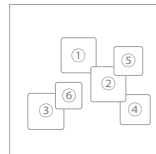




【表紙の写真・Cover photo】



- ①環状二号線・虎ノ門ヒルズ(地上52階、高さ247m)
[立体道路制度]を活用し、道路上にビルを建設
都市整備局
Ring Road No. 2 / Toranomon Hills (52 floors above ground; height 247m)
Taking advantage of the system that allows buildings to occupy the space over roads
Bureau of Urban Development
- ②神田川・環状七号線地下調節池(内径12m、延長4.5km、土被り34~42m)
建設局
The Kanda River Ring Road No. 7 Regulating Reservoir
(Inner diameter 12m; Length 4.5km; Depth 34-42m)
Bureau of Construction
- ③東京港(取扱貨物量8,631万t、貿易額16兆4,032億円、平成28年速報値)
港湾局
The Port of Tokyo (Volume of cargo handled 86million tons; Foreign trade value 16,403billion yen; 2016)
Bureau of Port and Harbor
- ④更生工法による下水道管きょ(馬蹄形)の施工状況(管径:1,760mm×1,630mm)
下水道局
Reconstruction work inside a horseshoe-shaped sewer (Inner diameter:1,760mm×1,630mm)
Bureau of Sewerage
- ⑤燃料電池バス(平成29年3月21日より東京駅丸の内南口~東京ビッグサイト間で2台運行開始)
交通局
Fuel Cell Bus (Two buses commenced operations on the Tokyo Station Marunouchi South Exit-Tokyo
Big Sight route on March 21, 2017.)
Bureau of Transportation
- ⑥山口貯水池(有効貯水量 1,953万m³)
水道局
Yamaguchi Reservoir (Effective Storage Capacity 19.53 million m³)
Bureau of Waterworks



Tokyo Tech Book September 2017

東京都技術会議 Tokyo Metropolitan Government Technology Council

Tokyo Tech Book

Addressing Urban Challenges

September 2017



Tokyo has been working to solve various issues that require a technological perspective, such as disaster management and environmental issues, and has made many successful achievements. What Tokyoites take for granted, for example, earthquake and flood response, delicious water, clean air, trains that run frequently and on time, are some of those accomplishments that will be of value to people around the world.

Among the technologies that underpin such assets, we have compiled the technologies possessed by the Tokyo Metropolitan Government in this brochure. Through this Tech Book, we are taking the initiative in helping solve urban issues by introducing cities around the world to our advanced technologies and expertise in fields such as infrastructure development, disaster management and environment.

Technological capability is at the foundation for realizing policy. We have just three years to go to the Olympic and Paralympic Games Tokyo 2020. Focusing on the success of the Games and the future that lies beyond, the Tokyo Metropolitan Government will further enhance the technological capabilities needed to realize the three “cities” of Tokyo—“Safe City,” “Diversity (Diverse City),” and “Smart City.” Along with increasing Tokyo’s presence in the international community, we aim to become a highly mature city that is both comfortable and energetic.

September 2017
Yuriko Koike
Governor of Tokyo

東京は、これまで防災対策や環境問題など、技術的な視点を必要とする様々な都市問題の解決に取り組み、数多くの成果を上げてきました。例えば、地震や水害への対応、おいしい水、さらには空気、そして正確かつ高頻度に運行する鉄道など、東京では当たり前でも、世界では価値あるものが沢山あります。

そうした価値あるものを支える技術、その中でも、都の保有する技術をまとめたものが本冊子です。

この冊子を通じて、インフラ整備や防災、環境対策などの分野における先進的な技術やノウハウを世界各都市に発信し、都市問題の解決に率先して取り組んでまいります。

技術力は政策実現の礎です。東京 2020 オリンピック・パラリンピック競技大会まであと3年。都は、大会の成功とその先の未来を見据え、「セーフ シティ」「ダイバーシティ」「スマート シティ」の3つのシティを実現するための技術力にさらに磨きをかけていきます。

そして、国際社会における東京のプレゼンスを向上させるとともに、活力とゆとりのある高度成熟都市を目指してまいります。

平成 29 (2017) 年 9 月

東京都知事

小池百合子



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世界に誇る 都庁技術の紹介

Overview of the Technology of the Tokyo Metropolitan Government



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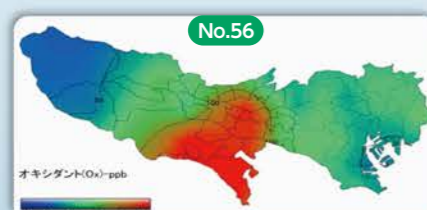
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省エネ・再エネ東京仕様
Specifications to Make TMG-Owned Buildings
Greener

世界とつながる国際貿易拠点港
International Trade Port Connecting the World

世界最高水準の正確かつ高頻度、
安全・安心な鉄道システム
A Railway System with the World's Highest Level
of Safety and Reliability

世界最高水準の無収水削減技術
Technology for the World's Highest Level of
Non-Revenue Water Reduction

老朽化した下水道管の再構築
Renewing Aged Sewers

インフラ
Infrastructure

防災
Disaster
Prevention

世界トップクラスの消防救助技術
World-Leading Fire Rescue Techniques

特殊災害(NBC等)対応技術
Response Technology for Special Incidents
(e.g. NBC)

流域対策や調節池等による
浸水被害の軽減
Reduction of Flood Damage through River
Basin Measures and Flood Control



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Tokyo Tech

環境
Environment

保健・産業
Health, Industry

世界に誇るブランド豚「トウキョウX」
Tokyo's Proud Brand of Pork: Tokyo X

ハード分野からソフト分野まであらゆる知識・技
能をカバーする
職業能力開発センターの建設・運営・技術
Establishment and Management of Vocational
Facilities with Courses Ranging from
Engineering to Office Work

世界とつながる感染症健康危機管理情報ネット
ワークシステム(K-net)
Connecting the World with the Health
Crisis-Management Information Network for
Infectious Disease (K-net)

首都にふさわしい美しく風格のある
景観形成
Creation of Beautiful, Elegant Cityscapes
Befitting the Capital

世界トップクラスの動物の繁殖実績
Top-Class Achievements in
Keeping and Breeding Rare Species

世界に誇るクリーンな都市環境を実現する
大気汚染対策
Leading the World in Air Quality Control

世界初のホウ素フリーニッケルめっきの開発
The World First Boron Free Nickel Electroplating

Use of Urban Planning Systems to Achieve Policy-Led Urban Development

Objective: To achieve a city that is attractive and has vitality

Through the appropriate regulation of land and buildings and guiding private sector development projects that utilize urban planning systems such as priority development areas for urban renaissance, Tokyo is working to enhance the attractiveness of the city, including bolstering international business functions, creating urban green spaces, and forming elegant cityscapes.

Overview: Guidance for proper land use and urban functions

Using methods such as urban planning regulations and guidance, Tokyo guides the creation of urban functions, greenery, and cityscapes, in order to achieve an attractiveness and vitality befitting a comfortable, international city.

- Reasonable land use through methods such as zoning and floor area ratio regulations
- Utilization of urban redevelopment systems (district plans that define areas for the promotion of redevelopment, etc.)
- Realization of projects that strengthen international competitiveness through the creation of special development areas for urban renaissance

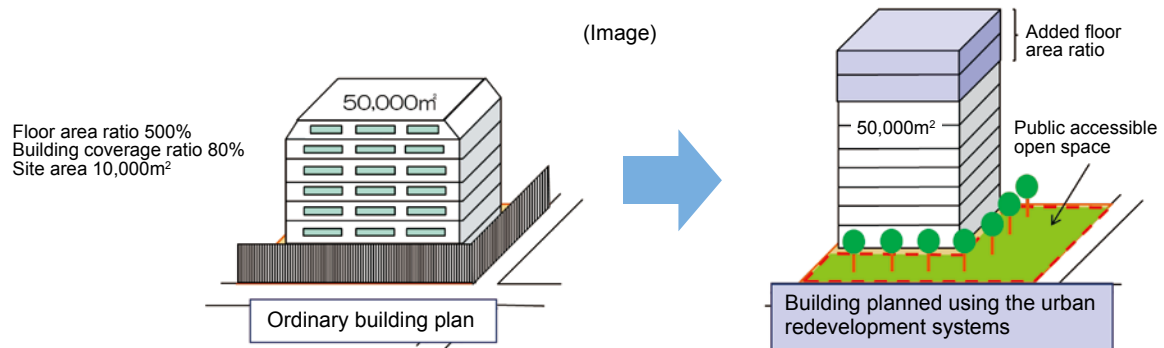
Details: Examples of urban planning systems

Zoning districts and floor area ratio

- Zoning system that places certain restrictions on buildings to encourage reasonable land use

Urban redevelopment systems

- For development projects that contribute to the formation of a pleasant urban environment such as those providing space open to the public, these systems relax regulations such as those applying to floor area ratio and roof height and angle.



Special Development Areas for Urban Renaissance

- In priority development areas for urban renaissance, this system takes the place of existing regulations and sets building use and floor area ratios within the extent necessary to achieve redevelopment.

Example: GINZA KABUKIZA (Kabukiza Theater)

Floor Area Ratio: 1,220% (Previously 670%)

Building height: 145.5 m

Completed: February 2013

Contributions to urban renaissance: Creation of a basement level plaza with direct subway access, a public parking facility, and the rebirth of the Kabukiza Theater



(May 2013)

Photo courtesy of Shochiku Co., Ltd., Kabukiza Co., Ltd.

Land Readjustment Projects, Urban Redevelopment Projects

Exchange with Asia, Africa, South America, etc.

Objective: To improve urban functions and create highly convenient urban areas

To implement comprehensive urban development in an integrated manner such as building roads, parks, and plaza, along with developing residential land and supplying quality urban housing.

Overview: Integrated comprehensive urban development

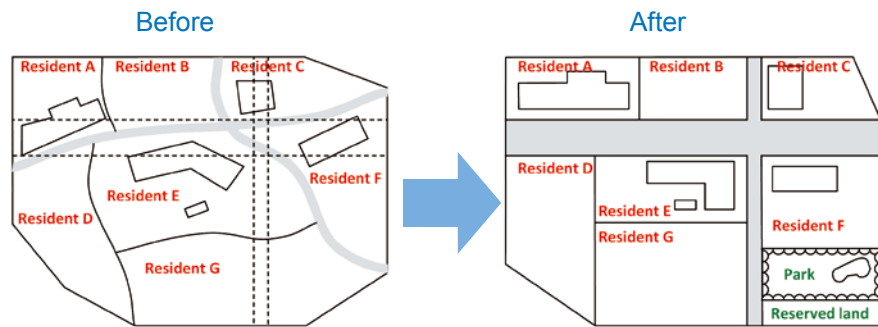
The TMG takes the initiative in implementing projects that are highly public in nature or those that are difficult for the private sector to execute, and projects such as the creation of a new transportation network.

Land readjustment and urban redevelopment projects are also carried out by other entities, including municipalities, associations, organizations, and public corporations.

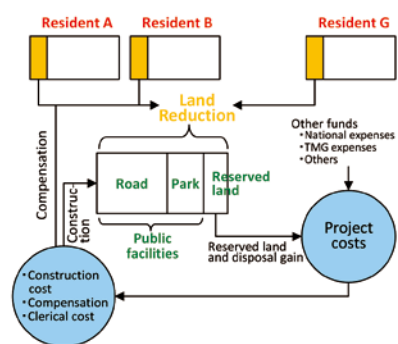
Details:

(1) Land readjustment projects

- The location and area of individual housing lots are changed and reallocated (i.e. replotted) for the new development or expansion of public facilities such as roads and parks.



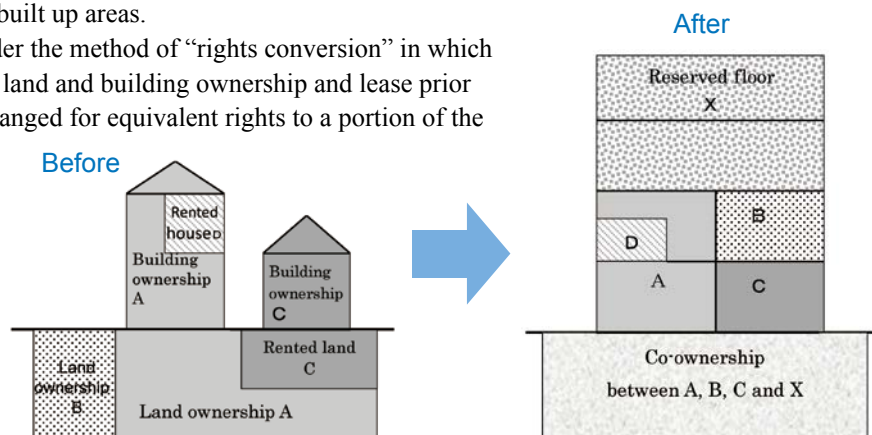
- A part of the individual housing lots within the district may be reduced and consolidated as a contribution (land reduction) for creation of land needed to develop the public facilities and as reserved land that will be sold to cover the project costs.



(2) Urban redevelopment projects

- Utilizing schemes such as relaxing floor area ratio and subsidizing costs required for the communalization of land and buildings, construction of public facilities such as roads and the shared use of land is promoted to improve the environment of built up areas.

- Projects are implemented under the method of “rights conversion” in which the rights (original assets) of land and building ownership and lease prior to project execution are exchanged for equivalent rights to a portion of the land and building following project execution (resultant assets = entitled floors). A portion of the floors of the building to be constructed by the project are sold to help cover the costs of the project.



Infrastructure

Disaster prevention

Environment

Health, Industry

Public-Private Town Development Incorporating Local Color

Objective: To keep enhancing an area's appeal after completion of urban development

Have private entities, including landowners, leaseholders and developers, take the initiative in efforts to continuously enhance the appeal of an area, such as maintaining and managing the area's environment and creating vibrancy, and also reduce government burdens for public space maintenance and management.

Overview: Creating attractive neighborhoods through area management activities

The Tokyo Metropolitan Government supports the area management activities of local landowners, businesses and others that make the best of an area's characteristics, by establishing guidelines for such efforts and easing regulations on the use of public space. This is aimed at sustaining vibrancy of the area after completion of the area's urban development project, as well as reducing burdens on the government to maintain and manage public areas.

Formulation of urban development guidelines

- Guidelines include the future vision for the area, development policies, and rules on area management activities.

Measures to create new vibrancy that is attractive to people visiting Tokyo

- Hold events in public open spaces (relax regulations to allow events that create vibrancy).
- Allow local groups to partially take on road management so that they can use revenues from outdoor cafés and advertising on roads to enhance the appeal of the area.

Details: Examples of area management activities



- Tokyo Station (Otemachi-Marunouchi-Yurakucho District)
 - Urban development guideline formulation
 - Renting advertising space on roads



- Roppongi
 - Event held in public open space



- Ring Road No. 2 (Shimbashi/Toranomon District)
 - Outdoor café on the road



Renewal of Large-Scale Housing Complexes in Tama New Town and Other Areas

Exchange with Gyeonggi-do Province (South Korea) and Edmondsberry (United Kingdom)

Objective: To revitalize the area through renewal of large-scale housing complexes

To improve the living environment at housing complexes and also create vitality in the community by providing appropriate support for the reconstruction or renovation of aging large-scale housing complexes.

Overview: TMG assistance for residents and local governments

The Tokyo Metropolitan Government works with municipalities to subsidize a portion of the design costs and common facility construction costs in order to reduce cost burdens on condominium associations. In addition, to promote the proactive efforts of local residents and governments, the TMG has issued housing complex renewal guidelines, and also offers technical support to local governments, including assistance with finalizing district plans. Through these efforts, the TMG is promoting the renewal of residential complexes.

Details: Example of a renewal project (Suwa 2-chome housing development, Tama New Town)

Project Overview

	Before	After
Number of units	640 units	1,249 units
Number of floors/ Number of buildings	5 floors/ 23 buildings	11-14 floors/ 7 buildings
Site area	About 64,400㎡	About 64,400㎡
Total floor area	About 34,050㎡	About 124,900㎡

Characteristics

- Doubled the number of units by utilizing unused floor area ratio. Through the sale of new units, the cost burden on original residents for reconstruction was reduced.
- Attached facilities such as a daycare center, facility for seniors, café, and convenience store were incorporated in the development so that a multi-generational community would be formed and interaction within the community generated.

Before Reconstruction



After Reconstruction



Attached Facilities



Accredited daycare center

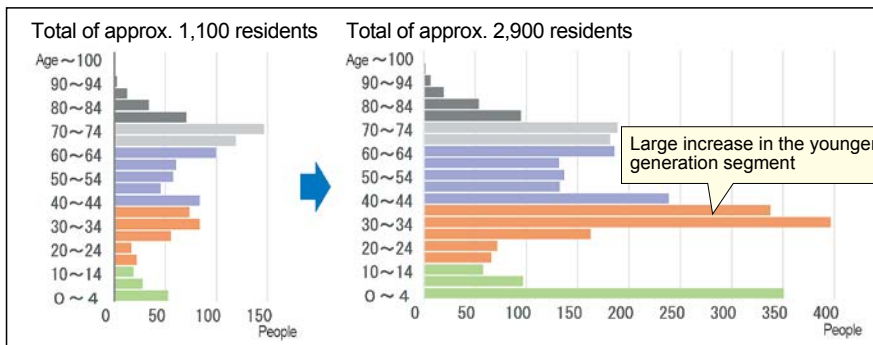


Facility for senior citizens



Café

Resident Population by Age



The number of residents more than doubled, increasing from approx. 1,100 to approx. 2,900. There was a large increase especially in the number of young families with householders in their 30s and 40s.

Effective Use of Metropolitan Housing through Systematic Maintenance and Repair

Objective: To ensure effective long-term use of metropolitan housing stock

With approximately 260,000 units and 1,600 housing developments, Tokyo aims to effectively utilize this metropolitan housing stock through seismic retrofitting and efficient repairs, as well as improvements to make buildings more barrier free and eco-friendly.

Overview

Seismic retrofitting: Ensure the safety and peace of mind of residents

Renovation/repair of high-rise Residences: Renovate high-rise developments in an efficient manner

Barrier free: Install elevators at existing housing developments to facilitate the smooth movement of senior citizens, the disabled, and others

Eco-friendly: Help reduce CO₂ emissions through the installation of heat reflective/insulating roof coverings, solar power generation systems, and LED lighting

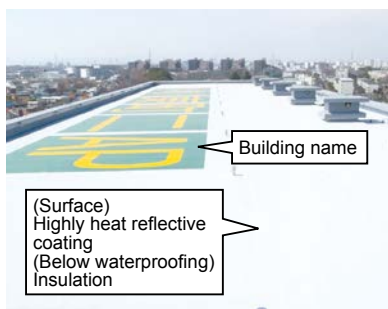
Details: Examples of renovations and repairs

Seismic retrofitting



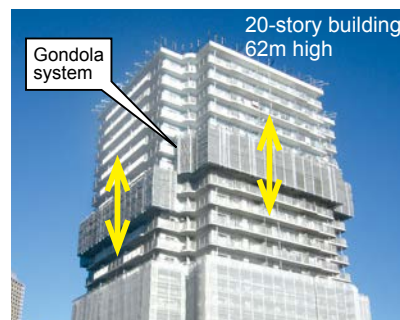
- Installation of external bracing allows residents to live in the building during the seismic retrofitting work.

Heat reflective/insulating roof coverings



- Heat reflective/insulating coverings are used when roof waterproofing work is carried out, enhancing the level of comfort inside the building.
- Application of a highly heat reflective coating on the surface helps to reduce environmental impact.
- The name of the building is painted on the roof to make it easier to identify from a helicopter when a disaster strikes.

Efficient renovation of a high-rise Residence



- In comparison to conventional suspended gondolas, gondola systems fixed to buildings using dedicated metal fixtures are resistant to strong winds and swaying to provide a safe working environment. With modules linked together to form a continuous work space, these systems also improve work efficiency.
- Portions of the building not subject to work carried out on the gondola remain uncovered, allowing for daylight and air circulation to be maintained in the units, reducing the burden on residents.

Solar power generation system



- Installation of roof-mounted solar power generation systems helps to promote energy efficiency.
- Excess electricity generated is sold to TEPCO.

Barrier free renovation example



- By installing elevators at existing buildings, housing that offers peace of mind to all residents, including senior citizens and the disabled, will be secured.

LED lighting



- LED lighting is installed in common areas, promoting energy efficiency.

Systematic Maintenance and Renewal of TMG-Owned Buildings

Objective:

Many of the metropolitan-owned facilities were built around 1970 or in the 1990s. Those built around 1970 are aging, and those built in the 1990s now require refurbishment.

To ensure that such a situation would not affect metropolitan government services, the Bureau of Finance formulated the “10-Year Plan for Maintenance and Renewal of Major Facilities” in 2009 for well-planned maintenance and renewal, and has been steadily implementing the planned works.

Six years have passed since the establishment of the 10-year plan, and new administrative challenges are arising, such as the need to extend the life of public buildings. To properly address these challenges, the Bureau formulated the “Second 10-Year Plan for Maintenance and Renewal of Major Facilities” in March 2015.



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Examples of TMG-Owned Buildings

Overview:

Other than works carried on from the previous plan, facilities subject to the new plan were selected from buildings including metropolitan government offices, metropolitan schools, and police stations. Of these facilities, those meeting certain conditions, such as being about 35 years old or older and having a total floor space of at least 3,000 m² were screened according to such criteria as the future prospects of facility operations, the state of degradation, and how the TMG could effectively utilize the property.

The Bureau has selected 356 facilities with a combined floor space of around 3 million m² (about 31 percent of the facilities covered by the general account).

- Key points in maintenance and renewal
 - Ensure safety and security · Reduce environmental impact · Reduce future costs · Ensure convenience
 - Use metropolitan-owned properties efficiently and effectively
- Project period

Ten years from fiscal 2015 to fiscal 2024 (Phase I: four years, Phase II: three years, Phase III: three years)

Note: Plans are to be reviewed for each phase.

Details:

- Specific measures to be taken under the new 10-year plan
 - Promote measures to extend the life of buildings
 - e.g.) Measures against concrete neutralization and rebar corrosion; materials and construction methods that can withstand degradation
 - Promote measures that reflect TMG policies, such as reducing environmental impact and adopting new technologies
 - e.g.) LED lighting and highly energy-efficient equipment; solar power generation equipment; new technologies that help extend the life of facilities and reduce environmental impact
 - Further promote measures in line with TMG policies to effectively use metropolitan-owned properties, such as combining facilities and leasing properties under fixed-term contracts
- Project costs (estimate)

Phase I (2015-2018)	Phase II (2019-2021)	Phase III (2022-2024)
330 billion yen	190 billion yen	230 billion yen
Approximately 750 billion yen		

Note: Costs for each facility will be estimated again in the process of compiling each year's budget, with consideration given to the most appropriate method and scope of construction.

Making TMG-Owned Buildings Greener

Objective: To transform Tokyo into a smart-energy city

The TMG takes the initiative in incorporating energy-saving measures and use of various renewable energies in metropolitan-owned buildings on occasions such as the rebuilding of such facilities.

Overview: Practical use of energy

Using its guidelines, the “Tokyo Energy Savings & Renewable Energy Specifications,” the TMG works to make its buildings “green” and aims for the highest Grade 3 rating in the following three categories under the Tokyo Green Building Program*.

- Reduction of thermal loads
- Use of renewable energies
- Energy-saving system

Studies are also conducted to expand a building’s share of renewable energies to all possible extent by considering factors such as the characteristics and location of the building. (*See No. 52)

Details: “Tokyo Energy Savings & Renewable Energy Specifications”

Image of application of the specs in a metropolitan government office with a floor space of 3,000 m²

Energy-saving systems

- | | | |
|---|---|--|
| <ul style="list-style-type: none"> - Power monitoring device - Cogeneration system* - “Top runner (most efficient)” transformer - LED lighting (base light) - Daylight-linked control system - Task-ambient lighting (office space)* - Motion sensor (lighting) - LED lighting (downlight) - LED guide lights, LED lighting (exterior) | <ul style="list-style-type: none"> - Standby power reduction system - Waste heat-powered water heating and air conditioning* - High-efficiency air conditioning - High-efficiency cooling tower/pump/fan - Variable air volume, variable water volume - Large temperature difference air conditioning* - Floor outlet air conditioning system* - High-efficiency packaged air conditioner - Motion, temperature, and other types of sensors* | <ul style="list-style-type: none"> - Separate sensible and latent heat (desiccant) air conditioning* - Ice storage air conditioning* - Fresh air intake control system (CO₂ sensor) - Fresh air cooling, pre-cooling/pre-heating control - Total heat exchanger (total heat exchanger unit) - DC motor ventilation fan* - Water-saving equipment, flush sound effect device - High-efficiency water heater - Waste heat recovery water heater* |
|---|---|--|

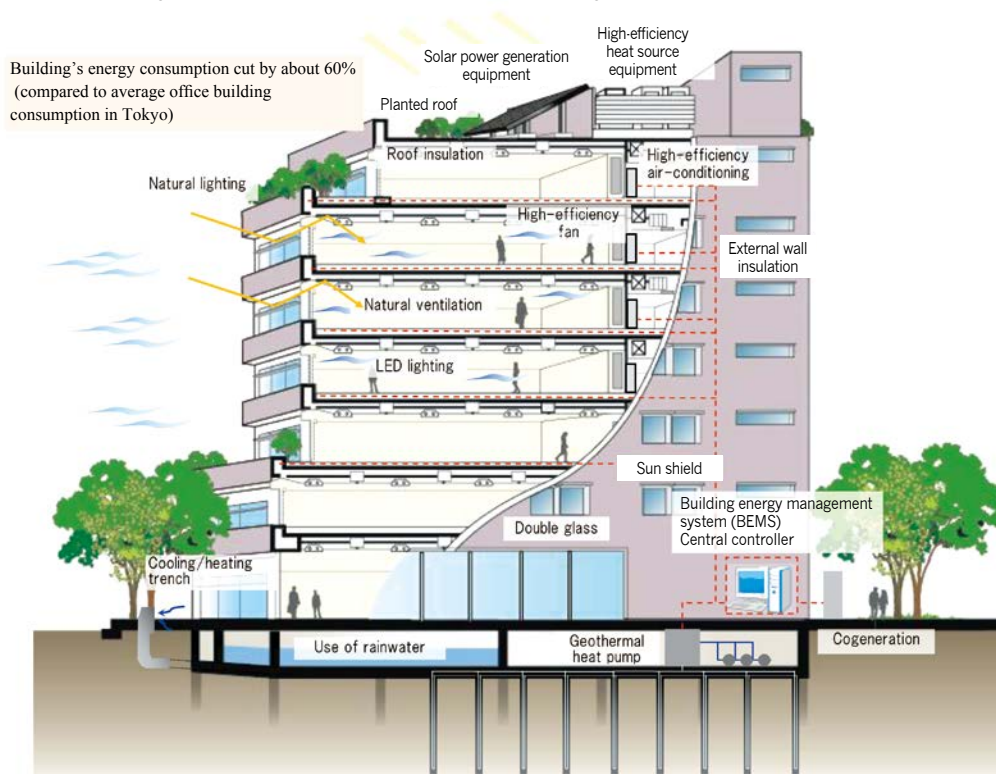
Reduction of thermal loads

- Roof insulation (75mm)
- External wall insulation (50mm)
- Double glass (Low-E)
- Airtight sash
- Sun shield (eaves, vertical louver, etc.)

