

**Zeitschrift:** IABSE reports = Rapports AIPC = IVBH Berichte  
**Band:** 83 (1999)

**Artikel:** Durable watertight lining system for Tokyo Wan Aqua-line shield tunnel  
**Autor:** Funazaki, Tsuneyoshi / Sugie, Kiyoshi  
**DOI:** <https://doi.org/10.5169/seals-62835>

### **Nutzungsbedingungen**

Die ETH-Bibliothek ist die Anbieterin der digitalisierten Zeitschriften auf E-Periodica. Sie besitzt keine Urheberrechte an den Zeitschriften und ist nicht verantwortlich für deren Inhalte. Die Rechte liegen in der Regel bei den Herausgebern beziehungsweise den externen Rechteinhabern. Das Veröffentlichen von Bildern in Print- und Online-Publikationen sowie auf Social Media-Kanälen oder Webseiten ist nur mit vorheriger Genehmigung der Rechteinhaber erlaubt. [Mehr erfahren](#)

### **Conditions d'utilisation**

L'ETH Library est le fournisseur des revues numérisées. Elle ne détient aucun droit d'auteur sur les revues et n'est pas responsable de leur contenu. En règle générale, les droits sont détenus par les éditeurs ou les détenteurs de droits externes. La reproduction d'images dans des publications imprimées ou en ligne ainsi que sur des canaux de médias sociaux ou des sites web n'est autorisée qu'avec l'accord préalable des détenteurs des droits. [En savoir plus](#)

### **Terms of use**

The ETH Library is the provider of the digitised journals. It does not own any copyrights to the journals and is not responsible for their content. The rights usually lie with the publishers or the external rights holders. Publishing images in print and online publications, as well as on social media channels or websites, is only permitted with the prior consent of the rights holders. [Find out more](#)

**Download PDF:** 01.04.2026

**ETH-Bibliothek Zürich, E-Periodica, <https://www.e-periodica.ch>**



## Durable Watertight Lining System for Tokyo Wan Aqua-Line Shield Tunnel

### Tsuneyoshi FUNAZAKI

Executive Director  
Highway Corp.  
Tokyo, Japan

Tsuneyoshi Funazaki, born 1943,  
received his civil engineering degree  
from the Univ. of Tokyo



### Kiyoshi SUGIE

Project Manager  
Tobishima Corporation  
Tokyo, Japan

Kiyoshi Sugie, born 1946,  
received his civil engineering  
degree from the Nihon Univ.



### Abstract

Tokyo Wan Aqua-Line, a dual highway with two lanes in each direction, was constructed across Tokyo Bay which sits on an active earthquake area. Its total length is 15.1 km, of which 9.4 km is for the tunnel section, 2x0.2 km for the man-made islands, 4.4 km for the bridge and 0.9 km for the land access.

The tunnel section, consisting of two parallel tunnels, was driven through very soft ground 9.4 m to 18 m below the seabed under 0.6-MPa water pressure. Eight world's largest slurry shield machines with a diameter of 14.14 m were used for boring. To shorten the construction period, the shield machines were advanced from the vertical shafts both at the land area and the man-made islands. Underground shield machine docking was carried out below the seabed under high water pressure.

To achieve durability and watertightness of tunnel linings under such a severe condition, special considerations were given to various items from mix proportion of segment concrete to membrane waterproofing.

The authors will present these considerations including the following:

- 1) Admixture for segment concrete  
Blast-furnace slag powder was mixed to give concrete a lower coefficient of permeability, thereby increasing its anti-corrosion.
- 2) Backfill grout holes  
The number of holes was limited to four per ring. And to give watertightness, a butyl-based, hydro-expansive rubber seal was set around the grout pipe.
- 3) Watertight gasket  
A hydro-expansive seal, which would swell when it got wet, was set along each liner segment.
- 4) Steel materials  
-The covering of iron bar for the segment was set at 5 cm.  
-A semi-permanent anti-rust coating was applied to the segment bolts.
- 5) Shield machine docking below the seabed  
Skin plates of the machines were connected to one another by welding. Some flexibility was provided in the joint section.
- 6) Watertight membrane  
A watertight membrane was laid between the primary and secondary liners to lead unexpected water leak down for drainage.

Leere Seite  
Blank page  
Page vide