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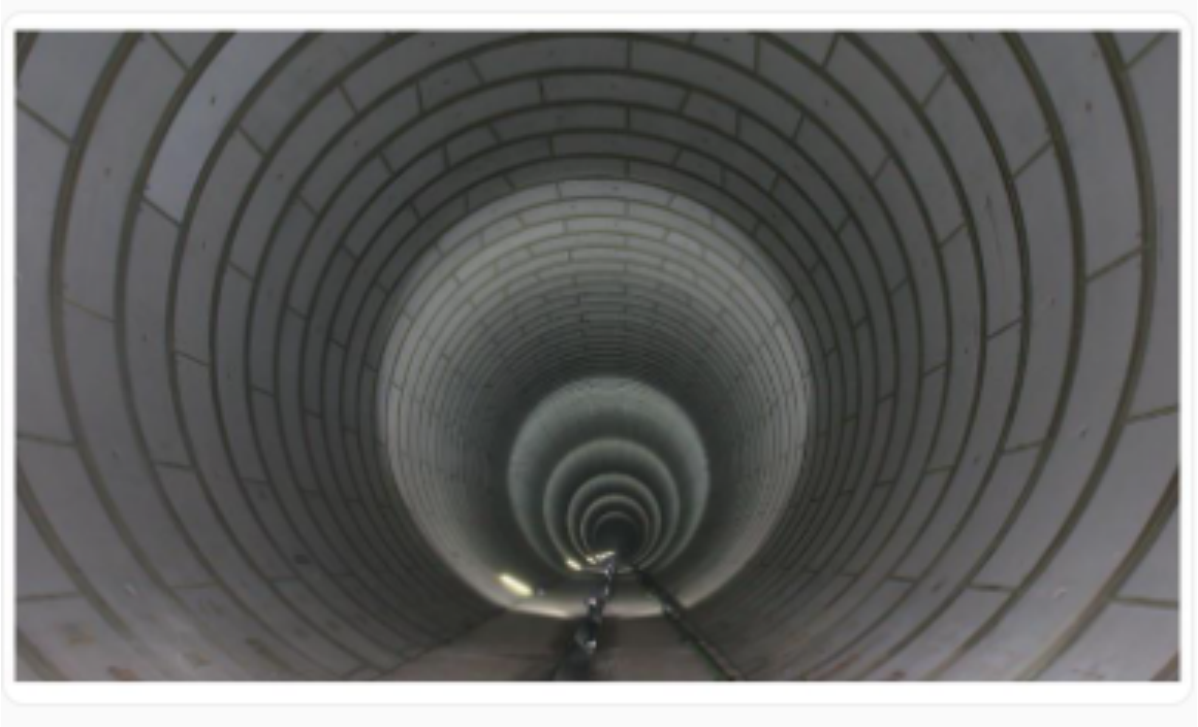
Disaster-Proofing Tokyo

Japan frequently faces natural disasters such as typhoons, heavy rain, and earthquakes, with the Great East Japan Earthquake 14 years ago leaving 15,900 dead and 2,520 missing.

Tokyo of course is no exception, so how does this massive, complex metropolis prepare for the worst?

Discover how the Tokyo Metropolitan Government (TMG) works to ensure the city evolves into a disaster-resistant capital through a series of advanced prevention measures. Tokyo's disaster countermeasures are not only based on robust infrastructure and earthquake-resistant structural technology, but also establishing world-class rescue teams that can respond quickly in times of need.

As a leader in disaster mitigation and prevention, Tokyo's initiatives can serve as a model case for other countries in a world where risks are increasing.



(c) Tokyo Metropolitan Government

Flood Control Reservoirs

In recent years, typhoons and torrential rains have caused large-scale flood damage throughout Japan. In light of this damage, the TMG has promoted the construction of "regulating reservoirs" where high levels of rainwater can be temporarily stored.

The river channel improvements began in the 1960s to cope with heavy rainfall, which is defined as precipitation of 50 millimeters per hour. Improvements to reduce flooding generally involve widening the river from downstream. However, in urban centers with dense housing this takes time, which led to the idea of creating regulating reservoirs to temporarily store the rising water.