Use of renewable energies

- | | |
|--|---|
| <ul style="list-style-type: none"> (Direct use of renewable energies) - Natural lighting, natural airing - Natural ventilation* - Biomass energy equipment* - Solar heat equipment* | <ul style="list-style-type: none"> - Geothermal heat pump* - Cooling/heating pit/tube/trench* (Energy generated from renewable source) - Solar power generation equipment |
|--|---|

* To be introduced depending on the characteristics and location of each building



Development Policy for City-Planned Roads

Objective: To systematically and effectively develop city-planned roads

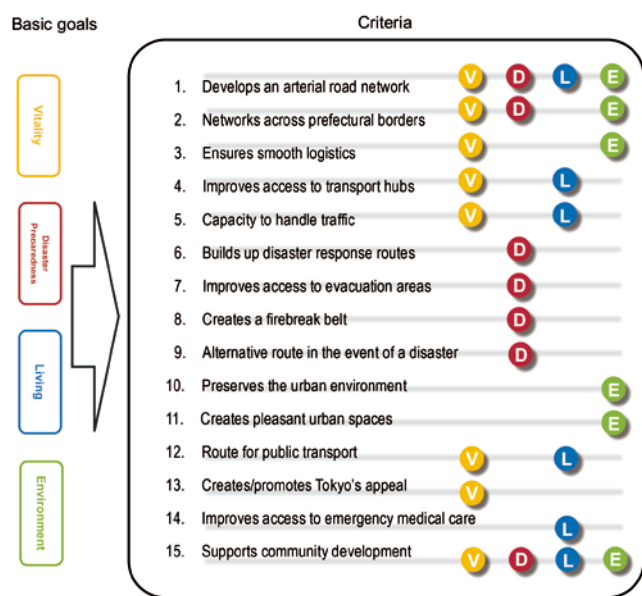
Roads designated for development under the City Planning Act (city-planned roads) play a crucial role in not only boosting transportation and logistics functions and thus revitalizing the economy, but in other capacities as well, such as supporting people’s daily lives and, in the event of a disaster, aiding rescue and relief efforts. The TMG formulated the “Development Policy for City-Planned Roads in Tokyo (4th Construction Plan)” in March 2016, and is proceeding with the systematic and effective construction of city-planned roads with the aim to achieve a smooth flow of people and goods by significantly alleviating traffic congestion, Tokyo’s greatest weakness.



City-planned road

Overview: Review of the future city-planned road network

Road projects for which work has not yet started were reviewed based on 15 criteria, from the standpoint of what kinds of city-planned roads will continue to be necessary. Those projects that did not meet any of the criteria were designated as “routes for review.” Also, areas where additional city-planned roads would be necessary to achieve Tokyo’s future vision were indicated. Among road projects that were confirmed to be necessary, those whose details, such as the width and structure of the road, need to be reviewed for various reasons were designated as “routes for re-examination of plans.”



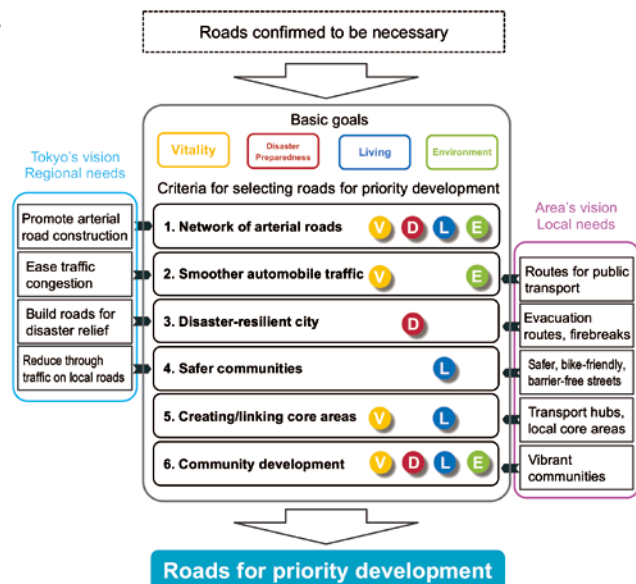
The numbers above do not indicate the order in which the criteria were applied.

Overview: 4th Construction Plan (selection of roads for priority development)

Of the city-planned roads confirmed to be necessary, 320 sections totaling 226 kilometers of roads were selected as roads that should be developed on a priority basis over the 10 years from FY2016 through FY2025. Six criteria were used in the selection, with both regional and local needs taken into account.

Project undertaken by	No. of sections	Length (km)
TMG	139	146
Special ward	92	42
City/town	72	33
Other	17	5
Total	320	226

Projects undertaken by “other” include land readjustment projects by associations.



The numbers above do not indicate the order of priority.

Undersea Tunnel (Immersed Tunnel Method)

Objective: To build a road network connecting reclaimed land

In the Port of Tokyo, the immersed tunnel method was used to construct undersea tunnels in order to deal with restrictive conditions at the site, such as height limits due to Haneda Airport and the need to secure passage for large ships.

Overview: Immersed tunnel method

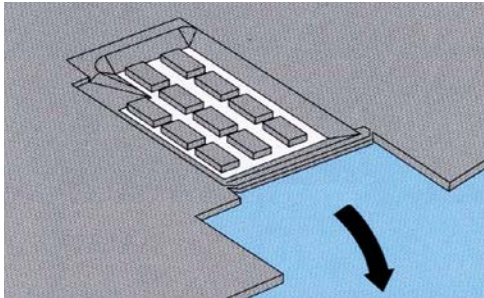
In this method, boxes for the tunnel are prepared at the dry dock, towed and lowered into a trench dug on the ocean floor, and then joined together in the water.

This method has advantages such as reducing the total length of the tunnel because of the shallow earth covering, and its suitability for soft ground conditions.

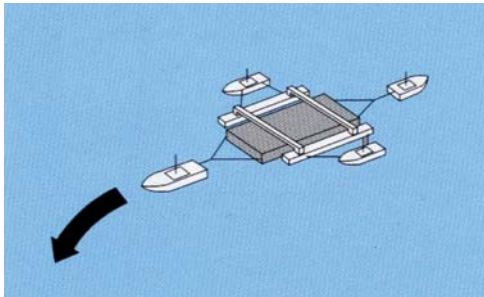
Details: Example of Rinkai Tunnel (total length about 2km, immersed section 1.3km)

Construction process

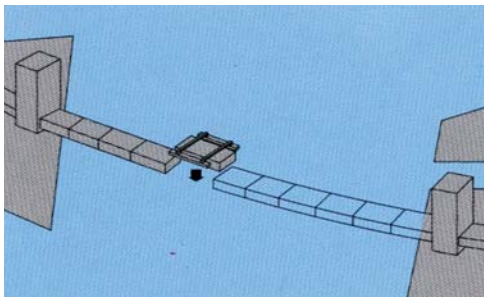
1. Boxes for the tunnel are prepared at the dry dock



2. Towed to the site



3. Sunk and joined



- The boxes are constructed at the dry dock
- The size of each box is:
W30m x H10m x L120m
Weight 40,000 t



- Towed to the tunnel construction site by a placing barge.
- Ballast tank of the floating box is filled with water and submerged.
- Boxes are joined by using water pressure.



Inside view of immersed units

Life Extension of Bridges

Objective: To spread out bridge renewal periods and reduce total costs



Eitai Bridge (built in 1926)



Yamato Overpass (built in 1964)

Many of the bridges managed by the TMG were built during Japan's rapid economic growth. They are aging and will reach their period of renewal at the same time in the near future.

Overview: Life extension through the latest technologies

After checking the seismic resistance, load-bearing capacity, durability and other conditions based on the latest technical standards set forth in the "Specifications for Highway Bridges," the Bureau of Construction combines advanced technologies to repair and reinforce bridges with the aim to extend their lives for another 100 years after implementation of measures.

Details: Examples of life extension measures



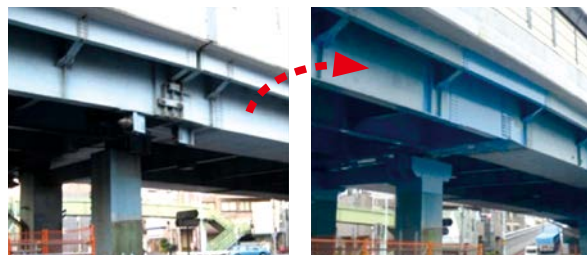
Reinforcement of footing



Main girder replacement



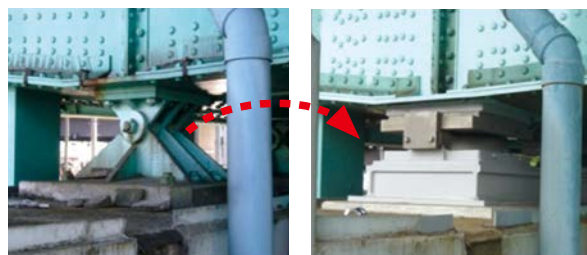
Installation of additional piles



Connecting girders together to make the structure continuous



Deck slab replacement (from reinforced concrete to steel)



Bearing replacement

Preventive Maintenance of Road Tunnels

Objective: To secure the safety of road tunnels

- With the goal of having all tunnels in sound condition without need of renewal for the next 100 years, the TMG takes proper measures before damage and deterioration progress so as to ensure the safety of facilities. The systematic implementation of such measures also aims to spread out repair work and costs and reduce total cost.

Oyamadairi Tunnel (completed in 1990)

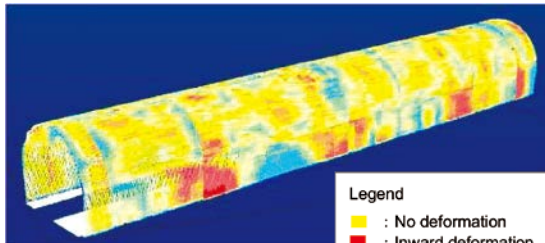


Overview: Systematic life extension measures based on inspection using the latest technologies

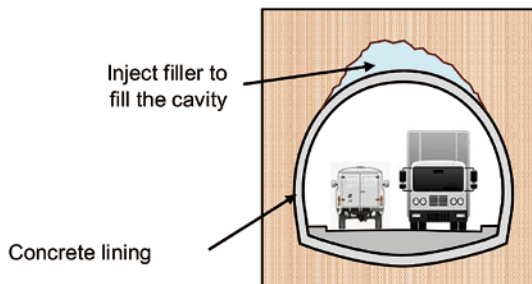
- The Tunnel Preventive Maintenance Plan was formulated upon the results of regular inspections (once every five years) and studies employing the latest technologies.
- The TMG implements measures such as filling cavities appearing behind tunnels built in mountains and enhancing the durability of cut-and-cover tunnels.



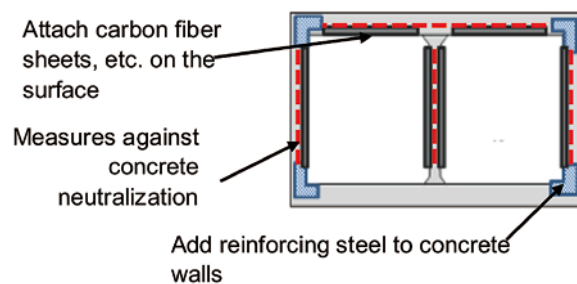
*A moving vehicle performs laser scanning to automatically measure tunnel deformation.



Tunnel Preventive Maintenance Plan (formulated in 2015)



Key measures for mountain tunnels



Key measures for cut-and-cover tunnels

Details: Examples of life extension measures



The tunnel is lined with carbon fiber sheet panels to strengthen it (mountain tunnel).



Workers repair a deteriorated concrete surface by spraying (cut-and-cover tunnel).

Infrastructure

Disaster prevention

Environment

Health, Industry

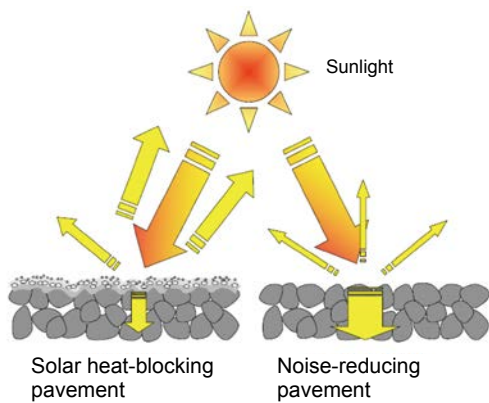
Assessment of Road Surface Temperature Reduction Performance

Objective: To help reduce the heat of metropolitan roads

By installing solar heat-blocking pavement and water-retaining pavement materials, the daytime rise in road surface temperatures can be curbed.

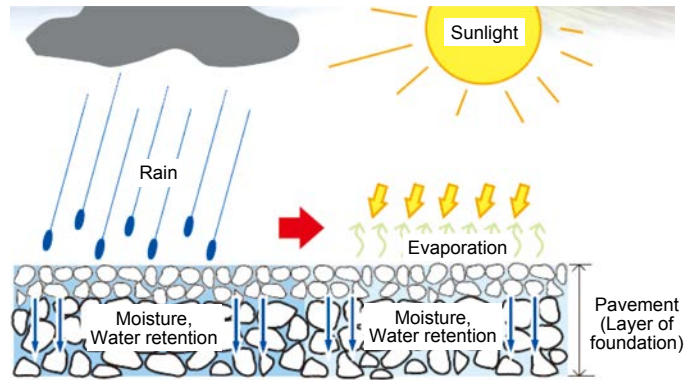
Overview: Method of assessing the road surface temperature reduction performance of pavement materials

The TMG has been promoting the development and use of solar-heat blocking pavement and water-retaining pavement materials that curb the daytime rise in road surface temperatures. We established a method to assess their performance in order to stipulate the performance benchmarks of the materials.



Solar heat-blocking pavement

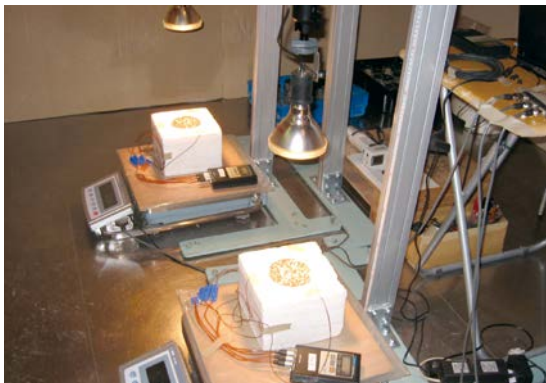
Some of the sun's rays are reflected to curb the rise in road surface temperature.



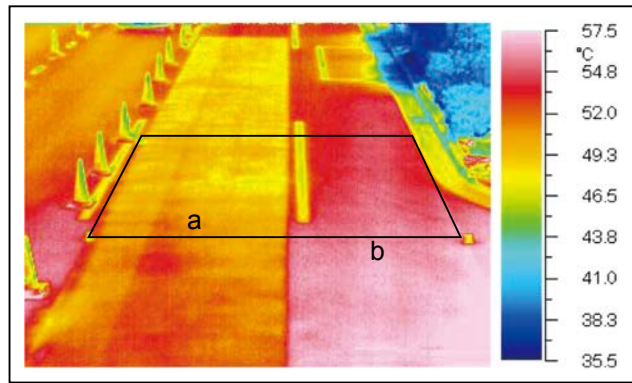
Water-retaining pavement

The evaporation of water that is retained within the pavement curbs the rise in road surface temperature.

Details: Development of technology for assessment through indoor irradiation tests



Assessment of pavement performance
Indoor irradiation test to measure the reduction in road surface temperature



Example of road surface temperature measured by thermography

a: Solar heat-blocking pavement 48°C
b: Dense-graded asphalt pavement 56°C
Solar heat-blocking pavement is 8°C cooler than dense-graded asphalt pavement.

Infrastructure

Disaster prevention

Environment

Health, Industry

Sinkhole Prevention and Repair

Exchange with Seoul

Objective: To prevent sinkhole accidents and secure road safety



Sinkhole

Sinkholes and other road surface irregularities on trunk roads with heavy traffic, such as metropolitan roads, can lead to serious accidents with great social impact. These include cars caught in sinkholes or huge traffic jams. The road administrator conducts inspections to prevent sinkholes from appearing and to ensure road user safety.

Overview: Void detection and emergency response

A subsurface void can cause a sinkhole. On metropolitan roads, a vehicle-mounted radar system is used to detect subsurface voids. When a large void is detected in such a survey or when any irregularity is found during a patrol, the cause is investigated and emergency work is carried out to quickly repair the road and prevent the formation of a sinkhole.

Details: Detection methods and response measures

- Radar surveys are performed to detect subsurface voids without digging up roads.
- When a subsurface void is detected, the cause is investigated and emergency work is carried out to repair the road.
- When a sinkhole appears, repair work is conducted swiftly.



Radar survey for subsurface void detection



Test digging



Repair

Traffic Congestion Measures

Objective: To implement comprehensive measures to ease traffic congestion

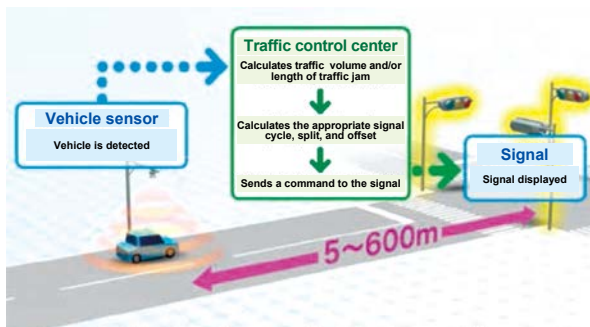
TMG bureaus responsible for road management and logistics measures work with the Metropolitan Police Department, which is responsible for traffic enforcement and control, to implement fast-acting measures to ease traffic congestion where it is most pronounced.

Overview: A combination of approaches to address traffic congestion causes

<Examples of measures>

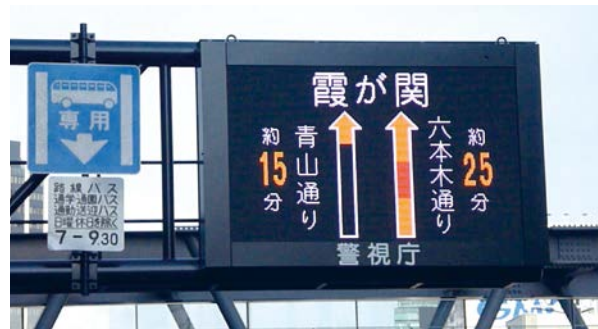
- **More sophisticated and optimized traffic signal control**

Introduction of traffic control systems that predict incoming traffic demand



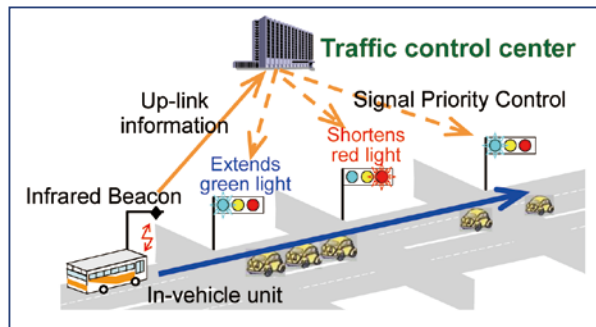
- **Traffic dispersion**

Installation of traffic information signs that display the time required by each route to reach a point



- **PTPS (Public Transportation Priority Systems)**

Detects public vehicles such as buses and performs traffic signal control including extending green lights and shortening red lights



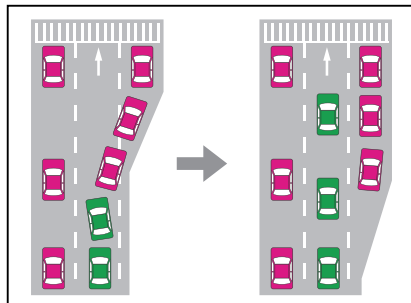
- **Upgrades to road facilities**

Intersection improvements, construction or extension of right-turn lanes

By installing red-colored pavement to show no parking zones, these zones are clearly indicated to drivers.

(Before)

(After)



(Before)

(After)



- **Space for delivery trucks to load/unload goods**

To prevent delivery trucks from parking on the road to pick-up or deliver goods, space is secured for these activities in pay parking facilities.

Measures are implemented through collaboration between the Bureau of Urban Development, Bureau of Environment, Bureau of Construction, Metropolitan Police Department, and Tokyo National Highway Office.

Comprehensive Measures for Parking

Objective: To ensure a safe and pleasant road traffic environment

- Promote comprehensive measures for parking through means such as having car owners secure a place to keep their car, promoting the development and use of parking facilities, and cracking down on illegal on-street parking.

Overview: Initiatives to reduce on-street parking

<Securing a place to keep a car>

- Mandatory for an owner of a car to first secure a proper place to park it

<Development of parking facilities>

- Development of parking facilities capable of meeting a specific area/building's demand for parking
- Responding to a range of parking problems

<Promotion of the use of parking facilities>

- Effective use of existing parking facilities

<Crackdown on illegal on-street parking>

- Entrusting matters related to the enforcement of illegal on-street parking to a private company

Details: Development of parking facilities

Development of parking facilities capable of meeting a specific area/building's demand for parking

- The TMG supports municipalities in the formulation of parking facility development plans so that facilities meeting the demand for parking in an area are developed.
- In line with the Tokyo Metropolitan Parking Ordinance, when a building is constructed, the creation of parking facilities capable of meeting the demand that will be generated is mandatory.

Responding to a range of parking problems

- As a measure to address the issue of delivery vehicles parking on the street to process the delivery packages, the TMG is promoting the dedication of space at pay parking lots for this purpose.
- The TMG has formulated guidelines for the development of public parking facilities that can accommodate motorcycles and is encouraging the creation of such facilities.



Space at pay parking lot secured for delivery trucks



Example of motorcycles at a public parking facility

Details: Promotion of the use of parking facilities

Effective use of existing parking facilities

- The Tokyo Metropolitan Public Corporation for Road Improvement and Management provides parking information through the "s-park" application.

Via its website, smartphones, and IT car navigation systems, the "s-park" service provides information on the locations of approx. 21,000 parking facilities in Tokyo and the current availability status of approx. 7,200 parking facilities, mainly in busy business and shopping areas.

Route to the parking facility is shown using the car navigation system application

The system selects and displays parking facilities according to parking fees and vehicle size

Display showing the availability status of parking facilities



Construction of a Multilevel Container Warehouse

Objective: To strengthen terminal functions to meet the increase in cargo

- Increases container capacity in a limited amount of space
- Also contributes to reduced CO₂ emissions and enhanced convenience (reduces waiting time for trucks picking up containers)

Overview: Multilevel container warehouse

Start of operations: April 2011

Facility specs

Length: Approx. 150m

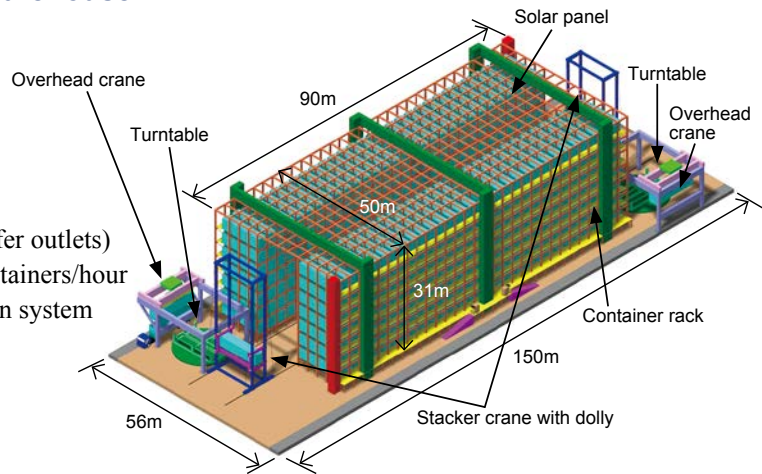
Width: Approx. 56m

Height: Approx. 31m

Maximum capacity: 840 TEU
(All levels equipped with reefer outlets)

Maximum processing capability: 48 containers/hour

Attached facility: Solar power generation system
(200kW)

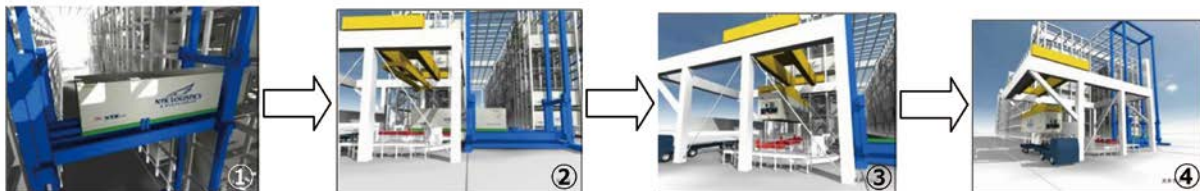
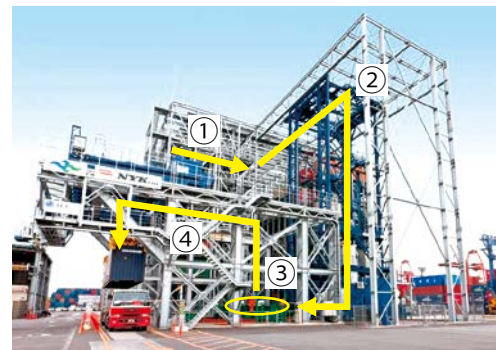


Facility's effectiveness

- Containers can be loaded/unloaded from any location resulting in an approx. 30 percent improvement in efficiency over use of general handling systems.
- With seven levels of container racks, storage capacity is increased approx. 70 percent over a storage yard.
- Through the use of commercial electric power, CO₂ emissions are reduced approx. 60 percent over the use of diesel fuel.

Details: How containers are moved from the warehouse to trucks

- ① Using a dolly, a container is removed from the container rack.
- ② The container removed is transferred to the turntable by the stacker crane.
- ③ On the turntable, the container is rotated 90 degrees.
- ④ The overhead crane then mounts the container on the chassis.



