

Construction of an underground passage with small cross-section under railroad tracks by covering with steel plates



Satoshi HONDA ▶ Assistant Manager, Structural Engineering Center, East Japan Railway Company

Motoaki KURISU ▶ Manager, Underground & Foundation Technology Department, Civil Engineering Division, Tekken Corporation

This project built a pedestrian underground passage after the removal of the Yabe Grade Crossing at Yabe Station on the JR Yokohama Line. The underground passage directly below the JR Yokohama Line is a single-level single-span box culvert with the following dimensions: width 4.8 m, height 3.8 m, and length 14.5 m. The ground in the construction area is composed of a highly self-standing formation of cohesive soil with an N-value of 4 to 5, and the groundwater level is beneath the level of the planned section (Fig. 1). Construction methods were compared and the COMPASS (COMPact Support Structure) method, an outstanding method in terms of time required for construction, cost and safety, was selected as the construction method for this project.

(1) Construction method overview

The COMPASS method is a non-open-cut method for building small cross-section structures under railway tracks and roads. In this method, guide pipes that contain earth-cutting wires are installed. Next, the ground in the outer periphery of the planned structure is cut with the wires, and then steel plates are inserted immediately. After that, the ground enclosed with steel plates is excavated by sequentially connecting precast boxes behind a specific cutting unit to form a box culvert.

In the COMPASS method, the ground is cut with wires and the supporting steel plates are inserted simultaneously, so the construction is possible in all kinds of soil, has little impact on the ground surface, and the excavation of the ground enclosed within the steel plates poses almost no risk of ground subsidence.

(2) Construction results

This project was constructed with shallow earth cover (approximately 1.2 m) directly under the JR Yokohama Line, which is located in a metropolitan area, so risk control measures to deal with railroad track deformation were considered for each construction step. Operations that were likely to affect train operation were scheduled at night. During construction, displacement meters were installed at all times in order to monitor the effect of construction on the railroad tracks for continuous track measurement.

No vertical displacement was recorded due to construction exceeding a control value of 7 mm (40% of the value that requires immediate termination of construction) during the insertion of upper floor slab protection steel plates located directly under the railroad tracks. The vertical displacement during the precast box excavation was negligible as seen during the insertion of protection steel plates for the upper floor slab.

As a result of employing the COMPASS method and rigorous risk control measures, no deformations likely to affect train scheduling occurred throughout the construction period, and the project was successfully completed.



Photo 1 Insertion of protective steel plates



Photo 2 Completion of construction of precast box

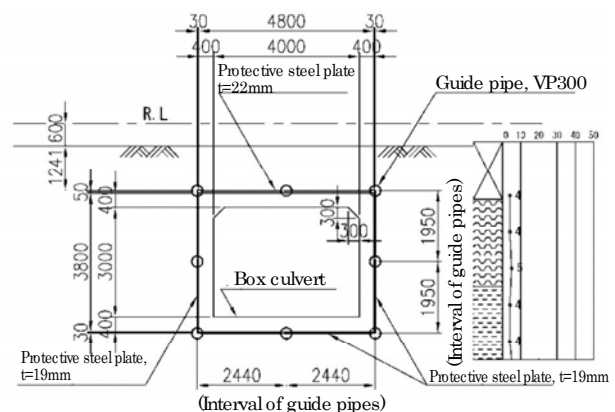


Fig. 1 Cross-section diagram of the structure