

Building a Global Model of Sustainable City Management –Case of Yokohama–



Yokohama Project Profiles

- ☐ 1. Minato Mirai 21 (MM21)
- ☐ 2. Kohoku New Town
- ☐ 3. Kanazawa Reclamation Project
- ☐ 4. Road Development
- ☐ 5. Railway Network Development
- ☐ 6. Intermodal Transfer Facility Development
- ☐ 7. Pollution Prevention Agreement and Environmental Conservation Agreement
- ☐ 8. Global Warming Countermeasures
- ☐ 9. Yokohama G30 and 3R Dream Plans
- ☐ 10. Waterworks of Yokohama City
- ☐ 11. Sewerage System in Yokohama
- ☐ 12. Port of Yokohama
- ☐ 13. Yokohama Smart City Project (YSCP)
- ☐ 14. Incineration Plant
- ☐ 15. CASBEE Yokohama
- ☐ 16. PACIFICO Yokohama

Rejuvenating the Waterfront as a New Business & Commercial Center

Panoramic View of Minato Mirai 21 in 1983



Source: "MINATOMIRAI 21 Information Plans and Projects Vol.84", Urban Development Bureau, City of Yokohama

- Minato Mirai 21 (MM21) -

Today, MM21 accommodates 1,520 firms & 89,000 workers

Panoramic View of Minato Mirai 21 in 2013



Source: "MINATOMIRAI 21 Information Plans and Projects Vol.84", Urban Development Bureau, City of Yokohama

Background and Objective

From the sixties through eighties, when a strong inflow of population took place in Tokyo, neighboring Yokohama became a bedroom town. As a result, Yokohama experienced rapid urbanization, with aggressive residential development occurring throughout the city. However, the hope that this phenomenon would contribute to the city's economy was dashed, because many of the residents already had jobs in Tokyo and they did not create businesses at home. By this time Yokohama desperately needed an economic center to attract investments and businesses, as well as provide employment for its residents.

Toward this end, the project "Minato Mirai 21 (MM21)," which

means "Future Port for the 21st Century," commenced in 1983 to redevelop 186 ha of waterfront and reclaim 74 ha of land. The redevelopment of this area aimed to establish a business, commercial, and cultural hub for the city. The people of Yokohama always had a special attachment to their port, which has played a key role in the city's history and modernization. Rejuvenation of the waterfront also aimed at restoring Yokohama's cultural identity.

Project Impacts

Today, MM21 has become a readily recognizable central business district, an engine of growth, and a cultural center, attracting businesses, shops, museums, MICE events, and tourists from all over the world. In

2010 alone, it generated some JPY1.8 trillion of economic benefits. The area is also disaster-resilient, utilizing various disaster-proof technologies such as quake-resilient quays, underground utility tunnels, etc.

Infrastructure Development Project Map of MM21



Zone	Project name	Developer
	Coastal land reclamation	Municipal government
	Land readjustment	Urban Renaissance Agency (independent administrative institution)
	Port facility improvement	Municipal government, national government

Source: "MINATOMIRAI 21 Information Plans and Projects Vol.84", Urban Development Bureau, City of Yokohama

Preservation & Promotion of Heritage

The history and cultural heritage embodied in the waterfront environment, which formed the city's identity as a port town, were preserved, with new structures effectively becoming integrated with the existing landscape.

Red Brick Warehouse, an old customs office now utilized as a shopping mall. Recipient of the UNESCO Asia-Pacific Heritage Awards for Culture Heritage Conservation's Award of Distinction in 2010.



Red Brick Warehouse

Source: Urban Development Bureau, City of Yokohama

Nippon Maru Memorial Park, oldest commercial dockyard in the country restored as a green park with a sail training ship, the Nippon Maru.



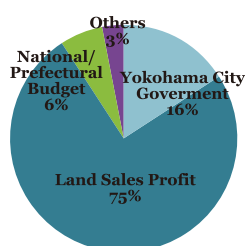
Nippon Maru Memorial Park

Source: Urban Development Bureau, City of Yokohama

Sharing the Financial Burden

The total amount spent on MM21 up to 2011 was JPY515.6 billion. The city shared the financial cost with various sectors, including the national government and the public agency which undertook land readjustment programs. So far, the city has borne 16% only of the total cost of this ambitious urban redevelopment project.

Financial Share of MM21 Project Cost



Source: JICA Study Team based on data from Urban Development Bureau, City of Yokohama

Revitalized Waterfront as a Multifunctional Center for Global Business and International Conventions

MM21 has successfully attracted leading global firms, such as Nissan, JGC, Fuji Xerox, Lenovo, Tata, Accenture, etc., to establish their offices there. It has also served as venue for major international conferences such as the Asia-Pacific Economic Cooperation and the Tokyo International Conference on African Development, both of which were held at Pacifico Yokohama, a world-class convention complex, further attracting business activities from overseas.

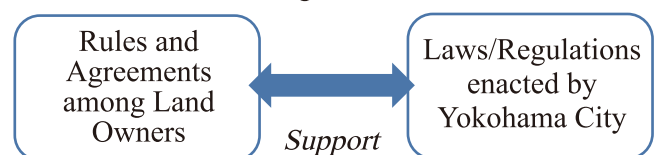
- **Offices: 1,520 firms (2012)**
- **Employment: 89,000 workers (2012)**
- **Visitors: 67 million (2012)**
- **Tax Paid to the City: JPY15.7 billion (2011)**
- **Economic Benefits: JPY1.8 trillion (2010)**

The MM21 project is not yet complete; it is a work in progress with a target of creating 190,000 jobs and accommodating a population of 10,000 in the future.

Collaboration with Citizens in Effective Area Management

To realize the achievements MM21 has so far made, one key factor was the active participation of land owners in the project area. Without this, it would have been difficult for the city government to plan, implement, and coordinate such a grand, long-term project on its own. Land owners discussed and agreed among themselves about urban design and land-use plan, among others, to improve land values in the entire waterfront. Such agreements preceded official laws and regulations on area management, but which were eventually supported by laws issued by the city.

Area Management of MM21



Green Road in Kohoku New Town



Kohoku New Town accommodated 75,000 households or 199,000 residents in 2010.

Source: Urban Development Bureau, City of Yokohama

Background and Objective

From the sixties through eighties, when a strong inflow of population took place in Tokyo, neighboring Yokohama became a bedroom town, leading to extensive residential development throughout the city. However, until the mid-sixties, legal tools to regulate these developments were absent. The resulting degradation of water sources, lack of arterial roads, and insufficient public facilities, including schools, became major social issues.

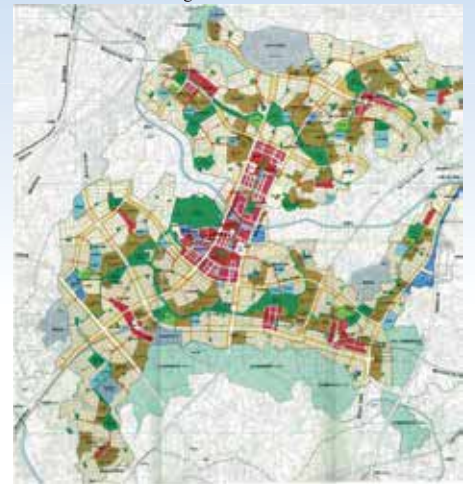
Project Impacts

In order to provide new residents with a livable environment and control the spread of disorderly development, the city developed “Kohoku New Town,” a designated residential area located some 12 km northwest of downtown Yokohama and 25 km southwest of downtown Tokyo. The new town was planned

to accommodate a maximum population of 300,000 within a land area of 2,530 ha. The new town was designed to showcase a sustainable, high-quality living environment.

- ✓ The land-use plan reflected the various interests of citizens.
- ✓ “Green matrix” for greenery preservation and special “urban agriculture zones” for farmers who wanted to continue farming even in the advent of urbanization.
- ✓ Enhanced transportation systems, including roads and subway networks.
- ✓ Business and commercial activities integrated with residential areas for economic sustainability.

Land Use Map of Kohoku New Town
The red areas are designated for business/commercial use.



Source: Urban Development Bureau, City of Yokohama

Trunk road in Kohoku New Town



Source: Urban Development Bureau, City of Yokohama

Public Participation in Land-use Planning

The state-owned residential developer, the city government, and the residents held joint discussion forums to create the development plan for the new town. Giving the public a key role in development planning was a pioneering effort in those days. As a result, it facilitated public understanding about the plan and public cooperation during implementation.

The new town project also allowed landowners displaced by development to select the location of the land to be given to them as compensation, instead of simply giving them land that was proximate to their originally owned land. Again, this was an innovative approach which readily and successfully earned the cooperation of landowners.

Spreading Greenery

“Green Matrix” map: This is a greenery preservation map showing a 14.5-km green road, a network of parks, trees surrounding shrines or temples, and hillside open spaces. Owners of land along the green road were also encouraged to preserve greenery in their respective properties to expand the coverage of green spaces.