Redevelopment of Existing Container Terminals

Objective: To achieve high-standard terminals by using existing facilities

- Greatly improve functions of the existing container terminals while they are in service
- Reduce and even out life cycle costs through a preventive maintenance program

Overview: Example of a redevelopment project (1996 to 2003)

Addressing Container Vessels Upsizing

Extension of Berths
 250m × 2 Berths
 300m × 6 Berths
 (Total wharf length 2,300m) → 330m × 5 Berths
 350m × 2 Berths
 (Total wharf length 2,354m)

Deepening of Quay Wall
 -13m → -15m

Upgrading of Container Cranes
 For 16 Rows 14 Units
 For 14 Rows 1 Units
 For 13 Rows 3 Units → For 18 Rows 7 Units
 For 17 Rows 5 Units
 For 16 Rows 6 Units
 (Existing 4 Units, Modified 2 Units)

Expansion of Terminal Capacity

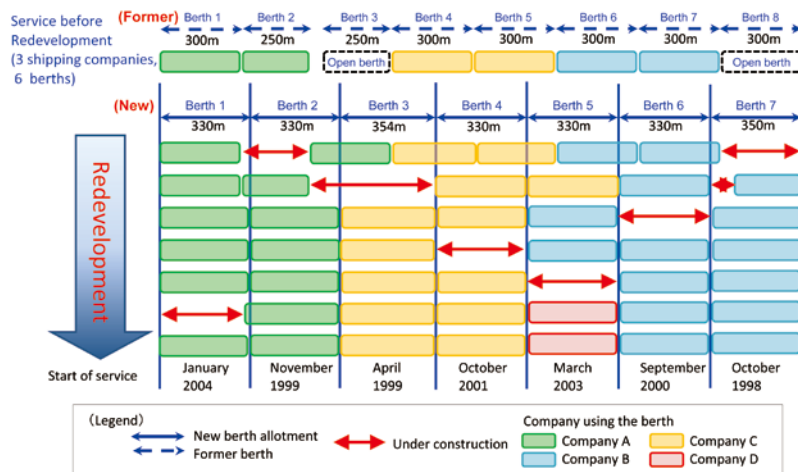
Extensions of Terminal Area
 109,000m² / Berth
 (Total Area: 875,000m²) → 135,000m² / Berth
 (Total Area: 946,000m²)

Improvement of Cargo Handling System in Yard
 Straddle Carrier System (Some Terminals) → Transtainer System (All Terminals)

Details: Redevelopment and introduction of preventive maintenance

Projects to be carried out in sequence while port operations continue

- Projects were carried out while keeping six berths in service at all times.



Preventive Maintenance

- Early detection of areas in need of repair and steady implementation of systematic repairs
 Anticorrosion measures including cross-section repair, surface coating, and electric anticorrosion



Visual inspection of piers



Repairing by electric anticorrosion

Infrastructure

Disaster prevention

Environment

Health, Industry

Steel Formwork Construction Method for Port and Harbor Construction under Harsh Conditions

Objective: Advancing port and harbor construction on the islands of Tokyo

To advance port and harbor construction on the islands of Tokyo, which are up against severe weather and ocean conditions due to their location on the open sea, in order to raise the service rates of liners and other ships for improvement of the lives of the residents and development of their basic industries.



Overview: Technique considering severe natural conditions

An engineering technique to quickly complete construction without being affected by the severe weather and ocean conditions that limit the period of construction throughout the year and make ongoing construction difficult.

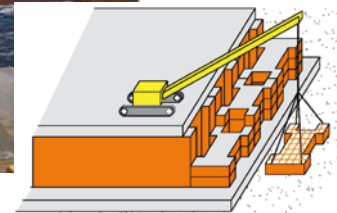
- A steel formwork assembled on land is installed on the concrete foundation, and concrete is poured into it.
- This process is repeated, stacking the box-shaped steel formworks to construct breakwaters and other such facilities.



Completed assembly of steel formwork



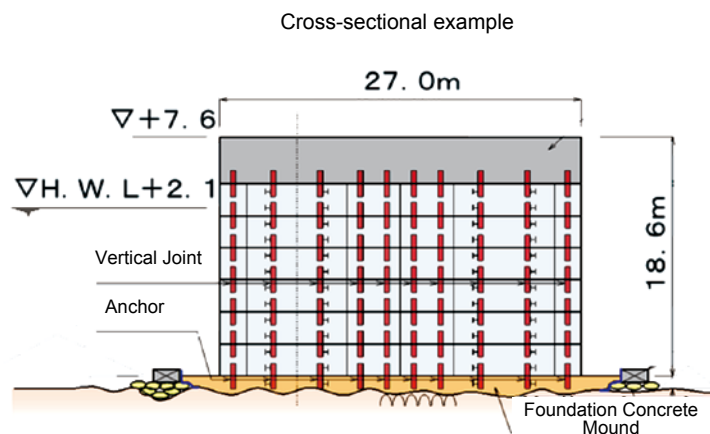
Installation of steel formwork



Details: Characteristics of this method

- The structure is divided into multiple blocks, and an integrated structure is created by pouring concrete into the steel formwork on site. Stability against waves is secured at each stage of block construction completion.
- Construction from installation of the steel formwork to concrete pouring can be done in a short period of time.
- Pouring concrete into the steel formwork unites the section with the completed concrete blocks via the right and left and lower joints, making this a stable structure at this stage.

This method allows construction to be completed without being affected by severe weather and ocean conditions such as being hit by a typhoon during the construction period.



Anchor

Horizontal joint

Vertical joint

Infrastructure

Disaster prevention

Environment

Health, Industry

A Safe and Reliable Railway System

Exchange with Buenos Aires

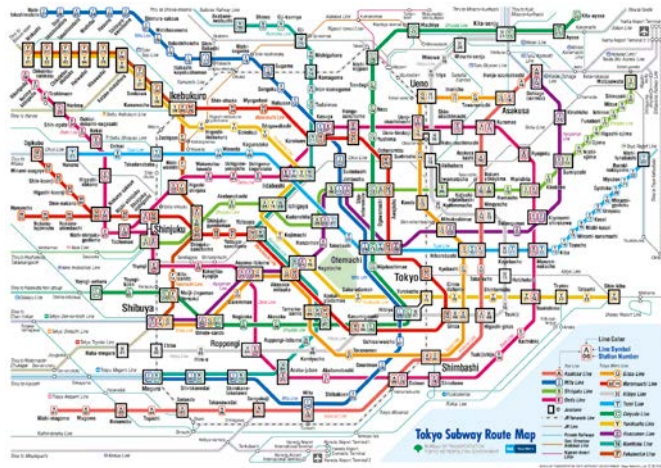
Objective: To provide high-quality railway services

Placing safety and reliability first, we have realized a high-quality railway system with high-frequency service that is capable of moving large numbers of passengers.

Overview: Realization of precise, high-density train operations

When compared to overseas cities, Tokyo's railway system is considerably advanced with respect to railway density and development of the subway network.

This subway network is used by 9.66 million people a day to move around the city. Trains are operated on a precise, high-frequency schedule, including trains operating on time at intervals of 2-3 minutes during peak commuting hours. A daily 2.6 million of these people use Toei Subway (operated by TMG Bureau of Transportation). Including the three examples below, Toei Subway is implementing a range of measures to ensure safe and reliable operations.



Tokyo Railway Network Map

Details: Systems used by Toei Subway

(1) Integrated Control Center

The Integrated Control Center adopts systems that facilitate the automated control of train operations on all Toei Subway lines. While monitoring train movements, the center is able to conduct efficient management of train operations.



Integrated Control Center

(2) Signal Safety Systems

Toei Subway lines are equipped with signal systems that automatically apply the brakes to decelerate or stop a train when it exceeds the speed limit.

A system for detailed control employing advanced information transmission technology has also been installed to enable more efficient operations.

(3) Regular Inspections and Maintenance

Inspections and maintenance of rail cars, tracks, power lines, signals, communication cables, tunnels, elevated sections, bridges, and other structures are conducted on a regular basis.



Train inspection



Track inspection

Infrastructure

Disaster prevention

Environment

Health, Industry

Electric Power Regeneration System

Objective: Effective energy use

Through the adoption of an electric power regeneration system, Toei Subway aims to make the railway more energy efficient.

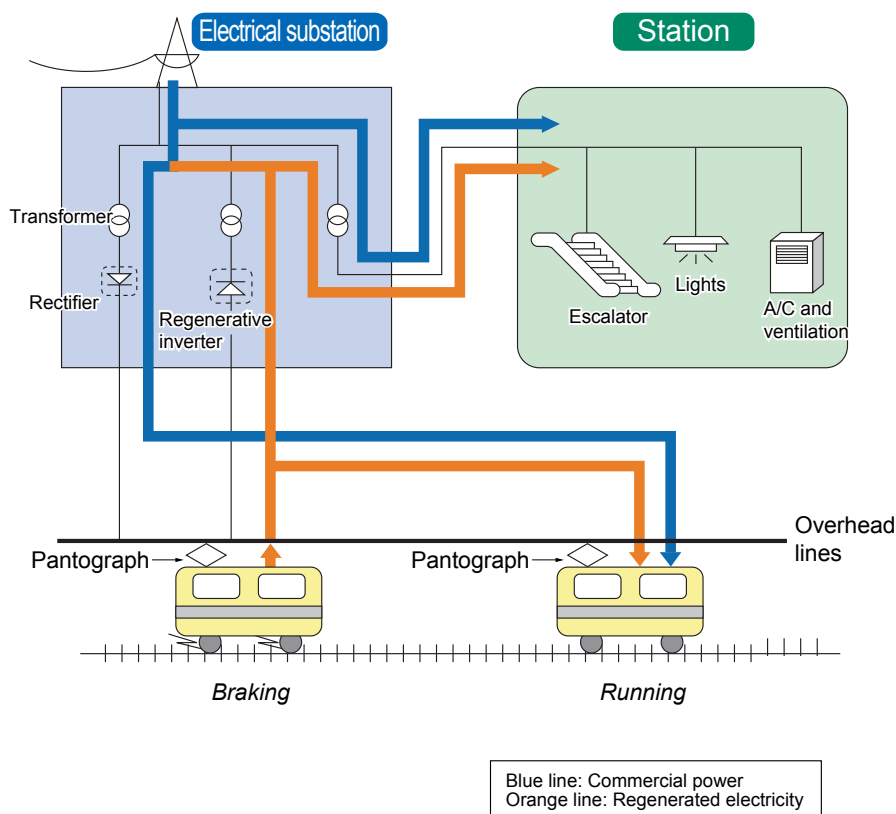
Overview:

- Trains consume a great deal of electricity when they accelerate. With the installation of an electric power regeneration system, however, power generated when trains decelerate can be used, making railways more energy efficient.
- This is an energy efficient technology widely used by Japanese railway companies, and it is one of the technologies expected to make further growth abroad.

Details: How the electric power regeneration system works

- An electric power regeneration system is a regenerative braking system. By using the motor that powers the train as a generator when the brakes are applied, some of the kinetic energy that would otherwise be lost to heat can be converted to electric power and reused.
- This electricity is transferred to the overhead lines via the train's pantographs (see below) and either used to power other trains, or sent to a power substation and used to power lights and escalators in subway stations.

How the electric power regeneration system works



Systematic Repair of Subway Tunnels

Objective: To secure safety of subway structures from a long-term perspective

- To secure facility safety while also ensuring the regular operation of trains by implementing planned maintenance and management of aging subway structures constructed several dozen years ago from a long-term perspective based on site inspections and application of the PDCA cycle.

Overview: Systematic repair based on inspections

- Systematic repair is implemented by grasping the situation through detailed inspection results and changes.
- Continuous and spherical imaging in the tunnel is implemented and a database is built by adding data such as inspection and construction information.
- Inspections continue to be conducted after the repairs have been made and repair plans are revised accordingly.



Inspection by sounding concrete

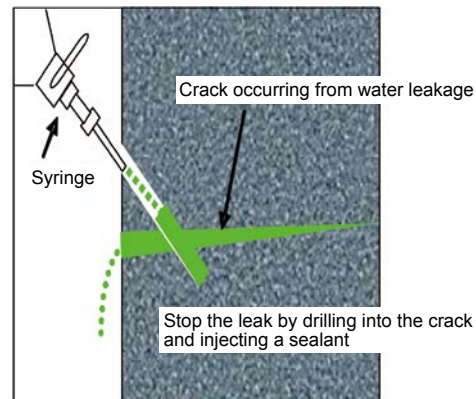
Details: Specific contents of repair

- Implementation of measures against exfoliation, water leakage, neutralization, and other problems.
- Notably, measures against water leaks (waterproofing of tunnel walls), which are a key cause of structure deterioration, have been bolstered by expanding construction scale.

Water leak



Schematic drawing of water leak measure



*PDCA (Plan-Do-Check-Act) cycle is used for systematic repair based on inspections. The efficacy of the methodology is always verified and reflected in the next repair work and inspection methodology.

Training and Preparedness for Toei Subway Safety

Exchange with New Taipei

Objective: To maintain and improve emergency response capabilities

Along with making the capital investment needed to ensure safety, public transportation services must also be fully prepared to provide a prompt response in the unlikely event of an accident or disaster. As such, transportation providers conduct drills based on a variety of scenarios with the aim of maintaining and enhancing emergency response capabilities.

Overview: Comprehensive drills for a large-scale disaster or accident

In addition to each office independently conducting routine training, joint comprehensive drills that simulate large-scale disasters and emergencies are conducted on a regular basis through the cooperation of various offices.

Details: Types of training drills

(1) Comprehensive Emergency Drill

Based on an emergency scenario, this is a large-scale, practical training exercise held annually since 1970, in which staff practice train protection, evacuation of passengers, rescue support, communications, derailment recovery, and restoration of facilities.



Comprehensive emergency drill

(2) Natural Disaster Preparedness Drill

This large-scale drill, which simulates floodwater entering a station through the station entrances/exits due to a torrential downpour, has been held annually since 1990. In addition, each station holds drills for flood prevention.



Natural disaster preparedness drill

(3) NBC (Nuclear Biological Chemical) Drill

This drill, conducted with the police and fire departments, prepares staff to lead evacuations in the event of dispersion of chemicals, and to detect, collect, and remove suspicious objects.



NBC drill

(4) Drill for the Evacuation and Accommodation of Stranded Commuters and Others

This drill simulates what will occur when many people become stranded due to the suspension of train services following a major earthquake directly striking Tokyo. Exercises to lead passengers to safety and distribute emergency supplies to those stranded at temporary accommodation sites are held.



Drill for the evacuation and accommodation of stranded commuters and others

Operation of AGT (Automated Guideway Transit) Systems

Objective: To introduce a new means of transportation to built-up areas

It is possible to introduce this system in existing built-up areas without any need to purchase large pieces of land. Through the development of public transportation that has greater capacity than buses, a form of transportation that is safe, runs on time, and is not affected by traffic congestion is realized.

Overview: Medium-capacity rail transport system

- Constructing support pillars on median strips and special rails on top of those pillars allows the use of space above roads. At approx. 7-12 billion yen/double track km*, the cost is more reasonable than that of subway lines (approx. 25-35 billion yen/double track km*).
- It is possible to have the tracks curve at intersections, and this system can be introduced in redevelopment plans that make use of the existing cityscape.
- The systems are driverless. When there is the need to run extra trains to meet an increase in demand due to an event, etc., operation of the system will not be restricted by the number of drivers available.



*Source: Survey on the Introduction of Light Rail Transit Integrated with City Planning, March 2010, Institution for Transport Policy Studies

Details

(1) Driverless trains

1. ATO (Automatic Train Operation) controls operations such as running and stopping the train, opening and closing doors at stations, and train departure.
2. Speed control is achieved through ATC (Automatic Train Control). The system sends train signals to control speed based on conditions such as the distance between trains.
3. Both ATO and ATC are dual systems to ensure the safe operation of trains.

(2) Train car characteristics

1. The cars are compact in comparison to railway cars, and run on rubber tires.
2. The train's minimum curve radius is 30m (45m within the operating area), and steepest gradient is 60% (50% within the operating area).

(3) Station characteristics

1. At stations with no attendants, intercoms and security cameras are installed throughout the station, and customer service is handled collectively by the control center.
2. Full-length platform doors are installed at all stations to prevent passengers from making accidental contact with trains or falling onto the tracks.



Bus Location System

Exchange with Gansu province (China)

Objective: To provide detailed information on bus operations

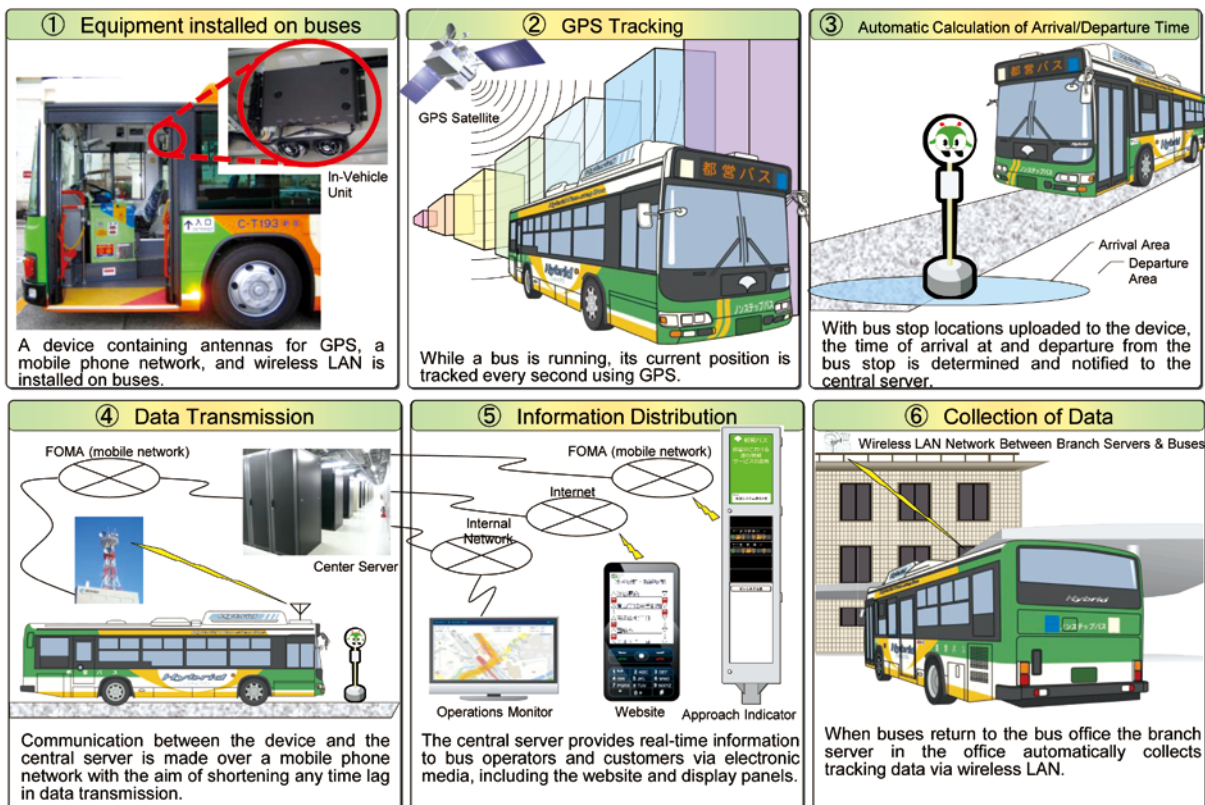
With the aim to enhance services, the system distributes detailed information on bus operations such as the location of approaching buses and the estimated amount of time required to reach a destination.

Overview: Provision of information on Toei Bus operations collected by GPS

- Data on the location of Toei buses (operated by the TMG Bureau of Transportation) is collected using GPS and other systems, and then shared with users through information terminals such as display panels at bus stops, mobile phones, and computers.
- Other services are also provided for these devices, including a search function that displays bus stops on a map, an application that guides users of GPS-equipped mobile phones to the nearest bus stop, and a Toei Transportation route search function.

Details: Specific technology utilized

Information on bus operations is transmitted by linking the following six systems.



Infrastructure

Disaster prevention

Environment

Health, Industry

Technology for Non-Revenue Water (NRW) Reduction

Exchange with Bangkok, Taipei, Yangon, Delhi

Objective: To reduce NRW, which is essential for the sound management of water utilities

Through technologies to reduce NRW, Tokyo works to achieve effective use of precious water resources, reduce environmental impact, and improve the efficiency of operations.

Overview: Leakage prevention technology to reduce NRW


Tokyo Waterworks has actively promoted leakage prevention measures, and has reduced the percentage of NRW to just 3 percent.

Details:

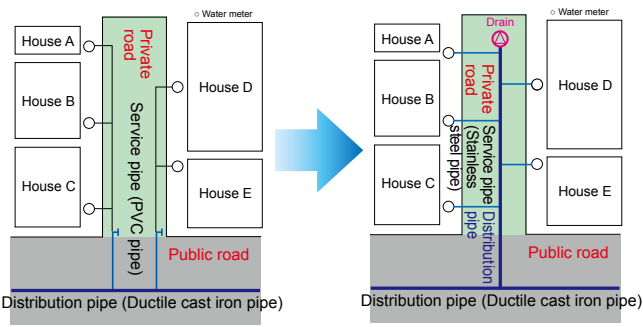
(1) Replacement of water pipes and improvements in materials

Preventive measures are taken to prevent water leakage before it happens, as well as to eliminate any existing underground leakage.

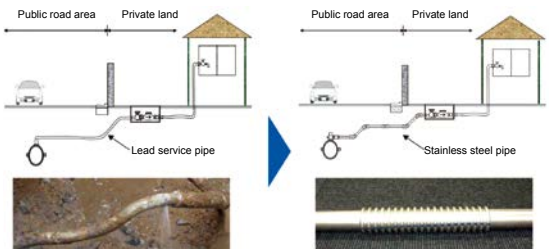
Replacement of old pipes



Upgrading service pipes



Introduction of stainless steel service pipes



(2) Methods of effectively finding and repairing leakage

- Scheduled work to detect and repair underground leakage early on. (Implementation of planned leakage tests by district.)
- Mobile emergency work to promptly repair leakages that appear above ground. (A system capable of 24/7 response has been built.)

<Instruments used to detect leakage>

Leakage sound detection bar





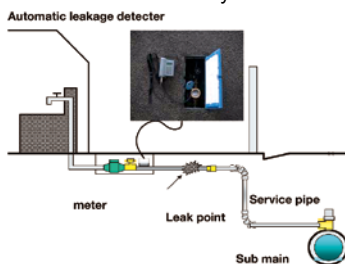
Electronic leakage detector



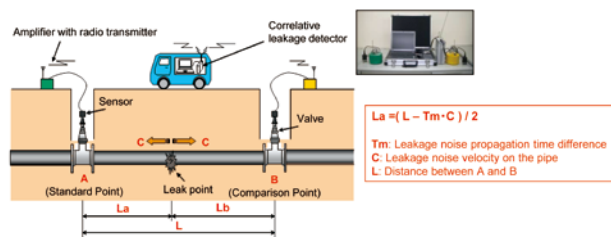


(3) Development of advanced technologies to prevent leakage

<Time integral type leakage detector>
Instrument that automatically detects leakage



<Correlative leakage detector>
Instrument that isolates the location of leakage



Infrastructure

Disaster prevention

Environment

Health, Industry

Water Purification Technology & Water Quality Management System

Exchange with Taipei

Objective: To supply potable and delicious tap water

To improve public health and the living environment by supplying potable and delicious tap water.

Overview: Technology and system capable of accommodating all water resources

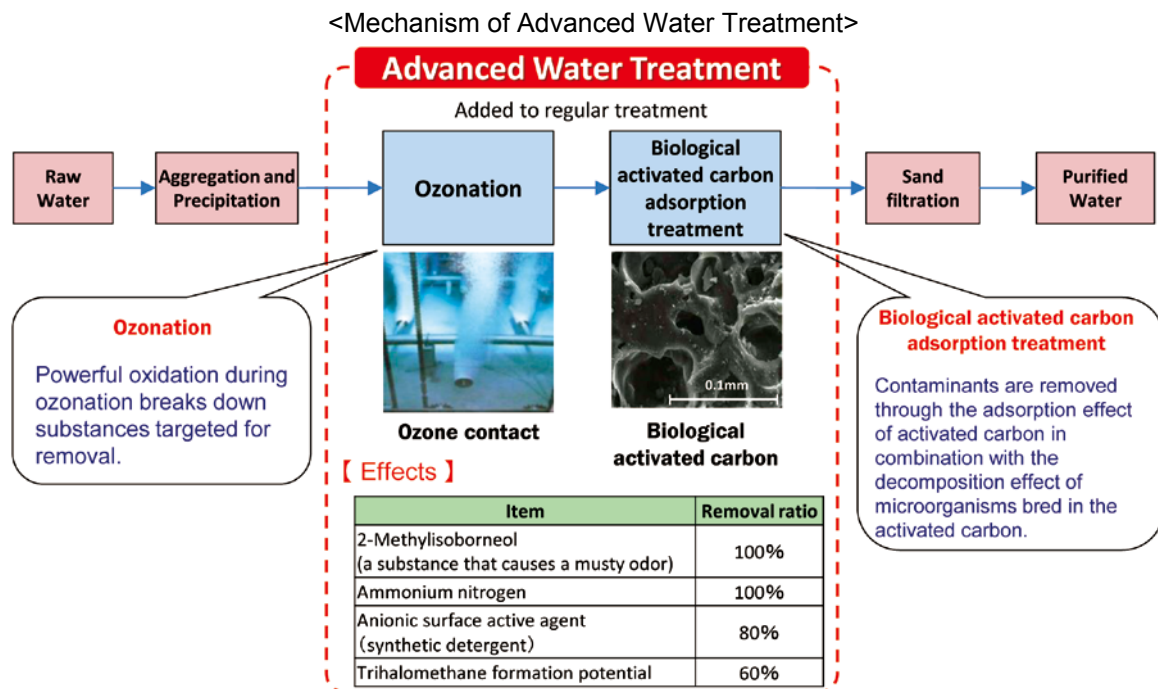
Water purification technology and a water quality management system for water from all kinds of water sources such as river water, lake water, and ground water.