As of 2022 there are reservoirs in 28 locations along 12 rivers in Tokyo, including 16 in-ground reservoirs, nine underground vaults, and three underground tunnels. Combined, they can store approximately 2.63 million cubic meters of water, equivalent to about 8,800 25-meter swimming pools.

The early regulating reservoirs were built in-ground, by digging out large parcels of land along a river, such as a vacant lot or park. The water that accumulates drains away on its own, and the reservoir can be used as a biotope—a small geographical region that supports its own unique community of organisms—or for other purposes, such as parks or even rice paddies.

With the progress made in installing regulating reservoirs and other facilities, flood damage has steadily decreased. However, Typhoon Hagibis in 2019 brought record-breaking rainfall that caused seven rivers in Tokyo to overflow and resulted in flood damage, a reminder of the importance of constantly improving the safety infrastructure of the capital.

Original article：https://www.tokyoupdates.metro.tokyo.lg.jp/en/post-660/

Over 100 Years of Earthquake Resistance Technology

Japan has dealt with earthquakes for millennia, but it was the Great Kanto Earthquake of 1923, which struck right at the heart of the Tokyo metropolitan area, causing over 100,000 deaths and inflicting enormous damage to lifelines like the electricity and water supply as well as roadways, that led to big changes in technology and legislation. Since then, Japan has been a world-leader in introducing seismic standards for buildings and significant advances in earthquake-resistant technologies.

These developments are what support Tokyo's high-rise buildings today, such as the capital’s iconic TOKYO SKYTREE®. Built in 2012 using the latest in Japanese building and seismic technology, this skyscraping radio tower can continue transmitting information to affected areas even in the event of a major disaster such as an earthquake.

One element of the tower that plays a major role in its earthquake resistance is the reinforced concrete cylinder in its center, the *shinbashira* or Core Column. Measuring eight meters in diameter and 375 meters tall, the column is fixed to the body of the tower with steel up to 125 meters above ground level. From that point up to the 375-meter point, the shinbashira is not fixed to the tower itself, but is connected by a cylinder with oil inside, called an oil damper. The oil damper acts as a cushion to prevent the core column from hitting the tower body when it shakes.

The steel frame of the tower's main body and core column are designed to sway at different cycles during an earthquake, which damps the swaying of the tower overall, reducing it by up to 50 percent. It was the first time this sort of damping system had ever been implemented.

The tower body has a truss structure consisting of steel pipe parts, vertically, diagonally, and horizontally, joined in a triangular shape. This structure is carefully calculated and designed so it can withstand the shaking caused by earthquakes and typhoons.

Additionally, TOKYO SKYTREE also functions as an important space for disaster preparedness activities and a disaster prevention stockpile, serving as a crisis management hub for Sumida City. The 7,000 tons of water stored in the tower for heating and cooling purposes can be utilized in homes and for firefighting purposes in the event of a major disaster.

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Hyper Rescue Team Protects Tokyo Residents (And Beyond)

The Fire Rescue Task Forces, also known as Hyper Rescue, were created after the Great Hanshin-Awaji Earthquake that hit western Japan in 1995. The quake did not only cause fires

but also other complicated rescue situations, including collapsed buildings and roads, that conventional firefighting forces were not equipped to deal with. It became clear that there was a pressing need for advanced units with specialized knowledge and skills, as well as custom-built heavy machinery and life detectors.

Hyper Rescue (HR) was established the following year. Currently divisions are stationed at five of Tokyo’s 10 fire district headquarters, always ready to respond quickly to large-scale disasters that fall within the jurisdiction of the Tokyo Fire Department.

6HR is one such division, headquartered in Adachi City. This district is surrounded by two major rivers, so water rescue is also part of their duties. Unlike other units they have watercraft systems such as jet skis, urethane boats and advanced lifeboats which can hold 20 people and be used to rescue people in wheelchairs.

The unit is also equipped with highly advanced rescue equipment such as underground sound detectors and electromagnetic life detectors, as well as heavy machinery that typical fire stations do not have. The members are required to hold various qualifications to handle these types of equipment, and they train daily between dispatches, simulating all kinds of disaster situations.

