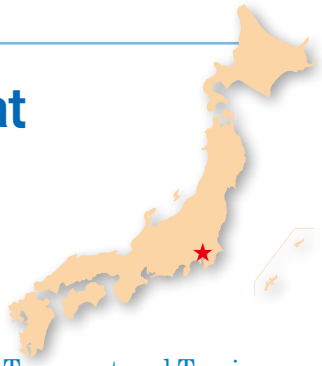
Immersed tunnel in the Tokyo coastal area that shortened the construction period Uminomori Tunnel in Tokyo Port



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1. Project Overview

The Tokyo Port Uminomori Tunnel, which has been in service since June 2020, is located in the coastal area of Tokyo. The port of Tokyo is an important logistics hub that supports the lives and industrial activities of eastern Japan as well as the Tokyo Metropolitan Area. In order to ensure such smooth logistics at the Tokyo Port, this tunnel was constructed to eliminate the chronic traffic congestion on the surrounding main route. Of the 2.5km long tunnel, a 931m undersea tunnel that crosses the route was constructed by the immersed tunnel method. The immersed tunnel consists of seven submerged boxes with a length of 134m, a width of 27.8m, and a height of 8.35m. Table 1 shows the construction companies of the tunnel element.

2. The Biggest Challenge in Tunnel Construction

Looking at the results of the immersed construction method in Japan, the construction period of a submerged tunnel of the same scale as the Uminomori Tunnel is usually 8 to 10 years. The Uminomori Tunnel, the 29th case under the Japanese immersed construction method, was launched after the IOC General Assembly in September 2013, which decided Tokyo as the site for 2020 Olympic and Paralympic Games. Since the competition venues and the Olympic Village of the Tokyo 2020 Games were concentrated in the waterfront area of Tokyo, the tunnel was expected a great role as a transportation route for the people involved in the Games.

3. Ingenuities Implemented by the immersed Construction Method

In order to significantly shorten the construction period, the ingenuities that were implemented by the immersed tunnel method are shown below. First, from the viewpoint of domestic construction results and securing routes for general vessels, it had been initially planned as eight tunnel elements for the undersea tunnel. However, as a result of additional reviews it was modified to seven elements with a length of 134 m, which is the longest in Japan, to shorten the process by reducing the number of immersion elements. Next, for the structure of the tunnel elements, we adopted the full sandwich type steel-concrete composite structure that is often seen in recent immersed tunnels in Japan, where there are many earthquakes.

The steel shells were divided and manufactured at more than 10 factories nationwide, and then assembled at two shipyards in Tokyo Bay by sea transportation (Photo 1). The completed steel shell was moored on the quiet quay of Tokyo Bay, and then high-fluidity concrete was placed inside the steel shell. The completed tunnel element had been immersed on the seabed of Tokyo Port and safely stored until it was sunk into the seabed. Thanks to this manufacturing method, a huge immersion box was smoothly supplied to the waterfront area of Tokyo.

These seven submerged boxes were sunk in succession in a short period of 11 months (Photo 2). The process was shortened by another 3 months compared to the conventional method thanks to the key element method which omits the final joint as the fourth case in Japan (Fig. 1).

Table.1 Constituent Company of the joint venture

Tunnel element No.	Constituent company of the joint venture that was constructed
1	KAJIMA CORPORATION TOA CORPORATION Aomi Construction Co., Ltd.
2, 3	TOA CORPORATION KAJIMA CORPORATION WAKACIKU CONSTRUCTION CO.,LTD.
4, 5, 6	PENTA-OCEAN CONSTRUCTION CO.,LTD. TOYO CONSTRUCTION CO.,LTD. NIPPON STEEL ENGINEERING CO., LTD.
7	Taisei Corporation PENTA-OCEAN CONSTRUCTION CO.,LTD. DAIHO CORPORATION

Photo 1 Steel shell of Tunnel element

Photo 2 Immersion status

Fig. 1 Schematic diagram of the key element construction method