Greenery Preservation Map of Kohoku New Town



Source: Urban Development Bureau, City of Yokohama

“Urban Agriculture”: Even though agriculture during this period was losing its importance among farmers, the city still designated agricultural areas in the new town for those who wanted to continue farming. This provided additional greenery and open spaces, ensured the supply of fresh vegetables and fruits, and served as emergency evacuation space for the new town.

Enhanced Transportation Network

Municipal subway routes were developed to connect Kohoku with other city centers. Three east–west and five north–south arterial roads, which are connected to inter-regional trunk roads, were also constructed. These rail and road networks made Kohoku very accessible from surrounding regions including Tokyo, attracting not only commuters but also weekend visitors to shopping districts in Kohoku.

Comfortable Living Environment, Active Economy & Rich Culture

What has differentiated Kohoku from many other new town projects carried out in prefectures surrounding Tokyo has been its vision of providing not just accommodation for commuters to Tokyo, but also the foundation for active commercial and business activities in the town itself. Kohoku’s center was designated for commercial facilities and offices to create a more self-sustaining and enjoyable space that would not depend excessively on the economy of other areas.

The Center of Kohoku New Town



Source: Urban Development Bureau, City of Yokohama

“The Green Matrix” Map



Source: "Green Matrix System of Kohoku New Town", Urban Development Corporation

Eco-friendly Industrial Zone on Reclaimed Land - Kanazawa Reclamation Project -

Project Profiles No.3

Industrial zone with a clean and livable environment



Source: Port and Harbor Bureau, City of Yokohama

Background & Objective

In the sixties, Yokohama City had a large number of factories which were randomly located all over the city. These factories were a source of many problems, such as air pollution, noise, and obstacles in proper zoning and land-use planning. Faced with these issues, the city of Yokohama planned to create an environmentally friendly and modern industrial zone in the city to which existing factories would be encouraged to relocate in order to improve the living environment in, and redevelop, the downtown area.

Project Impacts

To create such industrial site, a site beyond Kanazawa's coastline south of Yokohama was selected for land reclamation. The reclaimed land measured approximately 660 ha. Instead of creating a pure factory town, the area was designed to be multifunctional, encompassing industrial facilities, housing complexes for the workforce, as well as parks and recreational spaces to improve living conditions. Industrial estates and freight terminals built in the industrial zone likewise used modern, eco-friendly technologies. Kanazawa district thus became an

efficient industrial zone with a comfortable living environment. Relocation of factories to this area also improved the overall environment in the city and enabled the implementation of redevelopment projects. Yokohama City included the Kanazawa reclamation project as one of its six strategic projects. This strong commitment paved the way for a functional collaboration among relevant government departments, which led to the project's success. To finance this project, foreign bonds were issued.

Land Use at Kanazawa Industrial Complex



Source: JICA Study Team based on the brochure of Economic Bureau, City of Yokohama

Kanazawa Reclamation

A Sustainable Industrial Zone

Kanazawa district was planned to accommodate both industrial facilities and employee housing; therefore, keeping a livable environment was essential. The following are some of the measures taken by the city:

- ✓ **Zoning by sector:** Light industries were built inland and closer to the residential area, while heavy industries were built closer to the coast. A balanced zoning of industrial, residential, and public areas, such as roads, schools, etc., was developed in line with land use planning.
- ✓ **Wastewater treatment:** Shared wastewater treatment systems were installed
- ✓ **Use of less polluting energy sources:** Energy sources for industrial uses were limited to either gas or electricity.
- ✓ **Development of a “Pollution Prevention Plan”:** Companies were required to submit pollution prevention plans before constructing their factories.

Relocation Incentives

Partnerships among small and medium-sized companies were encouraged to enhance their creditworthiness and obtain financing. In particular, firms that relocated were offered the following:

Financial incentives: The city provided financial incentives in the form of tax deductions, subsidies from the city, and funding from the national government and public financial institutions.

- ✓ **Tax deduction:** real estate tax, business facility tax, etc.
- ✓ **Subsidies:** interests, guarantee fees, private road construction fees, etc.
- ✓ **Public Funding:** Small and Medium Sized Enterprise Facility Improvement Fund System; Pollution Prevention Public Corporation, etc.

Public wastewater treatment: Kanazawa district provided treatment systems for eliminating chemicals/oils from industrial wastewater. The systems were ready-made and shared by relocated factories as part of the public sewerage system, although it is normally the responsibility of individual companies to treat their own wastewater.

Enhanced mobility: Kanazawa Seaside Line, a transit system, was constructed to help residents travel through Kanazawa district, including commuting to factories.

Greenery & Recreational Spaces

Green zones and parks were established all over Kanazawa district, providing a variety of recreational spaces. The city also constructed the Kanazawa Industrial Promotion Center and equipped it with tennis courts, a gym, and playgrounds for the benefit of the workers.

Improved Labor Motivation

Relocation to Kanazawa, which offered improved working environment, boosted employee morale. Refreshing greenery surrounded factories in Kanazawa, which was totally different from their previous workplaces. Many factories also redesigned the layout of their facilities to improve efficiency and safety at work.

The Marine Park



Source: Yokohama Convention & Visitors Bureau

Vacated Lands Utilized to Create New Attractions

After the relocation of factories to Kanazawa, many of the vacated lands in the downtown area were bought by the city which built parks and other public facilities. They were also used as sites for redevelopment projects.

One of the major factories that relocated to Kanazawa was Mitsubishi Heavy Industries (MHI), which was originally located in the waterfront and owned vast lands in the area. Thus, when the firm agreed to move its factory and offices, the development of Minato Mirai 21 (MM21) started, leading to the successful transformation of the waterfront.

Green Zones along with Kanazawa Seaside Line Separate the Residential Area (left) and the Industrial Area (right)



Source: Economic Affairs Bureau, City of Yokohama

- Road Development -

90% of the area takes less than 30 minutes to/ from the urban center, thanks to the trunk road network development.



Ring Road No.2

Source: Road and Highway Bureau, City of Yokohama

Ring Expressway North Line at Underground Section (under construction)



Source: Road and Highway Bureau, City of Yokohama

Background and Objective

The road network of Yokohama City is functionally categorized as expressways and national roads for high speed and long distance, trunk roads for inner city transport, district roads for access to stations and district centers, and access roads in residential areas. This hierarchical road network allows the distribution of people and goods for socio-economic activities.

The ratio of trunk road development is not high compared to other cities in Japan, so roads have been developed mainly focusing on prioritized trunk roads. In addition, maintenance of road facilities is one of the critical issues, since more than 1,200 bridges are over 50 years old and need to be reconstructed or repaired soon.

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Project Impacts

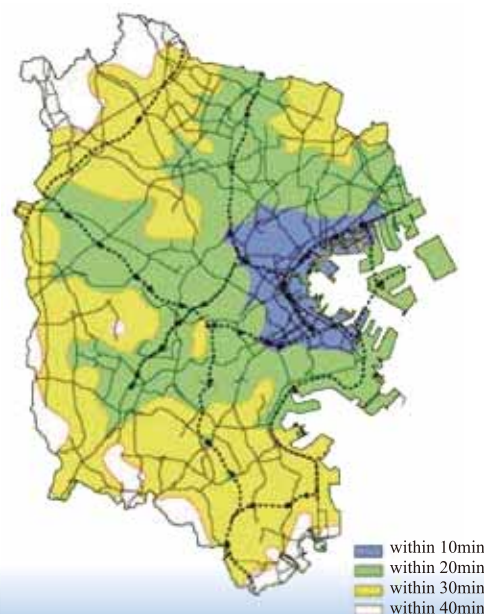
1) Traffic Improvement between Urban Center and Suburban Area

The slogan of “less than 30 minutes accessible to urban center” was set to allow citizens access between each district and the city center within 30 minutes, by formulating ring and radial networks of expressways and trunk roads. This objective was achieved in about 90% of the city in 2003, thanks to the development of expressways and interchanges, and trunk ring roads.

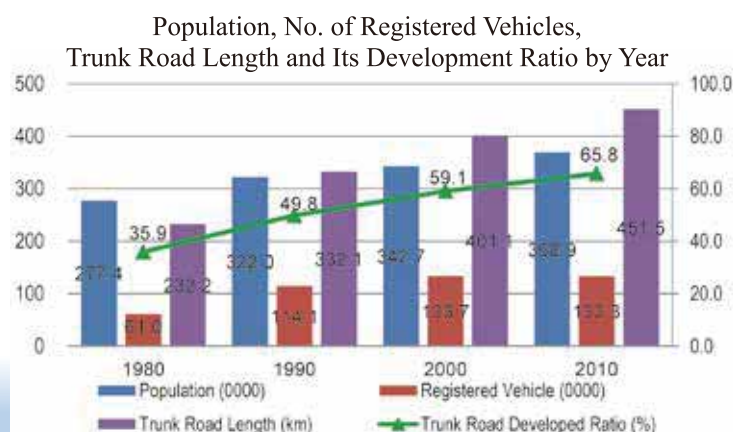
2) Steady Development of Trunk Roads

A trunk road is designated as an “urban facility” under the Urban Planning Law to secure public land for road development. In 2013, 66.4% of the total length (678km) of planned trunk roads authorized by law has been developed. To facilitate traffic demand, steady road development is indispensable.

