber, built free-standing, with little support from the ground surface. As mentioned previously, we tied the stand-alone forms to steel tubing, which was drilled into the ledge rock for added stability. Forming had to incorporate haunch walls on all vertically installed concrete. These haunch details supported stone veneer on those surfaces. Half-inch plywood was used with the bracing. All stakes and support kickers were spaced no more than 24 in. (610 mm) apart. The vertical change in water flow mandated that the pool be formed with supports in the lower surge pool to stabilize the main edge wall during the shotcrete process. These forms were then removed to allow us to shoot the lower pool after initial set of the shotcrete in the upper pool.

The reinforcing bar reinforcement was 1/2-in. No. 4 bars spread 6 in. (152 mm) on center. The steel was double caged. The shotcrete thickness on all vertical placements was 12 in. (305 mm). The floor thickness was 10 in. (254 mm). The footing depth was 3 ft (0.9 m) and the width was approximately 18 in. (457 mm). The reinforcing bar was placed in the footing and connected to the floor steel. Both vanishing edge walls had pre-bent reinforcing bars that followed the particular angle of the water in transit.

The shotcrete application process took 2 days to complete. Control of line and grade, accomplished using an assortment of guide wires, required wall thickness and angles of edge walls to incorporate stone veneer haunches.

Tolerance of elevations and measurements was critical to the success of our whole design. We went from our structural footing, which keyed the pool structure into the ledge up to and connected to the edge wall, with a 1/8 in. (3.175 mm) shotcrete tolerance along the overflow. Our ACI-certified nozzlemen were well aware of the variables that needed their attention during the shooting. We had to build the structure to be durable for every weather condition and be precise enough to create a detailed/intricate edge flow.

The pool dimensions are 35 x 20 ft (10.6 x 6.1 m) wide and 6 ft (1.8 m) deep, not including the surge pool and raised spa. The total amount of shotcrete installed was approximately 80 yd³ (61 m³). The shotcrete mixture had a 3/8 in. (9.5 mm) maximum size stone and 800 lb/yd³ (475 kg/m³) cement design with 10% air entrainment at the point of discharge into the shotcrete pump.

The air entrainment not only aids the durability of shotcrete in the severe freezing-and-thawing zones of the Northeast, but also helps in the pumpability of shotcrete. Especially in warmer weather, shotcrete is more easily conveyed to the nozzle and throughout the pumping process. Of the 10% air content in the shotcrete at the



This picture shows a double cage steel and rough sawn lumber for out of ground construction

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The spa wall design with its perimeter overflow was used to keep one's line-of-sight open. The water in transit over the edge mimics a sheet of glass and creates an illusion at the surface



A medium gray plaster finish was used over the shotcrete structure to give it a reflective, inviting quality

point of discharge into the shotcrete pump, less than half remains after placement. The shotcrete regains its sticky texture and overall firmness upon impact to the substrate (that is, the loss of air on shooting acts like a “slump-killer” for the material

as it impacts on the receiving surface.) Knowing the truck intervals, we separated the deliveries by 1-1/2 hours, keeping under the 90-minute window of time for unloading the trucks allowed by ACI. Strength gain after 28-days curing yielded on average strengths in excess of 4000 psi (28 MPa).

After all shotcrete had been placed, we set up soaker hoses and kept the structure moist for 28 days. During that time, we stripped forms and plumbed and set decorative rock, according to the design plan. The day all curing hoses were removed we began the masonry work, including installation of coping, tiles, and edge-wall details. The final step was to coat the shotcrete interiors with a plaster mixture, giving a deep-blue water look.

Conquering elaborate design and construction difficulties is always a possibility with shotcrete. As a contractor, you must know your product. In our case, it's a concrete watershape built using the shotcrete process. Understanding terminology, proper shotcrete mixture design, and nozzle-men techniques, results in not only a superior structure, but also gives our staff the knowledge to clearly and confidently explain the process or answer questions.

Mrs. Krayniy was present when we first filled the pool and activated the equipment for the edge

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The precise tolerances of the shotcrete create the perfect edge. The execution is critical and will show any flaws in the finished product

wall. She was very silent at first, and then we noticed tears on her face. Our crew froze and did not know what to do. After a minute, she smiled and said it was the most gorgeous thing she had ever seen and had no idea that a watershape could be so beautiful. Her reaction caught us off guard. We all shook our heads in puzzlement and went back to the task at hand. Because our construction

and shotcrete process had inspired such emotion, perhaps in our continuing quest for education, we should add a new seminar to our curriculum—sensitivity training.

Outstanding Pool & Spa Project

Project Name
Contemporary Edge

Project Location
Woodbury, CT

Shotcrete Contractor
Drakeley Swimming Pool Company

Project Owner
Krayniy Residence

Architect/Engineers
Ed Fenn, Jr., Drakeley Swimming Pool Company

Material Supplier
O&G Industries

General Contractor
Drakeley Swimming Pool Company



Bill Drakeley is a third generation watershaper and President of Drakeley Industries and Drakeley Swimming Pool Company in Connecticut. He is a Genesis 3 Platinum Member, American Concrete Institute

Certified Nozzleman, and is a corporate member and technical advisor for ASA. Drakeley is an instructor for the Genesis 3 Construction School with a focus on the shotcrete process. He has been a contributing writer for Shotcrete and Pool & Spa News and has had projects featured in Luxury Pools magazine, Better Homes & Gardens, and Aqua magazine. Drakeley Pools has been the recipient of "Outstanding Pool & Spa Project" for 2005 and 2006 by ASA. In addition, Drakeley is a speaker and presenter for the Aqua Show and will be presenting at World of Concrete 2008.