Details:

(1) Water purification technology currently used by Tokyo Waterworks

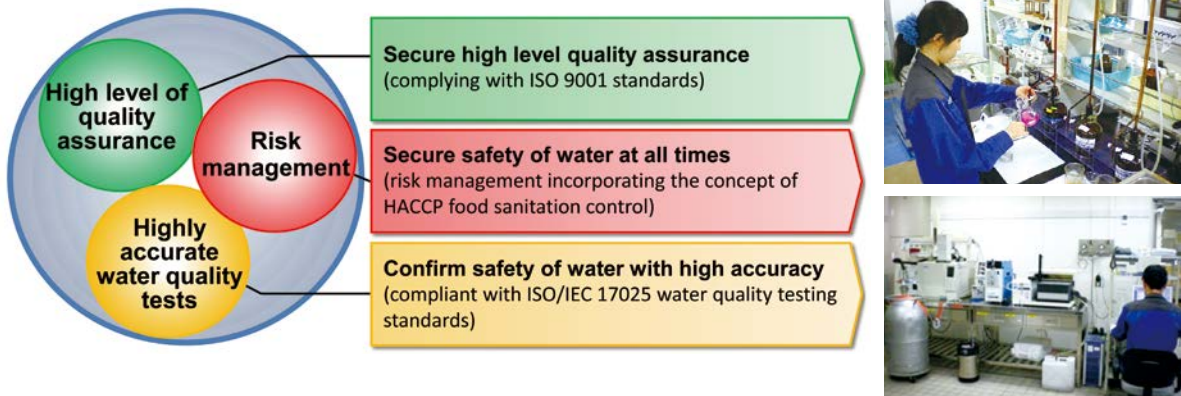
Rapid sand filtration, advanced water treatment*, slow sand filtration, membrane filtration, deferrization/demanganization, aeration, etc.

*Advanced water treatment is water purification with the objective of removing matter that cannot be removed through regular treatment.



(2) Comprehensive Water Quality Management System

Water quality from water resources to the taps is managed comprehensively in order to supply high quality tap water.



Infrastructure

Disaster prevention

Environment

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Water Supply Control and Management

Exchange with Delhi, Taipei

Objectives: To efficiently control the overall flow of water at all times

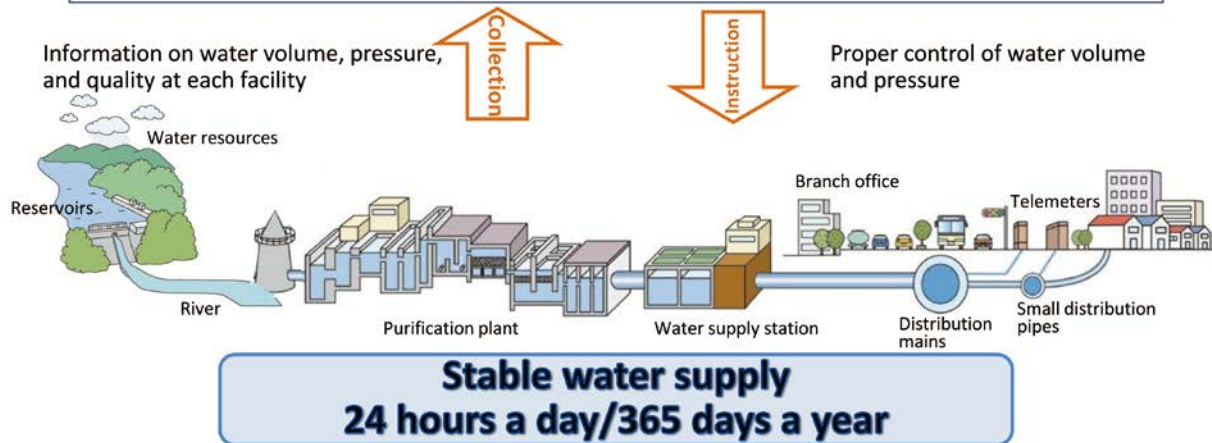
- Provide a constant supply of water in an efficient and stable manner even with day-to-day shifts in water demand
- Through constant monitoring, Tokyo works to spot trouble and irregularities in water quality early on and promptly respond to incidents.

Overview: Comprehensive control over waterworks for a large area in Tokyo

- In order to provide a stable supply of water to a water district that covers a wide area, the system consolidates collection of information on factors such as water volume, pressure, and quality, and comprehensively controls and manages water volume and pressure.

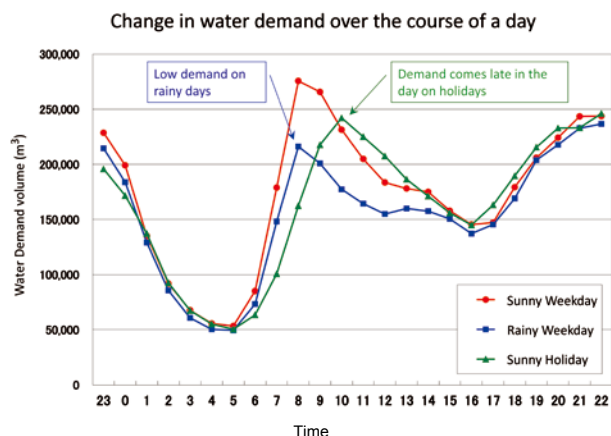
Water Supply Operation Center

(24-hour system to comprehensively control water supply from the reservoirs to distribution pipes)



Details: Implementing comprehensive control of water

- Water volume and pressure are secured through the operation of pumps synchronized to changes in water demand over the course of a day and other means.
- Water supply is ensured through measures such as the ability to quickly switch over to a different river system when trouble occurs.
- Efficient use of energy and low cost operations.



Infrastructure

Disaster prevention

Environment

Health, Industry

Robust Water System

Exchange with Taipei

Objective: To build a robust water system in preparation for disasters and accidents

To minimize damages to water facilities in the event of a disaster or accident, and secure water supply to all possible extent.

Overview: Bolster backup functions and earthquake resilience

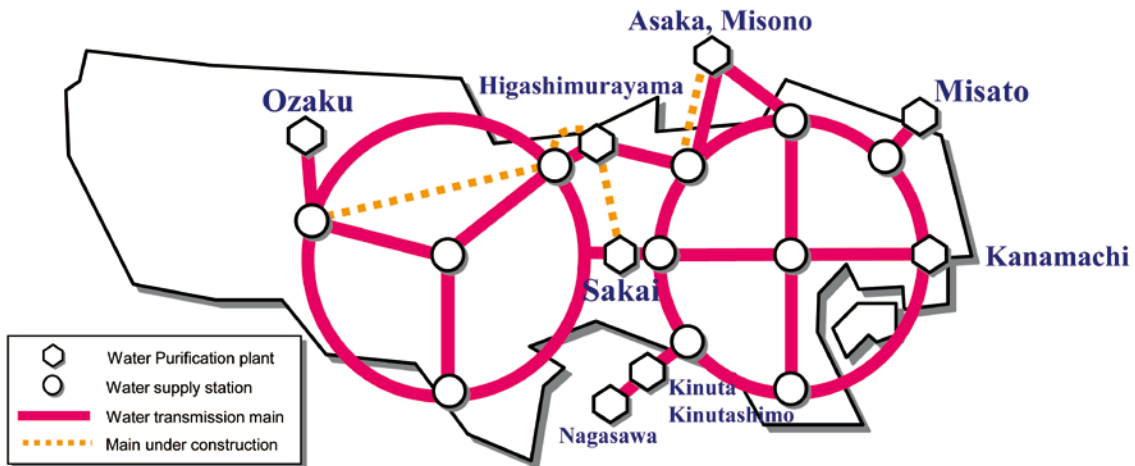
Along with bolstering backup functions in the event of an accident through the duplexing and networking of pipelines, efficient earthquake resistance of the water supply system will be implemented to prepare for disasters.

Details:

(1) Duplexing of conveyance facilities & duplexing/networking of transmission pipes

- Duplexing the conveyance facilities and transmission pipes, which must not stop operating
- Building a regional transmission pipe network that enables backup support

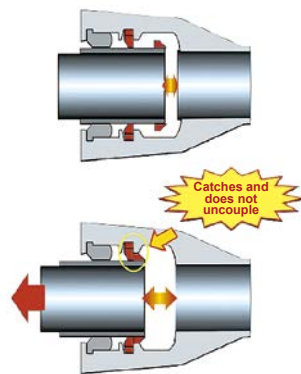
<Network of Water Transmission Pipes>



(2) Earthquake resilience of the water supply system overall

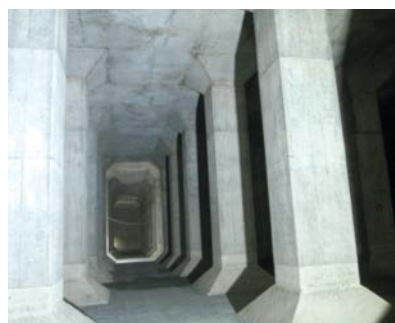
- Earthquake resistance is secured in order to minimize damage in the event of an earthquake and ensure water supply to all possible extent.
- To maintain continuity from water intake to water supply, enhancement of earthquake resistance is implemented effectively. These include setting priorities and implementing seismic retrofitting from key facilities.

<Earthquake-resistant joint pipe>



Joint with interlocking function

<Example of seismic reinforcement of distribution reservoir>



Before seismic reinforcement



After seismic reinforcement (installation of quake resistant walls)

Storage of Water for Tokyo's Water Supply

Objective: To secure stable water resources

To secure stable water resources capable of handling seasonal changes in precipitation and shifts in water demand

Overview: Store rainwater and snowmelt (raw water) to provide a stable water supply

(1) Ogouchi Reservoir

Located in Okutama Town, Nishitama-gun, Tokyo, on the main stream of the Tamagawa River, Ogouchi Reservoir is Japan's largest dam specifically used to contain water to be used as an urban water supply.

Effective storage capacity 185.4 million m³

Type Gravity-type concrete dam

Height 149

Length 353

(2) Yamaguchi Reservoir

The Yamaguchi Reservoir was built utilizing the geography of the Sayama Hills, which straddle the Tokyo Metropolis and Saitama Prefecture.

Effective storage capacity 19.53 million m³

Type Earth dam

Height 34m

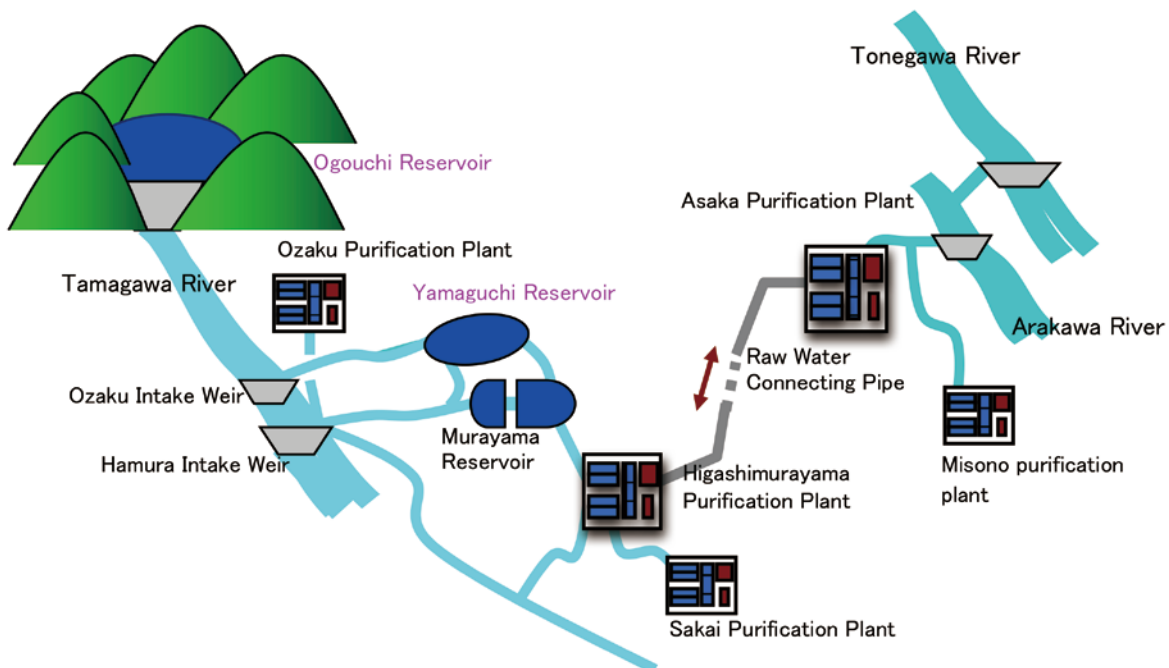
Length 716m



Details: How raw water is brought into Tokyo's water supply

After being used to generate electricity at hydroelectric power plants of the Tokyo Metropolitan Government Bureau of Transportation and the Tokyo Electric Generation Company, the water is released into the Tamagawa River, where it is later drawn in at the Ozaku and Hamura intake weirs.

Through natural downward flow, water that has been drawn flows toward the Higashimurayama and Sakai purification plants via the Murayama and Yamaguchi reservoirs or the Tamagawa Josui water channel. Water can also be pumped to the Ozaku Purification Plant. It is also possible to send water to both the Asaka and Misono purification plants using raw water connecting pipes.



Infrastructure

Disaster prevention

Environment

Health, Industry

Consolidation of Wastewater and Sludge Treatment Facilities

Exchange with Malaysia (Langat area)

Objective: To provide a reliable wastewater treatment system and improved water environment

More efficient wastewater treatment by consolidating wastewater treatment and sludge treatment facilities will make reliable wastewater treatment possible and improve the area's water environment.

Overview: Efficient treatment of wastewater and sludge

Abolishing existing, small wastewater treatment facilities, laying an extensive network of sewer pipes, and consolidating wastewater and sludge treatment processes at a large-scale wastewater treatment facility, will make efficient and reliable treatment possible, including savings in personnel and maintenance costs.

Details: Case study of a sewerage project in the Langat area, Malaysia

A project that will consolidate about 160 small wastewater treatment facilities into a new plant to treat wastewater and sludge in an efficient manner, is scheduled for the Langat area, about 25 km away from the Malaysian capital of Kuala Lumpur.

This is Japan's first overseas project undertaken by a public-private consortium that covers an entire sewerage system. The consortium will handle all aspects from design to construction and maintenance of the system covering facilities from sewer pipes to pumping stations and the treatment plant.

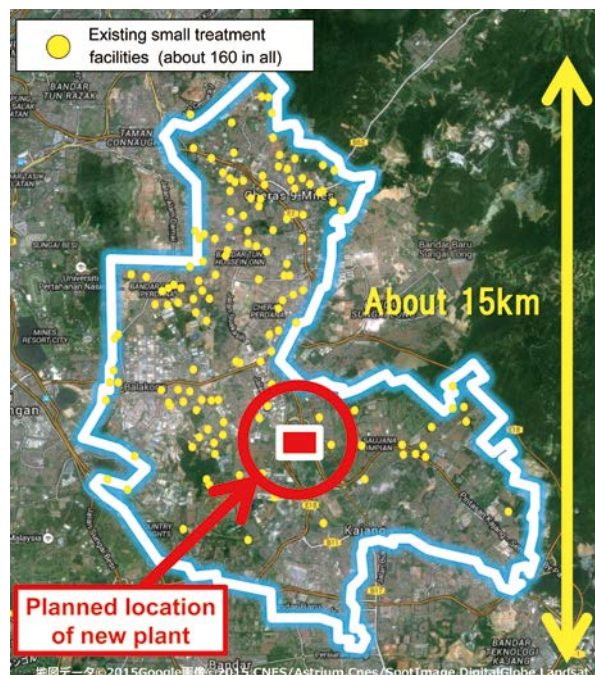


Pollution of the Langat River is increasing



On-site study for project plan formulation

Project Area Map



Infrastructure

Disaster prevention

Environment

Health, Industry

Deep Reaction Tank for Compact Wastewater Treatment Facilities

Exchange with Malaysia (Langat area)

Objective: To secure sufficient treatment capacity even on small sites

Using a reaction tank that is deeper than conventional tanks makes it possible to build a wastewater treatment facility with sufficient capacity even on a small site.

Overview: Small footprint with twice the depth

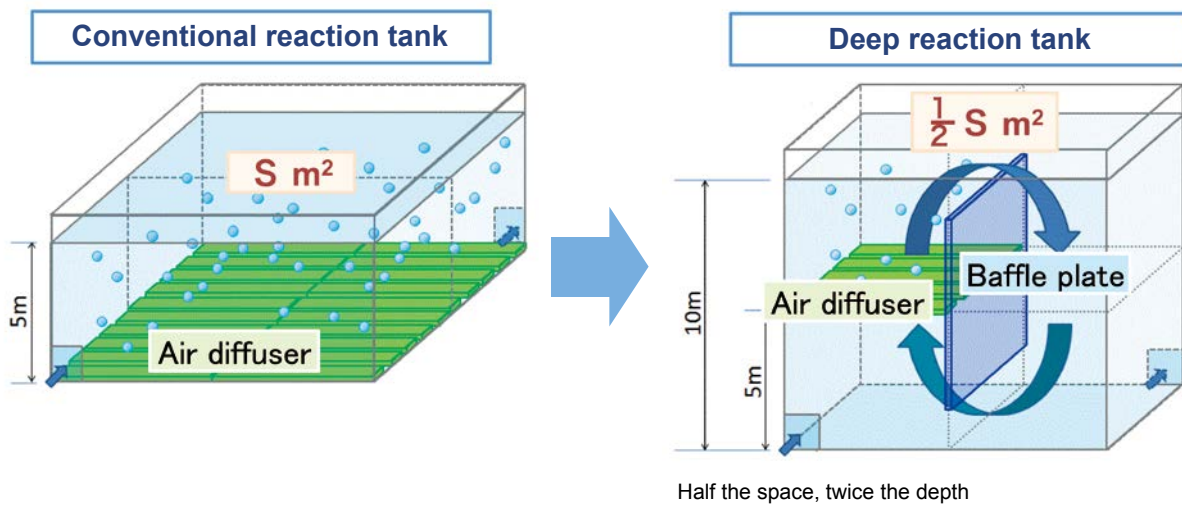
Treatment of large volumes of wastewater requires an expansive water reclamation center site. In a congested city like Tokyo, however, it is not easy to secure such a large space. Using a deep reaction tank with twice the depth of a conventional tank makes it possible to build a facility on an area half the size.



Example of reaction tank

Details: Characteristics of the deep reaction tank

- The deep reaction tank developed by the TMG can efficiently remove pollutants from sewage, thus contributing to the improvement of water quality.
- This technology is slated to be adopted for the sewerage system project in Malaysia’s Langat area, as only a small area is available for the treatment plant.



Air diffuser

Infrastructure

Disaster prevention

Environment

Health, Industry

Sewer Rehabilitation Method

Exchange with Singapore, South Korea, the United States, etc.

Objective: Reinforcing aged sewers from the inside without the need to rip up streets

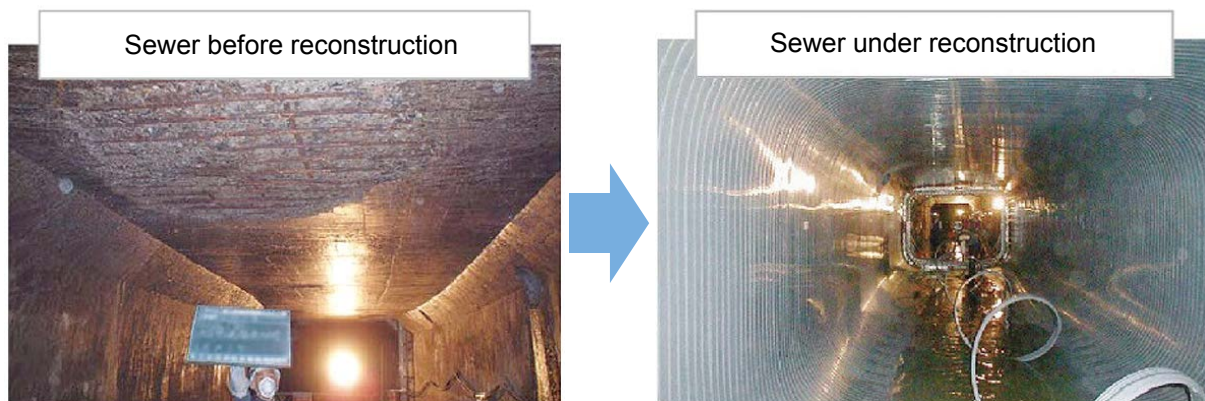
Sewerage services in Tokyo's 23 wards started in the 1880s, and coverage reached nearly 100% (over 99.5%) in 1995. However, sewers installed in the early stages are aging. The Bureau of Sewerage is therefore promoting reconstruction of its sewers using a rehabilitation method that reinforces pipes from the inside, without the need to rip up streets.

Overview: Sewer rehabilitation by lining the inside of sewer pipes

This method rehabilitates existing sewers by lining the inside of the sewer pipe. Because trunk sewers are large sewers that form the backbone of the sewer network, collecting and sending large volumes of sewage downstream to pumping stations and water reclamation centers, etc., this method is taken to reinforce them from the inside without digging up the road.

Details: Example of rehabilitation method provided overseas

This method can be used even in sewers in service, and can be applied in pipes with various cross sections, including circular, horseshoe and rectangular shapes.



The strength of the sewer has been reduced due to deterioration of the concrete surface and corrosion of reinforcement steel.

The sewer is lined with rigid polyvinyl chloride material to strengthen it. This enables low-cost and quick renewal since the streets do not have to be ripped up.



Reconstruction work inside a circular-shaped sewer

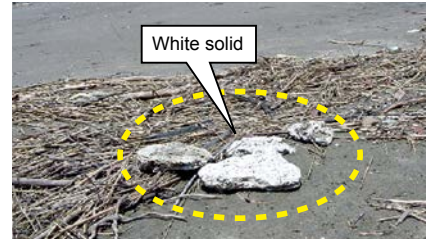
Preventing Flow of Debris into Rivers during Rain

Exchange with Europe, Korea, and the United States

Objective: To alleviate pollution load on the rivers

Debris and white solids from combined sewer systems could flow into rivers during rain, increasing the pollution load on the rivers.

With the aim to improve the water quality of rivers and the sea, the Tokyo Metropolitan Government has installed water surface control devices to prevent the flow of debris into the rivers.



White solid that has floated to the beach (before installation of the water surface control device)

Overview: Installation of guide wall and board for water surface control

By installing a guide wall and board for water surface control in the manhole before the stormwater outlet to prevent overflow, a swirl is created and makes it easier to send the debris to the water reclamation center.

Details: Mechanism of the water surface control device

The device features easy installation, has no need for power, and is inexpensive. It can remove over 70 percent of the debris in wastewater.

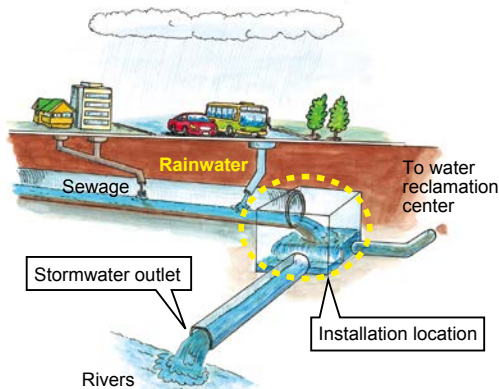
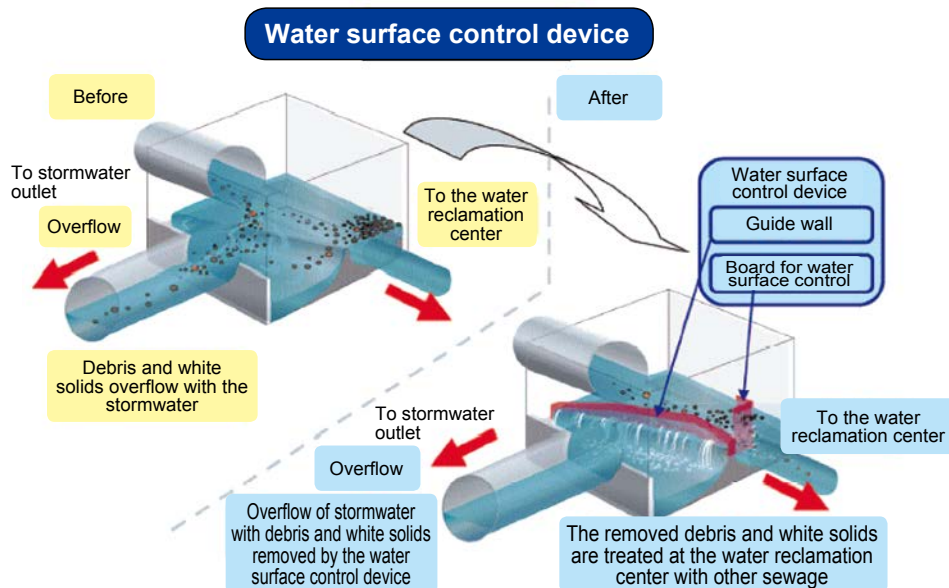


Image of installation location of water surface control device



Installation of water surface control device (case of Germany)



Mechanism of the water surface control device

Infrastructure

Disaster prevention

Environment

Health, Industry

Sewerage Technology Training Center

Exchange with Brazil, Vietnam, etc.

Objective: To train personnel in the sewerage field and pass on technologies

Through the process of experiencing operations first hand, including training in a variety of areas, such as civil engineering, machinery, electrical systems, and water quality management, and simulations, the center effectively facilitates quick mastery of knowledge and skills, as well as the transmission of technology and operational know-how.

Overview: Sewerage Technology Training Center

Located within the Sunamachi Water Reclamation Center, the Sewerage Technology Training Center is Japan's first large-scale training facility dedicated to sewerage technologies. There are 21 types of training facilities set up within the training building and 12 outdoors. The basic concept for the training facility is to allow trainees to "see, touch, and experience." Training facilities replicate actual facilities to the extent possible in size, materials used, and structure, allowing trainees to practice under the same conditions as in the field.



Sewerage Technology Training Center

Details: Training Facilities

(1) Manhole replica

A replica of an actual manhole and sewer pipe allows trainees to learn safety measures to be taken when entering a manhole and other skills.



(3) Operations simulator

This facility replicates an actual monitoring room, enabling trainees to experience management of operations at facilities, including operating pump stations and response in the event of malfunctions.



(2) Simulation of walking in water in a pipe

This facility recreates actual water flow in a sewer pipe, allowing trainees to experience the difficulty and dangers of walking in water flowing through a pipe.



(4) Industrial wastewater treatment experimental system

Trainees are able to learn hands-on about methods in actual use at facilities, including neutralization and heavy metal treatment methods, and hexavalent chromium reduction methods.



Fire Rescue Training Techniques

Exchange with Bangkok, Hanoi, Jakarta, Kuala Lumpur, and Taipei

Objective: To develop rescue technique trainers

To systematically develop emergency responders' abilities to cope with a range of challenging, complex disasters by passing on fire rescue training techniques.

