



Simple Still Works

By John Becker

Coastal Gunite Construction recently executed a few phases of a storm sewer rehabilitation in a line running under the Blue Plains Advanced Wastewater Treatment Plant operated by the District of Columbia Water and Sewer Authority. The company was a subcontractor on a much larger contract with PC Construction Company. The crown of the 7 ft (2 m) tall arched concrete pipe was damaged due to biogenic corrosion, which necessitated the removal and replacement of the deteriorated concrete. Shotcrete was the perfect choice for the repair due to the speed of installation, durability of the product, and minimally invasive nature of the work by avoiding excavation and formwork.

For many of people in the industry this is a familiar story, similar repairs have been done for over 100 years. In fact, the gunning machine used on the project was a 50-year-old



Fig. 1: Finished tunnel crown installation



Fig. 2: N-style gun and mixer rig

N-style double chamber dry-mix shotcrete rig with a mixer and conveyor leading to a hopper affixed over the gun itself. This equipment would not look out of place at all in a photograph from a century ago. The shotcrete mixture, batched on site, was a minor tweak of a 3:1 sand-cement concrete mixture, adding silica fume and synthetic fibers. In a world of rapidly changing technology, where many tools and materials are obsolete so quickly, why do some things remain steadfastly useful with only minor modifications and improvements over great stretches of time?

Perhaps the best explanation for the stability of the shotcrete process is the amazing results that are achievable with the process at its simplest. Coastal Gunite Construction recently impressed Florida Department Transportation officials on a job outside of Orlando, FL. After negative experiences on a culvert repair project with an engineered spin-cast lining alternative, Lane Construction Corporation, the prime contractor, convinced the engineers to allow another culvert on the project to be repaired using the simple 3:1 sand and cement dry shotcrete mixture still present in the state's standard specifications. The concrete placed was dense, durable, and greatly exceeded the required

compressive strength, and was installed inexpensively and quickly. Swiftly scrubbing the existing culvert allowed an excellent bond with the new material with no signs of separation or cracking after placement and followed by traditional water curing. The dry-mix shotcrete was placed with the same well-proven equipment that was used on the Blue Plains Project a few weeks earlier.

Coastal Gunite Construction still uses N-Style double-chamber guns for the same reason that FDOT still has the 3:1 mixture in its spec book—it is basic, reliable, and provides proven quality results. The gun itself is powered by the same compressed air source that conveys the dry concrete material through the delivery hose and accelerates the material to impact on the substrate at high velocity. The gun is built out of thick steel and a few rubber gaskets, is entirely mechanical, and rarely requires repair. Testament to the N-gun's earned workhorse status is obviously its age. The hours of dry-mix shotcrete that have run through it are uncounted, as its future reliability is just assumed. It would be interesting to know how many different generations of compressors have powered this sturdy and effective device.

The project at the Blue Plains facility was not without challenges and problems, including hydrodemolition equipment issues, tidal flows, tight schedules, and issues surrounding surface preparation testing all contributed to

a difficult but ultimately successful project. The site batch dry-mix shotcrete was an oasis and low-stress component amongst other complexities.

Coastal Gunite Construction is very fortunate that the core technology in the shotcrete industry is so strong. Sand, cement, and decades-old equipment work together extraordinarily well for most applications. This proven base capability gives us the opportunity to evaluate and choose improvements, tweak and test new technology. Ultimately it is comforting that these things improve an effective method that when properly designed and installed far outlast all the people involved in the project.



John Becker is an ACI Certified Nozzle-man who for over a decade has worked in many capacities, most recently as Project Manager, for Coastal Gunite Construction Company based in Cambridge, MD. He has been involved with many shotcrete projects large and small including the \$15 million Bonner Bridge Rehabilitation Project in Nags Head, NC; the \$5 million Old Mill Creek Sewer Rehabilitation Project in St. Louis, MO.; and the \$19 million Fort McHenry Tunnel Rehabilitation in Baltimore, MD.



Fig. 3: Tunnel after hydrodemolition



Fig. 4: Tunnel being shotcreted after surface preparation