

# Overview of the Nihonbashi Underground Tunnel Project of the Metropolitan Expressway

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## 1. Introduction

The structure of the Metropolitan Expressway over the Nihombashi River was built before the 1964 Tokyo Olympics and more than half a century has passed since its opening. The severe use of the Nihonbashi section of the expressway, with approximately 100,000 vehicles per day, has resulted in severe damage to the structure, necessitating drastic countermeasures. Therefore, a large-scale renewal project was prepared to replace the existing viaduct with a tunnel structure. In this project, the tunnel is to be constructed underground under many constraints, such as the fact that the construction is linked to several redevelopment projects in the surrounding area. The subsequent removal of the existing viaduct will improve the appearance of the Nihonbashi area and enhance the attractiveness of the area (Fig. 1). The underground route is scheduled to open in 2035 and the viaduct to be removed in 2040.

## 2. Outline of the structure of the Nihonbashi Underground Tunnel

In order to minimize the impact on the ground surface, the structure was selected based on the shield tunneling method, which is non-open-cut and has a good track record as a construction method for road tunnels. The section connecting to the existing Yaesu Tunnel is to be constructed using an open-cut tunnel structure (Fig. 2).

The launching shaft for the shield tunnel is to be installed near the Edobashi Bridge, which was the only place where the backyard necessary for construction could be secured, and the tunnel will be launched with a small earth cover. In order to reduce costs, the shield machine will be rotated after reaching the shaft near the Ichikokubashi Bridge, and the same shield machine will be used to excavate to the launching shaft. Evacuation passageways in the tunnel will be installed under the slab from an economic point of view. Other equipment spaces, including smoke ducts and inspection passages, will also be installed under the floor slab. The shield tunnel has a small earth cover, steep curves and steep gradients, and many redevelopment buildings are constructed right above the tunnels. Composite segments have been adopted for the lining of all lines, taking into account the overburden load of up to  $200 \text{ kN/m}^2$ , the small earth cover, the seismic effect and the risk of damage during construction due to the curve shape. No secondary lining will be installed to reduce construction costs by reducing the cross section. While ground improvement in the surrounding area and the use of weight-added members are possible measures to prevent lifting, in consideration of the project process, the segments made of fire-resistant heavy concrete have been adopted to provide the necessary weight. It is required that the water level is not raised above that of the existing river channel due to in-river works on the Nihonbashi River. As the surrounding area is a redevelopment project site and land acquisitions are difficult, measures to prevent water level rise by widening the river channel can only be implemented to a limited extent.

Therefore, the construction of an open-cut tunnel right under the river is planned to adopt a riverbed protection structure that separates the space where the tunnel is constructed from the river (Fig. 3). Boards will be installed in the river to replace the riverbed and prevent the river water from entering the tunnel construction space. This avoids the reduction in a cross-sectional area of the river due to river closures, etc. A double watertight structure will be installed at the joints between the boards and at the edges of them to ensure reliable watertightness.



Fig. 1 Images of the area around the Nihonbashi Bridge after the viaduct has been removed

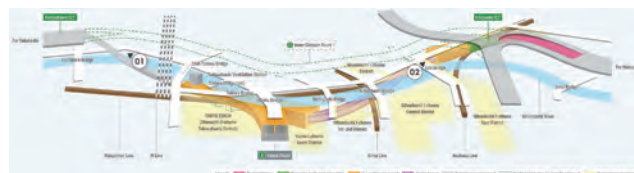


Fig. 2 Diagram of the Nihonbashi underground route

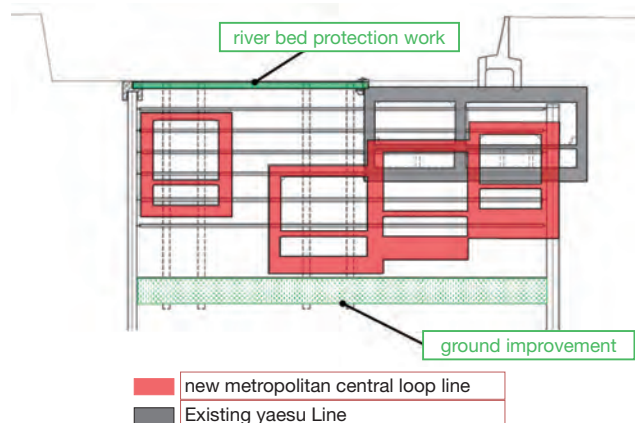


Fig. 3 Schematic diagram of construction right under the river