Improvement Project for Kiba Station on the Tozai Subway Line

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1. Summary of the project

Currently, Tokyo Metro is operating 9 lines in the central area of Tokyo, totaling approximately 200 kilometers of subway. This project is one example of subway remodeling, a project which is now in progress at Kiba Station on the Tozai Line to improve services for passengers.
The Tozai Line is a subway route crossing the metropolitan area of Tokyo from east to west. Since opening, the areas along the line have developed at a fast pace, and passengers using this line have increased accordingly. But with chronic delays in train operation, there was a growing danger that passengers might fall from the platform onto railways. For this reason, committing to improvement of the safety level on the Tozai Line , and as part of this effort, worked out a plan to improve Kiba Station.

2. Overview of Kiba Station and problems for immediate solution

Kiba Station is the first station which was constructed in a shield tunnel in Japan (inner diameter 7,240 mm, outer diameter 7,740 mm, segment width 800 mm, using ductile segments). The station has a total length of 220 meters, bored in a thick, soft diluvial clay formation 30 meters in depth. At both ends of the station's length, there is a shaft which was constructed by sinking caissons below the road.
Currently, Kiba Station has two problems. First, flow lines of passengers are complicated and intertwined because the platform is narrow and elevators and escalators are provided only where shafts exist, and secondly, since passengers currently tend to concentrate at both ends of the platform, waiting queues of passengers have difficulty approaching the train they are going to ride.
For these reasons, planning to widen the platform and provide additional elevators and escalators (Fig. 1) in order to provide a safer and less congested environment for passengers in the area between the platform and the ticket gate.

3. Construction plan

Kiba Station is a station built in a shield tunnel. The unique features of this project which was the first of its type in the world, included a process of creating a new cavity to allow the platform to be widened by removing the existing shield tunnel walls, without suspending operation of trains.
For this purpose, the process is divided into two steps; the first is to build a box culvert with three layers and three spans in a new space which is created by demolishing and widening the tunnel over an 80 m section from the east, while keeping trains running, and the second to remove the segments (Figs. 2 and 3). Then in order to provide sufficient transport capacity, two escalators are installed inside the box culvert.
Considering the construction site was in extremely soft ground around Kiba Station, the authors first constructed underground girders to improve the in-situ ground, and used an inverted lining method, using the main structure of tunnel as a key support to build an underground cast-in-site diaphragm wall.
The ground underneath the existing segments, first underpinned for safety with the support of an already improved ground structure, was to be excavated into trenches.
The project is currently underway. Making full use of the technology available so far, we have done our best to direct this project successfully as a high quality innovative effort, in a manner to meet the needs of the times.

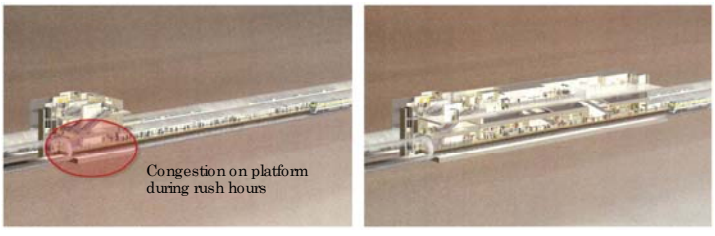

Fig. 1 Current status and improved status

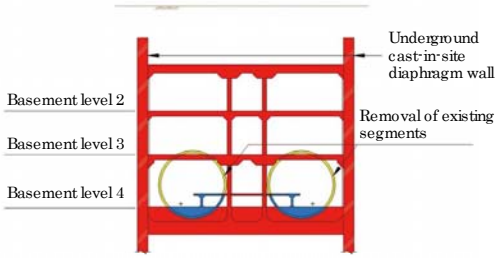

Fig. 2 Sectional drawing of plan

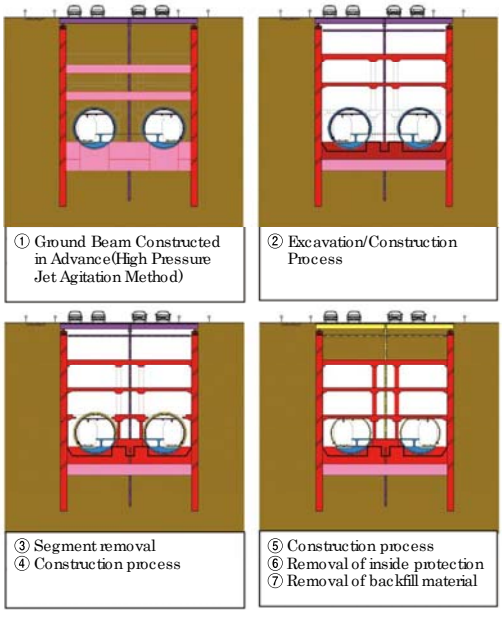

Fig. 3 Cross section