

TUNNEL BORING MACHINE

Tunnel Boring Machine

The tunnel will be excavated by a tunnel boring machine (TBM) to a diameter of 12-1/2 feet. The TBM was assembled at the base of the access Shaft in a short section of tunnel called the "bell out". The bell out was excavated by the drill and blast method. The TBM is approximately 70 feet long, and is supported by 700 feet of trailing gear. Initial excavation will be south of the Shaft; upon completion of the south leg the TBM will be backed out to the shaft, where it will be turned around to mine the north leg. It is anticipated that the TBM will excavate bedrock 24 hours a day, 5 days a week, at a rate of 75 feet per day.

The TBM is a Robbins 1215-257 hard rock-main beam type tunnel boring machine. It uses a rotating cutter head containing twenty seven (27) – 17 inch diameter disc cutters to crush the rock. The disc cutters push into the rock under a thrust load of 1.9 million pounds and crush the rock into small fragments. Four 450 horsepower electric motors rotate the cutter head at approximately 12 revolutions per minute. Two massive grippers press against the tunnel wall allowing two hydraulic thrust cylinders to force the cutter head forward into the bedrock at an increment of five feet per stroke. The trailing gear rides on rails and contains the electrical power equipment, the operator's cabin, hydraulic systems, fire suppression equipment, ventilation and scrubbers as well as conveyors and equipment to load the muck trains.

The crushed rock, or muck, is removed from the face of the tunnel through the TBM and over the trailing gear by conveyor. The conveyor discharges the muck into muck cars. Trains of four muck cars pulled by locomotives transport the muck through the bored tunnel to the access Shaft, where the muck is transferred and raised to the surface by a vertical conveyor belt.

Five foot long rock bolts, 4 bolts every 4 feet, will provide initial temporary support in the tunnel after the rock is excavated. It is anticipated that over 19,000 rock bolts will be installed.

Except for activities at the access Shaft the general public will not be aware of the ongoing tunneling work since TBM rock excavation will not produce any noise or vibrations at street level.

Quantity of Rock Excavation

All rock excavated from both the tunnel and its shafts will be removed through the access Shaft. The volume of rock to be excavated from the Manhattan Tunnel, would fill an area the size of a football field with a mound of broken rock to a height of 250 feet.