Coverage Area of “Less than 30 Minutes Accessible to Urban Center”



Source: Road and Highway Bureau, City of Yokohama



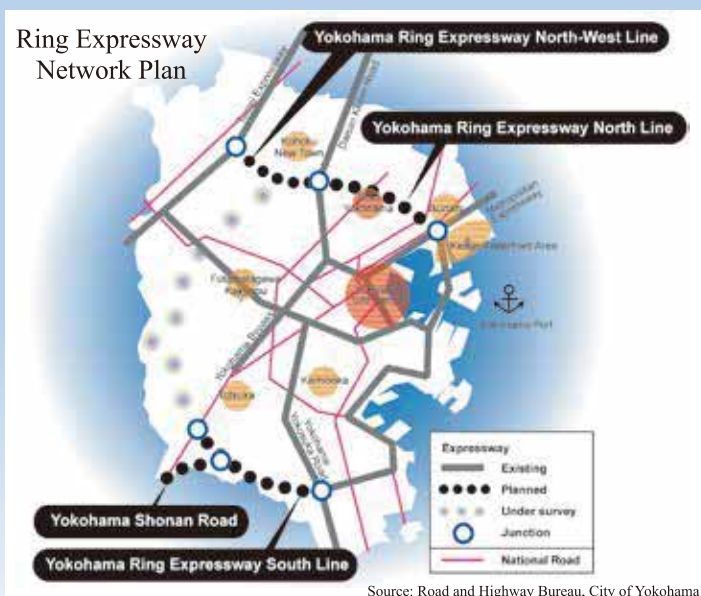
Source: JICA Study Team based on data from Road and Highway Bureau, City of Yokohama

Road Development

Expressway Development

The Yokohama Ring Expressway, located 10-15km away from the urban center of Yokohama City, aims to improve convenience, integrate districts, ease traffic congestion, and reestablish functions of access roads by connecting radial expressways and trunk roads.

The Ring North Expressway is under construction by the Metropolitan Expressway Company in charge of expressway, and by Yokohama City in charge of roads near interchanges. This Ring Expressway will pass through built-up area, so 70% of its total length of 8.2km will be underground to reduce land acquisition and negative environment impact.



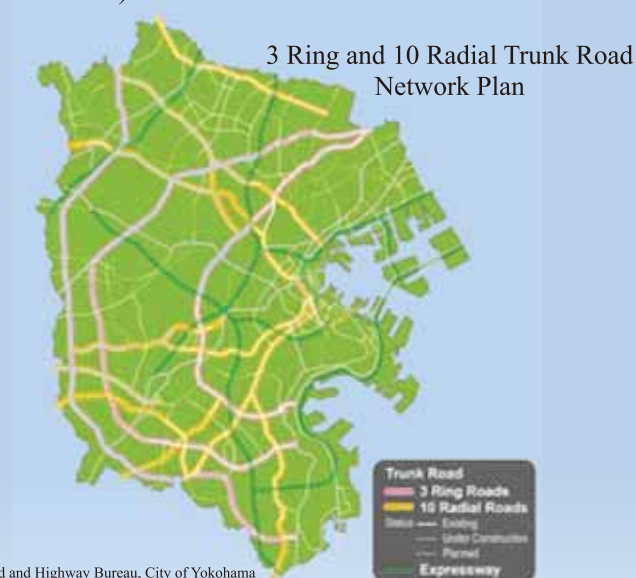
Measures to Ease Traffic Congestion on District Roads

To ease traffic congestion, local-based improvement projects such as intersection improvement and bus bay construction are implemented. These measures contribute to facilitating traffic flow of buses and cars, and to promoting the utilization of public transport.



Prioritized Trunk Road Development

The project costs of trunk roads are huge, particularly for land acquisition and construction. To maximize project impacts with limited budgets, Yokohama City has developed the “3 Ring and 10 Radial Trunk Road Network” intensively. This network can connect the city center and sub-urban areas. To date, 73.1% of the total length (approx. 200km) has been constructed.



Rehabilitation of Bridges for Longer Operating Life

Some 70% of the total of road bridges (1,744) were constructed intensively from the 1960's to 90's. The number of deteriorated bridges older than 50 years will increase in the next decades, so prolonging the life of bridges is of critical importance.

Yokohama City formulated the “Maintenance Plan of Bridges for Prolonging Life,” and has repaired bridges based on the “planned maintenance” concept which regularly check and repair them by applying the PDCA (Plan – Do – Check - Act) cycle.



Urban Railway with Integrated Urban Development

- Railway Network Development -

An urban railway network of 308km in length and with 157 stations develops a public transport oriented society.



MRT (Mass Rapid Transit)
Elevated Section of Yokohama
Municipal Subway

Source: Transportation Bureau, City of Yokohama

Railway Network with Coverage of
"15-min Accessible to Station"

Source: Road and Highway Bureau, City of Yokohama



Kohoku New Town along with
Yokohama Municipal Subway

Source: JICA Study Team

● Station of Yokohama Municipal Subway Green Line
— Yokohama Municipal Subway Green Line
● Other Railway Station
— Other Railway Station
■ Coverage of 15-min Accessible to Station

Background and Objective

In the process of economic growth, cities have faced both local issues such as air pollution, traffic congestion and traffic accidents, and global issues such as global warming and depletion of resources. A car dependent society often suffers external diseconomy and slowdown of economic growth.

While logistics are managed by developing expressways and trunk road network, road capacity cannot meet demands of increasing person trips. To transport persons massively and effectively, a mass rapid transit network must be developed.

connecting the city center and the suburban areas to integrate urban development with public transport as well as reduce inconvenient transport areas, and (ii) other mass rapid transit railways such as the MM21 Line and Kanazawa Seaside Line to meet increasing demands of commercial and business districts of new waterfront areas.

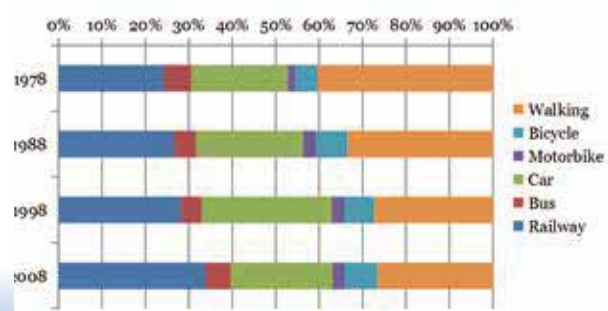
2) Expansion of service coverage area of public transport: In 1997, Yokohama City indicated a quantitative target of "15 minutes access to stations" to promote public transport. At present, a

railway network 308km long and with 157 stations has been developed in cooperation with JR (former National Railway), private railways and municipal railways in Yokohama City. By developing new stations and railways, and by improving accessibility to stations, around 86% of the population was covered inside the catchment area of "15 minutes access to station" in 2005. Today, more than a third of citizens use railway, contributing to the realization of a public oriented society.

Project Impacts

1) Promotion of urban development: Yokohama City developed a railway network consisting of the (i) Yokohama Municipal Subway

Modal Split in
Yokohama City



Source: Results of Person Trip Survey,
Tokyo Metropolitan Region Transportation Planning Commission

Railway Network Development

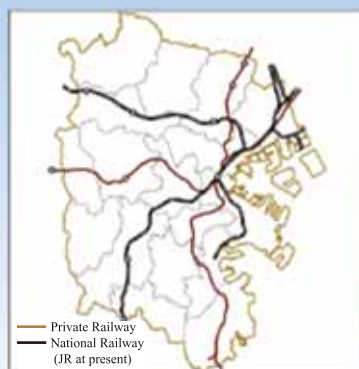
Integrated Urban Development along with Urban Railway

During the period of population expansion from the 1950s, most railways were concentrated in Yokohama Station, but commuters just passed Yokohama and went to Tokyo. To enhance business and livable functions in Yokohama City, the City decided to develop a commuter line between suburban areas and urban centers (Kannai and Minato Mirai 21).

The Yokohama Municipal Subway connects the north-west suburban areas, the suburban center connecting to the high speed railway (Shinkansen), and the urban centers formulating a public transport network inside the City.

