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READYING FOR THE SR 99 TBM

The world's largest TBM gets a lot of the attention when the SR 99 tunnel project in Seattle is discussed. Let's face it, a 57.5-ft diameter machine tends to turn heads. In preparation for the machine's arrival, crews are busy building a massive launch pit south of downtown from which "Bertha" the massive TBM will begin her push.

The SR 99 tunnel project is part of the Alaska Way Viaduct Replacement Program for the Washington Department of Transportation. It involves construction a 2-mile section of vehicular tunnel under downtown Seattle that will accommodate SR 99 current and future traffic demands which will allow the decommissioning of the aging viaduct adjacent to the shoreline.

The TBM is currently in the final stages of manufacturing in Japan and at press time the machine was being prep for the journey across the Pacific in time for erection and boring this summer. Meanwhile, Malcolm Drilling Company Inc., a San Francisco-based specialty contractor, has teamed with the design-build contractor (Seattle Tunnel Partners, comprised of Dragados USA, Tutor Perini Corp., HNTB, Frank Coluccio Construction and Mowat) to build the launching pit. The principle construction components of the launching pits includes fully cased secant pile walls to depths of 140 ft. Multiple rows of tiebacks have been installed and post-tensioned by Malcolm with the final phase of construction is the dewatering of the launching pit.

In business for more than 50 years, Malcolm provides a multitude of services related to underground construction including soldier pile walls, tiebacks, secant pile walls, jet grouting, cutter soil mixing, dewatering and many more. No stranger to large-diameter tunneling projects, Malcolm recently completed a project under subcontract for Bouygues as part the Port of Miami Tunnel project,

which involves a 42-ft diameter TBM – the largest TBM currently in use in the United States (before Bertha arrives, that is).

In Miami, Malcolm crews used cutter soil mixing (a method of soil mixing utilizing Diaphragm Wall Technology), for the launching pits or portals and break-in/break-out blocks, as well as creating solid blocks in the porous ground through which underground crews could safely construct cross-passages. In contrast, Malcolm crews used secant wall construction to construct the launch pit in Seattle, as well as performing jet grouting and dewatering. With an expansive list of Geotechnical competencies Malcolm used two completely different construction methods for the support of excavation at two sites which could not be further apart in the United States.

In Seattle, the ground conditions include very soft, highly saturated and unstable soils along with abandoned wood and timber foundations. The launch pit construction plan was to build 5-ft diameter secant pile walls to depths of 140 ft.

"To meet these various geotechnical challenges, and clearance issues, which precluded internal bracing, the retention system of choice was heavily reinforced secant pile walls supplemented with high capacity strand anchors," said Lance Rasband, project manager for Malcolm.

Key to successful installation is maintaining verticality with tight tolerances. "Construction secant piles to those depths with a high degree of verticality is a very difficult proposition," Malcolm president Terry Tucker said.

Malcolm used high torque rotary drills with oscillators and temporary casing to maintain verticality and ensure that the bore hole does not collapse. This approach has the added benefit of allowing wooden obstructions to be removed from within the



Malcolm was tasked with constructing the secant piles for the 400-ft long by 80-ft wide by 80-ft deep SR 99 launch box. (Photo: Washington State Department of Transportation)

casing should they be encountered. When the piles are drilled to the depth, the casings are extracted during tremie concrete placement ensuring a positive head of concrete is maintained above the bottom of the casing during withdrawal. The fully cased method of pile construction ensures a virtually flaw-free pile, Tucker said.

“For about two decades Malcolm has been a pioneer in bringing this and other technologies to the United States” Tucker said. “It allowed us to build SR 99, which was a truly difficult and challenging project, without issues.”

In total, 1,700 each 5-ft diameter secant piles were constructed for the SR 99 project with depths up to 140 ft. Verticality was achieved within 0.5 percent. Additionally, Malcolm installed tiebacks to provide lateral support for the secant pile walls, which are exposed to depths of approximately 65 to 70 ft. A total of 747 tiebacks, 125 ft long, are incorporated into the 400-ft long by 80-ft wide by 80-ft deep structure.

All work is on schedule to allow the massive TBM to begin boring this summer and create a new chapter in tunneling history. 

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