

# The work of large-scale cross-section expansion of underground station constructed with pneumatic caisson method

— Minami-sunamachi Station, Tokyo Metro Tozai Line —

Keisuke OKANOYA ▶ Staff, Tokyo Metro Co., Ltd.



## Introduction

In order to address the congestion on platforms and train delays during rush hours on the Tokyo Metro Tozai Line, underground stations with one island platform and two tracks will be upgraded to two platforms and three tracks, and elevating facilities and ticket gates will be relocated for smoother passenger flow. The total length of the project is about 430m, and the new structure will be constructed by excavating to a depth of 14m using the open-cut method (Fig. 1).



Fig. 1 Current and planned view

## Construction challenges

Minami-sunamachi Station, which was a canal at the time of construction, was built using the caisson method, and the surrounding ground was extremely soft (N value = 0~1). Therefore, measures to control the displacement of the surrounding ground and existing structures (canals) are required for station improvement.

## Construction outline

The station improvement work was carried out in the following manner, with underground diaphragm walls and ground improvement as the main measures against the extremely soft ground (Fig.2).

- ① Prior to the construction of the new structure, the underground obstacles in the excavated section were removed and the earth retaining wall and intermediate piles were constructed in advance. The retaining wall is an underground RC diaphragm wall that can be used as the main body. The leading element (width: 1.9m, depth: 44m) and the trailing element (width: 6m, depth: 17m) are arranged in a comb structure and connected (Photo 1).
- ② The excavation began after improving the ground to prevent post-excavation heaving. The thickness of the ground improvement was 2m, and the improvement ratio was 50% in the longitudinal direction of the railroad line (Photo 2).
- ③ After excavation to the specified depth was completed, the new structure was constructed and the existing structure that interfered with the construction limit was removed.
- ④ The tracks were switched, and a two-sided, three-track system was achieved.



Photo 1 Underground RC diaphragm wall construction conditions



Photo 2 Ground improvement construction from within the station

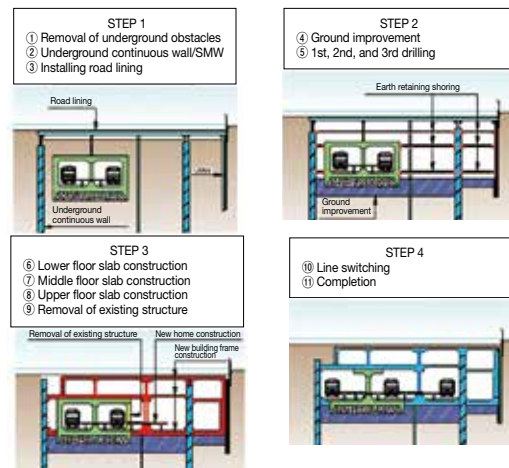


Fig. 2 Construction steps

## Construction results

During the construction, measurement and control of the surrounding ground and existing structures were carried out, and there was no impact on the surrounding ground during the construction of the underground RC diaphragm wall. The ground improvement also had minimal impact on the surrounding ground, but the existing structure showed a tendency to settle by 0.1~0.2mm/day when one machine was installed, and by 0.4~0.5mm/day when two machines were installed simultaneously. This construction work was able to proceed without interfering with the business line by taking measures against the extremely soft ground.