In particular, Kohoku New Town was developed and integrated with the subway to provide residents accessibility for commuting by connecting other railways as well as the center of Yokohama. Accessibility is one of the important criteria to increase value of real estate of the new

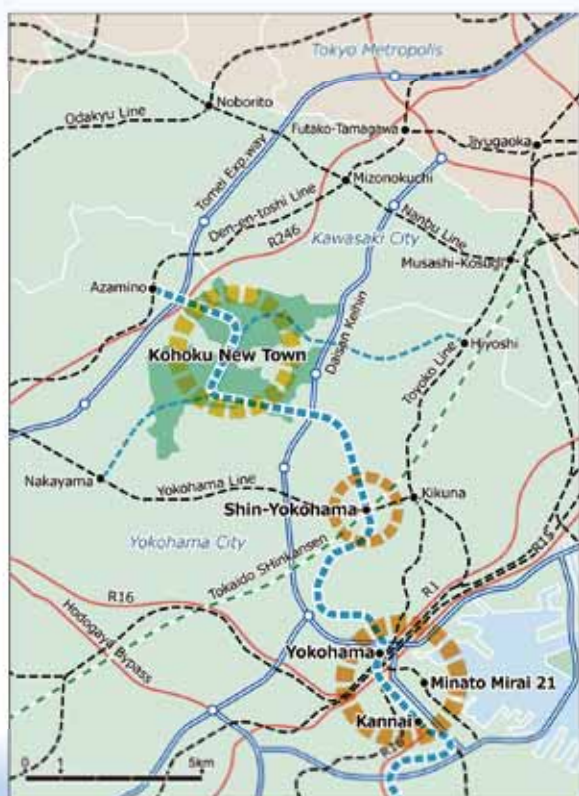
town, by inviting more residents and railway users and promoting private development investments.



Railway Network in 1965

Source: Urban Development Bureau, City of Yokohama

Yokohama Municipal Subway Network in the North Area of the City



Source: JICA Study Team

Development of Attractive Station to be a Symbol of the District

Minato Mirai 21 Line is a railway connecting the two urban centers of Yokohama Station and Minato Mirai 21 District. Yokohama Station is a terminal station to which JR, private lines and MM 21 Line connect. MM 21 Line goes underground through a commercial and business district along a port area, so passengers can access offices and commercial facilities easily and directly.

The stations themselves attract passengers and citizens not only to commute but also to enjoy shopping and rambling around the stations. In the case of Minato Mirai Station, passengers can directly access from the underground station the commercial building above the station.

Investment on extension of the railway network and development of attractive railway stations contributes not only to promoting railway utilization as a landmark, but also to reduce private vehicle movement and traffic congestion.

Railway Network Plan of Minato Mirai 21 Line



Minato Mirai 21 District City Center Area

Source: JICA Study Team

Commercial Building with Underground Minato Mirai Station

Source: Nikken Sekkei LTD.



Strengthening of Transfer Function of Urban Railway Station

- Intermodal Transfer Facility Development - Intermodal Transfer Facilities connect various transport modes for the safety and convenience of people and promote railway utilization.

Image of Station Area Development based on Transit Oriented Development Concept

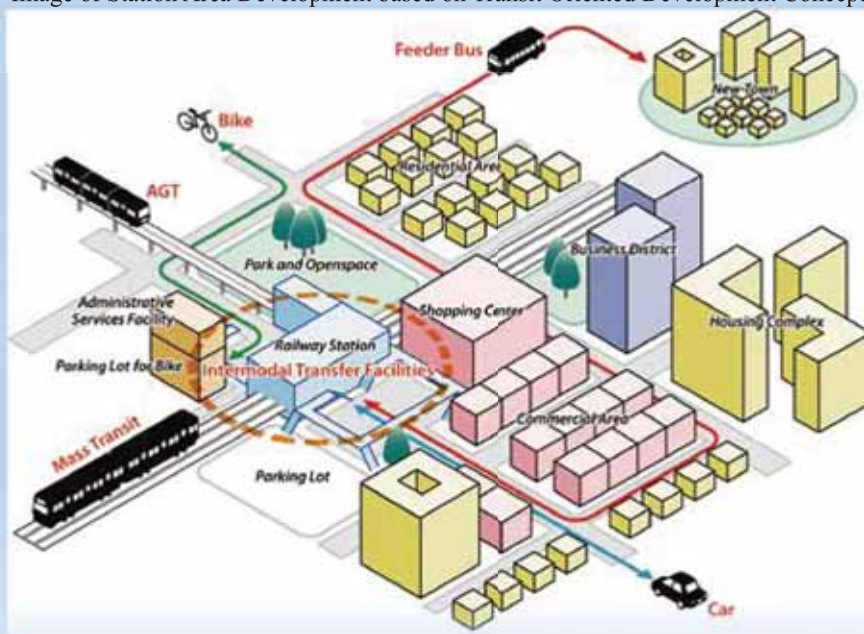
Intermodal Transfer Facility of Center Kita Station of Yokohama Municipal Subway (approx. 34,000 passengers/day)

Source: JICA Study Team



Bus Terminal in front of Azamino Station

(approx. 210,000 passengers/day) Source: JICA Study Team



Source: JICA Study Team

Background and Objective

To facilitate and manage various traffic flows and people's movement around railway stations, it is necessary to designate separate spaces for pedestrians, buses and cars to ensure safety and convenience.

The Intermodal Transfer Facility (ITF) is developed in front of the railway station to improve accessibility from bus and cars to the station.

In the case of Yokohama City, the public sector develops ITFs for the stations of Japan Railways and Yokohama Municipal Subway, while private railway operators develop their own ITFs.

Since ITFs are developed by various stakeholders such as local governments, railway operators, private

developers, etc., discussions and consensus building among these stakeholders and citizens is indispensable.

Project Impacts

1) Promotion of ITF development:

In Yokohama City, ITFs are developed in more than half of the stations (i.e., 81 of the total 157 stations), including almost all the stations with more than 100,000 station users. In the suburban areas, most of the stations develop these facilities even if station users are less than 50,000 per day.

2) Urban Redevelopment Project around station: In built-up areas, wooden houses are clustered with neither appropriate road network nor disaster preparedness. One method of improving the en-

vironment around stations for disaster preparedness and traffic safety is the adoption of an "Urban Redevelopment Project." This project is applied to redevelop built-up areas to consolidate rights of land plots into building floor areas and to provide for public facilities such as roads and parks. Thanks to urban redevelopment projects, urban functions are strengthened and values of real estate are increased.

Development Body of ITF in Yokohama City



Source: JICA Study Team based on data from Urban Development Bureau, City of Yokohama

ITF Development

ITF Development for Transfer between Public Transport Modes

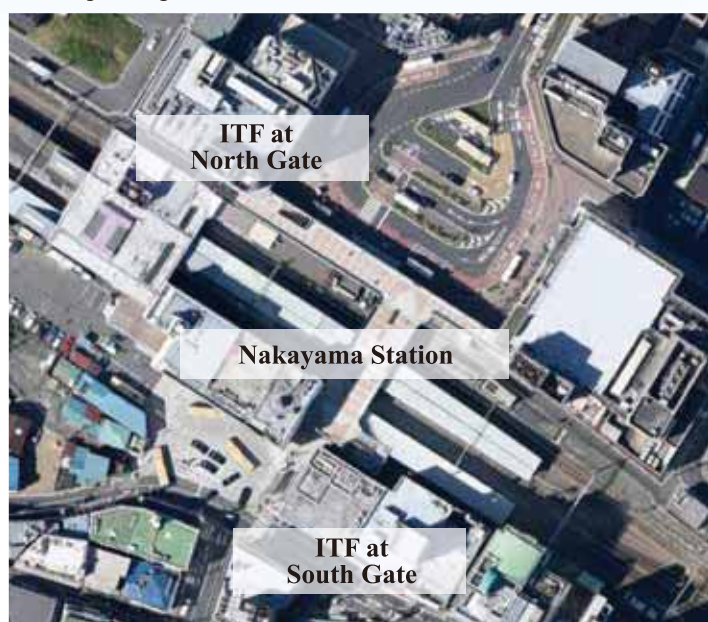
The ITF is a transport hub facility of railway and road. It has two major functions, namely: (a) to provide transit space between railway and other modes (bus, taxi, private car, motorcycle and bicycle) as a transport node; and (b) to provide open space for station users and the general public.

Yokohama City has tackled with issues of complicated traffic flow, traffic congestion, and lack of safety for pedestrians around stations. ITFs have been developed around most of the stations in suburban residential areas to provide feeder bus services connecting residential areas to the stations, and to facilitate the smooth flow of various transport nodes around the stations.



Source: Road and Highway Bureau, City of Yokohama

ITF of Higashi Totsuka Station: Berths for bus, taxi users and private vehicles were separately developed to avoid mixture of traffic and passenger flow.



Source: JICA Study Team based on Google Earth

ITF of Nakayama Station: While a typical ITF is developed in the north gate together with the Yokohama Municipal Subway, capacity of the ITF in the south gate is overloaded preventing the proper management of traffic flow.

Comprehensive Urban Redevelopment Project around Totsuka Station Area

The Totsuka station area has been promoted as a large-scale commercial district. It used to be difficult to find a bus terminal, the roads were narrow and car parking was limited, so traffic flow was complicated beyond control. Furthermore, wooden houses were clustered which faced danger of disasters. While station users increased, urban infrastructure was not developed to facilitate the movement of station users and vehicles.