Hyper Rescue units are normally dispatched within the districts where they are stationed. However, in the event of a major disaster they are sometimes dispatched to other prefectures, as members of the Emergency Fire Response Teams. 6HR has been dispatched to deal with disasters such as the Great East Japan Earthquake in 2011, the torrential rain in the Kanto and Tohoku regions in 2015, and the Noto Peninsula Earthquake in 2024.

Some of the members of the unit are also registered as part of the Japan Disaster Relief Team, which is organized by the government and dispatched during major disasters overseas at the request of the affected countries. 6HR members have flown in to help after numerous major earthquakes, including the ones in New Zealand in 2011, Nepal in 2015, central Mexico in 2017, eastern Taiwan in 2018, and southeastern Turkey in 2023.

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Protecting Tokyo Against Flood Damage

The Port of Tokyo is an international trading port that serves as a foundation for the industry and everyday lives of the 40 million people who live and work in the city. But it is also located on the furthest end of Tokyo Bay, where the connection to the sea combined with the shallow bay waters make the area particularly vulnerable to phenomena like storm surges.

This is important, as roughly 20% of the 23 wards of Tokyo—approximately 124 square kilometers, housing 1.5 million Tokyo residents—consists of "zero-meter zones" that fall below sea level at high tide.

The Port of Tokyo’s coastal protection facilities—such as floodgates, inland locks, seawalls, and pump stations—continue to be built around low-lying areas to protect the lives and property of Tokyo residents. The bay itself is protected by a tidal barrier line, consisting of 15 floodgates, 21 flood embankments, and approximately 60 kilometers of continuous seawall. This barrier system, which is about five to eight meters higher than the sea level at low tide, has been built to surround the residential areas located behind it.

The Storm Surge Management Center of the Tokyo Port Construction Office is responsible for operating the floodgates and flood embankments during the occurrence of typhoons, earthquakes, and other phenomena that can cause abnormal tide levels. Both are normally kept open so as to allow the passing of ships, the flow of neighboring rivers, and the movement of

people and vehicles. But during emergencies they are immediately closed, after which they work in conjunction with the seawalls to prevent inland flooding. There are two Storm Surge Response Centers that use displays to monitor the camera footage and information signals of each facility and are able to use remote operation to respond to any unexpected situations. There are also plans to install an AI water-level prediction system in order to support these operations, with the goal being of refining the accuracy of this prediction model.

The TMG has established the TOKYO Resilience Project in order to prepare against five major potential disasters—storm and flood damage, earthquakes, ash fall from volcanic eruptions, power/telecommunication disruptions, and infectious disease. Through this 15 trillion yen project, the city is also promoting its safety-minded urban development to the wider world. Moving into the future, the TMG will also work with start-up companies to protect the lives of Tokyo residents by utilizing new digital technologies and other resources.

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*The stories above are provided by **TOKYO UPDATES**, an online magazine that features the latest fresh perspectives on Tokyo developments, with contributions from prominent figures, journalists, and independent writers of diverse nationalities, which focuses on daily life, leading SDG initiatives, and urban challenges in Japan's capital.*

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The tunnel-type Kanda River/Ring Road No. 7 Underground Regulating Reservoir. The inside of the tunnel measures 12.5 meters in diameter with a storage capacity of 540,000 cubic meters. (c) Tokyo Metropolitan Government

2

TOKYO SKYTREE has a height of 634 meters. Tembo Deck at 350 meters and Tembo Galleria at 450 meters offer a panoramic view of the city. Photo: courtesy of TOKYO SKYTREE

3

Hyper Rescue members line up in front of special vehicles. Of around 20 people working that day, several had been dispatched for an emergency rescue operation at the time of shooting. (c) Tokyo Metropolitan Government

4

There are 15 floodgates in Tokyo Bay. Of these, Tatsumi Floodgate (Koto City, Tokyo) is the water level observation point for when the gates are closed—the "front line" during emergencies. The pump station to the right and the seawall to the left work in tandem to protect the city. (c) Tokyo Metropolitan Government