



Design Review of Trans-Tokyo Bay Highway

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Summary

The Trans-Tokyo Bay Highway (TTBH), known as Aqua-Line, is a 15-km toll highway that traverses the central portion of Tokyo Bay from east to west connecting Kawasaki with Kisarazu (see Fig.1). The Tokyo Major Metropolitan Area consisting of Tokyo, Yokohama, Kawasaki, Chiba, Kisarazu and other large cities is located along the coast.

TTBH was completed in 1997 based on the concepts of “harmony”, “symbol” and “quality”. It is a marine road traversing Tokyo Bay, consisting of bridges, tunnels and man-made islands (see Fig.2). As the sea and air gateway to Japan’s capital city of Tokyo, TTBH is an invaluable cultural asset for the 21st century, and should have a public presence and sense of permanency. For this reason, an Aesthetic Study Committee was organized from among scholar, persons of learning and experience and engineers of the related parties to consider the visual designs of the various items, and every effort was made to create a new landscape harmonizing with the natural environment.

The bridge portion of TTBH (with a total length of 4.4 km) consists of five continuous girders, of which the ivory white box girders and the oyster grey piers combined to form smooth lines (see Fig.3). The Y-typed steel piers at the main local channels with a height of 50 m from the seabed were designed for the clearance of vessels and for large earthquakes. These parts protected with multiple coats of paint for the portion that is exposed to the air, cathodic protection for the portion beneath the sea and titanium clad plates for the splash zone. The intervals of their spans were fixed in arithmetical progression according to their heights so as to have a pleasant appearance. An automatic gondola has been installed to maintain the entire length.

The tunnels (see Fig.4) with a length of 10 km require three ventilation facilities. The name of the middle one (see Fig.5) located on the left side of the main international channel, is Kawasaki man-made island or Kaze-no-toh (The Tower of Wind). The tower also needs to fulfil the role of navigational aid for ships besides providing ventilation for tunnel. It has two slanted plump towers, painted in an alternative marine blue colour, with heights of 90 m and 75 m designed in the golden section. The wind passing between the two towers increases its velocity and works to suck the contaminated air from the underground tunnel by Pitot phenomena.

The Kisarazu man-made island with a length of 600 m and 100 m wide for ventilation, is a junction between the tunnel and the bridge (see Fig.6). It is designed as a luxury liner, including a service area with a parking area, TTBH museum various restaurants and so on. Visiting the Kisarazu man-made island to enjoy the scenery and dining is possible only by own channelization (shuttle) from both directions of the roadway using sophisticated ramps.

Another ventilation tower (see Fig.7) at the starting side of Ukishima is covered with an elegant pyramid of steel pipes for landscaping because the background is wide area of large scaled chemical industries with vertical and lateral pipes and spheres. However, the top of the pyramid has been cut off because of airspace restriction due to the newly constructed runway at the Tokyo-Haneda International Airport which is very close to Ukishima.

To achieve these designs together with great artists many sophisticated technologies were applied. During the construction of TTBH, various measures were taken to reserve the environment and minimize the impact of the project on Tokyo Bay, which has an abundance of fisheries. Furthermore, given the congested shipping conditions, various safety measures for navigating the waters have



been proactively promoted, resulting in a significant decrease in number of surface accidents.

Keywords: marine road, aesthetic design, bridge over sea, shield tunnel, man-made island, anti-corrosion, inspection gondola, ventilation tower, environmental reservation, navigation safety

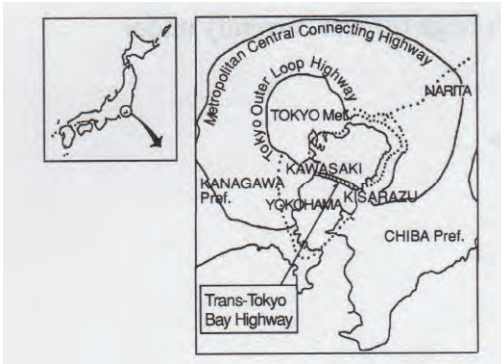


Fig.1 The location of TTBH and the related connecting highways and cities

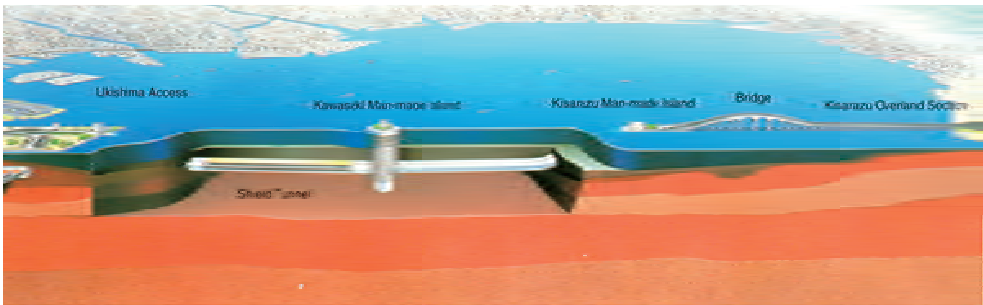


Fig.2 General views of the Trans-Tokyo Bay Highway



Fig.3 Continuous girder & Y-typed steel piers

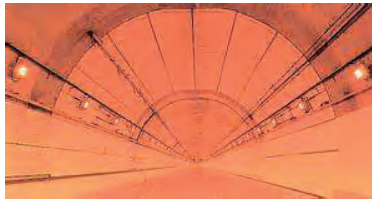


Fig.4 Inside of shield tunnel



Fig.5 Kawasaki Ventilation towers



Fig.6 Kisarazu Man-made island with ventilation tower and service area



Fig.7 Ukishima Ventilation tower covered with pyramid of pipes