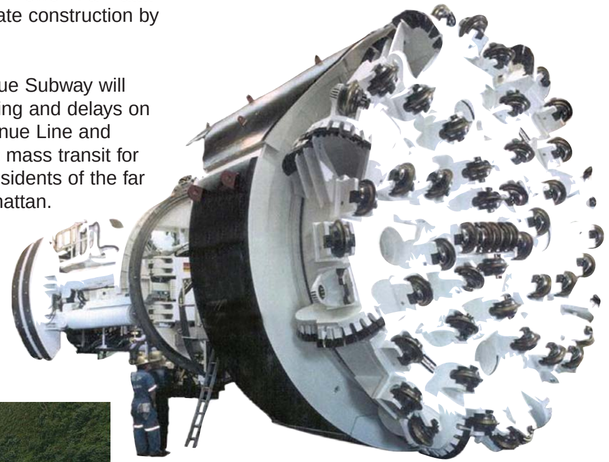
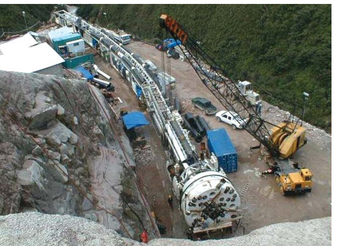
Second Avenue Subway

The Metropolitan Transportation Authority (MTA) and MTA New York City Transit have begun the final planning and environmental analysis for a full-length Second Avenue Subway, from 125th Street to the Financial District in Lower Manhattan. Our goal is to initiate construction by the end of 2004.

The Second Avenue Subway will reduce overcrowding and delays on the Lexington Avenue Line and improve access to mass transit for commuters and residents of the far East Side of Manhattan.



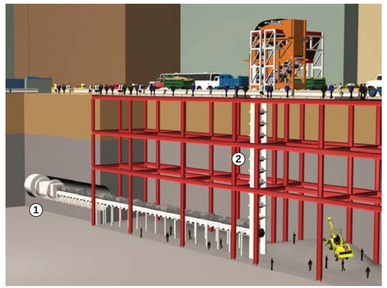


Tunnel Boring Machines

Construction

Three main techniques will be used for tunnel and station construction depending on geological conditions and on specific facilities that could be needed at street level, such as station entrances and vent shafts. The three construction methods are tunnel boring, cut-and-cover and mining.

Tunnel Boring



Much of the Second Avenue Subway will be built using tunnel boring technology, in which a powerful circular cutting machine drills a tunnel in rock or soil with minimal disruption to the street (①). The excavated material is then taken to street level and removed by truck (②). Tunneling will be done through bedrock wherever possible, which is quicker and more cost effective than mining or cut-and-cover.

There are two types of boring machines: the Tunnel Boring Machine (TBM), used in rock, and the Earth Pressure Balance Machine (EPBM), typically used in soil. A TBM is likely to be used between approximately 6th Street and 92nd Street, where the bedrock is close to the surface. An EPBM may be used in soil south of 6th Street, because the bedrock is relatively deep.

The actual tunnel construction will occur without many street disruptions. However, the street will be excavated and significant street disruptions will occur where the TBM is inserted into and removed from the ground, where excavated material is removed, and where stations and support facilities, such as vent shafts, are located.

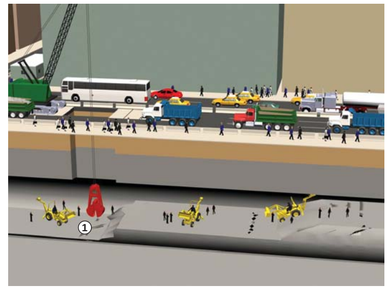
Cut-and-Cover

Most of New York City's subway system was built using the cut-and-cover technique. With this method, a trench is cut in the street, the soil is supported by vertical walls and a frame is built to support concrete or metal street decking (①). The decking allows the street to remain open to traffic and pedestrians while excavation and construction continue in the tunnel below.

Cut-and-Cover at Times Square

Cut-and-cover is likely to be used at many station locations, at other places where access to the street is required, and for sections of the alignment where the tunnel will be very close to the surface, such as the section between the existing tunnel segments, which were built in the 1970s. Through the "cut" in the street, excavated material can be removed and equipment can enter or exit the tunnel (②).

Mining



The third technique to be used to build the subway tunnels is mining. The primary method of mining in rock is drill and blast. This procedure involves drilling many small holes within a rock area and then placing small amounts of explosives in each hole. Under carefully controlled and monitored conditions, explosives are then detonated sequentially for short intervals, breaking the rock while spreading the release of energy from the explosives over a longer period, lessening potential ground vibration at nearby structures. When mining is done in soil, the drill and blast method is not required. Soil and rock will be excavated and removed by backhoes, bulldozers, and a clamshell shovel suspended by a crane (①).

Mining will be used on portions of the tunnel too short to make tunnel boring cost effective, and on curved portions of the tunnel that are too constrained for a TBM. Some stations will be excavated from below street level, and the street will be penetrated to build station entrances and venting. Additionally, an access shaft is needed to remove excavated materials and to bring in or remove equipment from the tunnel.

Removal and Reuse of Excavated Material

Cranes, small rail cars and conveyors will be used to bring excavated rock and debris to the street level. At the surface, material will be transferred either directly to a barge or to trucks. Trucks will then transport loads out of the city or bring the excavated material to a barge for removal. Two barge facilities are being proposed: one located near the line's north end, the other at the south end.

