

Garden State Parkway Tunnel

Clifton, New Jersey, USA

Ground freezing was key to the successful of a TBM that had stalled beneath a critical highway.



The project

When loose subsurface conditions stalled a jacked pipe tunnel boring machine (TBM) approximately 25 ft below the Garden State Parkway in Clifton, New Jersey, immediate action was needed to stabilize the soils so that the TBM could be advanced without further ground loss.

The challenge

The majority of the tunnel alignment was through medium dense overburden. Rock was anticipated in the tunnel invert over the last to 30 to 40 ft. Groundwater was below the tunnel horizon. The TBM, a mixed face machine, had advanced to within 35 ft of the receiving pit when soil conditions abruptly changed from medium dense material to very loose silty sand embankment fill, with rock surface rising in the invert. The tunneling contractor could not control the running ground once the TBM slowed down on the rock below, resulting in development of a sinkhole on the shoulder of the highway embankment. The critical concern was immediate stabilization of the running embankment sands to avoid damage to the Parkway. With the TBM almost at the end of the alignment, the tunneling contractor's jacking pressures were quickly approaching the jacking capacity of the system. Every day the TBM sat idle increased the likelihood that excessive jacking forces would be required to re-initiate movement.

The solution

Ground freezing was the only viable solution in the time frame. In light of the urgency, liquid nitrogen was used to form the freeze. Working from within the receiving pit, horizontal drilling techniques were used to install freeze pipes on a fan array and create a canopy of frozen ground above the TBM. The natural moisture content of the soil above the water table was sufficient to form the freeze, which was completed in less than two days. Mining of the tunnel continued immediately thereafter.

Project facts

Owner(s)

The New Jersey Turnpike Authority

Keller business unit(s)

Keller

Main contractor(s)

Keller

Solutions

Ground improvement

Markets

Tunnels and shafts
Infrastructure

Techniques

Ground freezing

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