To solve these issues, the “Urban Redevelopment Project of Totsuka Station Area” was designated in the Urban Planning of the City in 1994, covering 21.8ha. Though it was difficult to secure lands in the built-up area, application of the “right conversion” method to secure rights by replotting original rights to new floor rights but not to acquire lands, convinced owners to participate in the project.

After the project, midrise commercial and public facilities were developed in limited land spaces with appropriate urban infrastructure. Today, Totsuka Station area has been promoted as the urban center of the southwest area of Yokohama City.

History of Urban Redevelopment Project of Totsuka Station Area

1994: The urban redevelopment project was designated under the Urban Planning of Yokohama City.



Negotiation and consensus building among stakeholders

2007: The project implementation plan (including right conversion) was approved.



Demolition and construction

2012: The project was completed.

Totsuka Station Area before Urban Redevelopment Project



Totsuka Station Area after Urban Redevelopment Project



Source: Urban Development Bureau, City of Yokohama

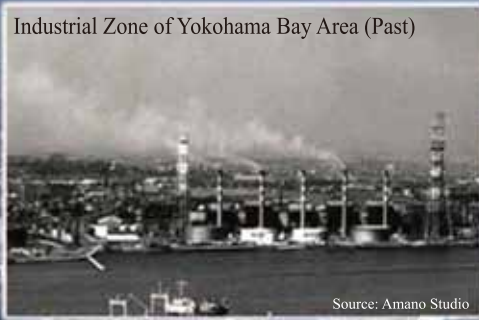
Collaboration of Local Government and Business Entity for the first time in Japan for preventing pollution measures

- Pollution Prevention Agreement and Environmental Conservation Agreement -

Project Profiles No.7

Industrial Zone of Yokohama Bay Area (Present)

Industrial Zone of Yokohama Bay Area (Past)



Source: Amano Studio

Agreement between Local Government and Business Entity concluded prior to the enactment of the relevant laws



Source: Port and Harbor Bureau, City of Yokohama

Project Summary

During the period of Japan's high economic growth, especially in the sixties up to the eighties, Yokohama faced serious environmental pollution.

At that time, the city was reclaiming the coastal area in Negishi Bay to provide land on which power plants and petroleum refineries, among others, would be built, a scenario the people thought would cause further environmental degradation. In those days, too, under the Japanese legal system, local governments were not authorized to regulate pollution sources such as factories. Despite this limitation and because of the worsening environment, the Yokohama City government in 1964 negotiated and entered into a "Pollution Prevention Agreement" with a thermal power plant company, which wanted to build on the

reclaimed land. For the first time in Japan, such an agreement was reached. Since then, Yokohama City has entered into similar agreements with other companies to prevent pollution and conserve the natural environment of the city.

In the course of time and with the changes in the country's legal system and the people's circumstances, Yokohama City decided to fine-tune the "Pollution Prevention Agreement" and sign "Environmental Conservation Agreements" with companies to comply with relevant laws and meet the needs of society.

By 2012, Yokohama City has entered into various agreements with 28 companies to deal with the issues of global warming, ecological conservation, and landscape improvement, among others.

Through years of collaboration with business entities, Yokohama's environment has improved dramatically based on compliance with the rules and regulations of relevant laws, with the terms of the "Pollution Prevention Agreement" and the "Environmental Conservation Agreement" for industrial pollution sources, in addition to the development of sewerage systems for domestic pollution sources.

Recently, however, the "Pollution Prevention Agreement" is just a part of the overall strategy to protect the environment; Yokohama City is now implementing the "Environmental Management Plan (2011-2025)" to revitalize the city's economy while ensuring the development of an attractive, sustainable city.

Pollution Prevention Agreement and Environmental Conservation Agreement

Outline of the Pollution Prevention Agreement

While in the beginning, agreements only covered new facilities or expansion of existing ones, eventually they were made to cover existing facilities as well. The contents of earlier agreements include but are not limited to the following:

- ✓ General pollution prevention measures;
- ✓ Control of raw materials and fuel;
- ✓ Improvement of production processes;
- ✓ Control of pollutants;
- ✓ Monitoring and reporting of emissions, effluents, etc.;
- ✓ Public disclosure of information;
- ✓ The right of city officials to enter business facilities and conduct on-the-spot inspection; and
- ✓ Prior consultations, etc.

Activities of Stakeholders in Executing Agreements

In the course of finalizing agreements, stakeholders carried out the following activities:

- ✓ Companies planned, designed, and presented optimum technologies to develop, operate, and manage their facilities;
- ✓ The public, supported by local medical associations, held environmental conservation conferences to gather scientific data and information, establish linkage with city authorities, and discuss relevant issues; and
- ✓ City authorities invited experts to develop their technical capacity for and knowledge in preparing agreements and evaluating their contents.

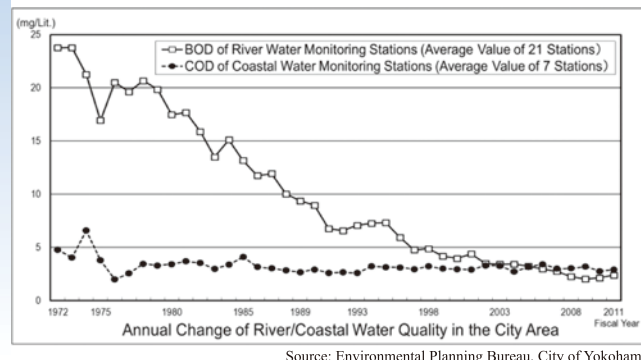
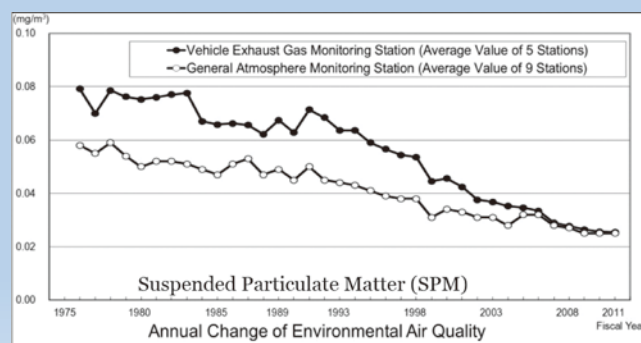
A Clean Coal-fired Power Plant Developed in the Metropolitan Area

The Isogo thermal power plant, the first power plant that entered into a “Pollution Prevention Agreement” with Yokohama City, was built in the sixties. In accordance with government policy at that time, the plant was designed as a coal-fired power plant, but it already adopted a clean technology developed by Japan’s highly advanced technological minds. The features of the existing plant are as follows:

- ✓ The coal-fired thermal power plant has a total power generation capacity of 1,200 MW;
- ✓ Using ultra supercritical pressure boiler systems, the plant has a power generation efficiency of 43%;
- ✓ With such highly advanced technology, emission levels of sulfur oxide (SOx) and nitrogen oxide (NOx) have been measured at less than 20 ppm, which is almost the same as that of a gas-fired power plant; and
- ✓ Other pollution control measures are used to ensure that the plant is environment-friendly, such as coal ash recycling, wastewater treatment, and noise control.

Environmental Improvement in Yokohama

With the enforcement of laws on pollution control since the late sixties, the local government and the business community have had to implement pollution control measures. But even before laws requiring such were enacted, Yokohama had already required factories to implement control measures based on pollution prevention agreements both parties had signed. Consequently, the environmental quality in the city in the early seventies greatly improved. Nowadays, ambient air and public waters in various monitoring points comply with environmental standards.



Evolution of the Agreement

The “Pollution Prevention Agreement” has evolved and its contents have changed following the revisions to the “Environmental Conservation Agreement” which now include emerging environmental impacts harmful to men, as well as a wide range of global and urban environmental issues such as global warming, ecological conservation, biodiversity preservation, and landscape improvement, to name a few.

Isogo Thermal Power Plant



Photo is provided by J-POWER (EPDC)

Mitigating Climate Change through Unique Programs -Global Warming Countermeasures-

Project Profiles No.8

Source: Yokohama Convention & Visitors Bureau

Mitigating climate change through PDCA cycle

Background and Objective

In August 2008, the City of Yokohama was selected as an “Eco-Model City,” and in December 2011, as a “FutureCity” by the national government. Being the second-largest city in Japan in terms of population, Yokohama has actively worked toward carbon reduction and energy conservation in its pursuit of becoming a role model for other cities in and outside Japan. In 2011, Yokohama prepared the “Action Plan for Global Warming Countermeasures” as a master plan for the city’s global warming mitigation program. The action plan aims to reduce GHG emissions by 25% by 2020 and 80% by 2050 using the emission amounts of 1990 as baseline. It also sets specific

plans for different sectors, such as residential, commercial and industrial, transportation, etc., in three phases, i.e., short term (until FY 2013), medium term (until FY 2020), and long term (until FY 2050).

