AI-aided Automatic Shield Machine Driving System

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Background

In shield construction, planning excavation instructions and operating shield machines require many years of experience and skills, as well as a great deal of effort. We have developed an AI-aided shield machine automatic operation system with the aim of reducing the labor involved in these works.

Summary

This technology mainly consists of a planning support system that creates a shield tunnel excavation plan and an operation support system that supports the operation of the shield machine. (Figure 1.)
The planning support system is equipped with a segment planning function that plans the arrangement of straight segments and tapered segments, and a function that determines the target alignment of shield machine excavation by considering the positional relationship between the shield machine and the segment ring. Furthermore, it has the function to create "excavation instructions" based on these results and hand it over to the operator or the operation support system.
The operation support system can instantly judge a huge amount of excavation information such as the current attitude and direction of the shield machine and select the appropriate jacks using AI that has learned how skilled operators operate the shield machine. (Figure 2.)

Achievements

These systems have been repeatedly tested and improved at a total of six sites, and we have now confirmed that highly accurate driving is possible. (Figure 3.)

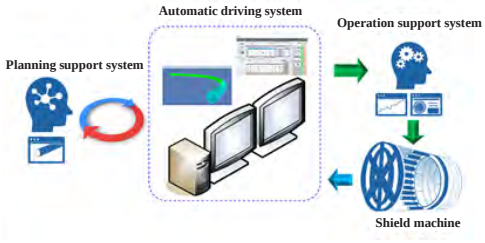

Fig. 1 Outline of automatic driving system

Fig. 2 User interface screen of automatic operation

Fig. 3 On-site verification of automatic operation