Most of the excavated material will be clean crushed rock that can be used for such projects as filling abandoned mines, building artificial reefs, reinforcing bulkheads or paving roads.

MTA Metropolitan Transportation Authority

Traffic Mitigation

A key aspect of construction is to develop a plan that will allow the city to continue to function normally during construction. Every effort will be made to minimize disruptions to pedestrian and vehicular traffic.

In general, the project will not require closing of entire streets. During construction, at least two lanes will remain open to traffic. Efforts will be made to maintain access to businesses and residences.

Building and Infrastructure Protection

Structural and ground improvement techniques will be used to minimize ground settlements, and to preserve the structural integrity of various facilities, including utility lines, buildings, tunnels and ramps.

Underpinning is a structural process that includes the use of drilled or jacked supporting piles to provide temporary support or reinforcement to protect existing structures. Ground freezing and grouting are typical soil improvement options used to control ground settlement and distortion.

Construction Compliance and Green Design

All work will comply with applicable federal, state and city codes and regulations, with the goal of achieving the highest degree of public safety.

The Second Avenue Subway project will include design elements that foster the prevention of pollution and minimization of waste. Wherever possible, the project will use technologies to minimize adverse environmental impacts and incorporate sustainable design principles, including energy efficiency, enhanced environmental quality and material conservation.

Second Avenue Subway

Stay Involved

Stay informed of upcoming meetings and receive the latest information on the project.

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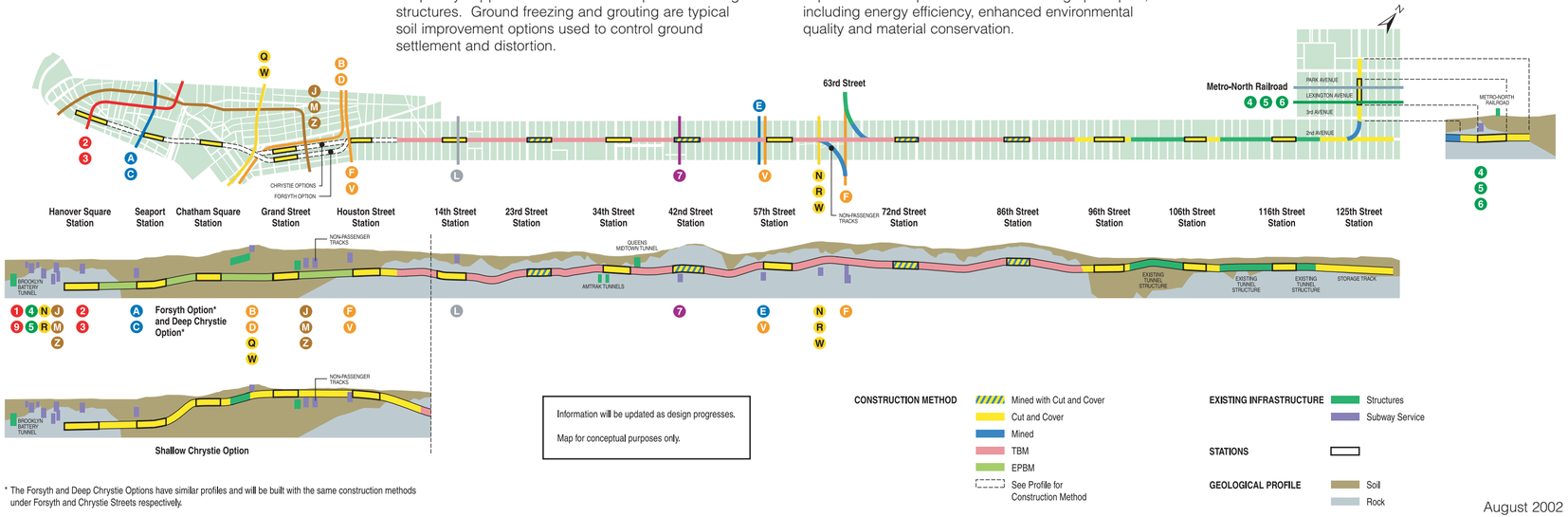

* The Forsyth and Deep Chrystie Options have similar profiles and will be built with the same construction methods under Forsyth and Chrystie Streets respectively.

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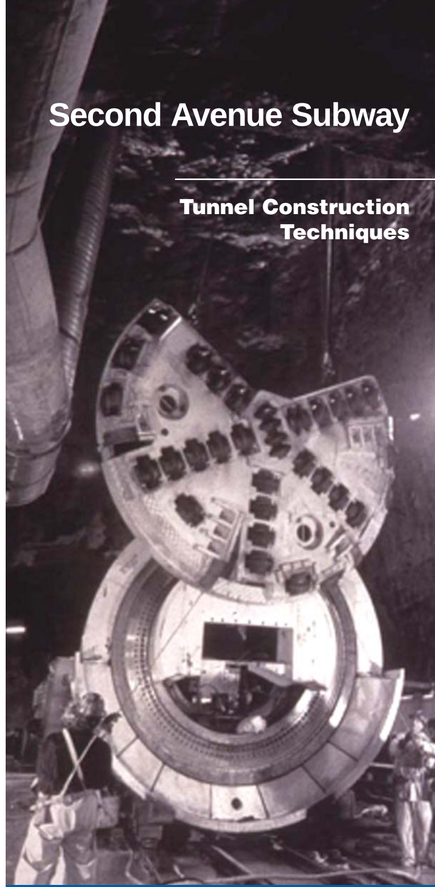

Second Avenue Subway

Tunnel Construction Techniques

Metropolitan Transportation Authority