OCCI Engineering Contractors uses a 3352-mm crane-mount oscillator and a BUMA 3150 spherical grab to place 7-ft-dia. and 11-ft-dia. shafts for a BNSF railroad bridge in Bosworth, Mo.

PHOTO: COURTESY OF ROC

Underground Today III

Digging Deeper

Underground projects benefit from the evolving innovation of tools, technologies and techniques

WHAT'S INSIDE

Deep Foundation Advancements

As new underground tools and technologies are introduced, concepts that were once unimaginable are becoming the new norm.

For example, a crane-mounted casing oscillator designed by BUMA and ROC Equipment of Salt Lake City is being used to assist crews replacing an existing railroad bridge over the Grand River in Bosworth, Mo. The new bridge foundation is being built slightly outside and under the foundation of the existing bridge, which will remain in use during construction, explains ROC CEO Vanessa Lucido.

The extremely tight clearance between the new and old bridge and frequent flooding issues called for innovative tools to make the replacement project possible. The oscillator installs 7-ft and 11-ft OD diameter permanent casing 120 ft deep without disturbing the foundation of the existing bridge during the excavation process. It operates by turning the casing to install the permanent pipe, rather than using a vibro hammer or other methodologies that would disturb the existing foundations. The stiffness and size of the casing oscillator allows for more precision in location and less deviation from verticality when inconsistent subsurface conditions are encountered.

Tests reported by ROC on shafts advanced using a casing oscillator have shown deviations from vertical in the range of 0.35% to 0.5% in 200 ft vs. 1.5% for other foundation drilling techniques, Lucido says. In addition, spoils can be removed using a grab without the disturbance associated with an auger, and water issues can be more easily controlled. Once foundation and falsework is complete, OCCI has a 16-hour window to remove the existing span and place the new span before the new bridge will see traffic.

Meanwhile, crews applied creative techniques in an atypical format while adding a sub-basement to a National Historic Landmark in Washington, D.C. Underground specialty contractor Berkel & Co. recently completed a tricky excavation process that entailed supporting the 99-year-old structure with a combination of micropiles and underpinning pits that were installed prior to the excavation. The pits acted as vertical support of the exterior as well as lateral support of the excavation, says Berkel structural engineer Richard Guenther. The micropiles were used to support the interior columns during excavation and, as the excavation progressed, steel angles were welded between the micropiles to form a truss system. The new columns were formed inside these towers.

"Micropiles are a typical deep foundation, but using them in this way is not typical," Guenther says. Controlled hydraulic jacking was used to transfer the loads between the original columns, the micropile towers and the new columns.

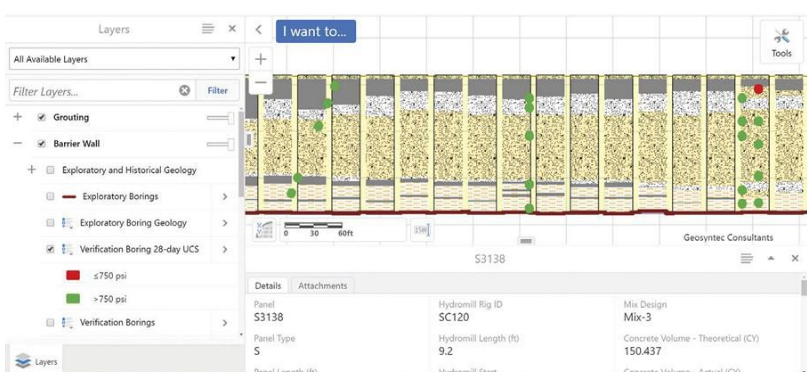
Data Management

A new trend in data management principles and workflow techniques is being applied to the underground industry, says Jamey Rosen, a geoscientist with the Atlanta-based civil engineering firm Geosyntec. "We are using a lot of geospatial database technology and geographic information systems (GIS) in two and three dimensions. One of the newer techniques is to create a GIS in profile view to cut through subsurface," he adds. (See map on this page.)

"For example, once an excavation is completed, a tool is used to take measurements of the hole at specified depth intervals; then in real time, we can develop a three-dimensional view of that excavation that can be approved before a drill rig has to move. Thus, we can get a sense of whether the excavation is large enough and vertical enough to place the concrete. It's a significant savings of time and staff money, and ultimately, good data will yield a higher-quality dam or structure."

This information must be stored in a way that it can be easily retrieved and displayed in a usable format, adds Mary Ellen Large, director of technical activities for the Deep Foundations Institute. "To maximize the value of the data, it is important to manage and archive information from various electronic sources using consistent protocols. Instrumentation used to monitor construction could be kept in place after construction and used to assess the performance of the dam or structure during its service life," she says.

Geosyntec is managing the data for the Chickamauga Lock Excavation, a United States Army Corps of Engineer project in Chattanooga, Tenn. This project involves installation of exploratory borings, a secant pile wall and inclined rock anchors. In addition to ongoing instrumentation monitoring, each of these tasks yield data that are compiled and visualized in a database and provided in specified formats. ◆



In this GIS example, several subsurface data layers are shown in a profile context.

PHOTO: COURTESY OF GEOSYNTEC