Overview: Two-phased program

Domestic training: Fire/rescue members in leadership positions are accepted from participating cities as trainees.

Overseas training: After completion of the domestic training session, participants return home to become trainers. TFD instructors are then sent to the training sessions held by these new trainers to confirm their skills and provide support.

<Past Achievements>

YEAR & CITY	Foreign Trainees Accepted	TFD Members Sent Out	Local Training Session Participants
2008: Bangkok	6	5	60
2009: Kuala Lumpur	2	3	21
2010: Bangkok	6	3	75
2011: Jakarta	2	5	34
2012: Bangkok	6	5	40
2013: Hanoi	6	3	48
2014: Hanoi	6	3	51
2015: Jakarta	5	—	—
2016: Taipei	6	3	80

Details: Examples of basic fire rescue skills instruction

- Ropework (for equipment & people) • One rope bridge crossing/Rappelling
- High angle rescue • Confined space rescue • NBC (nuclear, biological and chemical) disaster management
- Victim transportation • Safety management awareness



Session for rope rescue anchor creation



Session for a ladder rescue (with a victim trapped below)



Session for horizontal stretcher rescue from a single suspension point



Session for rappelling

Response Technology for Special Incidents (e.g. NBC*)

(*nuclear, biological, and chemical)

Exchange with France, Korea, Taiwan, the United States, Vietnam, etc.

Objective: To respond to special disasters

To handle hazmat/NBC disasters.

Overview: Fire Rescue Task Forces for NBC disasters and Hazmat Units

The 3rd and 9th Fire Rescue Task Forces are in service as “high-performance” units to specially deal with hazmat/NBC disasters. In addition, there are nine Hazmat Units that are specially equipped for chemical disasters.

TFD Service Area



Details: Special vehicles & equipment

Special vehicles and equipment are deployed to the 3rd and 9th Fire District HQ Fire Rescue Task Forces.



Special Incident Trucks

Special incident trucks carry advanced equipment, such as analyzing equipment, to respond to NBC disasters. The TFD is the only organization in Japan to have special incident trucks with enhanced radiation protection features such as barriers of lead and water to shield the vehicle, as well as positive air pressure inside the vehicle.

Detection Robot

The remote-controlled cameras of the robot are used for fact-finding at disaster scenes that cannot be entered by rescue personnel. Its instruments also detect and measure radiation, flammable gases, chemicals, and other substances.



Rescue Robot

The remote-controlled arms of the robot remove debris. The robot’s conveyor belt is used to rescue victims by drawing them inside.

Fire Department Earthquake Preparedness Systems

Exchange with China, France, Israel, Portugal, Romania, and the United States

Objective: To mitigate earthquake damage

To mitigate earthquake damage by putting together and systemizing necessary information in data systems to help emergency responders take appropriate action immediately after a devastating earthquake.

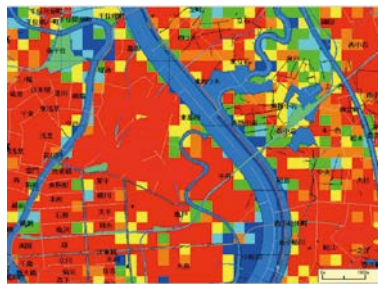
Overview: Temporal and spatial understanding of the disaster situation and firefighting capabilities

A set of 10 unique systems was developed to support the TFD's firefighting activities for earthquake damage mitigation. The systems allow temporal and spatial understanding of the disaster situation such as fire and building collapse (outbreaks and spread estimates), and response capabilities such as the number of firefighters and vehicles that can be mobilized.

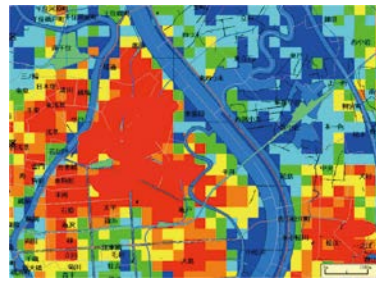
Details: Examples of systems

● Earthquake Damage Estimation System

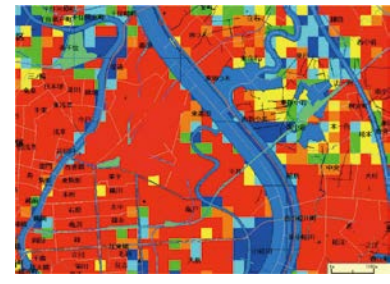
This system estimates the risk of fire outbreaks, fatalities, building/ground damage, road obstructions and other kinds of damage immediately after an earthquake.



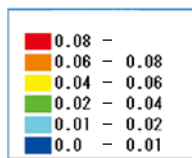
Fire Outbreak Estimates (Ward A) *EXAMPLE



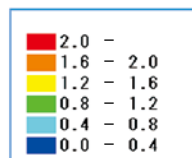
Fatality Estimates (Ward A) *EXAMPLE



Bldg. Collapse Estimates (Ward A) *EXAMPLE



Fires



Fatalities



Building Collapse

Damage Estimation (64 items) *EXAMPLE

Ward: A
 Number of Fires: ○○
 Burned Area: ○○○○m²
 Number of Fatalities: ○○
 ●
 ●
 ●

Earthquake Damage Estimation System

● Fire Spread Simulation System

This system estimates both the spread of fire and the number of necessary firefighting units based on weather conditions (e.g. wind direction/velocity), city composition, expected building collapse, and other factors, and depicts this on maps where necessary information such as building shape, structure, and number of floors have been entered beforehand.



1 hour later



2 hours later



3 hours later

Fire Spread Simulation System

Infrastructure

Disaster prevention

Environment

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Improvement of Districts with Close-Set Wooden Houses

Objective: To turn areas with close-set wooden houses into communities that do not burn or spread fire

Of areas with close-set wooden houses, which contain a high concentration of aging wooden structures, those expected to sustain particularly serious damage when a major earthquake occurs have been designated as development districts*. In order to eliminate this danger, Tokyo is promoting the fireproofing of these neighborhoods and development of firebreak belts in an integrated manner.

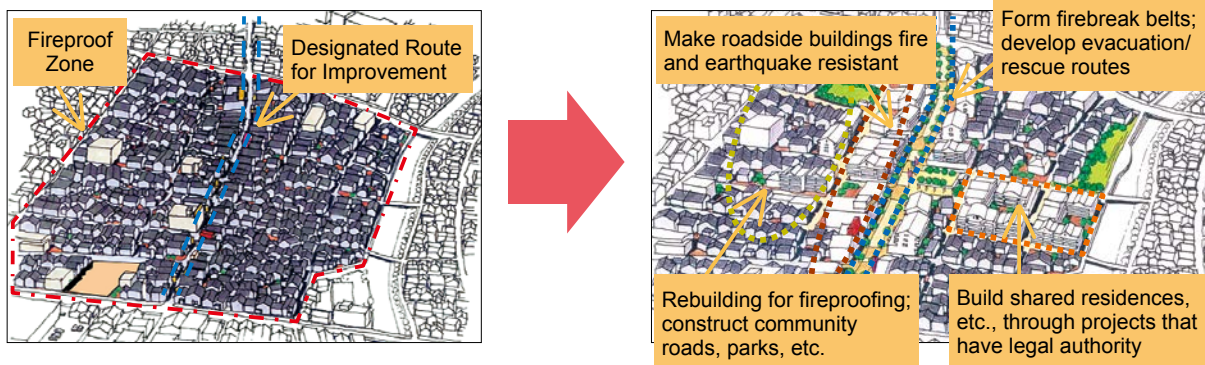


*Districts covering an area totaling approx. 6,900 ha

(About 11% of the land area of the wards, containing about 300,000 wooden houses and a population of about 1.8 million people)

Overview: Prompt resolution of issues through two initiatives

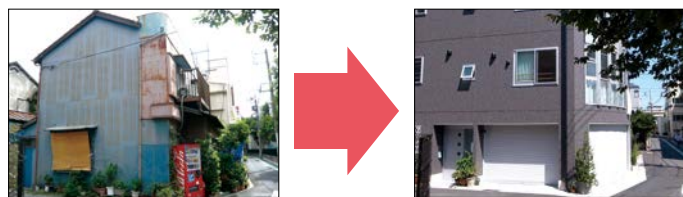
Tokyo designates areas in particular need of improvement as fireproof zones, and is promoting the fireproofing of buildings through tax incentives and subsidies for the cost of rebuilding. In addition, Tokyo designates roads that will be effective in blocking the spread of fire and facilitating evacuation as designated routes for improvement. While extending support to property rights holders to assist them in rebuilding their lives, Tokyo works for early completion of these roads.



Details: Examples of initiatives

1) Fireproof zones

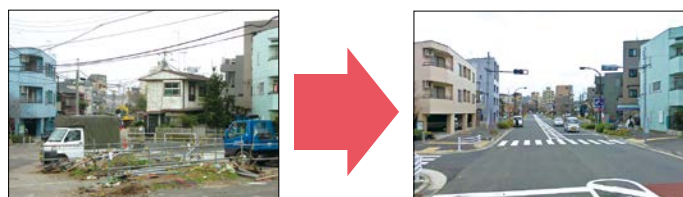
- Provision of subsidies to cover demolition costs and design costs to rebuild houses
- Reduction/exemption of Tokyo Metropolitan tax
- Provision of plans by experts to support displaced residents
- House-to-house surveys of local residents' needs



Replacement of an old wooden building with a fireproof one

2) Designated routes for improvement

- Conducting surveys on residents/businesses in the area regarding their wishes; establishment of consultation desks using private sector businesses
- Assistance with relocation expenses, finding replacement land for relocation or introducing metropolitan housing



Development of a city-planned road

Seismic Resistance of Buildings along Disaster Response Routes

Objective: To prevent the blockage of disaster response routes following a major earthquake

Road blockage could greatly hinder wide area evacuation, as well as emergency and firefighting activities, leading to huge damages.

In preparation for a major earthquake, the TMG designates roads that should not be blocked after an earthquake strikes, and places priority on promoting the seismic resistance of buildings along these roads.



Road blocked by a collapsed building following the 1995 Great Hanshin-Awaji Earthquake



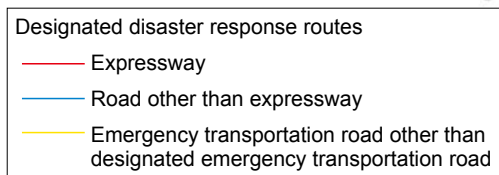
A disaster response route, which will serve as a major artery for the transport of relief, etc. in the event of a disaster

Overview: Carrying out seismic inspections and retrofitting

- It is mandatory for owners of buildings located alongside designated routes to carry out seismic inspections
- The TMG subsidizes building owners for the cost of seismic retrofitting.

Details: Map of designated disaster response routes

Designated Disaster Response Routes (about 1,000km in total length) are emergency transportation roads in particular need of the promotion of seismic retrofitting of buildings along the route.



Details: Mandatory seismic-resistance inspections, enlightening the public about seismic-resistance inspection and retrofitting, and subsidizing retrofitting costs

- Seismic inspections are mandatory for owners of buildings along designated disaster response routes.
- Advisors are sent to buildings situated along designated disaster response routes to help formulate retrofitting plans. In addition, metropolitan and municipal staff members visit areas along routes that have a low rate of seismic-resistant buildings to actively enlighten the public.
- When the inspection reveals lack of seismic resistance, the TMG urges the owner to carry out seismicretrofitting, and supports efforts by subsidizing a portion of the costs.

Measures to Suppress the Surfacing of Manholes Due to Liquefaction

Exchange with New Zealand

Objective: To mitigate the uplift of manholes and ensure transportation functions

Liquefaction from the strong shaking of an earthquake could result in buoyant forces lifting the manholes. As this would have a large impact on sewer functions and passage of emergency vehicles, manholes are being fitted with mechanisms to prevent uplifting during an earthquake.



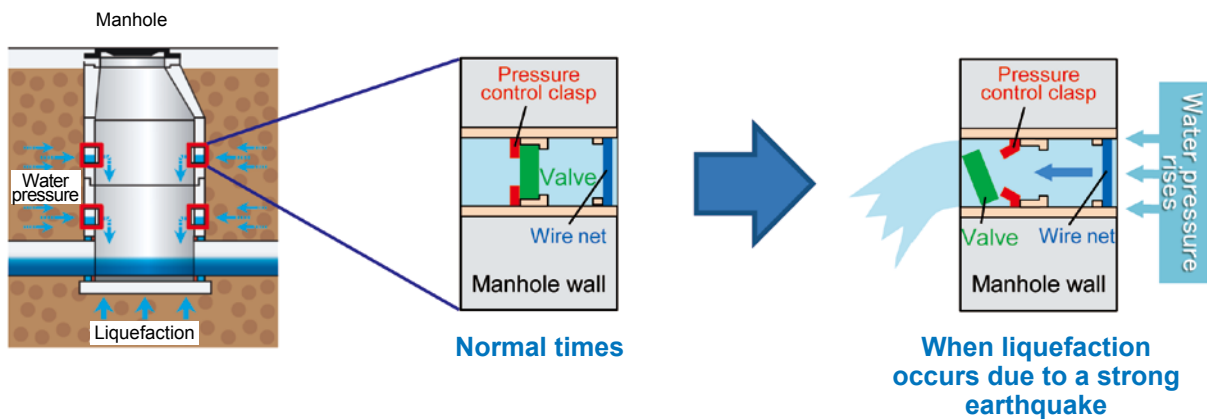
Manhole uplift due to liquefaction
(Great East Japan Earthquake (March 11, 2011))

Overview: Releasing excess pressure into the manholes

This technology installs pressure control devices on the wall of the manhole, and by releasing the excess pressure generated from liquefaction into the manhole, the uplift of the manhole is suppressed.

Details: Mechanism of mitigating floatation

Valves are installed on the inner wall of manholes. When liquefaction occurs from the strong shakings of an earthquake, and water pressure rises, the valves automatically fall off and ground water flows into the manholes. This lowers the water pressure and mitigates the uplift of manholes.



Valve placed inside the manhole



Approx. 12 cm

Infrastructure

Disaster prevention

Environment

Health, Industry

Collection and Provision of Ground Survey Results

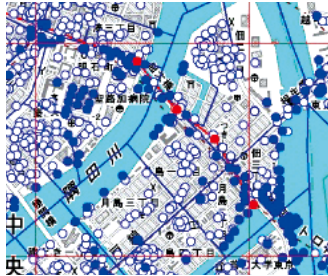
Objective: To broadly use ground survey data to implement measures for disaster preparedness, construction, and the environment

Tokyo has created a database of ground survey results to be used as a basic reference source for earthquake measures, including liquefaction measures, and the construction of urban infrastructure. The database is also available online for broad use of the information by the residents of Tokyo.

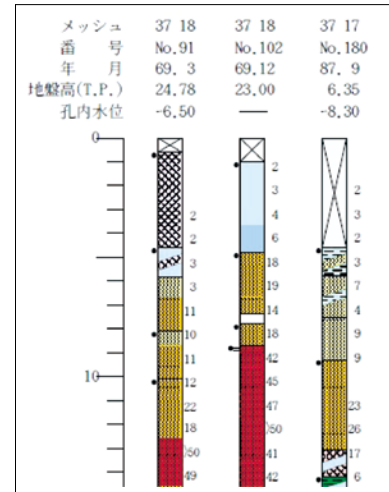
Overview: Collection, sharing and usage of boring data

Data from ground surveys conducted by various organizations, including data on ground firmness and soil properties, is collected and compiled to form a database.

In addition to being used for disaster preparedness, this data has been used in the construction of the Toei Oedo Subway Line and plans for the Chuo Shinkansen line. Tokyo is making this information accessible to the public through the Internet and pamphlets.

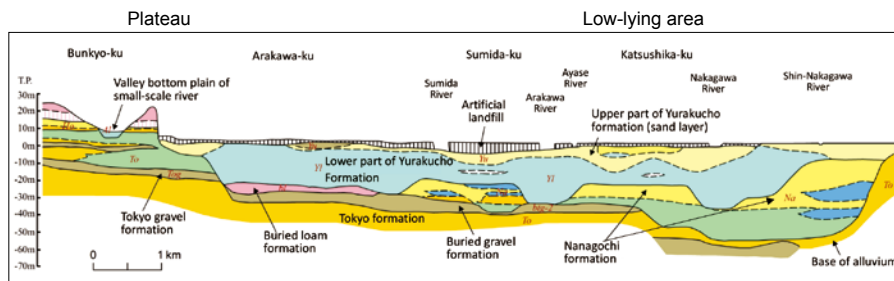


Screen display for boring data search results
 * Data available for approx. 20,000 points throughout Tokyo
 * The highly concentrated data for the 23 special wards is provided in an average 200-meter mesh (No data available for the mountainous areas and the Tokyo islands)

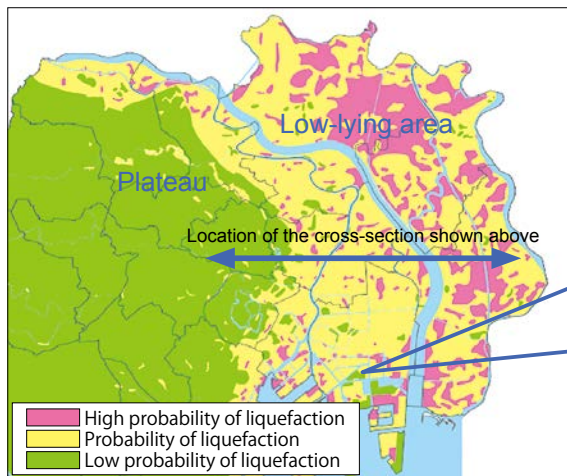


Borehole Log
 *Soil data by depth

Details: Examples of use of ground survey results



Cross-sectional soil profile map created from boring data
 * You can see that in comparison to the plateau, bearing layers (hard soil that supports building piles, such as the Tokyo gravel formation) are located more deeply below the surface in the low-lying area.



Liquefaction potential map created from boring data
 * You can see that low-lying areas with silty sand deposits are prone to liquefaction.



Liquefaction caused by the Great East Japan Earthquake (March 11, 2011)
 • Sand and groundwater is gushing out of the crack in the road.

Infrastructure

Disaster prevention

Environment

Health, Industry

Development and Management of Shoreline Protection Facilities

Objective: To prevent flood damage caused by storm surges and tsunamis

Facilities protect the lowland waterfront area of Tokyo, which makes up approximately 40% of the land of the ward area and has a population of about 3.0 million, from flood damage caused by storm surges and tsunamis.

Overview: Structural and non-structural measures

- Technology related to the construction of shoreline protection facilities such as floodgates, seawalls, and interior embankment structures

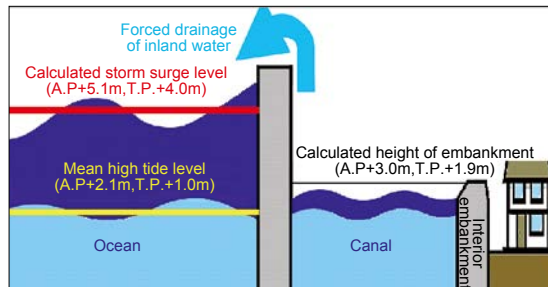
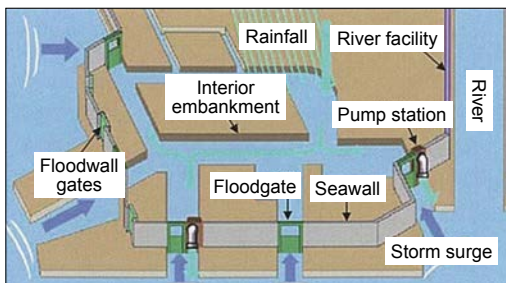
The TMG builds a line of protective structures approx. 5-8 meters in height to prevent seawater from flooding inland due to storm surges or tsunamis occurring from an earthquake of the largest scale.

- Technology related to the operation of floodgates, floodwall gates
- Normally, floodgates (on canals and rivers) and floodwall gates (on roads) are kept open for the passage of ships, people, and cars. When a typhoon or earthquake strikes, the floodgates and floodwall gates are closed, allowing them to serve as part of the embankment to protect inland areas from flooding.



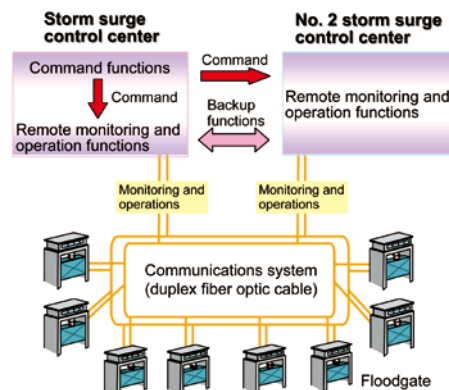
Details: Mechanism of shoreline protection facilities and their management by remote control

- Mechanism of shoreline protection



- Remote control of floodgates and backup functions

Storm surge control centers are prepared for sudden, unexpected situations by constantly monitoring images from onsite surveillance cameras and information signals. The two storm surge control centers and floodgates are connected by duplex fiber optic cable, allowing the floodgates to be closed by remote control. Backup functions are also in place. If one of the centers should fail to function, the other center will be able to open and close all the floodgates.



Reduction of Flood Damage through River Basin Measures

Objective: To reduce flood damage

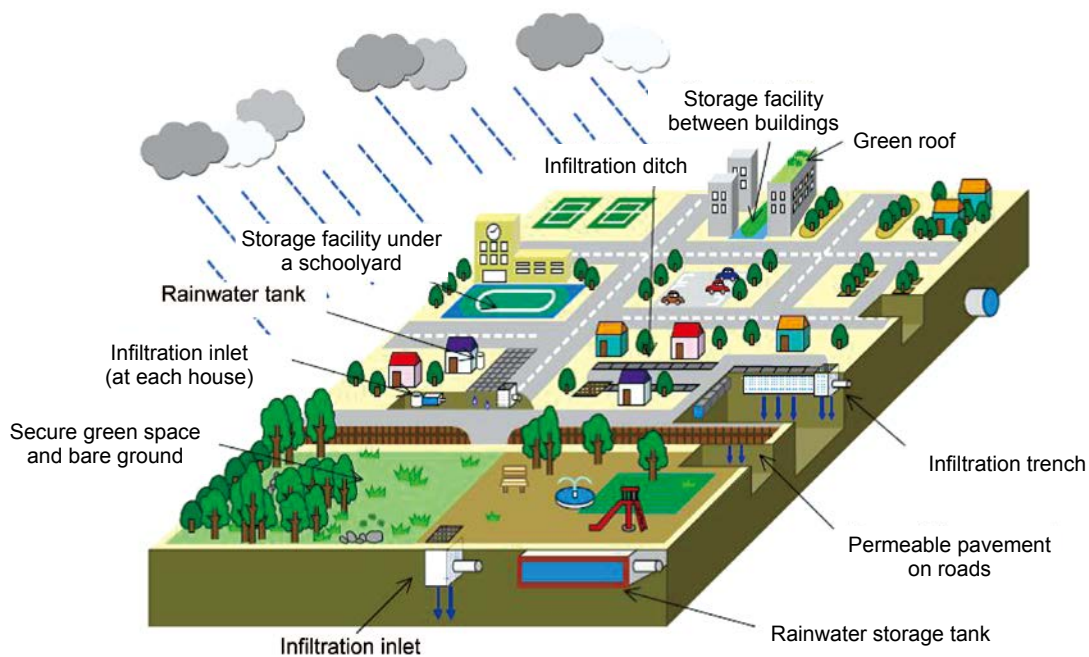
- We aim to reduce urban flood damage by inhibiting the direct flow of rainwater into rivers and the sewer system during a torrential downpour through maximum use of rainwater retention and rainwater infiltration.

Overview: Implementation of river basin measures

- Installation of rainwater storage and infiltration facilities at public facilities such as schoolyards and parks
- Promotion of the installation of rainwater runoff control facilities through efforts such as subsidizing programs conducted by the municipalities for installation of infiltration inlets at private residences

Details: Types of rainwater runoff control facilities and installation examples

- Types of rainwater runoff control facilities



- Installation examples



Rainwater storage facility under a schoolyard



Infiltration inlet



Infiltration trench

Infrastructure

Disaster prevention

Environment

Health, Industry

Flood Control through Regulating Reservoirs

Exchanges with Seoul and Beijing, etc.

Objective: To prevent flood damage caused by typhoons and torrential rains

With torrential rains occurring more frequently in recent years, the TMG is promoting the improvement of small and medium-sized rivers to protect the lives and livelihoods of Tokyo citizens from floods resulting from typhoons and heavy rains.



1982 typhoon (Kanda River)



2005 torrential rain (Myoshoji River)

Overview: Improvement of small and medium-sized rivers

The Bureau of Construction is working to quickly enhance safety from flood damages. Along with river channel improvements, including widening, in urban areas where there are many buildings and houses along a river, the Bureau constructs regulating reservoirs to hold flood waters and diversion channels to divert some of the flood water.



Before



After

River channel improvement



Underground regulating reservoir

Regulating reservoir

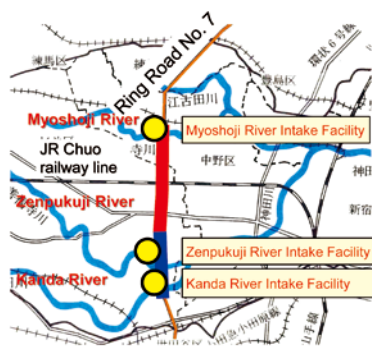


Diversion Channel

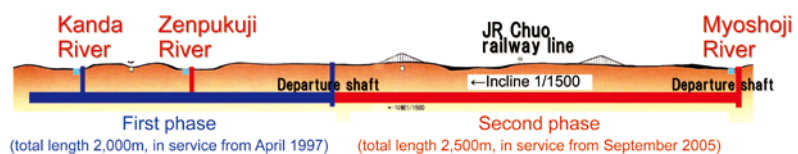
Diversion channel

Details: Kanda River / Ring Road No. 7 Underground Regulating Reservoir

The Kanda River / Ring Road No. 7 Underground Regulating Reservoir was constructed with the aim of quickly enhancing safety from flooding in the Kanda River middle basin that is prone to flooding. Located about 40 meters beneath this arterial road, it is a 4.5km long tunnel with an inner diameter of 12.5 meters, which can store 540,000 cubic meters of water. As of August 2016, the facility has taken in water from the river 39 times since it went into service in April 1997, demonstrating high effects in reducing flood damages in the downstream area.



