Shield machines excavate underground tunnels using rotating cutters located at the front of the steel units. As a result of impressive technical advancements over the last 170 years, very complex projects can now be carried out using two shield machines designed to work in tandem—an excavation method called the “H&V Shield Tunneling Method.” Begun in 2013, a Tokyo Metropolitan Government Sewage Bureau project to construct Begun in 2013, a Tokyo Metropolitan Government Sewage Bureau project to construct Excavation by H&V Shield Tunneling Method

Kawasaki Achieves World’s First Spiral Excavation by H&V Shield Tunneling Method

Shield machines excavate underground tunnels using rotating cutters located at the front of the steel units. As a result of impressive technical advancements over the last 170 years, very complex projects can now be carried out using two shield machines designed to work in tandem—an excavation method called the “H&V Shield Tunneling Method.” Begun in 2013, a Tokyo Metropolitan Government Sewage Bureau project to construct tunnels using a H&V Shield Tunneling Method, slurry prepared at the ground plant is fed to the entrances in the departure and arrival shafts, and excavated soil is discharged to the ground plant after slurry treatment. In the slurry shield method, the shield machine advances spirally by allowing the shield jacks to push the tunnel wall structures (segments) to the rear and building the tunnel wall gradually. The axial force of the shield jacks is transmitted to the ground plant in the arrival shaft through the shield jack attachment section. By adjusting the axial force of the shield jacks, the shield machine is capable of changing between a horizontal and a vertical configuration. In this rainwater overflow drainage project, the machines to the right advance upward and to the left, gradually achieving a vertical configuration. Because the machines had to be articulated at 3.5 degrees and perform three-dimensional movements, development of a flexible joint mechanism was essential. The two shield machines, placed in horizontal configuration in the departure shaft, perform spiral excavation about 137 m, then change their position to a vertical configuration and excavate a further 600 m.

Slurry feed and discharge pipes

A partition is installed between the anterior of the front body (in the case of a sealed machine) in the slurry shield tunneling method. Slurry prepared at the ground plant is fed to the entrances in the departure and arrival shafts, and excavated soil is discharged to the ground plant after slurry treatment. In the slurry shield method, the shield machine advances spirally by allowing the shield jacks to push the tunnel wall structures (segments) to the rear and building the tunnel wall gradually.

Cutter head

The shapes of the face plate and the excavation cutter bits are designed to accommodate the geological features of the site and the hardness of the rock. The face plate is provided with teeth that are made of suitable material for the geological conditions. The cutter bits are designed to accommodate the hardness of the rock. The shapes of the face plate and the excavation cutter bits are designed to accommodate the geological features of the site and the hardness of the rock.

Articulation jack

This jack supports rotation of the anterior body of the machine to make it possible to change from a horizontal to a vertical configuration or vice versa. In the rainwater overflow drainage project, the machine excavated with their positions changing from the horizontal to the vertical settings.

Shield jacks

Each shield machine is custom made, tailored to the site’s geographical features and the structure’s purpose.

Project to Accommodate Challenging Urban Restrictions

The site for constructing has 5 m diameter pipelines under the Tachiaigawa River for drainage excess rainwater is approximately 778 m long. The pipelines will take up rainwater overflow to prevent flooding in the vicinity and contamination from sewage coming from the “combined sewage system.” The excavation under the river first installed the shield machines to go under the river’s width. It was a challenging project with many challenges involved in excavating earth with varied geological features, soil properties, and pressures.

Flexible Joint Mechanism of the Connecting First Unit Blade Spinning Possible

In this rainwater overflow drainage project, the machine to the right advances upward and to the left, gradually achieving a vertical configuration. Because the machine had to be articulated at 3.5 degrees and perform three-dimensional movements, development of a flexible joint mechanism was essential. The two shield machines, placed in horizontal configuration in the departure shaft, perform spiral excavation about 137 m, then change their position to a vertical configuration and excavate a further 600 m.

Kawasaki’s Superior Technology

A flexible joint mechanism (diameter of the right machine’s rear body)

Working deck

This area within the machine permits workers to perform segment assembly and other tasks. Even when the machine is spiraling, the angle of the working space floor changes up to 360 degrees so that the deck remains level.