

A sludge-based jacking method for obstructions in the earth

φ800mm~φ3000mm

Milling Mole Method



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ISTT 2012
No-DigAward



N E T I S
Registration Number **KK-130054-A**

Features of the milling mole method



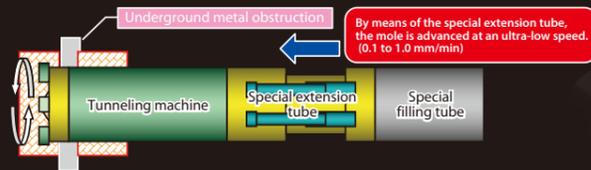
Cutting

Metal obstructions cut into powder and removed

The tunneling machine is fitted with an exclusive bit for cutting obstructions. A special extension tube is used so the tunneling machine cutter comes into contact with obstructions at an ultra-low speed, and the cutting action is performed with the rotation of the cutter. The principle is the same as that used in lathe machining.

●Obstruction cutting

Using the special extension equipment in the special extension tube, the tunneling machine cuts obstructions at speeds of 0.1 to 1.0 mm/min. The key feature of the milling mole is turning cut metal obstructions into iron pieces and taking them into the machine together with ordinary sludge with the aim of transporting the mixture to the ground surface via vacuum transport.



On-the-ground-surface cutting experiment (conducted by cutting type-III steel sheet piles) June 7, 2011 Metal pieces



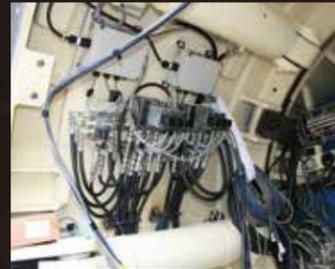
Special extension equipment control panel



Tunneling machine cutter head



Cutting bit

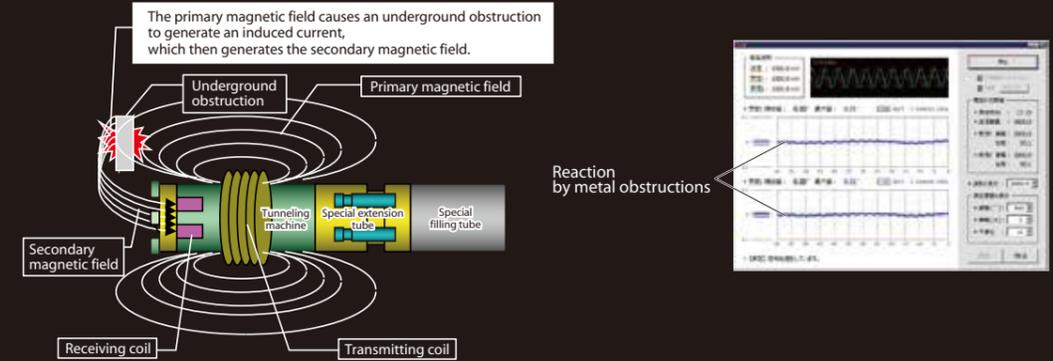


Inside view of the special extension equipment

Exploring

The machine explores metal obstructions ahead while tunneling through.

Electromagnetic waves are emitted from the transmitting coil mounted on the tunneling machine, with magnetism (primary magnetic field) enveloping metal obstructions in the ground. Magnetized metal obstructions generate induced current, with magnetism (secondary magnetic field) emitted. This secondary magnetism is detected by the receiving coil mounted on the tunneling machine to determine whether metal obstructions exist.

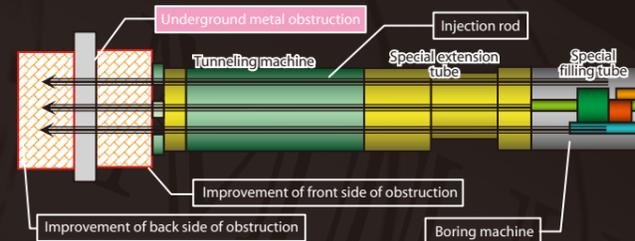


Improvement

The ground in front of and behind an obstruction is improved from within the tunneling machine.

Cutting an obstruction at ultra-low speed prevents the obstruction from being loaded. For this reason, ground improvement is basically not necessary. However, when the ground is extremely soft (drop hammer sinking) or when the site is crowded with underground installations, the ground can be improved from within the tunneling machine to avoid any effects from underground installations and the ground surface. A boring machine is set to a special injection tube, and an injection rod is inserted from the exclusive valve position located on the tunneling machine partition wall to improve the ground around an obstruction. A shielding wall can typically be cut through to improve the ground including the back side.

●Simultaneous stabilization of ground in front of and behind an obstruction



Using the special injection tube located at the rear of the tunneling machine, the ground in front of and behind an obstruction can be stabilized. A boring machine is set to a special injection tube, and an injection rod is pressed against the obstruction from the exclusive valve position located on the tunneling machine partition wall, with the injection rod cutting through the obstruction to improve the ground from the back side to the front side simultaneously. The maximum length of improvement is 5 meters.



Work examples



Type-III steel sheet piles, at 6 sites in Kishiwada City, Osaka Prefecture



Reinforced concrete walls with a thickness of 2 meters, at 2 sites and H300 shaped steel structures at 6 sites, in Nagata-cho, Chiyoda-ku, Tokyo



Type-III steel sheet piles, at 2 sites in Sasebo City, Nagasaki Prefecture



Eight H300 shaped steel structures at 4 sites, Nishi-Shimbashi, Minato-ku, Tokyo



Reinforced concrete manhole wall with a thickness of 1 meter, 5 H150 shaped steel structures with 6 liner tiers, at Otemachi, Chiyoda-ku, Tokyo



Three wooden piles with a diameter of 150 mm, in Taisho-ku, Osaka City



H300 steel pipe with a diameter of 1000 mm, at 2 sites, Yao City, Osaka Prefecture

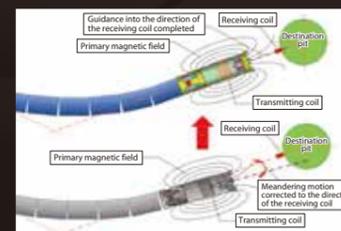


Hume pipes, 8.2 meters long, with a diameter of 1800 mm, in Yao City, Osaka Prefecture

Guiding

Guiding the tunneling machine to the designated location in a pit (recommended for long-distance propulsion)

An electromagnetically guided surveying device (Neo Just System) can be installed. This is a system in which the tunneling machine is guided to the designated location in a pit where a receiving coil is installed. The measurement starts about 40 meters before the tunneling machine reaches the designated location, with the bearing angle of the tunneling machine calculated and indicated in real time.



The electromagnetically guided surveying device (Neo Just System) is installed on the milling mole tunneling machine. The electromagnetically guided surveying device sends current to the coil wound on the tip of the tunneling machine to transmit electromagnetic waves in the propulsion direction of the tunneling machine. The transmitted electromagnetic waves are caught by the receiving coil installed at the target destination to determine the current position of the tunneling machine. Through these actions, the electromagnetically guided system allows the tunneling machine to precisely reach its destination. Thus system enables you to measure in real time the direction in which the tunneling machine is positioned.

Obstructions that can be handled

- Wooden piles •PC piles •Steel pipe piles •Steel sheet piles •H-shaped steel structures
- Continuous walls •Reinforced concrete structures

※Objects with diameters of 800 mm and 900 mm are subject to some conditions.

Cutter bits can be replaced inside the machine for a diameter of 1000 mm or larger. Work execution based on the obstruction-insured system is available.