Location of the reservoir



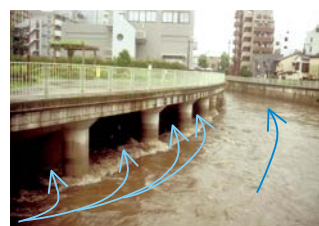
Cross section of the reservoir



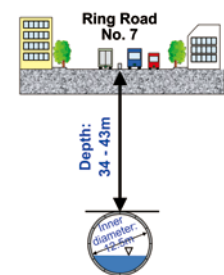
Shield machine



Tunnel interior



Water flowing into the intake facility



Typical cross-section

Infrastructure

Disaster prevention

Environment

Health, Industry

Flood Control through Sewerage Storage Facilities

Objective: Mitigation of flood damage

To make Tokyo a safe and sound place for its residents by securing urban functions through the advancement of measures to control flooding in the event of localized intense rainfall, which has been occurring frequently in recent years. One way to mitigate flood damage is to temporarily store stormwater in sewer system storage facilities.



Flood damage

Overview: Storage of stormwater exceeding the capacity of sewers

Flood damage can be mitigated by temporarily storing stormwater in storage facilities when sewer water levels rise due to a rapid increase in the volume of rainfall from typhoons or concentrated, intensive rain.

Details: Example of storage facility construction

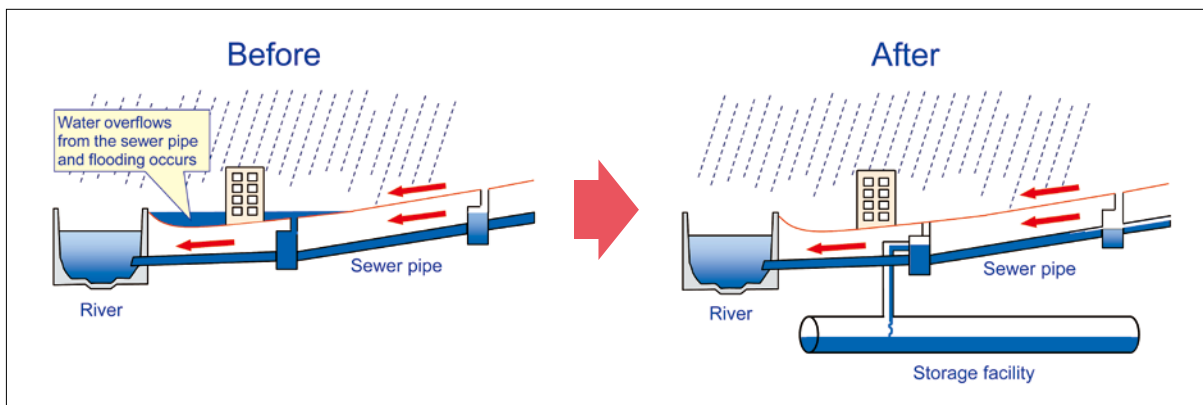


Image of reducing flood damages by constructing storage facilities

The Wada-Yayoi Trunk Sewer is a storage facility with an inner diameter of 8.5 meters and length of about 2.2 kilometers. This trunk sewer and the collecting pipes can collect stormwater from an area as wide as 573 hectares and store up to about 150,000 cubic meters of water.



Wada-Yayoi Trunk Sewer
(Inspection tour after completion)

Infrastructure

Disaster prevention

Environment

Health, Industry

Information Provision on Heavy Rainfall and Flooding

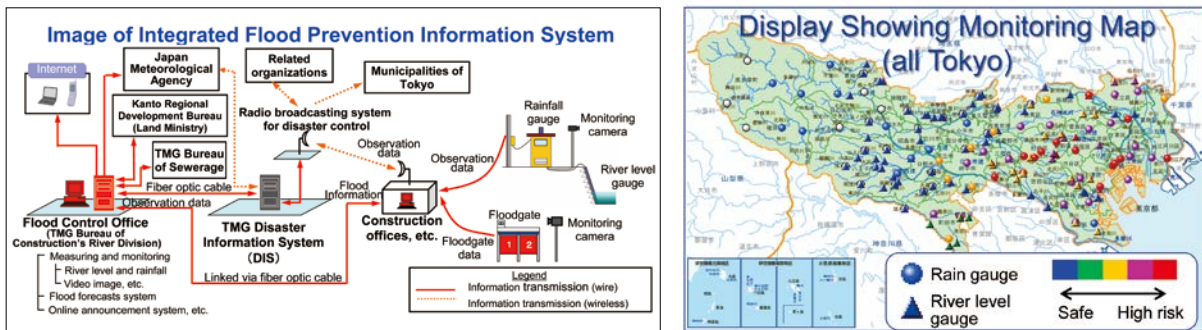
Exchange with Tigre (Argentina) and the United States, etc.

Objective: To quickly provide flood and storm surge information

Flood control activities are very important in preventing and mitigating damages from flooding and storm surges. To ensure smooth flood control activities, the TMG provides its citizens and municipalities with river level and rainfall data, flood warnings and other relevant information utilizing its Integrated Flood Prevention Information System.

Overview: Integrated Flood Prevention Information System

The TMG Integrated Flood Prevention Information System consists of the observation and monitoring system, flood forecast system, online announcement system, and others. It monitors data from 140 rain gauge sites and 164 river level gauge sites in Tokyo every minute, 24 hours a day.



Monitoring room (During flood control activities)



River level gauge



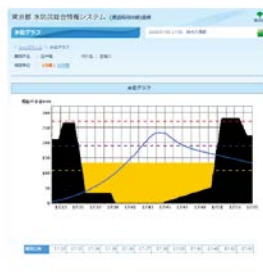
River level monitoring camera

Details: Online announcements and flood forecasts

Monitored rainfall and river levels and other information are made public over the Internet



Rainfall display



River level display

The system forecasts river levels up to one hour ahead using rainfall and river level information, and announces flood forecasts when there is a risk of flooding.



Rise in river level (Meguro River)

Infrastructure

Disaster prevention

Environment

Health, Industry

Creation of Beautiful, Elegant Cityscapes

Objective: To create beautiful, elegant cityscapes that blend history and culture with new charms

By keeping history and culture alive and adding new charms to the city, Tokyo is creating beautiful, elegant cityscapes with the aim of enhancing the attractiveness of the city.

Overview: Landscape guidance in line with the Tokyo Landscape Plan

- The TMG holds discussions with the developers of large-scale buildings that have received an increase in floor area ratio before city planning decisions are made, in order to encourage high-quality designs that blend in with the cityscape.
- Local community development groups are encouraged to take the initiative and create attractive landscapes that highlight a community's unique characteristics in accordance with the townscape guidelines.

Details: Examples of landscape creation initiatives

■ Landscape guidance using a council that includes experts

High quality designs are induced by setting standards in the Tokyo Landscape Plan and conducting discussions between private developers and experts (Landscape Council).



Case 1

Creation of a cone-shaped skyline with the Imperial Palace at its center



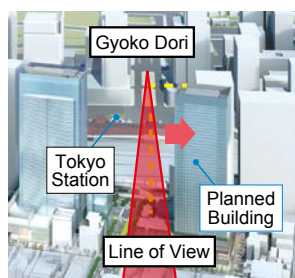
Case 2

Ensuring continuity of the historically observed 31m height of buildings around the moat of the Imperial Palace.



■ Preserving the scenery around landmark buildings (Tokyo Station)

To preserve the scenic landscape around Tokyo Station, guidance is provided on the size, color, and other qualities of buildings planned in the area.



View of Gyoko Dori from the planned building

↑ View of Tokyo Station from Gyoko Dori Avenue

Guidance to prevent buildings from appearing in the background behind Tokyo Station when viewing the station from Gyoko Dori Avenue



■ Community-led creation of townscapes (Shibamata district)

Local community development groups set standards on matters such as building design and the display of advertisements, and take the initiative in inducing good townscapes.

Creating a traditional Japanese-style atmosphere in the approach to the historic Shibamata Taishakuten and shops along the road



Burying power lines underground, new lighting, removal of signs



Air conditioning units camouflaged to preserve the historic appearance



Stone pavement laid on approach to shrine

“Umi-no-Mori (Sea Forest)” Project at a Landfill Site

Objective: To turn an island of waste into a beautiful forest

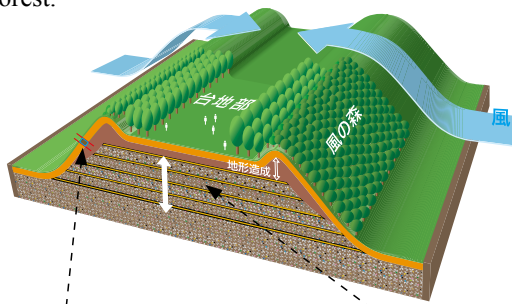
The Tokyo Metropolitan Government is turning land in Tokyo Bay, which has been reclaimed with waste and construction-generated soil, into an island rich in greenery to be cherished as a symbol of Tokyo. In this Umi-no-Mori (Sea Forest) project, Tokyo citizens and businesses participate in activities including growing saplings, creating healthy soil, planting saplings, and cultivating a forest.

Overview

- 1) Creating a forest using recycled resources
- 2) Creating a forest with citizen participation

Details

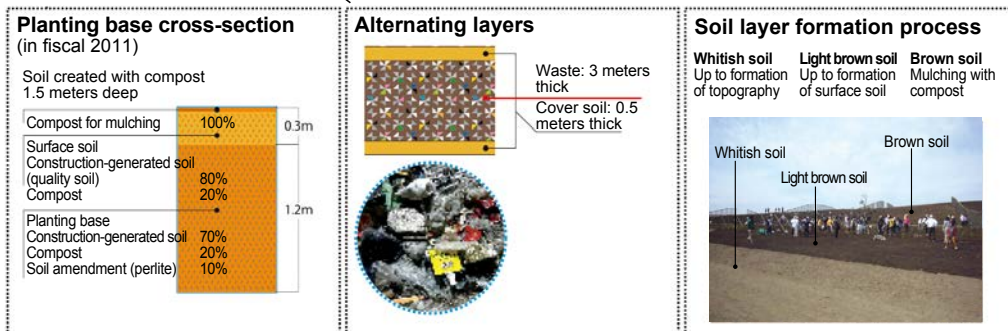
- 1) Importance is placed on maintaining a recycling perspective for forest creation; for example, pruned branches and leaves are turned into compost, which is then mixed with construction-generated soil to create soil for the forest.



Planting Base

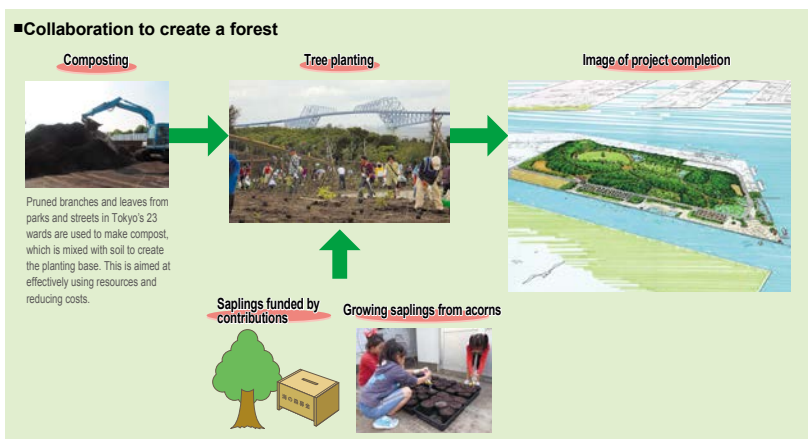
To turn a mountain of waste into a forest, surplus soil generated from construction works is used to form hills and other topography. On top of that, a 1.5-meter deep planting base is created from a mixture of compost made from pruned branches and leaves, soil amendment*, quality soil, and construction-generated soil.

*Perlite, sludge from water purification plants, etc.



- 2) The project is implemented with the cooperation of Tokyo residents and companies. Activities range from the cultivation of saplings by volunteers to sapling planting by citizens and businesses, and use of donations to purchase saplings.

Planting of saplings ended in fiscal 2015 and compost production ended in fiscal 2016.



Infrastructure
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Zoos Contributing to the Conservation of Biological Diversity

Exchange with Mongolia, Monterey County (the United States), Province of Barcelona (Spain), State of New South Wales (Australia), etc.

Objective: To conserve biological diversity (wildlife conservation)

To contribute to the conservation of biological diversity by keeping and breeding animals.

Overview: Keeping and breeding a variety of animals at zoos and an aquarium

Metropolitan zoos and a metropolitan aquarium are undergoing upgrades according to their respective locations and distinguishing features and are keeping and breeding animals in an effort to create very attractive facilities. As proof of friendship and to cooperate in wildlife conservation, the Tokyo Metropolitan Government and overseas cities provide each other with information on handling and breeding techniques, and also provide, exchange, and lend animals born in their facilities.

Details: Keeping and breeding of animals at four metropolitan facilities

1. Ueno Zoological Gardens 144 JAZA breeding commendations*

(No. 1 among zoos)

- Keeping and breeding rare species (giant panda, western lowland gorilla, aye-aye, etc.) (The world's top-class breeding achievements with aye-ayes)
- Keeping reptiles and amphibians
- Showing animals' natural behaviors (up-close view of polar bear in water; the world's first display of Japanese black bear in hibernation)



2. Tama Zoological Park 94 JAZA breeding commendations

- Keeping animals in herds (giraffe, chimpanzee, lion, Przewalski's wild horse, gray wolf, etc.)
 - Implementing environmental enrichment (chimpanzee, Bornean orangutan, etc.)
 - Breeding endangered species (snow leopard, Malayan tapir, African cheetah, etc.)
 - Keeping insects (successive rearing of butterflies; display of glowworms)
- <Wildlife Conservation Center>
- Contributing to the conservation of endangered species (artificial breeding techniques; cooperation in returning Oriental white stork, Japanese crested ibis, and other species to the wild)
 - Accumulating bioengineering techniques (DNA analysis, hormone analysis, etc.)



3. Inokashira Park Zoo 28 JAZA breeding commendations

- Artificial breeding of a leopard cat
- Keeping and breeding Japanese squirrels



4. Tokyo Sea Life Park 51 JAZA breeding commendations

(No. 1 among aquariums)

- Keeping Pacific Bluefin tuna (The world's first spawning of Bluefin tuna in an onshore tank)
- Keeping and breeding Humboldt penguins



* **JAZA breeding commendations:** The number of breeding commendations each facility has been awarded from the Japanese Association of Zoos and Aquarium (as of June, 2015). The commendation is given to a member of the association for the first successful breeding of a species in Japan.

Preservation of Plant Varieties and Culturally Significant Gardens

Exchange with Cairo governorate (Egypt), Chile, etc.

Objective: To preserve and introduce Japan's traditional culture through plants and gardens

- To preserve and display Japan's traditional garden plants, such as cherry and camellia
- To preserve and restore traditional Japanese gardens that convey the culture of the Edo period

Overview: Measures at metropolitan gardens and botanical gardens

Metropolitan botanical gardens preserve and cultivate many varieties of gardening plants that have long existed in Japan, as well as display plants in settings that allow visitors to learn about plants while enjoying the lush greenery and beautiful flowers. At nine metropolitan gardens, which are designated as cultural properties, management and maintenance are carried out in a way to ensure that gardening skills are sufficiently passed down to younger generations. Restoration and repair works are conducted on buildings and other structures based on historical records in an effort to enhance the value of the gardens and pass down these cultural properties to future generations.

Through exchange of plant cultivation technology and techniques in building Japanese gardens, the Tokyo Metropolitan Government and overseas cities cooperate in the development of botanical gardens and the building of friendly relations.

Details: Preservation efforts and exchange with overseas cities

Jindai Botanical Gardens

- There are as many as 100,000 plants of approximately 4,800 varieties, including cherry, camellia, plum and other traditional garden plants of Japan.
- To convey the attractions of plants, plants are cultivated and displayed by species, and various special exhibits and events are held.
- The Plant Diversity Center was established to preserve endangered botanical species and promote the importance of botanical diversity.



Cherry trees (Jindai-Akebono)



Rose garden (WFRS Award of Garden Excellence)



Chrysanthemum exhibition



Okutama zone of the Plant Diversity Center learning garden

Preservation of culturally significant gardens

- Efforts are being made to pass down garden maintenance techniques to younger generations.
- Teahouses and other historical structures are being restored and repaired.
- Events are held to introduce traditional Japanese culture, such as demonstration of falconry and tea ceremonies.



Tsubame-no-Ocha teahouse at the Hama-rikyu Gardens



Tokyo Grand Tea Ceremony at the Hama-rikyu Gardens

Exchange with overseas cities in the area of gardening

- (1) Technical cooperation between Chile's national botanic garden and Jindai Botanical Gardens
 - The TMG will extend technical support when the Chile garden builds traditional Japanese gardens.
 - Plants and cultivation techniques will be exchanged.
- (2) Establishment of traditional Japanese gardens in Tokyo's friendship cities, etc.
 - Tokyo Garden in Cairo, Egypt
 - Cowra Japanese Garden in New South Wales, Australia



Tokyo Garden in Cairo, Egypt

Guidance on Soil Contamination Measures

Objective: To avoid environmental risks from soil contamination in urban redevelopment projects

In Tokyo, where urban redevelopment is constantly in progress, buildings, condominiums, parks, and markets are being constructed on the former sites of factories and gas stations. When a project to redevelop such a site is undertaken, the site is tested for soil contamination, and measures are taken to prevent groundwater pollution, airborne pollutants, and environmental contamination at the place where excavated soil is sent.

Overview: Soil contamination measures mechanisms

In accordance with the Soil Contamination Countermeasures Act and the Tokyo Metropolitan Environmental Security Ordinance, the TMG provides guidance to factory and business operators who are closing down facilities that use hazardous substances, as well as those who will be undertaking large-scale development projects, on carrying out soil contamination surveys covering 26 substances, including VOCs and heavy metals, and measures to address contaminated soil, in order to prevent the health risks of groundwater pollution or direct intake of contaminated soil.

Furthermore, the TMG has advanced measures to clean up dioxin-contaminated soil on public land based on the Act on Special Measures against Dioxins.

Details: Expertise on soil contamination measures

TMG has a wealth of know-how with respect to soil contamination measures, through its implementation of measures at public facilities and through supervising and receiving notifications from private companies.

1970s Guidance on mercury contamination begins

1979 Hexavalent chromium slag pollution cleanup (1 site)

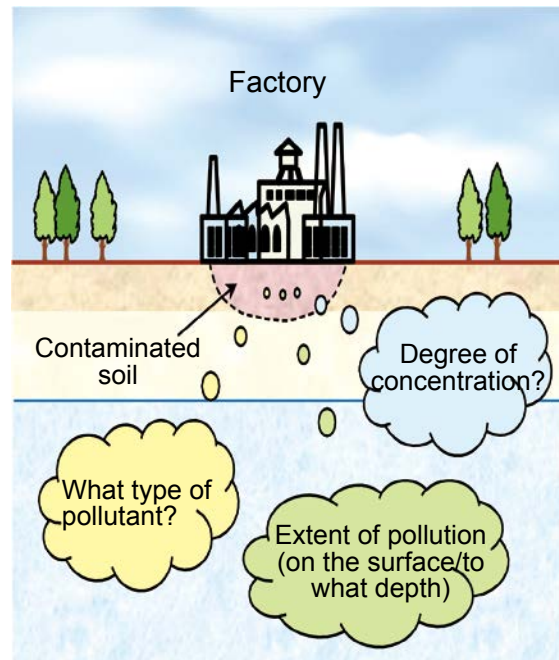
1999 Dioxin pollution cleanup (3 sites)

2012 Benzene pollution cleanup (at the planned site for a major food wholesale market)

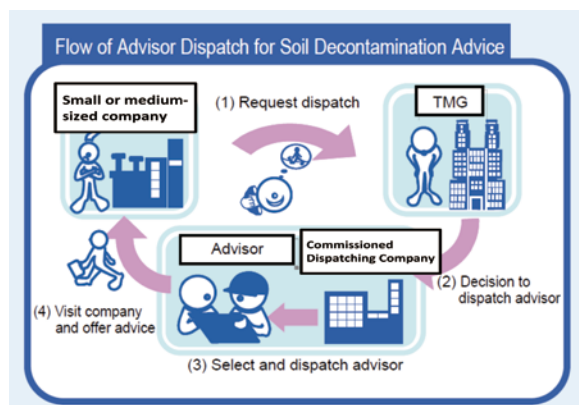
2001 Guidance on soil contamination surveys and measures concerning heavy metals, VOCs, and other pollutants begins

In FY2016, the TMG received 2,974 notifications from private companies in accordance with laws and ordinances

2012 System to dispatch advisors to SMEs planning to conduct soil decontamination measures



Land used as a park following hexavalent chromium slag pollution cleanup



System to dispatch advisors on measures against soil contamination

Monitoring Groundwater Levels and Land Changes

Objective: To protect the lives and assets of Tokyo citizens from land subsidence

- In Tokyo, heavy extraction of groundwater with the progression of industrialization caused massive land subsidence, making the affected areas vulnerable to flooding and putting the lives and assets of residents in danger.
- To grasp the situation of secular subsidence, the Bureau of Construction monitors groundwater levels and land heights, and collects these data.

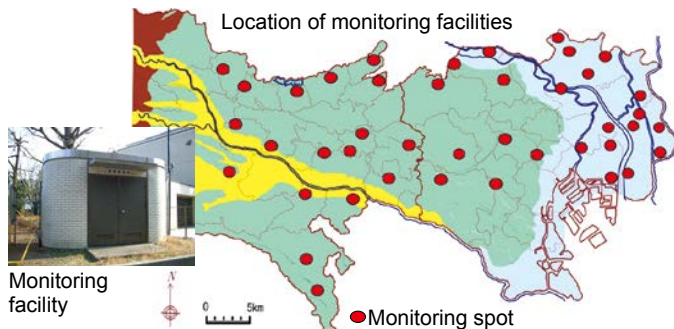
Overview: Monitoring and collecting data

- Groundwater levels are monitored every day at a total of 104 wells; a telemetry system is used to transmit the data, which is then accumulated.
- Every year, leveling is conducted over a total distance of about 700km with a precision of 0.1mm in height to collect land change data across a wide area of Tokyo.
- The data is provided to the groundwater management section of the TMG to help determine whether to restrict groundwater pumping. The figures are also made public over the Internet, brochures, and others.

Details: Collecting, transmitting, accumulating and publicizing data on groundwater levels and land changes

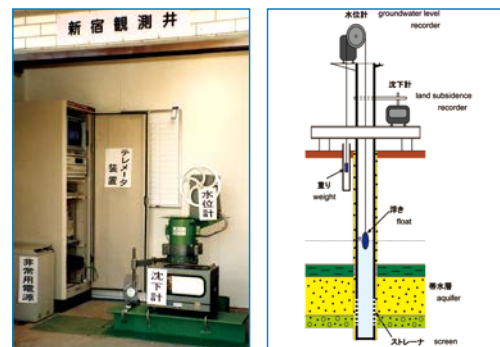
Location of land subsidence monitoring facilities

- ▼ Land subsidence monitoring facilities (104 wells) are established at 42 locations in Tokyo.



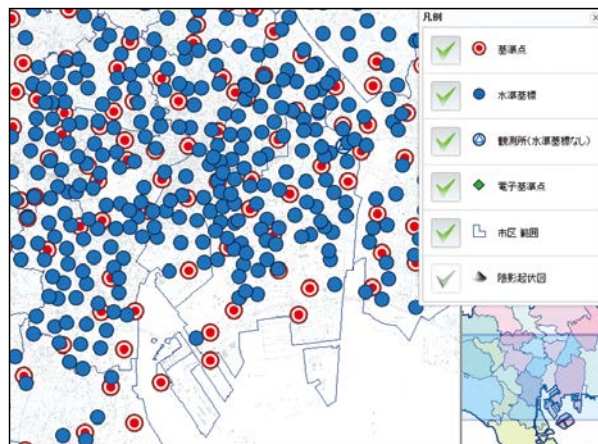
Monitoring groundwater levels

- ▼ Data on groundwater levels are transmitted by a telemetry system.



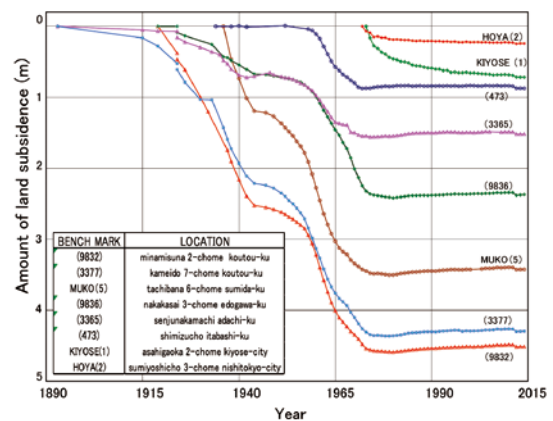
Data disclosure

- ▼ Each year, leveling data are made public over the Internet.



Data accumulation

- ▼ Various data such as leveling, subsidence, and groundwater levels, are collected and accumulated to grasp land changes.



Tokyo Cap-and-Trade Program

Exchange with major cities and countries such as China, France, Germany, Thailand and the United States

Objective: To reduce CO₂ emissions from large facilities

This CO₂ reduction program aims to promote energy efficiency measures in large facilities and reduce their CO₂ emissions.

Overview: First urban program in the world that covers office buildings

The Tokyo Cap-and-Trade Program is a mandatory reduction program designed to reduce total CO₂ emission levels in Tokyo, targeting factories and commercial facilities, including office buildings. Covered facilities are required to reduce their emissions by themselves or through emissions trading.

Detail: Cap and Trade

Covered facilities: Approx. 1,300 facilities (facilities with annual energy consumption of 1,500 kL or more (crude oil equivalent))

Compliance period: 5-year periods (1st period: FY2010-2014; 2nd period: FY2015-2019)

Mandatory reduction: Base emission* × compliance factor** × 5 years

* Average emissions for 3 consecutive years between FY2002 and 2007

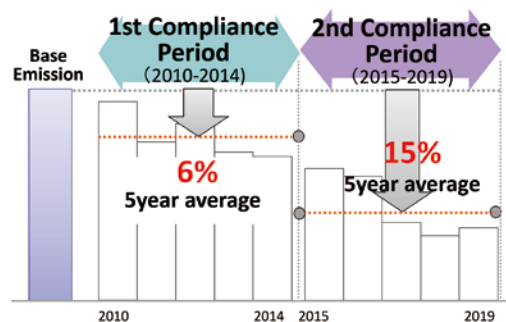
** 1st period: 6% (mainly for factories) or 8% (mainly for office buildings and commercial buildings)

2nd period: 15% (mainly for factories) or 17% (mainly for office buildings and commercial buildings)

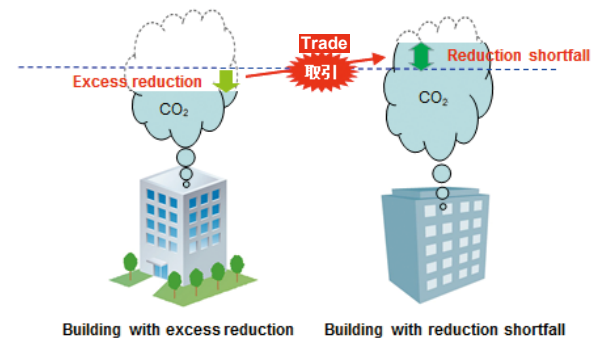
Compliance: Facilities can meet their obligation by reducing emissions at their own facilities or through the purchase of excess reductions of other facilities and offset credits, such as renewable energy credits.

