Diverse Tunnelling in Urban Areas

— Fukuoka City, Nanakuma Subway Line Extension Project (Tenjin Minami to Hakata) —

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1. Intro

The length of Fukuoka city Nanakuma Subway line extension project is 1.4km. The civil engineering work began in 2013, and after about nine years of construction including track works, station construction, and utility works, the line was opened on March 27, 2023.
For the extension section, cut-and-cover method was used for the intermediate station, shield method mainly for between the stations, and NATM (New Austrian Tunnelling) method and underpinning method for the section terminus. This paper describes the characteristic construction methods and sections at the end of the section.

2. Mountain Tunneling Method (NATM)

For the 0.2 km section between the stations to Hakata Station, the terminus of the project, an urban NATM was adopted because the required space changes to install a scissors crossing and a base rock layer exists in relatively shallow position.
In determining the cross section, a double-track tunnel was chosen considering the track alignment, construction and economy, and the space for shield to turn. The station junction side was constructed as a triple cross-section that gradually changes. The cross section of the double track is a compound circle.

Fig. 1 NATM Tunneling

3. Underpinning Method

The Hakata Station, the terminus of this extension project, was to be constructed under the existing underground structure to connect with Airport Subway Line. For this reason, the under-pinning method was adopted, in which construction is executed while the existing underground structure is temporarily supported by piles. The structures to be temporarily supported were the underground roadways connected to the JR underground mall parking, the JR underground mall, and the track section of Airport Line. A broad range of structural forms and managers were involved, and the project was extensive as the total supported area was bout 2,700㎡ , with about 290 piles, and the duration was about 5 years.

Fig. 2 Underpinning Method

4. Conclusion

Although the extension length was not very long as a subway construction project, it became a very characteristic subway section in the city as various methods including the shield method, NATM method, underpinning method are used for the underground of the central area of Fukuoka city.

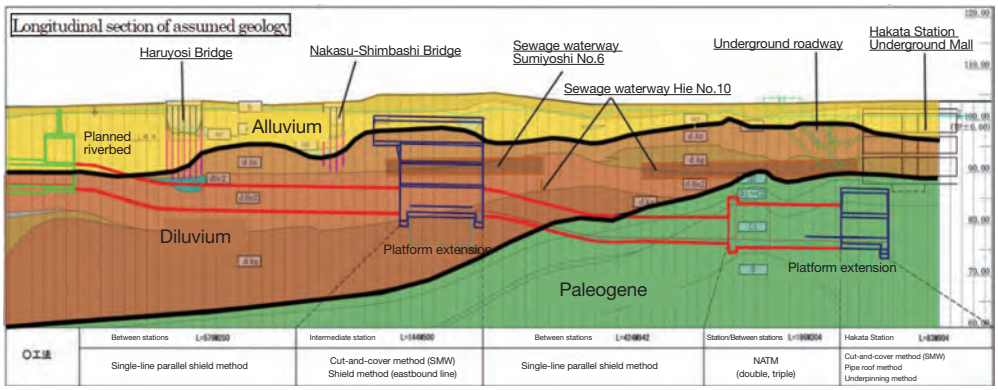

Fig. 3 Longitudinal section of assumed geology