

New energy-saving cutter structure for large section shield machines for rapid construction

Hiroshi UEDA ▶ Manager

Civil Engineering Technology Division OBAYASHI CORPORATION

Background

Operation of shield machines requires enormous amounts of electrical power, and 70% of this power is used to drive the cutter, which excavates the ground. An energy saving shield construction method that uses a double-cutter mechanism was developed in order to reduce the power consumption of the cutter shield construction method.

Summary

Unlike the conventional single-drive mechanisms, in the double-cutter mechanism, the cutter head of the shield machine is divided into an inner circumferential part and an outer circumferential part, which can be operated independently of each other. This structure allows the optimal rpm for the inner circumferential part and the outer circumferential part to be selected separately (Fig. 1). With this design, it is possible to control the rpm of the outer cutter which is normally too excessive to maintain its circumferential speed, as well as to reduce power consumption for operating the cutter.

Characteristics

1. Reduces by 30% the amount of electrical power necessary to operate the machine by optimizing the rpm of the cutter on the outer circumference.
2. Improves by 25% the excavating speed by reducing the burden on the cutter bit in the inner circumference during ground excavation and increasing the aperture ratio.
3. Improves boring operation rate by preventing problems caused by clogging of soil onto the central part of the cutter.

These effects have been confirmed through verification tests conducted using simulation experiment machines (Fig. 2).

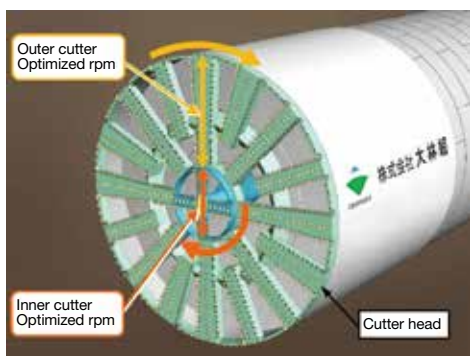


Fig.1 Cutter rotation frequency

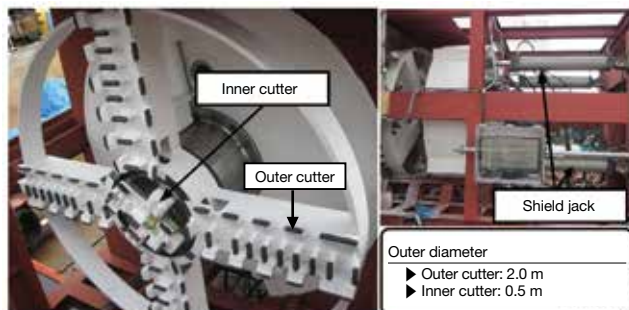


Fig.2 Verification tests