Penalties: If the reduction is not achieved, an order will be issued to reduce emissions by the amount of reduction shortage multiplied by 1.3. If violated, the violation will be announced and the payment of a monetary amount equal to the reduction shortage and/or additional penalties will be ordered.

<Cap Setting>

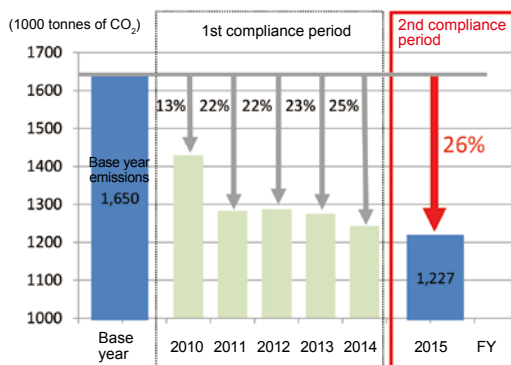


<Image of Tokyo Cap-and-Trade Program>



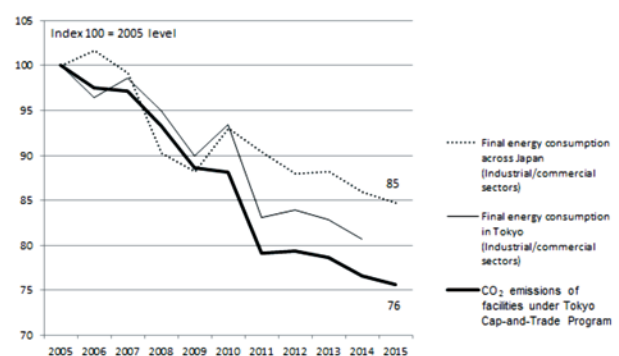
<Outcome of the program>

Achieved 26% reduction in FY2015



Transition of total CO₂ emissions from facilities under Tokyo Cap-and-Trade

Drastic and continuous reductions compared to national average



Infrastructure

Disaster prevention

Environment

Health, Industry

Carbon Reduction Reporting Program for Small and Medium Facilities

Exchange with major cities and countries such as China, France, Germany, Thailand and the United States

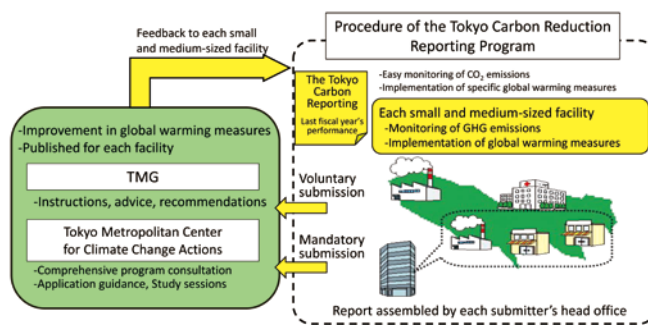
Objective: To reduce CO₂ emissions from small and medium-sized facilities

A CO₂ reduction program aiming to promote climate change measures by small and medium-sized facilities

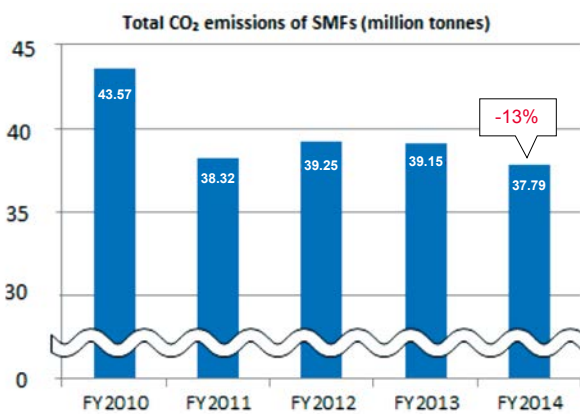
Overview: Promoting activities by small and medium-sized facilities

Through this program, small and medium-sized facilities can easily grasp their own CO₂ emissions and implement specific climate change measures.

Details: Program and outcomes



Coverage: Small and medium-sized facilities not falling under the Cap-and-Trade Program
Required content: Annual emissions of CO₂, plan for CO₂ reductions
Purpose: Visualization of CO₂ emissions and promoting CO₂ reduction measures
 - Submission of this report is required for tax deduction eligibility and participation in the Tokyo Cap and Trade market



CO₂ reduction
 - Approx. 13% reduction from the 2010 level was achieved in FY2014.
 - Over 30,000 facilities are submitting reports each year.

Medium-sized tenant buildings benchmark

Rank	Standard	Carbon intensity (kg-CO ₂ /m ²)	Number of SMFs (%)
A4	under 55%	under 41.6	6.8
A3	55%-70%	41.4 - 52.9	9.3
A2	70%-85%	52.9 - 64.2	17.2
A1	85%-100%	64.2 - 75.5	23.1
B2	100%-115%	75.5 - 86.9	18.6
B1	115%-150%	86.9 - 113.3	16.5
C	150%	above 113.3	8.4

verage carbon intensity 75.5

CO₂ emissions benchmark
 - Amount of CO₂ emissions per year divided by total floor space (kg-CO₂/m²)
 - Buildings grouped into 30 categories by use, each with 7 performance rating ranges
 - Allows submitters to compare their CO₂ emissions with the average of other facilities in the same building category



Carbon Report

- CO₂ emissions benchmarks are used to visualize the energy-saving and low carbon levels of small and medium-sized tenant buildings
 - Allows building owners to indicate the energy saving levels of their buildings to tenants and potential tenants

Infrastructure

Disaster prevention

Environment

Health, Industry

Tokyo Green Building Program

Exchange with major cities and countries, such as China, France, Germany, Thailand and the United States

Objective: To reduce CO₂ emissions from new buildings

The Tokyo Green Building Program aims to improve the environmental performance of new buildings

Overview: TMG publicly discloses green building plans made by new building owners

Reporting, rating and disclosure system to improve environmental performance of large buildings newly constructed or expanded

Details: Program and outcome

Facilities covered: Newly constructed/expanded buildings with a total floor area of 2,000 m² or more (submission of plans mandatory for buildings with a total floor area exceeding 5,000 m²)

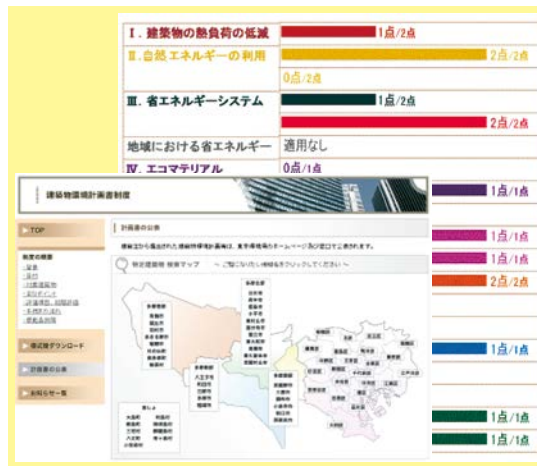
Purpose: To create a real estate market where greener buildings are valued more

Requirement: Building owners are required to design eco-friendly initiatives and to submit a Building Environmental Plan outlining the building's environmental performance

Items Assessed

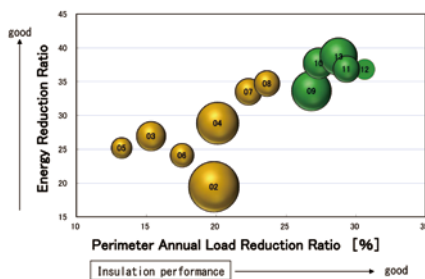
Category	Items
Energy	Heat load resistance of the building shell
	Use of renewable energy
	Energy performance (shells and equipment)
	Efficient operation systems
Use of resources	Usage of eco-materials
	Protection of ozone layers
	Longer building life expectancy
Natural environment	Hydrological cycle
	Greening (vegetation, landscape, etc.), bio-
Heat island mitigation measures	Atmospheric heat waste
	Surface of ground and buildings
	Wind environment

Disclosure at TMG website / Plans with ratings are displayed



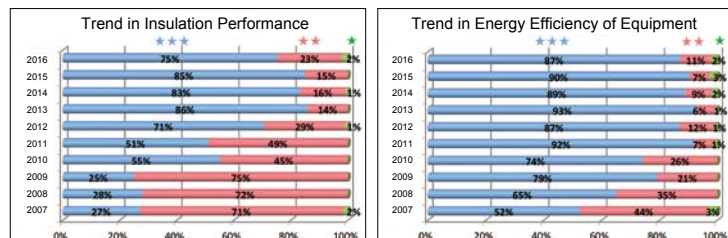
Outcome of the Program

Non-Residential Buildings



- Energy efficiency is improving
 Number in the circle: Fiscal year
 Size of circle: Average total floor area

Residential Buildings



Energy efficiency and insulation performance has been improved



Green Labeling for Condominiums

This label provides information on the environmental performance of the newly built condominium to potential purchasers or renters

Infrastructure

Disaster prevention

Environment

Health, Industry

Air Quality Control

Exchange with Bangkok, Beijing, Seoul, etc.

Objective: To improve air quality in Tokyo

Major pollutants that contaminate the atmosphere and can have adverse effects on human health include NO₂, SPM, PM2.5, photochemical oxidants, sulfur dioxide, and carbon monoxide. Environmental standards have been established for these substances as administrative targets. In order to reduce air pollution and protect the health of Tokyo residents, the Tokyo Metropolitan Government is working to meet these environmental standards.

Conditions When Environmental Standards Were Set and in Recent Years
(At the time environmental standards were set FY2015)

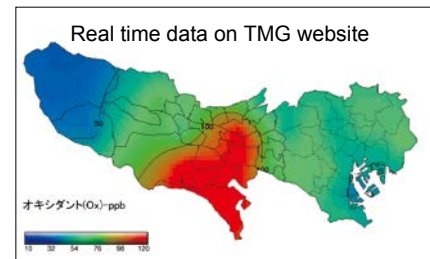
	Conditions that existed when the environmental standards were set*1			FY 2015	
	Year	Achievement rate*1	Average concentration	Achievement rate	Average concentration
SO ₂	1973	10/19 (53%) ^{*2}	0.019ppm	20/20 (100%)	0.002ppm
CO	1973	17/17 (100%) ^{*2}	1.8ppm	11/11 (100%)	0.2ppm
SPM	1973	0/19 (0%) ^{*2}	0.085mg/m ³	47/47 (100%)	0.019mg/m ³
Ox	1973	0/19 (0%) ^{*2}	0.029ppm	0/41 (0%)	0.031ppm
NO ₂	1978	10/35 (29%)	0.034ppm	44/44 (100%)	0.017ppm
PM2.5	2009	2/16 (13%) ^{*3}	15.7μg/m ³	40/47 (85%)	13.8μg/m ³

*1 Number of monitoring stations meeting the standard / Number of valid monitoring stations
 *2 FY1974 data
 *3 FY2011 data

Overview: Air pollution monitoring system

Soot and smoke from factories were the main cause of air pollution in 1970s. The TMG has been able to significantly improve air quality through ordinances and other regulations concerning smoke. Following this, various initiatives were taken, such as promoting the use of low-emission vehicles, regulating diesel vehicle emissions, introducing photochemical oxidant measures, and, more recently, engaging in reduction of VOC emissions.

TMG has installed equipment to monitor air pollution 24 hours a day at 82 locations in Tokyo. Hourly measurements are displayed on air pollution maps on the Bureau of the Environment website as preliminary values.

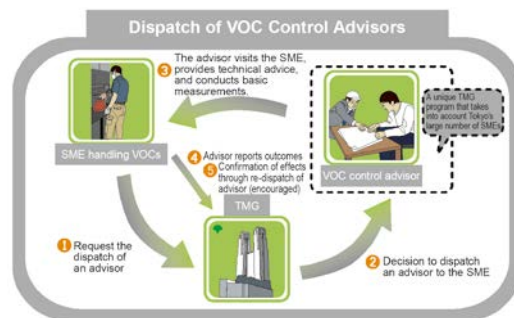


Auto Analyzer

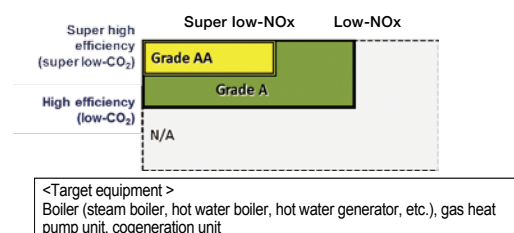
Details: Measures to reduce VOC and NOx emissions

Although Tokyo's air quality has improved, photochemical oxidants and PM2.5 concentrations remain above environmental standards at many monitoring stations. To address this situation, the TMG has been engaging in the following measures to reduce emissions of VOCs and NOx, which are the cause of photochemical oxidants and PM2.5.

- VOC
 - Holding seminars for small and medium-sized companies
 - Distributing a handbook on VOC control
 - Dispatching VOC Control Advisors
 - Analyzing the effects of switching to low-VOC paint
 - Gasoline vapor reduction
- Strengthening the accreditation criteria for low-NOx and highly-efficient small boilers
- Research on PM2.5 generation and reduction



Accreditation system for low-NOx and highly-efficient small boilers and gas heat pumps



Infrastructure

Disaster prevention

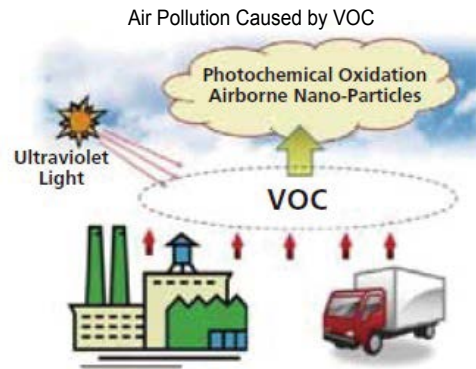
Environment

Health, Industry

Preventing Air Pollution through the Reduction of VOC Emissions

Objective: To reduce VOCs in factory emissions

Under a regional cluster collaborative research and development program supported by the Tokyo Metropolitan Government and the Japan Science and Technology Agency, the Tokyo Metropolitan Industrial Technology Research Institute jointly conducted research with universities and companies to develop technology aimed at reducing emissions of volatile organic compounds (VOCs), a precursor for air pollutants, from factory emissions.



Overview: VOC decomposition catalysts and system

New VOC decomposition catalysts using Cobalt (Co) and Cerium (Ce) oxide were developed. In addition, a new VOC treatment system using these catalysts was developed for paint curing ovens through joint research with private companies.

Details:

(1) New VOC decomposition catalysts using Co and Ce Oxide

Applications

- Decomposition of VOCs in gas emissions from paint and printing factories
- Odor removal in chemical factories

Features

- Effective for most VOCs
- Low cost. Precious metals such as platinum are not used



Ball type



Honeycomb type

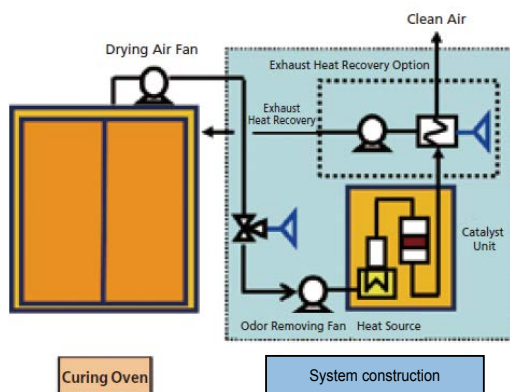
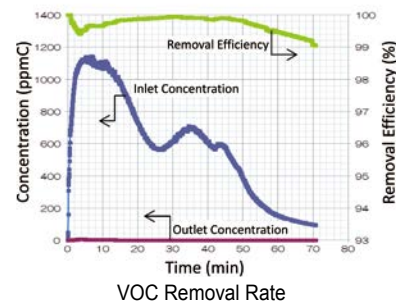
(2) VOC treatment system for paint curing ovens

Applications

- Reduction of VOCs and odors from emissions from paint curing ovens

Features

- Automatic control possible
- Energy efficient through exhaust heat recovery



Exterior appearance

VOC Treatment System

Infrastructure

Disaster prevention

Environment

Health, Industry

Diesel Vehicle Emissions Control

Exchange with Bangkok, Beijing, Seoul, etc.

Objective: To reduce air pollution caused by automobiles

To date, the TMG has worked to improve air quality by regulating the use of old diesel vehicles in accordance with Tokyo’s environmental protection ordinance and other measures and promoting the use of low-emission vehicles, and has made significant achievements.

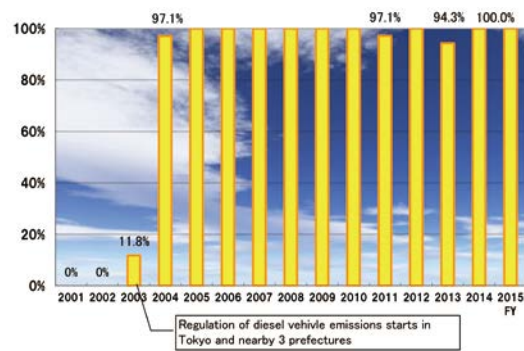
Since the enforcement of regulations, diesel vehicles that do not satisfy particulate matter (PM) emissions standards designated by the ordinance have not been allowed to be driven in Tokyo as is. Owners must either replace such vehicles with models meeting the latest regulations or low-emission vehicles, or equip them with PM reduction devices designated by the Governor of Tokyo. Vehicles are waived from regulation for the first seven years after new vehicle registration.

Overview: Improvement in air quality through diesel vehicle regulations

As Japan’s vehicle emissions regulations were limited to central government regulations for new vehicles, it was inevitable that improvement to air quality in urban areas where vehicles are especially concentrated would take time. The TMG then stepped in as the first local government to set diesel vehicle regulations that required vehicles in use to comply with emissions regulations, with this commencing in October 2003.

With the start of regulations, the TMG strongly urged the auto industry and others to develop diesel particulate filters (DPF), and the oil industry to supply low-sulfur diesel fuel. Furthermore, the TMG created an enforcement system and extended financial support to vehicle users.

As a result, air quality in Tokyo improved dramatically from 2004 with respect to suspended particulate matter (SPM) concentrations.



Achievement Ratio of Environmental Standards for SPM Concentration at Roadside Air Pollution Monitoring Stations

Details: Measures against diesel vehicle exhaust emissions



Enforcement using a mobile camera



Enforcement on the street



Fixed cameras on an expressway

<Enforcement of Diesel Regulations>

To ensure effective enforcement of diesel regulations, a team of vehicle pollution inspectors, mainly former police officers, are dispatched to identify vehicles in violation. Enforcement by the team includes inspections of vehicles on the street and at distribution centers, and the use of video cameras to record vehicles driving in Tokyo. An ordinance regulates that violators will be prohibited from operating the vehicle, and in the case of a repeated offense, can be fined.

<Support measures>

To assist small and medium-sized enterprises in complying with the requirements of the ordinance despite their challenging business environment, the TMG offers subsidies for the purchase of DPF and low-emission vehicles, as well as assistance in obtaining loans.



Sticker displayed by vehicles equipped with PM reduction devices

Infrastructure

Disaster prevention

Environment

Health, Industry

Realizing a Hydrogen Society

Objective: To spread the use of hydrogen energy

<Significance of a hydrogen society>

- 1) Lower environmental impact
- 2) Diversification of energy sources
- 3) Major economic impact due to its broad industrial coverage
- 4) Effective source of energy in times of emergency

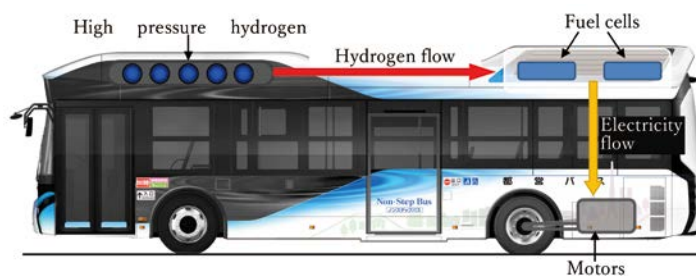
Overview: Initiatives for realizing a hydrogen society

- 1) Promote the use of fuel cell buses
- 2) Promote the use of CO₂-free hydrogen
- 3) Realize a community that will serve as the model for an advanced eco-city (Athletes' Village following the Olympic and Paralympic Games Tokyo 2020)

Details:

1) Promote the use of fuel cell buses

- Operation on Toei Bus routes commenced March 21, 2017.



- First use of a commercial fuel cell bus on a public transport route in Japan.

<How a fuel cell bus works>

High pressure storage tanks on the bus supply fuel cells with hydrogen. There, the hydrogen reacts with oxygen in the air, producing electricity which powers the motor of the bus.

2) Agreement with Fukushima Prefecture, the National Institute of Advanced Industrial Science and Technology (AIST), and others to promote the use of CO₂-free hydrogen, etc.

- Boost research and development of CO₂-free hydrogen produced by renewable energies.
- Work together with the aim of using CO₂-free hydrogen produced in Fukushima Prefecture at the Tokyo 2020 Games.
- Support Fukushima Prefecture as it works to recover from the 2011 Great East Japan Earthquake by expanding the use of renewable energies and gathering energy-related industries in the prefecture, among other efforts.



3) Realize a community that will serve as the model for an advanced eco-city. (post-Games use of the Tokyo 2020 Games Athletes' Village)

- Be the first district in Japan to use a pipeline to supply hydrogen for practical use.
- At the time of the Tokyo 2020 Games, along with leading initiative to supply hydrogen to a portion of vehicles and facilities, an information center will also be established to promote the usefulness of hydrogen and Japan's latest technologies to the people who gather from around the world.

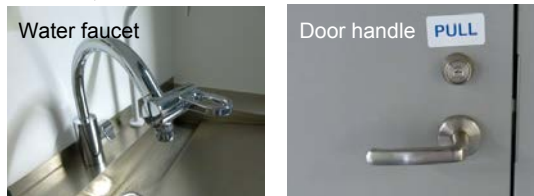


Nickel Electroplating Method with Low Environmental Impact

Objective: To comply with boron discharge regulations through a new nickel electroplating method

Nickel electroplating is widely used for surface finishing. The conventional nickel electroplating bath contains a high concentration of boric acid. However, there are concerns that boric acid may be toxic to humans. In 2001, restrictions were introduced in Japan on boron concentrations in effluent. Against this backdrop, responding to a request by the Tokyo Electro-Plating Industrial Association, the Tokyo Metropolitan Industrial Technology Research Institute developed a boron-free nickel electroplating bath with low environmental load.

Typical examples of nickel electroplating

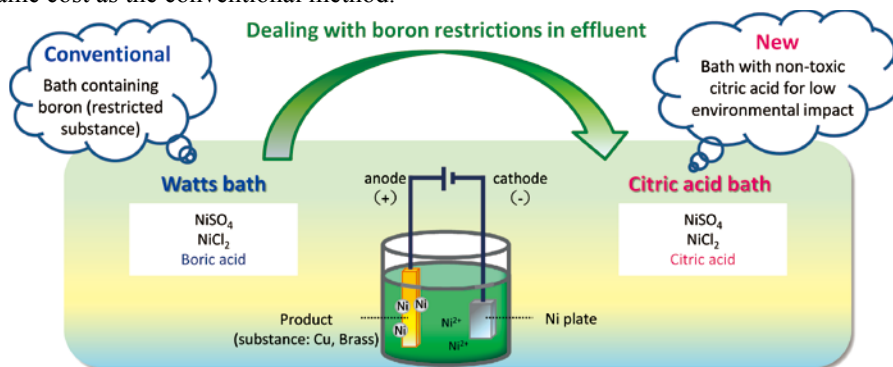


Water faucet
Top layer: Chrome plating
Undercoat: Nickel plating
Undercoat: Copper plating
Substrate: Iron

Door handle PULL
Top layer: Chrome plating
Undercoat: Nickel plating
Undercoat: Copper plating
Substrate: Zinc die cast

Overview: The world's first boron-free nickel electroplating method (citric acid bath)

- Development of a new nickel electroplating bath that complies with effluent regulations by replacing conventional boric acid with non-toxic citric acid.
- Electroplating by the new method can be done with the same equipment, under the same conditions, and at about the same cost as the conventional method.



Details: Features of the new nickel electroplating method using citric acid

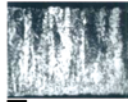

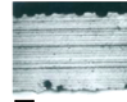
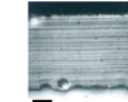
- Film properties of non-glossy plating are superior to that of conventional baths (fine and hard).
- Metallic impurities in the bath have little effect on the plating.
- When a citric bath nickel undercoat is used for chrome plating, coverage is improved with little color irregularities. (see photo)

Chrome plating with nickel undercoat



Left: Citric acid bath undercoat (little color irregularities)
Right: Conventional bath undercoat (significant color irregularities)

Comparison of conventional bath and citric acid bath

	Non-glossy nickel plating		Glossy nickel plating	
	Conventional	Citric acid	Conventional	Citric acid
Composition	NiSO ₄ 280g/L			
	NiCl ₂ 45g/L			
	Boric acid 40g/L	Citric acid 30g/L	Boric acid 40g/L	Citric acid 30g/L
Hardness	HV220	HV450	HV585	HV595
Structure	Columnar	Fine	Lamellar	Lamellar
Ni plating				
	10μm	10μm	10μm	10μm
Appearance	Matt	Smooth	Mirror gloss	Mirror gloss

Further application of the technology

Capitalizing on the superb undercoating properties of the citric acid bath, use of this technology is being expanded to areas other than decorative applications, such as nickel undercoats for electronic components.

Incineration Plant

Exchange with many cities and countries such as Hanoi, Jakarta, Malaysia, Moscow, Singapore, etc.

Objective: To control pollution in the incineration process; effective use of heat energy and incineration ash

Environmental impact is reduced through emission control and proper treatment of hazardous substances in flue gas and effluent from incineration plants, and heat energy and incineration ash are also efficiently used.