Project Impacts

The city is dedicated to carry out its action plan and achieve its goals by promoting energy conservation among residents and the business sector, including requiring large, GHG-emitting industries to create their own mitigation plans and submitting monitoring reports to show their respective achievements. The city government monitors the progress of each sector every year and reports the same to the national government, which in turn provides the

city with expert advice to make its initiative more effective. Lessons from implementing the plan are also reflected in the following year’s actions.

With a unique action plan for each sector coupled with the dedicated efforts of individual citizens encouraged by the city’s information and educational campaigns, Yokohama has made notable progress in mitigating climate change. In 2009, the World Bank selected Yokohama as one of the first six Eco2 Cities (Ecological Cities as Economic Cities), and in 2011, the city won the first Smart City Award at the Smart City Expo World Congress in Barcelona.

Harnessing Sectoral Action against Global Warming

In order to mobilize its citizens and private firms in its efforts to mitigate the impacts of global warming, the city government has prepared various GHG reduction/energy conservation programs in which each sector of society can participate. Some examples are the following:

◆Residential Sector:

“CASBEE Yokohama Program”

- Comprehensive Assessment System for Built Environment Efficiency (CASBEE) evaluates and rates the environmental performance of buildings. It requires building owners to submit plans before construction of buildings with a floor space of more than 2,000 m².

◆Industrial, Commercial and Other Sector:

“Carbon Reduction Planning by the Private Sector”

- Big firms are required to create their own carbon reduction plans and report the results every year.

◆Transport Sector

“Subsidies for Purchasing EVs & Plug-in Hybrid Vehicles”

- Yokohama provides subsidies to citizens who want to buy eco-friendly vehicles.

◆Energy Sector:

“Subsidies for Purchasing Solar Panels”

- Yokohama provides subsidies to citizens who want to buy solar panels.

Taking Small Steps to Achieve Bigger Goals

GHG reduction is gradually being achieved through programs set out for each sector. While progress might seem slow, each of these programs count and their respective achievements will lead the city closer every year to achieving the collective goals. Yokohama believes that the key to a successful initiative against global warming is for everyone to continue doing his/her share, checking the results of one's actions, learning lessons from everyone's experiences, and coming up with better actions.

In 2011.....

178 building owners submitted plans under the CASBEE program

⇒ Reduced: 4,446.5 tons of CO₂ (data from 101 projects)

318 companies reported their achievements in reducing GHG emissions

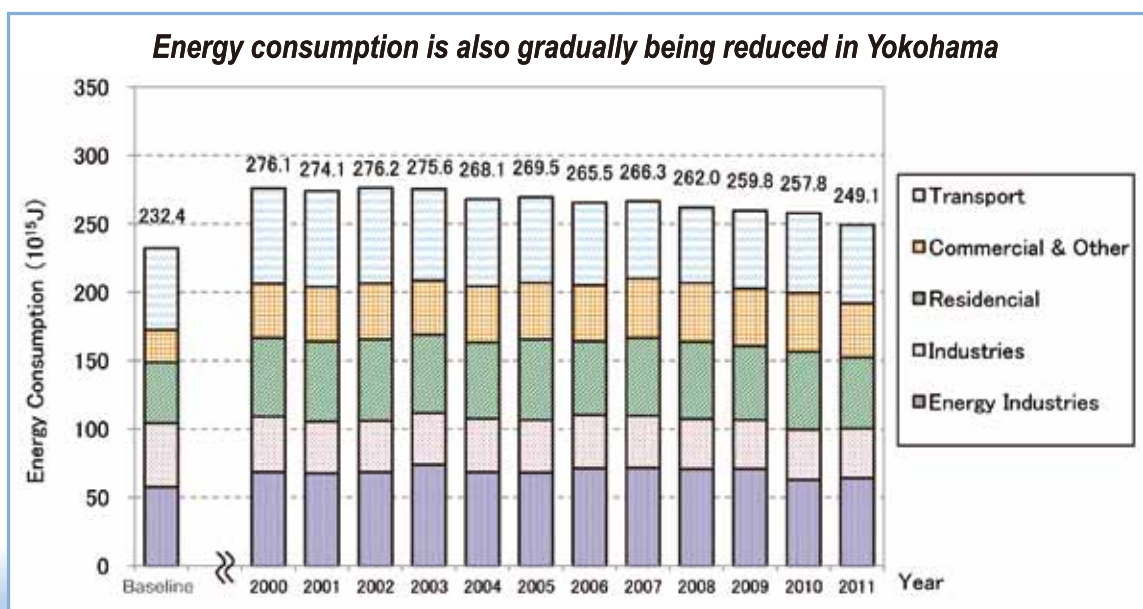
⇒ Reduced: 316,819 tons of CO₂

358 EVs or plug-in hybrid vehicles were bought with subsidy

⇒ Reduced: 448.1 tons of CO₂

3,368 solar panels were bought with subsidy

⇒ Reduced: 5,607.9 tons of CO₂



Waste Reduction through Collaboration among the Citizens, Government and Private Sector

- Yokohama G30 and 3R Dream Plans -

Project Profiles No.9

Education of Garbage Collection to Children

In 2010, waste amount was 43.2% lower than the amount in FY2001.



Source: Resources and Waste Recycling Bureau, City of Yokohama

Background and Objective

Yokohama experienced rapid growth of population from the sixties until the eighties due to urbanization and this brought about an increase in municipal waste as well. To design the economy and the society in such a way to facilitate recycling and restrain waste generations, the city leadership initiated the “Yokohama G30 Plan” in January 2003. Using the fiscal year (FY) 2001’s 1.61 million tons of generated waste as baseline, the Plan aimed to reduce generated waste by 30% by FY2010.

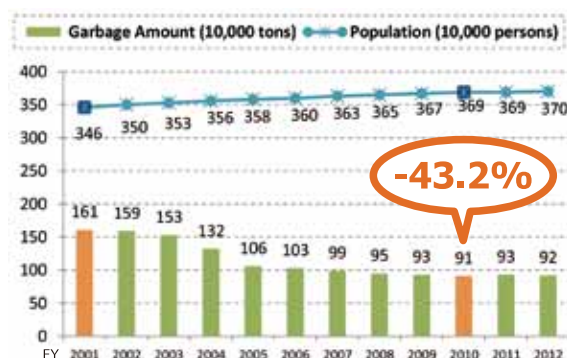
Impact of the Plan

In order to achieve the goal, Yokohama City worked closely with its citizens and the private sector. In the course of implementing the

plan, the city government conducted more than 11,000 lectures and educational programs to raise public awareness on the need to sort garbage to facilitate recycling and reduce the waste going to incineration plants.

As a result of this effort, the 30% waste reduction target was achieved earlier than expected, in FY2005. By 2010, the target year, generated waste was 43.2% lower than the baseline figure. This achievement benefited the city by saving considerable funds intended for waste management. Yokohama now aims to reduce greenhouse gases (GHGs) to support Japan in its national GHG reduction plan and demonstrate that it

is an Environmental "FutureCity". The new “Yokohama 3R Dream Plan,” created in 2011 after the G30 Plan was completed, aims to further reduce the amount of generated solid waste. Using the FY2009 figure as baseline, the targets are a 10% reduction in the combined amount of waste and resource use, as well as a 50% reduction in GHG emissions by FY2025.



Source: JICA Study Team based on data from Resources and Waste Recycling Bureau, City of Yokohama

Role Sharing in Waste Reduction

The city designed and implemented the G30 Plan jointly with the private sector and the citizenry based on the “polluter pays” principle and the concept of extended producer responsibility. The G30 Plan identified the responsibilities of stakeholders, i.e., the citizens, the private sector, and the government, and developed a strategy for collaboration among them in promoting the 3 Rs (reduce, reuse, recycle).

• Role of Citizenry and Businesses:

Promoted environmentally friendly lifestyles and complied with rules on sorting garbage into 15 categories.

• Role of City Government:

Created the social systems to facilitate the 3 Rs and raised public awareness by disseminating information.

Raising Public Awareness

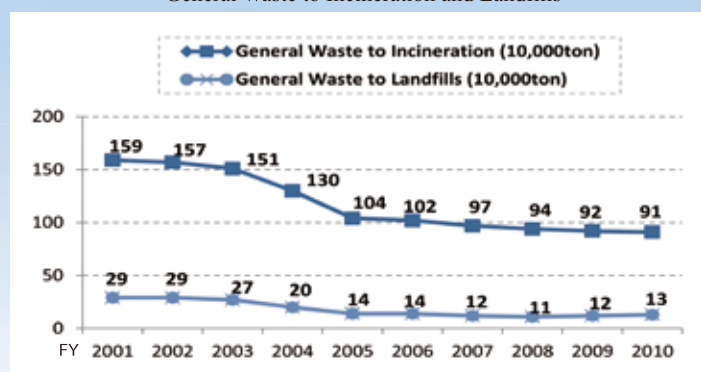
- ✓ More than 11,000 seminars held at neighborhood levels over a two-year period.
- ✓ About 600 campaigns at railway stations.
- ✓ More than 3,300 campaigns at local waste disposal points.
- ✓ Sharing of achievements, successful collaborations, as well as waste reduction and financial information related to the G30 Plan via a variety of events.

