41

Roller Cutter Replacement System for Shield Machine "THESEUS Method®" — Replace Roller Cutters Safely and Quickly by Robot Remote Operation —

TAISEI CORPORATION

A method to replace cutter bits of shield machines, "THESEUS Method®," is a system to enable replacement of roller cutters through remote robot operation within a shield machine. The development and application of this system enabled safe and quick replacement of roller cutters, which weighs several hundred kg per piece, without sending personnel to a narrow space. Figure 1 shows the configuration of this system. This system consists of (1) a roller cuter replacement robot, (2) roller cutter cases (inner case + front/rear outer cases, see Figure 2), (3) slide shutters (front shutter + rear shutter), (4) a movable manhole, and (5) a transport device.

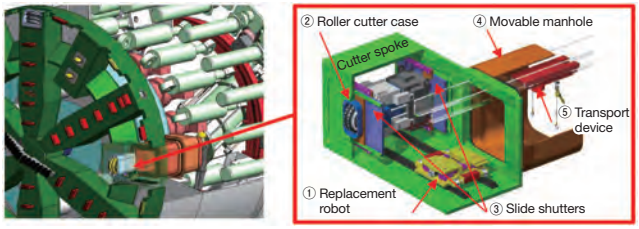

Fig. 1 Roller Cutter Replacement System to which THESEUS Method is Applied

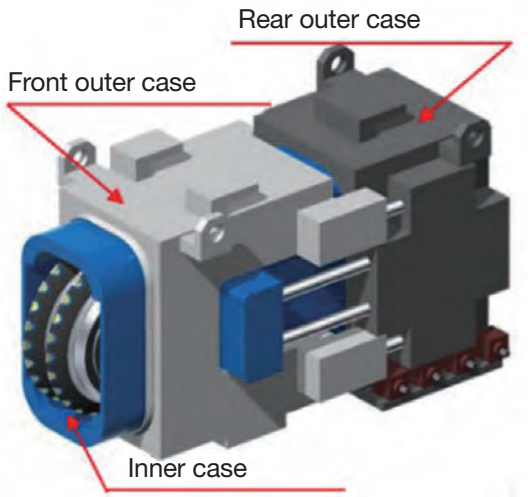

Fig. 2 Roller Cutter Case

In the future, this system will be applied to excavating of a gravel layer containing boulders, and in case that both rock bed and sandy soil ground are expected within the planned tunnel route, application of the THESEUS method will be expanded by using different cutter replacement systems depending on the ground.

42

T-Shot Marker Face ˜Real-time Measurement of Shotcrete Thickness˜

TAISEI CORPORATION

"T-Shot Marker Face" is a system that measures the thickness of shotcrete on the face during concrete spraying work of a mountain tunneling work and displays the measurement results in real-time. It uses a 3D-LiDAR which can measure the shape of the face quickly and precisely to understand the shotcrete thickness. This product is capable of measuring 240,000 points per second and has a wide viewing angle. Therefore, even in a tunnel construction with a large cross-section, only single unit of 3D-LiDAR can be used to determine the shape of the entire face (Fig. 1).

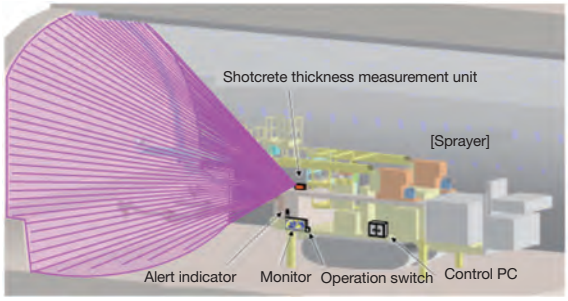

Fig. 1 Outline of Shotcrete Thickness Measurement by "T-Shot Marker Face"

The display of the result of measurement (Fig. 2) is updated to the latest data in every about 5 seconds. The point cloud data of the face is based on a high-precision measurement even under dusty environments with the aid of noise cut processing (Fig. 3).

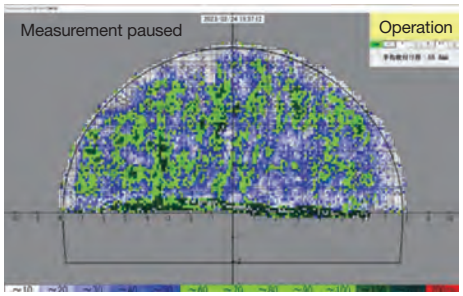

Fig. 2 Distribution of Shotcrete Thickness

Currently, this system is applied to mountain tunnelling projects in Japan, and improvements have been added in response to the site environment and construction conditions. In addition, development is underway to expand the scope of application of measurement to the outer circumferential side of the face, and this will be applied to automatic spraying technology to further improve construction efficiency and safety.

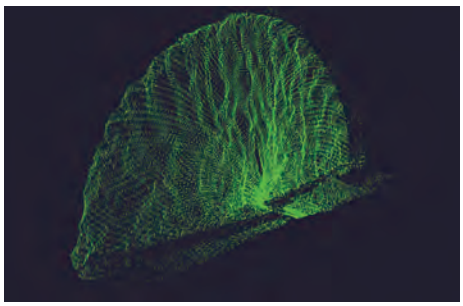

Fig. 3 Distribution of Shotcrete Thickness