Diverging the Slurry Shield Machine from The Narrow Shield Yard

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1. Overview

Nagoya City has implemented the "Emergency Rainwater Drainage Project" to improve the level of facilities to deal with rainfall of 60 mm/h in principle, in areas where urban functions are packed and where severe flood damage concentrated at the time of Tokai Heavy Rain in 2000 and the torrential rain at the end of August, 2008.
As a part of the project, the construction of the bypass pipe (inner diameter 1,500 mm, approx. 850 meters long, overburden 4.0 m to 6.5 m) was carried out in the Hojin, Minato Ward, located in the southwest of Nagoya City. (Fig. 1. Construction Outline)
For the tunnel excavation, the mini-shield tunneling method (outside excavation diameter: 1,950 mm) with small excavation cross-section was adopted because it was a field-proven method for the construction of sharp curved line up to 10 R, and the separation distance from the existing sewer pipe could not be secured with the ordinary shield tunneling method (outside excavation diameter: 2,280 mm).
This paper introduces the technical contrivance of the design and construction of the mini- shield method used beneath the highway in the urban area.

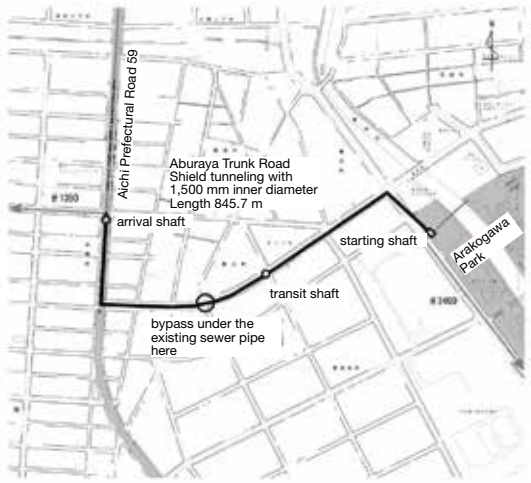

Fig. 1 Overview of Construction

2. Design

For the bypass pipe, the route under the existing sewer pipe (θ 1,100 mm) was selected, because there will be no influence on underground facilities of other enterprises and the sharp curved construction for changing the occupied positions were unnecessary.
The separation from the existing sewer pipe (θ 1,100 mm) was only about 20 cm, but to reduce any influences on the existing pipe, it was protected by the chemical grouting method.

3. Construction

A shield machine equipped with a gyrocompass and a level detector was used, since the distance from the existing sewer pipe is small and the construction with high accuracy was required due to the presence of many underground facilities. As a result, the maximum deviation from the designed value at the center line was + 20 mm, which was within the range of ± 25 mm, the standard value of the authorities.

In advancing the construction, CIM data was created on underground facilities in the whole construction section. (Fig. 2 CIM Data)
The CIM data, which visualized the positions of the underground facilities in 3D, enabled all workers to grasp the positions and to confirm the separation between the shield machine and the existing sewage pipe and the underground facilities.
The chemical grouting as an auxiliary method for soil improvement was conducted without affecting the underground facilities, since the confirmation of drilling positions and separation was made easy with the data.

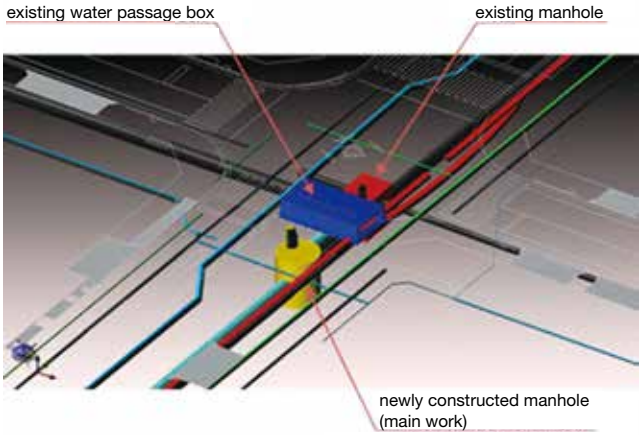

Fig. 2 CIM Data (Example)