



Tunnel Boring Machines Core Under Big Apple's East River

By: Mary Reed

A long-awaited Metropolitan Transportation Authority project currently under way in New York City is completing the construction of tunnels under the East River to Grand Central Terminal for the Long Island Railroad. It is believed to be the first job in New York where two boring machines are in operation at the same time, side by side and could well lay claim to having the longest conveyor belts — more than 15,000 linear ft. (4,572 m) in all — working in city construction.

The Authority's massive East Side Access (ESA) project will not only reduce congestion on Long Island Railroad trains to Penn Station and on New York City's Flushing and Queens Boulevard lines, but it will also provide a faster trip between Long Island and midtown Manhattan by connecting the Long Island Railroad's Main and Port Washington lines in Queens to a new eight-track terminal to be constructed below Grand Central Terminal. When completed, the new terminal will serve approximately 160,000 travelers a day.

The tunnels for the project are being built in a joint venture by Dragados USA Inc., based in New York City, and Judlau Contracting Inc., of College Point, N.Y., a member of the Judlau Companies group. With a scheduled completion date in 2011, the two-contract tunnel job has a total value of \$1.2 billion, funded from federal and state sources. The work involved also covers construction of cross passages between tunnels as well as a central instrument control room.

The overall \$7 billion East Side Access project began in 2001, at which time it had been 25 years since the New York subway system constructed tunnels. Tunnel boring machines had not been used before.

Two 22 ft. (6.7 m) diameter Double Shield Tunnel Boring Machines (TBMs) are now at work, having begun their task late in 2006. In order to begin boring, it was necessary to use an existing shaft in Queens, permitting the TBMs to access the bellmouth of Manhattan's 63rd Street tunnel.

Both TBMs were assembled at their starting point some 5,000 ft. (1,524 m) below the existing shaft. The TBMs' parts were lowered into the shaft and moved by rail to the assembly point, where final assembly took place. The two TBMs were delivered and assembled approximately a month apart.

By July 2008 the Metropolitan Transportation Authority was able to announce that the first TBM had reached Grand Central Terminal after eight months of boring, traveling through about a mile of bedrock between 63rd Street and 2nd Avenue in Manhattan and Grand Central Terminal.

In early November, three methods for mining and cavern construction were being used on this project: tunnel boring and road header machines, along with drill and blast operations.

The total project includes construction of approximately 30,000 lineal ft. (9,144 m) of tunnel.

TBMs carry out the primary mining operation and the road headers and drill and blast operations are used to construct caverns, cross overs, and drifts and to widen the Grand Central Cavern for building the station itself.

"We have completed two tunnels to their end points and moved both of the TBMs back to their launch point for the second tunnel," said Jay Dier, president of the Judlau Companies. "We are currently using the road header to construct the 'Y,' the point where one tunnel becomes two.

"The remaining work is extensive, including six more tunnels, concrete and shotcrete lining, construction of cross passages, ventilation, elevator and escalator shafts, and structural support of structures above Madison Yard under Grand Central Terminal," he added.

Major equipment working on the job includes a 22 ft. diameter Double Shield TBM manufactured by SELI of Rome, Italy, and a second 22 ft. diameter Main Beam TBM from the Robbins Company, based in Solon, Ohio.

By the time the job is completed they will have excavated 346,607 cu. yds. (265,000 cu m) of bedrock, while 50,000 cu. yds. (38,228 cu m) of material will have been removed by blasting.

The joint venture owns all the equipment in use on the job.

“We currently have one road header, a Sandvik 12- ton machine model MT720,” Dier said. “We also have a Loci, manufactured by Schoma. They are 25 metric ton [27.5 ton] machines.”

In addition to the Robbins conveyor, two boom Jumbo drills and a Robo Drill with 22-ft. slides plus [Caterpillar](#) 980 and 966 loaders, a Grove 35-ton (31.5 t) cherry picker crane and a Manitowoc 777 175-ton (158.7 t) crawler crane with a 110-ft. (33.5 m) boom, an Alimak personnel lift, and a PM500 shotcrete robot by Allentown also are working on the job.

“This is Judlau’s first tunneling project. Our partner Dragados, however, has years of experience in tunneling around the world. In addition they recently acquired Schiavone Construction of New Jersey, one of the premier tunneling contractors in the United States, and they are now providing some management staff on the project,” Dier said. “The workforce on the job includes craft crews running just over 200 in all and about 40 people on the management side. Our management team is made up of some of the best tunneling people in the world and is a mix of Judlau, Dragados and Schiavone people. The beauty of it is they all think alike and have one common goal, to build tunnels.”

A few problems have been experienced. Although an extensive geotechnical baseline report was prepared for this project, the team encountered some ground more fractured than anticipated. This meant slowing down mining operations while additional rock support was installed. The difficulty was overcome by the installation of lagging between ring steel, shot-creting to add structural support, and traditional blocking operations.

“Another area of concern has been the necessary coordination with the New York City Transit and Metro North railroads. While crossing beneath both NYCT and Metro North lines there is often only a few feet separating our blasting and mining operations from the active tunnels,” Dier noted. “This necessitates close coordination with both agencies to minimize impact to the riding public and to ensure no damage occurs to the existing infrastructure. With the help and cooperation of the MTA Capital Construction Company [MTA-CC], this coordination has taken place with only minor impacts to the work.”

Summing up the job, Dier described it as an immensely complicated project involving the cooperation of the MTA-CC, the designer, General Engineering Company, and the Joint Ventures labor force, which includes Local 147 “sandhogs,” Local 282 teamsters, Local 14 and 15 operators, and Local 731 laborers.

“To date this cooperative attitude is evident in the way problems are addressed and solutions determined. With this continued cooperation Dragados/Judlau will achieve its goal of an on-time, safe, and quality job,” he said.

About the Companies

Judlau Contracting Inc. is a 25-year-old heavy civil construction company. It provides mass transit, road construction, bridges and tunnels, subsurface utilities and water mains, electrical and signal work, design/build projects and environmental remediation. Previous notable subway projects include Brooklyn's Myrtle Wyckoff station, the Gunn Hill Road station in the Bronx, the historic Pelham Parkway subway station in the same borough, and Manhattan's 59th and Columbus Circle stations and new South Ferry subway station. The company also was responsible for the lower deck of the Henry Hudson Bridge in Manhattan.

Dragados USA Inc is a member of the ACS Group of Madrid, Spain. The company joined ACS in 2002, helping position the ACS Group as leader in the Spanish market and one of the most important companies in its industry in Europe. Dragados recently expanded its operations in the United States with projects in Florida and Texas.