From Edo to AI: Safeguarding Tokyo's Waterfront Against the Sea

Tokyo's waterfront has always balanced growth with risk. Today, advanced technologies such as AI and drones are reinforcing its historic seawalls and floodgates.

For centuries, Tokyo has expanded toward the bay, transforming its waterfront into one of Japan's busiest hubs for trade and daily life. Much of the area now lies at low elevation, and "zero-meter zones" are widespread—districts that would flood at high tide without protective infrastructure. Roughly 1.5 million people now live in these zones, where technology and vigilance work hand in hand to keep the city dry.

The city's vigilance is born of experience. Typhoon Kitty in 1949 and the Ise Bay Typhoon in 1959 left a lasting mark, pushing the Tokyo Metropolitan Government (TMG) to launch large-scale coastal protection projects. After the Great East Japan Earthquake of 2011, tsunami preparedness was added to the agenda. Today, a tidal barrier line of floodgates, embankments, and over 60 kilometers of seawall continues that legacy—physical reminders of the city's constant negotiation with the sea.

Harnessing Digital Transformation

Physical defenses remain essential, but Tokyo is now reinforcing them with digital transformation (DX). The initiative integrates new technologies into coastal protection in four key ways.

First, an online Storm Surge Disaster Prevention Information System publishes tide levels, floodgate status, and live camera footage in real time. Second, a Storm Surge Risk Search Service allows residents to enter an address and instantly see how deep flooding could become in a major storm surge.

Third, an AI-based model processes tide and weather data to forecast water-level changes up to 15 hours ahead, supporting floodgate and pump station operations. Finally, TMG officials are building in-house capacity to use drones for rapid, safe inspection of facilities during disasters.

Tatsumi Floodgate in Tokyo's Koto City, one of 15 protecting the Port of Tokyo, with the patrol boat *Kamome II*, which conducts regular safety checks on the water.

A beyond-visual-line-of-sight flight test is being conducted, with drones inspecting coastal protection facilities over a wide area.

On the Front Line

Tide forecasts once depended on lunar-based tide tables and the on-site experience of TMG officials. Today, digital forecasting systems use real-time data and AI to provide far more precise predictions. For short windows of several hours, accuracy is high, enabling better decisions on when to close gates or activate pumps. While long-term forecasts may still carry a certain margin of error, they now enable more accurate informed decision-making than in the past.

Inside the Storm Surge Management Center in Tatsumi, rows of screens track tide levels and gate positions. Here, the TMG officials interviewed describe how these new tools have changed their work.

Mobile access has also changed daily operations. Where officials once relied on radio updates or workstation terminals, they can now check forecasts in the field by smartphone, ensuring that critical actions are not delayed.

Drones add another dimension, making it possible to assess wide areas quickly and gather information even when it is unsafe for personnel to enter. With safety protocols in place, these inspections give the city both speed and reach in emergency situations.

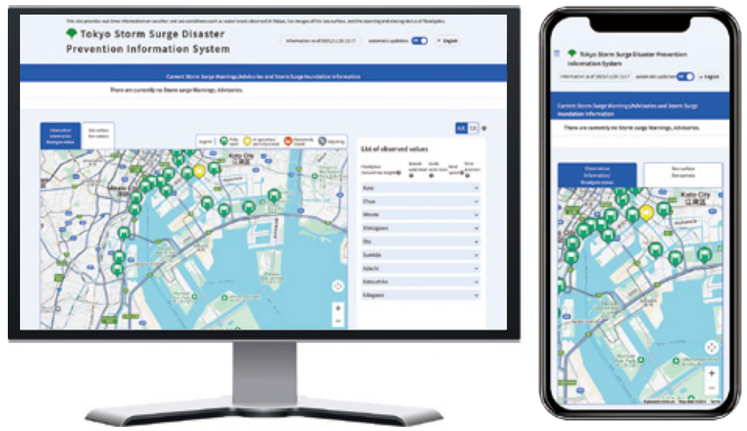
Sharing Knowledge Beyond Tokyo

Tokyo's approach is also being recognized internationally. In 2025, the city's AI water-level prediction system was presented at the Smart City Expo World Congress in Barcelona. Multilingual features have been added to the information systems so that residents and visitors alike can understand risks and prepare. The message is clear: disaster prevention is not only a local issue, but a shared responsibility.

Looking Ahead

Rising seas, stronger typhoons, and seismic risk continue to shape the city's strategy. By combining hard facilities such as seawalls and floodgates with digital tools powered by AI and drones, TMG is reinforcing its ability to withstand whatever comes next.

From Edo-period land reclamation—beginning around 1600, when engineers transformed tidal flats into new districts that expanded the city's reach and laid the groundwork for modern Tokyo—to twenty-first-century prediction models, the bayfront has always demanded innovation. Today's efforts reflect that balance of tradition and technology, ensuring that Tokyo remains both secure and connected to the sea.



The "Tokyo Storm Surge Disaster Prevention Information System" provides real-time information on water levels and sea conditions, helping residents take swift evacuation actions during storm surges.