21

FSC-100, machine drilling of an extremely long pilot hole

Hiroshi OSHIMA ▶ Supreme Technical Advisor, Kokusai Kougyo Co., Ltd.
Hiroyuki HAGIHARA ▶ Technical Manager, Social Infrastructure Dep., Kokusai Kougyo Co., Ltd.
Satoshi IKIMORI ▶ Deputy General Manager, Engineering Div., Koken Boring Machine Co., Ltd.
Kazuma SUZUKI ▶ Manager, Chuo Shinkansen Promotion Division, Central Japan Railway Company

1. Summary of the technology

FSC-100 is a boring machine that can rapidly drill extremely long exploratory holes of 1000 m or longer without coring, controlling the drilling direction ahead of the face. This technique enables us to acquire geotechnical conditions in the tunnel and groundwater conditions required for long-term planning of the construction. Also, the construction feasibility can be assessed adequately. Furthermore, large amounts of pressurized groundwater can be extracted beforehand which makes construction easier.

Features of FSC-100
① Able to drill holes of 20 to 30 cm in diameter, at a maximum speed of 100 m per day, even under circumstances where a large amount of pressurized water inflow occurs.
② Drilling direction can be controlled (within ± 5 m per 1000 m)
③ Compact design advantageous for installation in the tunnel.
④ Data acquired during drilling can be converted into geotechnical information beneficial for tunneling.
FSC-100 system consists of a drilling machine, downhole motor, drilling direction measurement unit, drilling tools and high pressure pump to drive the downhole motor as shown in Figs. 1 and 2.

2. Achievements so far with FSC-100

This system has been employed for more than 10 construction projects of long hole drilling. We have improved the machine and enhanced engineering skills for the overall technique of drilling and data analysis.
Main results and data are summarized below:
- Maximum excavation length: 1200 m, average: about 700 m
- Average drilling speed is from 18 to 37 m/day.
- Tunnel alignment can be controlled within 5 m in the target direction.

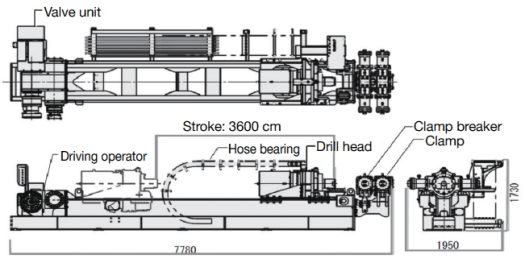

Fig.1 Schematic views of FSC-100

Fig.2 Construction with the FSC-100