Overview: Flue gas and effluent measures, power generation and heat supply, effective use of incineration ash

- 1 Emission control and removal of hazardous substances in flue gas and effluent
- 2 Effective use of heat generated during incineration for power generation and heat supply
- 3 Delivering incineration ash to private cement manufacturers for effective use as raw material for cement

Details: Strict self-imposed regulatory levels for flue gas and effluent; highly efficient power generation; proper management of quality and transportation of ash

- 1 Regarding flue gas measures, waste is stirred in the bunker and incinerated at 800°C or higher for at least 2 seconds, while flue gas is quickly cooled in the cooling tower, and hazardous substances are removed by flue gas treatment facilities. Emissions are controlled through self-imposed regulatory levels that are stricter than legally set regulations. As for effluent, pollutants are removed by coagulating sedimentation and filtration treatment.
- 2 Waste heat from combustion is either recovered in a boiler at 4MPa and 400°C for power generation by a steam turbine (efficiency of at least 20%) or supplied directly to heat pools, etc.
- 3 Incineration ash (bottom ash) is used as a raw material for ordinary Portland cement. Pre-shipment check of the ash, safe and well-planned transportation management, and confirmation of the manufactured cement's compliance with JIS standards are implemented.

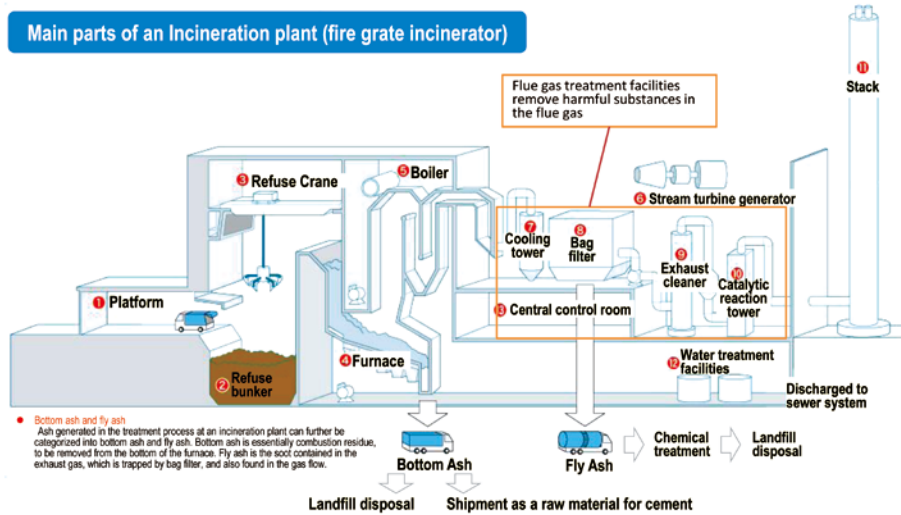


Figure: Mechanism of an incineration plant

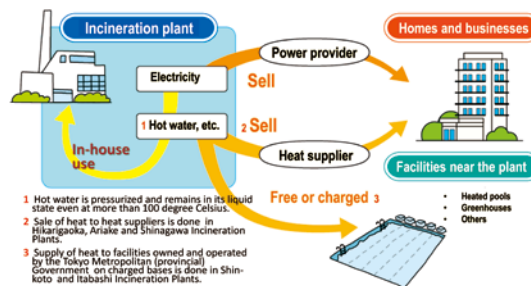


Figure: Effective use of heat

This is a technical solution of the Clean Authority of TOKYO (CAT 23).

Infrastructure

Disaster prevention

Environment

Health, Industry

Recycling Incinerator Ash into Eco-Cement

Exchange with Singapore

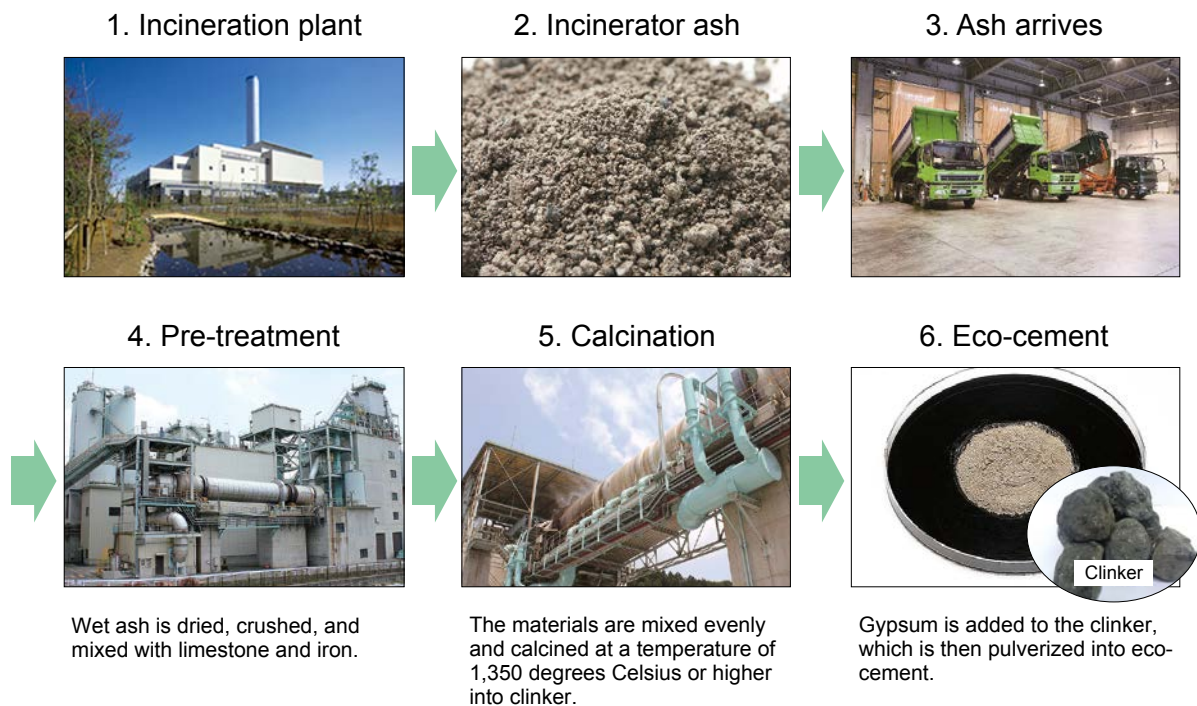
Objective: To create a recycling-oriented society

Incinerator ash, which used to be buried, is recycled into cement to extend the service life of landfill sites, as well as to build a recycling-oriented society.

Overview: Incinerator ash used to produce cement

Eco-cement, a combination of the terms “ecology” and “cement,” is made primarily from incinerator ash. Because incinerator ash contains calcium, silicon, and other substances needed to produce cement, it can be used as a raw material for cement. Eco-cement is a civil engineering and construction material covered by the Japanese Industrial Standards.

Details: Production process of eco-cement



Example of a concrete product made with eco-cement



Eco-cement has almost the same properties as ordinary cement and can be used in various applications, such as civil engineering and construction.

Eco-cement plant



The eco-cement project is undertaken by the Tokyo Tama Regional Association for Waste Management and Resource Recycling.

Leachate Treatment and Landfill Gas Power Generation at Tokyo Bay-side Landfill

Exchange with Jakarta, Singapore, etc.

Objective: To implement environmental measures at a landfill site

1. Leachate Treatment

Leachate is rainwater that has become contaminated by passing through layers of waste. With the aim to improve the quality of this water, the TMG collects leachate efficiently at a controlled final landfill site and treats it at a wastewater plant.

2. Landfill Gas (LFG) Utilization

Landfill gas, including methane gas, is generated from the decomposition of waste. The LFG is collected and used to generate power for the effective utilization of energy and reduction of environmental impact.

Overview:

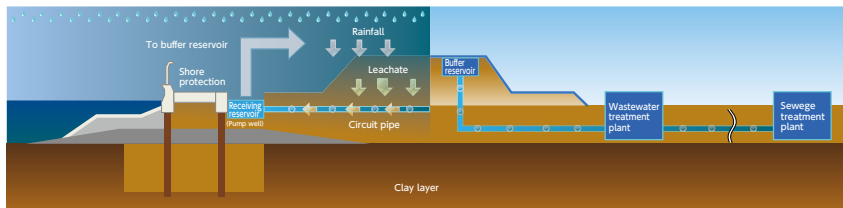
1. Leachate Treatment

The leachate quality fluctuates significantly according to the kind of waste, landfill period, amount of rainfall, and various other factors. Therefore, in order to level the load on the treatment plant, leachate is first collected in the buffer reservoirs to homogenize the quality and then sent to the wastewater treatment plant.

2. Landfill Gas (LFG) Utilization

LFG, collected by the gas-collection pipe, is used for power generation by the micro-gas turbine power generator after desulfurization and temporary storage.

Leachate Treatment flow



LFG Power Generation

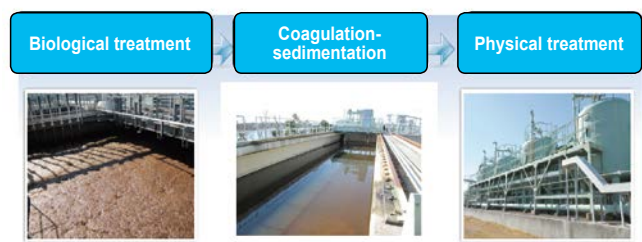


Details:

1. The process of leachate treatment

The leachate treatment involves the three following processes.

- Biological treatment: Organic matter is decomposed by microorganisms.
- Coagulation/sedimentation: The contaminants are bound by chemicals (coagulant) and precipitated
- Physical treatment: Small suspended solids are removed by a sand filtration system, etc.



Leachate treatment process

2. LFG power generation

• Desulfurizer

Desulfurizer removes the hydrogen sulfide contained in the LFG to prevent corrosion of facilities. The LFG is passed through a gas filler composed mainly of iron oxide.

• Gas holder

Gas holder stores the gas to enable stable power generation. Storage capacity: 1,000m³

• Micro-gas turbine generator

Small gas turbines generate power by burning the LFG.

Power generation capacity: 30kW×6 units, 95kW×1 unit



Desulfurizer, Gas holder



Micro-gas turbine generator

Leachate Seepage Control at a Landfill Site

Objective: To ensure the safety of landfill sites

In order to ensure the comfortable lives of Tokyo residents and maintain urban dynamism, measures are taken for the Shinkaimen Landfill Site, the last piece of such reclaimed land in the Port of Tokyo, to be used effectively and safely for as long as possible.

Overview: Seepage control and leakage prevention

(1) Seepage control

- A double layer of seepage control measures are taken to prevent contaminated water from leaching into groundwater or seawater.

(2) Triple tubular steel pile method

- When bridge piles are driven in a landfill site, they pierce an underground shielding layer, which could lead to the leakage of polluted water. This method was developed to address this problem.



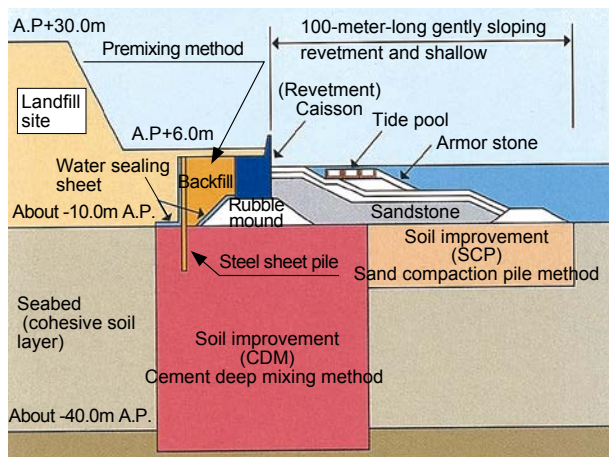
Details: Double layer of seepage control measures / triple tubular steel pile method

(1) Seepage control

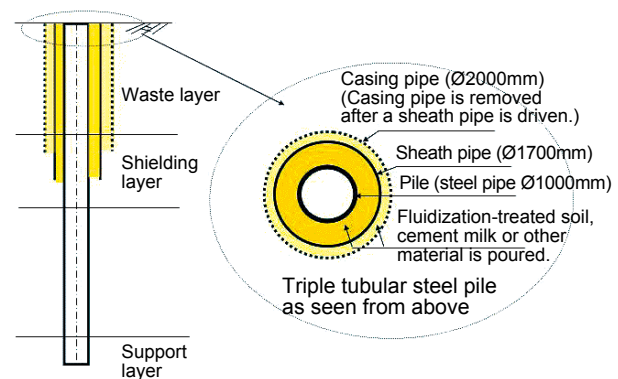
- In addition to seepage control sheets placed behind steel sheet piling, measures are taken on the masonry joints of the revetment and the joints of steel pipe sheet piles, such as using flexible masonry joints, asphalt mastic, and grout, for a double layer of seepage control measures.
- The premixing method was applied to reduce the earth pressure behind the revetment and to extend the life of the landfill by using soil from the site. This method is expected to also be effective in blocking seepage of leachate.

(2) Triple tubular steel pile method

- An all casing method is used. A casing pipe is inserted into the waste layer and the waste inside the pipe is removed. A sheath pipe is inserted within the casing, which is then inserted with a pile.
- By using this method, a pile can be driven without dragging in the surrounding waste. Also, it can prevent the spread of leachate even when the shielding layer is penetrated.
- This method can be applied at a landfill in operation, as well as at a covered site where the polluted soil has been contained.



Seepage control



Triple tubular steel pile method

Accelerating Consolidation Settlement at a Landfill Site

Objective: To effectively use landfill sites

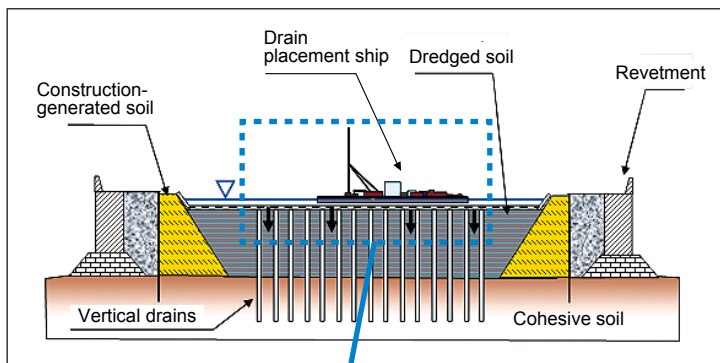
In order to ensure the comfortable lives of Tokyo residents and maintain urban dynamism, measures are taken for the Shinkaimen Landfill Site, the last piece of such reclaimed land in the Port of Tokyo, to be used effectively and safely for as long as possible.

Overview: Vacuum consolidation drain method using capped drains

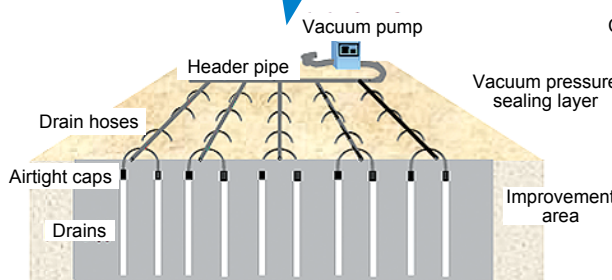
- This method is applied to increase the capacity of the landfill by accelerating the consolidation settlement of the reclaimed land and the seabed.

Details: Accelerating consolidation to increase landfill capacity

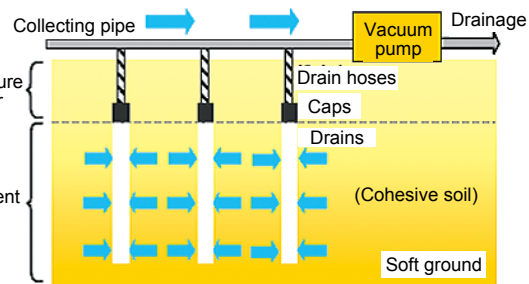
- In this method, a vacuum pump drains water from the cohesive soil under the seabed to accelerate settlement.
- By properly accelerating the subsidence of the seabed and soil within the reclaimed site, this method makes it possible to increase the capacity of landfills to accept dredged soil.
- Type of soil: cohesive
 N-value of ground: 15 or less
 Depth: up to about 40 meters
 Location: offshore landfill site



Drain placement ship



Schematic drawing



Drain mechanism

Infrastructure

Disaster prevention

Environment

Health, Industry

Health Crisis-Management Information Network for Infectious Disease (K-net)

Exchange with 12 cities participating in the “Countermeasures to Combat Infectious Diseases in Asia” project

Objective: To share information on diseases to contain the spread of infection

To prevent patients' conditions from worsening due to delayed diagnosis and prevent the spread of infection due to insufficient initial response.

Overview: Establishing a system for sharing and quickly obtaining infectious disease information

<Initiatives implemented in line with the central government’s infectious disease prevention and medical care systems based on the Infectious Diseases Act>

- Through the establishment of a network connecting the TMG, public health centers, designated medical institutes for infectious disease treatment, cooperating medical institutes for infectious disease treatment, major cities in Asia, etc., members are able to share information on infectious diseases, conduct discussions, and grasp treatment information efficiently.

➔

- Quick diagnosis to provide adequate medical care
- Swift initial response to prevent the spread of infection

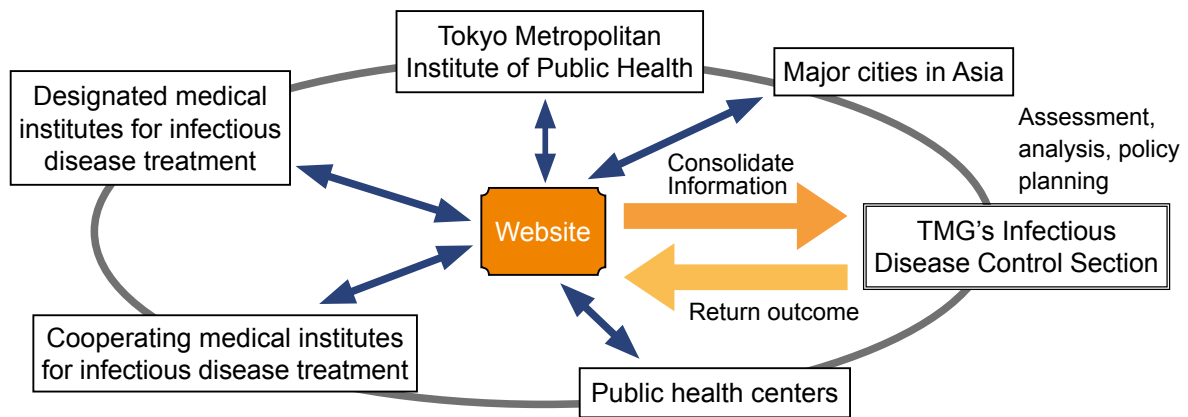
- Official Syndromic Surveillance is conducted to quickly detect new infectious diseases.

➔

- Fast detection of new infectious diseases to prevent the spread of infection

Details: Having relevant entities to quickly share information while ensuring information security

- (1) Infectious Disease Information Network**
Network dedicated to information on infectious diseases that consolidates such information and allows relevant entities to exchange views while ensuring information security.
- (2) Real-Time Treatment Information System**
 - System for obtaining treatment and other patient information from medical institutions continuously and efficiently in the event of an outbreak of Type 1 or other infectious disease.
 - Request for tests for diseases such as influenza and measles, and notification of results.
 - Information sharing among public health centers in Tokyo in the event of a mass outbreak.
- (3) Official Syndromic Surveillance System**
System for collecting information on each case of an unknown disease to quickly detect the onset of a new strain of influenza or bioterrorism.



Infrastructure

Disaster prevention

Environment

Health, Industry

Vocational Training Facilities

Exchange with Beijing, Hanoi, Jakarta, and other Asian cities

Objective: To establish and manage vocational training facilities

The TMG establishes vocational training facilities to help people acquire knowledge and skills necessary to land a job, and operates those facilities to nurture human resources needed by society.

Overview: Wide variety of courses ranging from engineering to office work

The TMG operates 13 vocational training facilities. In an effort to meet the diversified needs, the schools provide about 130 courses ranging from machinery, construction and electrical work to printing and design, office automation clerical work, and the fashion business.

The facility size and equipment for vocational training facilities differ significantly depending on the courses they offer. The floor space, electrical wiring, water supply and drainage lines, air conditioning and other facilities of the classrooms and workshops must be designed to meet the specific needs of each course. Knowhow to teach the courses is also necessary in the operation of the schools, with the need to recruit instructors, select textbooks, and create teaching materials, among others.

Having established and operated many such facilities, the TMG has a wealth of experience in vocational schools.



Joto Vocational Skills Development Center

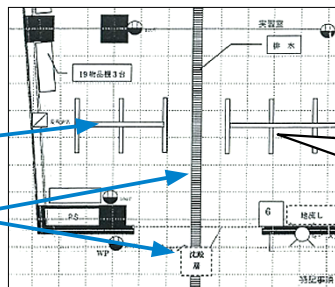
Details: Examples of how the TMG works to provide effective vocational training

(1) Design and construction of vocational training facilities

- Classrooms and workshops are designed to meet the specific needs of each course.

Example of workshop used in classes for exercises in interior and exterior finishing.

- Concrete panels installed for practice
- Drains and settling tank for easier clean up and low environmental impact



Concrete panels are used in tile installation classes

(2) Management of vocational training facilities, and guidance to students

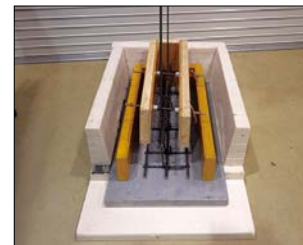
- Curricula are developed to effectively provide courses for students of various age groups, including the disabled. Vocational schools also develop teaching materials on their own to facilitate learning and allow students to be immediate assets.



Exercises in the machining course



Exercises in the architecture CAD course (class for the disabled)



Teaching materials developed for construction exercises

Development of Tokyo X—Tokyo’s Own Brand of Pork

Objective: To develop a delicious brand that can compete with imported pork

Develop a specialty brand of pork distinctive in flavor, revitalize Tokyo’s pig breeding industry, and offer the residents of Tokyo an ingredient that will enrich their diet. Improvement of the breed was carried out with a focus on the quality of meat, rather than the conventional focus on the volume of meat.

The “X” in the name “Tokyo X” originates from the cross (X) in crossbreed and the unknown hidden potential (X) of this breed of pig raised in Tokyo.

Overview: Three breeds of pigs were crossbred for a unique texture of meat

Over a period of seven years (April 1990 – March 1997) the TMG crossbred the following three types of pig to create the first generation of hybrid pigs. After repeated selection from this hybrid group for five generations, a synthetic line of pigs with improved intramuscular fat and distinctive high-quality meat was developed.

*Synthetic line of pigs

A new breed achieved through the repeated mating of the mixed offspring of purebred pigs



1) Beijing Black (PRC)
High-quality fat and good taste

2) Duroc (USA)
Rich intramuscular fat

3) Berkshire (UK)
Fine muscle fiber and high-quality meat

Tokyo X



Marbled loin

Details:

(1) Appearance and meat quality

- 1) Body weight at the time of shipment averages from 110 to 120kg.
- 2) The pigs are black, brown, spotted (black and brown), etc.
- 3) Meat is light pink, has excellent marbling and an attractive appearance.
- 4) Meat is tender and juicy. The fat is of good quality and easily melts in your mouth due to its low melting point. The flavor is superb.

(2)Tokyo SaBAQ

The Tokyo Development Foundation for Agriculture, Forestry and Fisheries maintains parent pigs and distributes the offspring to farmers for reproduction and fattening. Safe pork is produced under the Tokyo SaBAQ philosophy set by the foundation.

About Tokyo SaBAQ

Safety:	Maintain the health of the pigs, prevent infection, and give designated feed that contains no antibiotics.
Biotics:	Feed is “postharvest free” (No pesticides used after harvest, and the corn and soybean meal are not genetically modified).
Animal welfare:	Healthy animals are raised according to their natural physiological functions.
Quality:	Improved high-quality pork

Hydroponic Farming System for Cucumbers

Objective: To provide a steady supply of cucumbers at a low cost

As a method capable of raising the level of productivity and providing a stable supply of cucumbers, Tokyo has developed technology for hydroponic cultivation. In the area of greenhouse farming, which is gaining popularity in Tokyo, the introduction of hydroponic farming is effective in further increasing productivity. As Tokyo farmers operate on a relatively small scale, we aimed to develop a simple, low-cost, do-it-yourself system feasible for all.

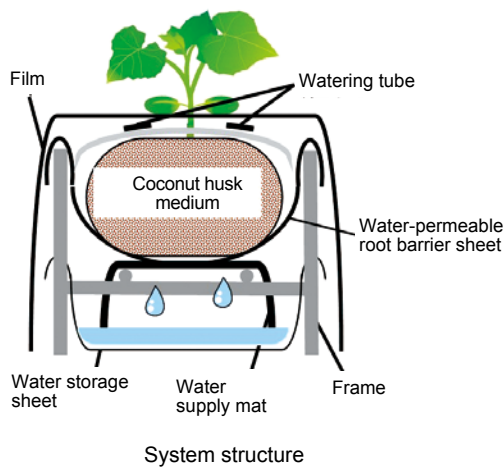
Overview: Merits of the hydroponic farming system

- Farmers can install the system themselves at a low cost, using materials available at retail stores.
- The system is versatile and can be used to raise other crops, including tomatoes.
- When compared to conventional soil cultivation, yield is increased by about 40 percent.
- Management of the cultivation system has been standardized, cutting down on work for farmers.
- As the system is not impacted by soil conditions, stable production is possible.



Cucumber cultivation

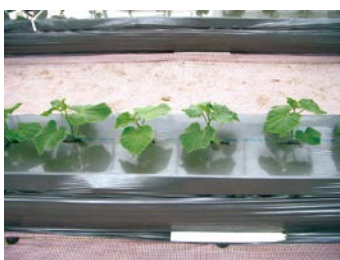
Details: System features



Frame is easily put together using pipes available at retail stores



Coconut husk medium



Planting cucumber seedlings



Simple fertilizing and watering system



Highly versatile system that can also be used to raise tomatoes

問合せ先 *Contact*

本冊子の内容に関するお問合せは、所管局（各ページの右上に記載）までお願いします。複数の局にまたがるなど、問合せ先が不明な場合は、総合問合せ先までお尋ねください。

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Please direct any inquiries regarding the content of the Tech Book to the relevant bureau (noted in the upper right corner of each page). If you are not sure where to direct your inquiry, please contact the Bureau of Urban Development or Bureau of Construction.

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交流実績都市について *Overseas Exchange*

そのページに掲載されている技術の全部または一部を海外都市に教えた事がある場合、または、その技術が海外都市で採用された事がある場合、「交流実績都市」として都市名または国名を記しています。

.....
Some of the cities or countries that have learned or employed all or part of the technology described on a page are listed there.

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