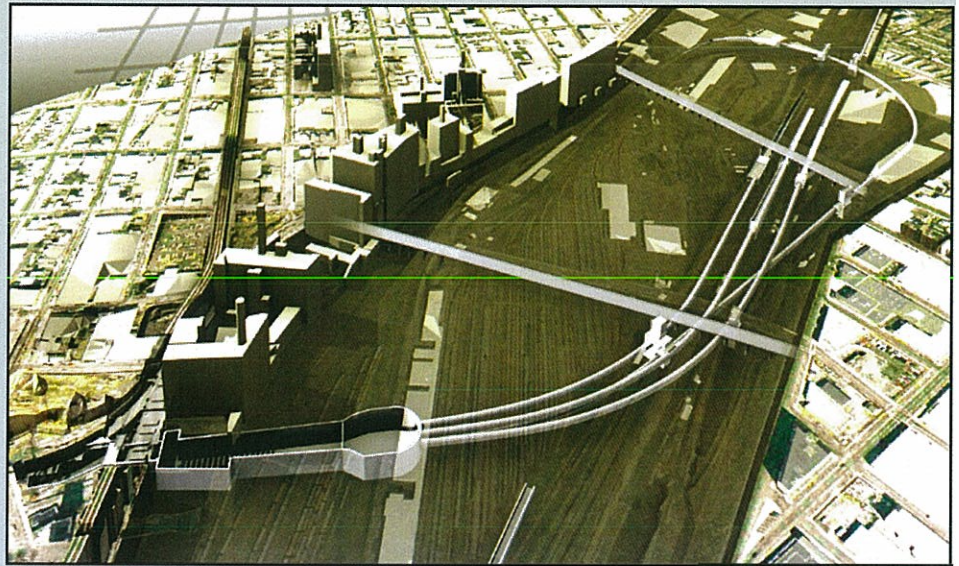


QUEENS TUNNELS EXCAVATION

In September 2009, the joint venture of Granite-Traylor-Frontier (GTF) was awarded the \$700 million four year Queens tunneling contract as part of the East Side Access project (ESA). The tunnels will be constructed using two soft ground tunnel boring machines (TBMs) which will connect the 63rd Street tunnel at Northern Boulevard to the LIRR mainline tracks in Woodside, Queens.

Pre-Excavation

Before tunneling began an Open Cut (bathtub structure) by Northern Boulevard and 41st Avenue was excavated.



Queens Bored Tunnels

FUN FACTS

- The combined volume of rock and soil removed from TBM tunneling and controlled drill-and-blast excavation in Manhattan and Queens, if poured into an Olympic-sized swimming pool, would fill it 400 times.
- The double shield soft grounds TBMs are equipped with trailing gear that stretch 200 + feet behind them.
- In the United States, early versions of the Tunnel Boring Machine date back to the 1850's with the construction of the Hoosac Railroad Tunnel in Western Massachusetts.



Tunnel Boring Machine

This structure was created to serve as the TBMs assembly and launch chamber.

ESA's contractor must also excavate 50 feet into bedrock to get to the base of the launch chamber as well as excavate an additional 750 cubic yards of rock below the base of the launch chamber.

The TBM has been factory tested and shipped to the Port of New York and New Jersey. In October, it will be transported to the work site in large pre-assembled parts with some pieces weighing approximately 70,000 lbs and once fully assembled each TBM will have an estimated diameter of 22 feet.

Pre-construction surveys and comprehensive monitoring programs have been established to ensure that vibration, settlement and movement remain within established thresholds. Surveys have been performed on bridge crossings and other key structures within proximity of the tunnels. Community outreach includes e-mail notifications, meetings and mailings to keep residents and businesses apprised of the construction schedule and anticipated effects.

Excavation

The scope of work includes the construc-

tion of four tunnels with a combined total length of 10,500 ft as well as reception pits for three tunnels and shafts for emergency access and ventilation.

The excavation methods used in Queens differ dramatically from those used in our Manhattan tunneling and excavation contracts. Manhattan is mostly in rock while Queens has a mix of rock, soil and boulders.

At its deepest, excavation of the tunnels by the TBMs will be at a depth of approximately 70 feet below street level.

The tunnel bores created must be supported with a lining that is installed as the TBM bores the tunnel. Concrete segments are assembled within the rear portion of the TBM and slid into position as the machine moves forward. The concrete segments serve as both the initial support and the finished product.

Post-Excavation

At the end of the tunneling operations, the TBM will be backed out of the tunnels and disassembled. Utilities, trackwork and benchwork will be installed within the concrete liner.