Domestic Civil Engineering

No. 7 Caisson

Maishima

Yumeshima

Sakishima

Port of Osaka Yumeshima Tunnel

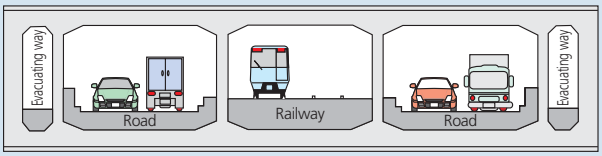
Yumeshima Submerged Tunnel Project, Port of Osaka / Osaka

To promote the construction of a new city core for the 21st century "Techno Port Osaka," international material-handling facilities are being developed and constructed at the Port of Osaka area, such as Yumeshima and Maishima.

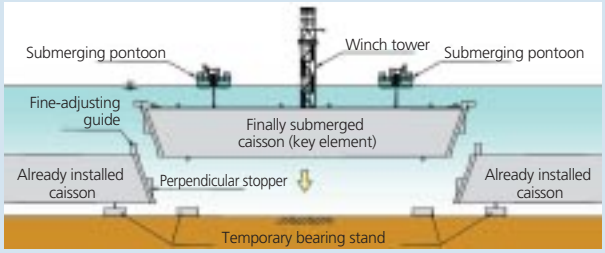
The Port of Osaka Yumeshima Tunnel was planned to be a submerged type that would not hinder vessel passage after it was completed and would save construction costs. The submerged tunnel method is to prepare on land gigantic submergible caissons (made of steel frames and reinforced concrete, about 100m long x 35.4m wide x 8.6m high), submerge them at the bottom of the sea, and connect them there with each other to form a tunnel. Among the 8 caissons submerged, Penta-Ocean Construction Co., Ltd. constructed Caisson No. 2 and installed Caissons No. 7 (finally submerged one) and 8.

Among submerged tunnel-installing processes, that for installing a finally submerged caisson is said to be most difficult because it needs accurate installation along the seabed and full waterproofing work. Among the submergible caisson-installing technologies the Company had developed, the key element method (patented for a final coupling method) was adopted in the installation of the finally submerged one (Caisson No. 7).

■ Cross section of the submerged No. 7 caisson



■ Key element method



In the key element method, water located in connected portions is exhausted after a submergible caisson of inverted trapezoidal shape whose ends are inclined is installed between already submerged ones. By utilizing large downward water pressure thus generated, the finally submerged caisson is further pressed downward until it compresses and comes in close contact with stopper rubbers provided at the end of connecting portions, thereby effectively stopping water invasion.

Land formation work, Sangawa East Waterfront Area / Ehime

Construction period: March 2004 to March 2008
Client: Shikoku Chuo City, Ehime Prefecture
Construction summary:

- Dredging and land-filling work: 898,214m³
- Seepage control work by driving sheet piles: 4,074 sheets
- Seepage control work for vertical walls: 8,495m³
- Seepage control work for slopes: 68,791m²
- Seepage control work for bottoms: 90,493m³
- Clay guard work: 90,000 m³

Shikoku Chuo City is an industrial city where industries with local tradition, such as paper-making and processing ones, flourish. This work was composed of the reclamation of publicly owned water body for separating dwelling and industrial zones, creating a water park with green space, and preparing land for building storage facilities for paper-making industry and a terminal treatment plant of industrial waste.

The bottom of the work site was finished with the **Clay Guard Method** that is one of Penta-Ocean's brand technologies.

East Nagoya/Osaka Expressway, Arimatsu Section / Aichi

Construction period: June 2005 to December 2007
Client: Central Nippon Expressway Co., Ltd., Nagoya Branch
Construction summary:

- Trench-excavating work, 640m long
- Trench section: 415m-long trench and 65m-long box structure
- Transition section: Wall-supporting work, 160m long
- Working volume: Reinforcement placing, 8,325 tons Concrete placing, 72,414 m³

Among a total of approx. 66 km of Nagoya Beltway No. 2 passing through the southeastern part of Nagoya City, Penta-Ocean accepted the construction of a total of 640m of trench structure, including Arimatsu IC directly connected to National Road No. 1. The Company completed the work without any accidents and disasters while paying heed to influences to adjacent structures and taking care of maximum wall thickness of 2m, mass concrete countermeasures for maximum concrete placement of 1,300m³ a day, and quality control.

Tunnel construction at Ikebukuro South IC, Metropolitan Expressway / Tokyo

Construction period: March 2002 to November 2007
Client: Metropolitan Expressway Co., Ltd.
Construction summary:

- Total length constructed: 170m long
- Sheathing work: A full set of sheathing work
- Ground improvement work: A full set of ground-improving work
- Excavation: 40,000m³
- Support to sheathing: 1,800 t

This is a large sealed work, 12m in diameter, embedded under the Central Beltway Shinjuku Line, Metropolitan Expressway. It adopted a sealed portion-cutting method rarely seen in the world, for building the IC.