Nicholson Construction is in the midst of an onshore and offshore grouting operation to optimize tunneling conditions for the Port of Miami Tunnel project.

INNOVATION IN MIAMI

One-of-a-Kind Grouting Program Aids POMT Tunneling

By Jim Rush

The Port of Miami Tunnel (POMT) project is a showcase in project innovation. The project boasts the largest EPB tunnel boring machine used in the United States to date, and it is being constructed under a unique public-private partnership that includes private financing. Additionally, it includes a one-of-a-kind grouting program that makes TBM tunneling more feasible in the porous limestone below the shipping channel.

Specialty contractor Nicholson Construction is in the midst of a grouting program to optimize ground conditions in advance of the tunnel boring operations, which will ultimately connect Watson Island and Dodge Island under the Government Cut Channel in Biscayne Bay. Nicholson is performing grouting along the tunnel alignment on both Watson and Dodge islands, as well as in the alignment below the shipping channel. The offshore work brings with it a multitude of construction challenges in addition to the logistical challenges associated with keeping the port open for business.

Project Background

The Port of Miami Tunnel has been part of the area's long-range planning since the 1980s. The purpose of the project is to provide direct access between the seaport and Interstates 395 and 95, thereby alleviating truck traffic in downtown Miami. The tunnel also helps keep the Port of Miami competitive by opening a second access point to the region's second largest economic generator.

The project, procured as a public-private partnership using a design-build-finance-operate-maintain contract, was awarded to MAT Concessionaire LLC, a consortium led by the global construction firm Bouygues. Under the terms of the

contract, the tunnel will be operated by the concessionaire until October 2044.

The tunnel portion of the project involves the construction of twin bores, approximately 39 ft ID and 4,200 ft in length, under the Government Cut Channel. MAT is using a 43-ft Herrenknecht EPB TBM, the largest EPB TBM used to date in the United States. The tunnel will connect Watson Island to the Port of Miami on Dodge Island approximately 120 ft below the surface of the channel.

The contractor broke ground in 2010 with TBM arrival in June 2011. Tunneling began in November 2011 and is expected to be completed by spring 2013. The entire project, which includes road widening and other improvements, is expected to be completed by August 2014.

After further testing of the tunnel alignment it was decided that grouting was needed in the Key Largo formation through which the TBM would mine. The Key Largo formation is an unstable and porous coralline limestone.

Grouting Program

Nicholson is performing grouting both onshore and offshore. The grouting program consists of drilling down to tunnel invert (up to 126 ft below grade of vertical depth at its lowest point with inclined holes up to 146 ft deep) and grouting approximately 40 ft up to the crown. Unlike typical grouting jobs in which grout is pumped until refusal, Nicholson is pumping specific volumes of grout at specific pressures to reduce voids and keep the grout contained within the tunnel alignment. Crews are using a low-mobility grout consisting of processed lake fill sand, bentonite, cement and chemical filtrate reducer as specified by the general contractor.

The offshore drilling brings with it a set of complications related to environmental regulations. "This is a sensitive area and we have several restrictions on what we are allowed to do, as well as mitigation measures that are required," said Luca Barison, Nicholson Construction's project executive. "We had to ensure the barges had the proper containment and ensure the equipment is properly functioning with maintenance and inspections above and beyond what we would normally do."

Environmental regulations protecting the shoreline required that the contractors maintain a 70-ft buffer from the shore. This required the innovative use of a pipeline bridge used to bring grout from the onshore batching plant to the offshore equipment. "We designed the bridge so that we did not affect the 70-ft buffer zone," Barison said. "It was designed to carry the grout from a fixed point on land to a barge without being affected by the changing tides."

Once the grout is delivered to the first barge, it is routed to an agitation tank at each of the four drilling stations set up offshore. Each drilling station consists of a barge with crane and drilling lead combo, along with four to five barges for ancillary and support equipment. Nicholson is using a custom drilling and grouting system developed with the assistance of sister company, Bermingham Foundation Solutions. The system uses the same drill string to drill and grout in a single stroke, thereby saving the time normally needed to change drill rods and tooling.

Perhaps the biggest challenge of working the channel is working around the cruise ships that use the port on Dodge Island. "Our offshore work is restricted by the schedule of the cruise ships," Barison said. "When there are cruise ships in the channel we have to completely evacuate the area. That essentially means we have to mobilize and de-mobilize up to

Offshore grouting operations require the contractor to mobilize and remobilize each week to keep cruise ship traffic flowing uninterrupted.

10 barges every week. Typically, we mobilize on a Monday afternoon, and de-mobilize either Thursday or Friday at 2 a.m., depending on the cruise ship schedule."

As part of an ongoing quality control program, grout properties are tested multiple times per day including weight, slump and UCS. Nicholson is also using the proprietary automated computerized Grout I.T. system to monitor and record in real time grouting parameters including pressure, volume, apparent lugeon and flow.

Looking Ahead

Barison said that despite the complications and the number of parties involved, including the Florida Department of Transportation, Miami-Dade County, City of Miami, MAT, USACE and the Port of Miami and its clients, the construction portion of the grouting project has been successful to date. One of the keys, he said, is effective communication between all parties involved.

"Clear communication is vital for these types of projects that involve several entities," said Barison, who has been with Nicholson since 1995. "It is crucial that all entities make their expectations very clear. Also, it is important to have a clear design before the job starts to help in the planning process and allow the contractor to optimize the efficiency of its equipment and personnel."

Nicholson was awarded the grouting contract in August 2011 and began mobilization in October. The project involves the drilling of more than 1,000 grout holes and about 93,000 lf of grouting, for a total estimated volume of 107,000 cu yd of grout.

Crews have competed 75 percent of the grouting, including completion of the onshore work on Watson Island and offshore eastbound tunnel. They are currently working on the westbound tunnel offshore with onshore grouting on Dodge Island scheduled to begin in late May. The grouting portion of the work is on pace for a late July completion. The TBM is currently mining within the treated layer of the tunnel.

Jim Rush is editor of *TBM*.