“Yokohama’s 30% waste reduction target was achieved five years ahead of schedule.”

Despite a population growth of approximately 230,000 from FY2001 to FY2010, waste generation in the same period decreased by 43.2%. As a result:

- *Existing Landfills* ⇨ Life span extended.
- *Incinerators* ⇨ Reduced from 7 to 4 plants, saving the city JPY110 billion in capital expenditure and JPY3 billion in annual operational expenditure.
- *CO₂ Emissions* ⇨ Reduced by 370,000 tons in 2010.

General Waste to Incineration and Landfills



Source: JICA Study Team based on data from Resources and Waste Recycling Bureau, City of Yokohama

Achievement through People Power

It was not only the government’s political will and social commitment which were instrumental in achieving the environmental targets. Collaboration with the citizenry and business was a key success factor.

Interview -Voice of the Yokohama City Government

“The rules were strict, but our explanations remained truthful and our motives sincere. Also, the citizens themselves actively shared information about the government’s plan, which largely helped in achieving our goal.”

Upon the enforcement of the G30 Plan, garbage collectors did not pick up residential wastes that were not properly sorted. As for commercial/ industrial wastes, they also returned wastes to firms when inappropriately sorted wastes were discovered at incineration plants. On the other hand, city employees provided all information sought by the people and disseminated information about the plan through various events and activities. Yokohama, which has a large number of small neighborhood associations, appointed waste management leaders in each association, who played a major role in teaching waste sorting, preparing venues for seminars, and other tasks in their respective neighborhoods. Efforts of such dedicated citizens contributed significantly to the program’s success.



Total Management from Water Source to Tap

- Waterworks of Yokohama City -

Growth of the City Depends on Water

Providing Safe Water



Source: Waterworks Bureau, City of Yokohama



Source: Urban Development Bureau, City of Yokohama

Doshi Watershed Protection Forest



Source: Waterworks Bureau, City of Yokohama

Water Purification Plant



Source: Waterworks Bureau, City of Yokohama

Water Quality Test



Source: Waterworks Bureau, City of Yokohama

Training



Source: Waterworks Bureau, City of Yokohama

Project Summary

Did you know that a modern water supply system played a big role in the development of Yokohama City, which is a key world center of industry and culture today?

In 1887, British engineer Henry Spencer Palmer, with the help of Japanese engineers, installed Japan's first modern waterworks in Yokohama which now has grown up as the 2nd largest city in Japan with a population of 3.7 million.

A stable supply of water is necessary for industries to grow and plays a major role in urban and regional development.

The Yokohama Waterworks Bureau has kept pace with the ever-increasing demand for water by developing water supply engineering technologies.



Source: Urban Development Bureau, City of Yokohama



Character of
Yokohama Waterworks Bureau
“Hama-pyon”

Status of Water Supply (March, 2013)

Item	Value
Population Served	3.694 mil Persons
Population Served Rate	100.0 %
Annual Water Consumption	425,280,300 m ³
Average Daily Water Supply	1,165,152 m ³
Daily Average Water Supply per a Person	315 litter
Total Length of Pipeline	9,247 km

Source: Waterworks Bureau, City of Yokohama

Waterworks of Yokohama City

Advanced Technology

Today, to supply 1.2 million cubic meters of high-quality water every day, the Yokohama Waterworks Bureau has three purification plants which comply with Yokohama's own purification standards that are stricter than the national ones.

Enormous quantities of water needed by Yokohama City continue to flow without fail largely due to the Bureau's adoption of advanced technology and its management experience.

Water quality is controlled by highly accurate technology. At each purification process, around 200 test criteria are used to ensure water quality. About 23 of these criteria are controlled according to ISO/IEC17025 to assure international compliance.

A water distribution block system was also introduced, and it has proven to be very effective in managing water pressure and flow to prevent water leakage and other problems.

Sustainable Management

The Bureau has consistently maintained a steady supply of potable water to the people of Yokohama City.

The trust between water supplier and customer is reflected in the high payment rate of water charges. Moreover, business plans guided by a long-term vision are the basis for the sound management of water supply services. With these conditions in place, the Waterworks Bureau can run a stable water supply system. The bureau has all the qualities indispensable to a successful business enterprise.

International Cooperation

The most unique characteristics of the Waterworks Bureau is its 40-year record of international cooperation. Over this period, it has received more than 2,400 trainees and executives from Asia, Africa, and other regions who visited the City to study the technologies and management experiences of the Bureau.

Under technical assistance projects, the Bureau has also dispatched around 240 experts of its staff to some 30 countries around the world. The expertise of its staff has contributed to solving the water problems and has improved the situations in these countries.

As for one of the activities of the Bureau, in the province of Hue in central Vietnam, which the bureau has been assisting since 2003, water quality has dramatically improved. As a result, a Safe Water Declaration was successfully issued by the Hue Water Company.

To enable the Bureau to contribute more to overseas waterworks services through technical cooperation and technology transfer, the bureau established the Yokohama Water Co., Ltd., in 2010, wholly funded by the Bureau. This company will go to meet more flexibly to various needs, from training to consulting services in technology and management capacity.

Advanced Technology



Source: Waterworks Bureau, City of Yokohama

Sustainable Management



Source: Waterworks Bureau, City of Yokohama

International Cooperation



Source: Waterworks Bureau, City of Yokohama

Improvement of Water Environment - Sewerage System in Yokohama -

Project Profiles No.11

Past Condition
in Yokohama

Wastewater Treatment Plant

**Diffusion Rate of Sewerage Service increased
from 17% to 90% in less than 20 years**



Source of Photos: Environmental Planning Bureau, City of Yokohama

Project Summary

The development of the sewerage system in Yokohama City was extremely delayed due to the destruction wrought by World War II. In addition, the rapid population growth in the sixties was accompanied by such problems as night soil disposal and pollution of major rivers. To address these issues, Yokohama City took a multipronged approach to ensure an effective and speedy development of the city's sewerage system.

In Past Years

Deterioration of Water Environment

- ✓ Water pollution
- ✓ Insanitation
- ✓ Flood/Inundation

Delay in Sewerage System Development

- Lack of Budget and Human Resources
- Shortage of Skills and Experience

Rapid Progress of

- ✓ Population Increase
- ✓ Urbanization
- ✓ Industrialization

Yokohama's Approaches

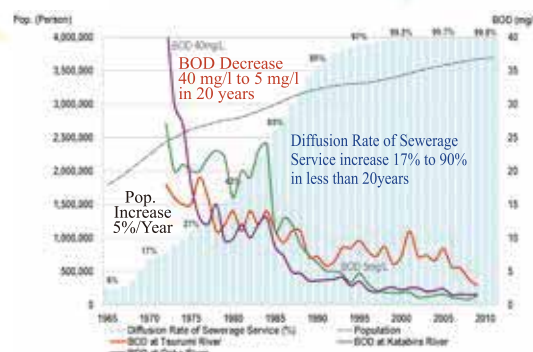
- ◆ Strategic planning and phased construction
- ◆ Adoption of advanced technologies
- ◆ Cooperation with the private sector
- ◆ Sound financial management
- ◆ Strengthening of public relations
- ◆ Comprehensive flood control system

Present



Source: Environmental Planning Bureau, City of Yokohama

Yokohama City has achieved a diffusion rate of sewerage service of 100% within a short period of time and nowadays works on sewage reuse for a sustainable future. Sewage sludge is now 100% incinerated and 100% reused.



Lower BOD levels in Yokohama's rivers
(reduction of river pollution)

Source: Environmental Planning Bureau, City of Yokohama

Key Approaches for Effective Development of Yokohama's Sewerage Systems

■Strategic Planning and Phased Construction

Based on a long-term plan, the city's sewerage system was built in phases, regulations and guidelines were developed, and certain areas were prioritized.

■Adoption of Advanced Technologies

The city's sewerage system consists of separate and combined systems both for efficient and speedy development. In urban areas, pipe jacking and shield tunneling methods, which have a small impact on traffic, were adopted to install sewer pipes.



Shield tunneling machine

■Cooperation with the Private Sector

The private sector played a key role in facility development. While private developers used their capital to install sewerage facilities, such projects had to comply with relevant government regulations. PFI schemes* have also been adopted in utilizing modern technologies and harnessing the experiences of the private sector.

*PFI projects include those in power generation from anaerobic digestion and soil improvement using incinerated sludge ash. The private sector is responsible for the rehabilitation, operation, and management of plants.

■Sound Financial Management

Sewerage projects are managed using municipal budget, national government subsidy, and user charges. Sewerage works are managed financially by an accounting system that is based on corporate accounting methods.

■Strengthening of Public Relations

To raise public awareness and understanding, many activities were implemented such as site visits of sewerage facilities, education of students, and conduct of public forums.



Site Visit for WTP

■Comprehensive Flood Control System

Flood and inundation problems are managed by comprehensive flood control which includes not only construction of drainage channels and pumping stations but also regulation of land development, preparation of hazard map for flooding, and installation of run-off control facilities such as storage and infiltration systems.

Outline of Sewerage System in Yokohama City

Item	Value (2012)
City Area	435 km ²
City Population	3.70 million
Diffusion Rate of Sewerage Service	99.8 %
Wastewater Treatment Plant	11 places
Sludge Treatment Plant	2 places
Total Sewer Pipe length	11,700 km

Source: Environmental Planning Bureau, City of Yokohama



Dai-chan, mascot for Environmental Planning Bureau

Sewerage System Map



Source: Environmental Planning Bureau, City of Yokohama

Note: Color-coded areas show coverage of treatment districts.

Use of Sewerage Resources and Assets: Global Implications

Yokohama City is continuing the recycling and use of sewerage resources and assets to create an eco-friendly society. Sewage sludge is now incinerated and reused 100%.

■Effective Use of Treated Wastewater

Treated wastewater is used for cleaning/cooling of machinery, toilet flush water and landscaping in public utilities.



As toilet flush water in public facilities



As water flow in small streams

■Effective Use of Digestion Gas

Digestion gas is used for gas engine to generate power and for fuel of incinerators in the sludge treatment plant.



To generate power using digestion gas



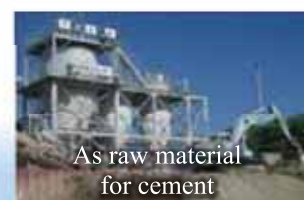
As auxiliary fuel for incinerators

■Effective Use of Incinerated Sludge Ash

Incinerated sludge ash is used for improved soil and cement raw material in construction works.



To improve soil for backfill



As raw material for cement

Source of Photos: Environmental Planning Bureau, City of Yokohama

Continuous Transformation to Meet the Needs of Users and Citizens

Project Profiles No.12

- Port of Yokohama -

Port of Yokohama

Developing one of the world's deepest quay walls at 20m

Source: Port and Harbor Bureau, City of Yokohama

Background and Objective

The port of Yokohama, Japan's leading international trading port, plays a significant role in developing the economy and culture of Yokohama. During the course of its development, Yokohama faced some problems in carrying out its port and urban functions:

- ✓ With innovations in maritime transportation, sizes of container vessels have grown and cargo volumes have increased rapidly;
- ✓ Increasingly complex port and urban functions have required better coordination; and
- ✓ The busy port has become less accessible to people.

Project Impacts

To cope with these problems, the city embarked on a modernization plan for the port, constructing berths on reclaimed land which are connected to other piers and the hinterland through a road network which includes the Bay Bridge. Yokohama diverted traffic from/to the port and the city, alleviating traffic congestion in the city center. At the same time, the city reconstructed and redeveloped the waterfront, including establishing green zones to improve the harbor's environment and ensure easy access for the public.

Japan's first and one of the world's deepest, Yokohama Port's quay walls are now under construction and are expected to be in operation by 2014. At 20 meters, they will be capable of accommodating super large container vessels.

Yokohama Port has acquired a distinct reputation for its world-class operation, highly efficient cargo handling, and quality assurance. Privatizing the Yokohama Port Corporation has enabled long-term planning and flexible management to meet users' needs together with support of the city, while promoting environment-friendly initiatives.

Basic Information of Yokohama Port

Opening of the port – June 2, 1859

Port Area -	7,315.9 ha
Waterfront Area -	2,863.8 ha
Commercial Zone -	1,012.8 ha
Industrial Zone -	1,697.2 ha
Marina zone -	4.2 ha
Recreational Zone -	89.5 ha
Others -	60.1 ha

Number of Berth – 248 berths
(public berth 89, private berth 159)

Number of incoming vessels - 37,047

Volume of Cargo Handling – 121.39 million tons / year

Number of Containers – 3.05 million TEU

Source: Port and Harbor Bureau, City of Yokohama

Port of Yokohama website

<http://www.city.yokohama.lg.jp/kowan/english/>

Yokohama Port Cooperation website

<http://www.yokohamaport.co.jp.e.df.hp.transer.com/>

Port of Yokohama

Creating a Logistics Center with Modern Berths and Support Infrastructure at Minami Honmoku Pier

The construction of Minami Honmoku Pier as a new logistics center has been underway since 1990. Approximately 40% of the total 216.9 ha of planned landfill area has been completed, so far.

MC-1 and MC-2, which started operations in April 2001, are state-of-the-art berths capable of accommodating increasing volumes of container cargo and growing sizes of container ships. They are equipped with advanced facilities such as a 16-meter deep berth, six mega container cranes with an outreach of 22 rows, and a total berth length of 700 m (350 m × 2 berths). They are advanced container terminals capable of smoothly accommodating the world's largest container ships.

Besides MC-1 and MC-2, reclamation work on MC-3 has been underway since January 2007, including work on the world's largest 20-m deep quay.

The area behind the container terminals serves as a new comprehensive logistics base equipped with a distribution warehouse, a delivery service center, and a distribution terminal complex.



Minami Honmoku Pier, one of the world's largest quays

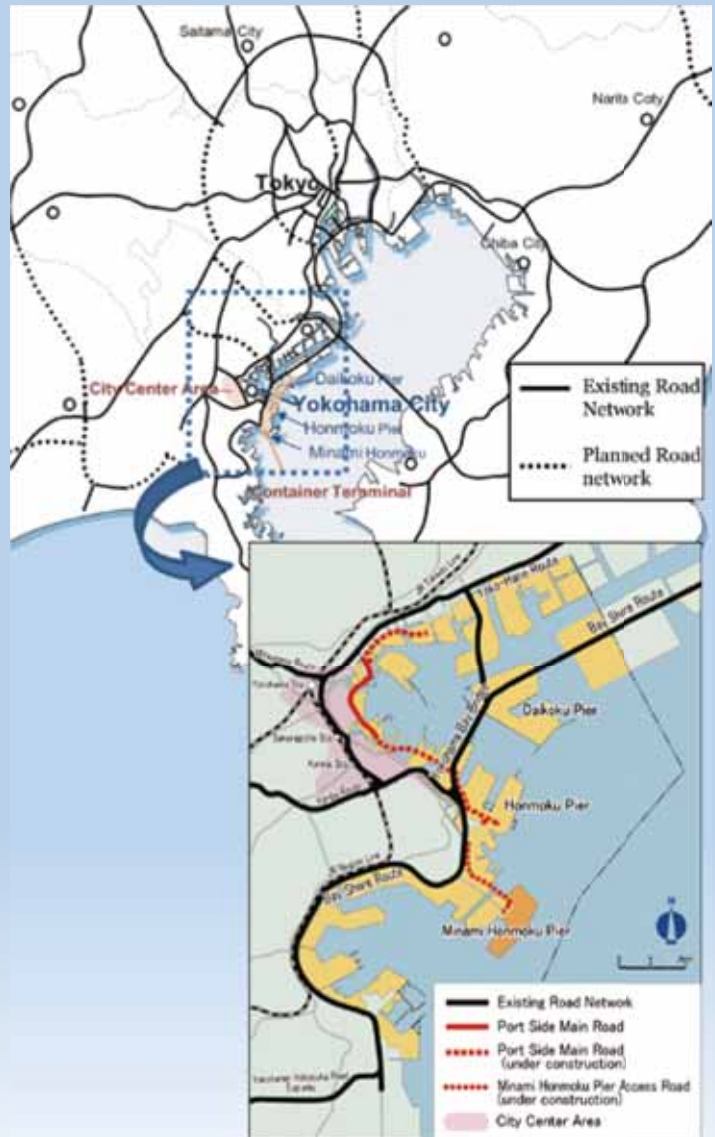
Source: Port and Harbor Bureau, City of Yokohama

Decongesting the City Center by Diverting Cargo Traffic

To strengthen its international competitiveness, Yokohama improved the access to its piers, which is being done in phases, and to the hinterland. A complete road network was developed to connect Yokohama to all locations within the metropolis. The Yokohane and Bay Shore routes of the Metropolitan Expressway are connected to Tokyo, located northeast of Yokohama, while the Tomei Expressway is linked to Shizuoka, which is southwest of Yokohama.

Furthermore, a loop road network is undergoing improvement and the access between Yokohama Port and its hinterland will be further strengthened in the future, both of which will further enhance the value of Yokohama Port for its users.

Road Network to the Hinterland and Diversion of Cargo Traffic from the City Center



Source: JICA Study Team based on map from Port and Harbor Bureau, City of Yokohama

Providing World-class Operation and Flexible Management

The privatization of the Yokohama Port Corporation has resulted in a more efficient management of port operation to meet users' needs. A long-term development and financing plan for the port has also enabled a flexible and timely disbursement of funds for operation and maintenance and suitable tariff setting. Together with efforts of the city and national government on facility development, the efficient and effective management and operation of the port have provided valuable services to users.

Yokohama Port has a strong reputation for highly efficient cargo-handling and quality assurance, which are supported by skilled operators and a knowledgeable private sector.

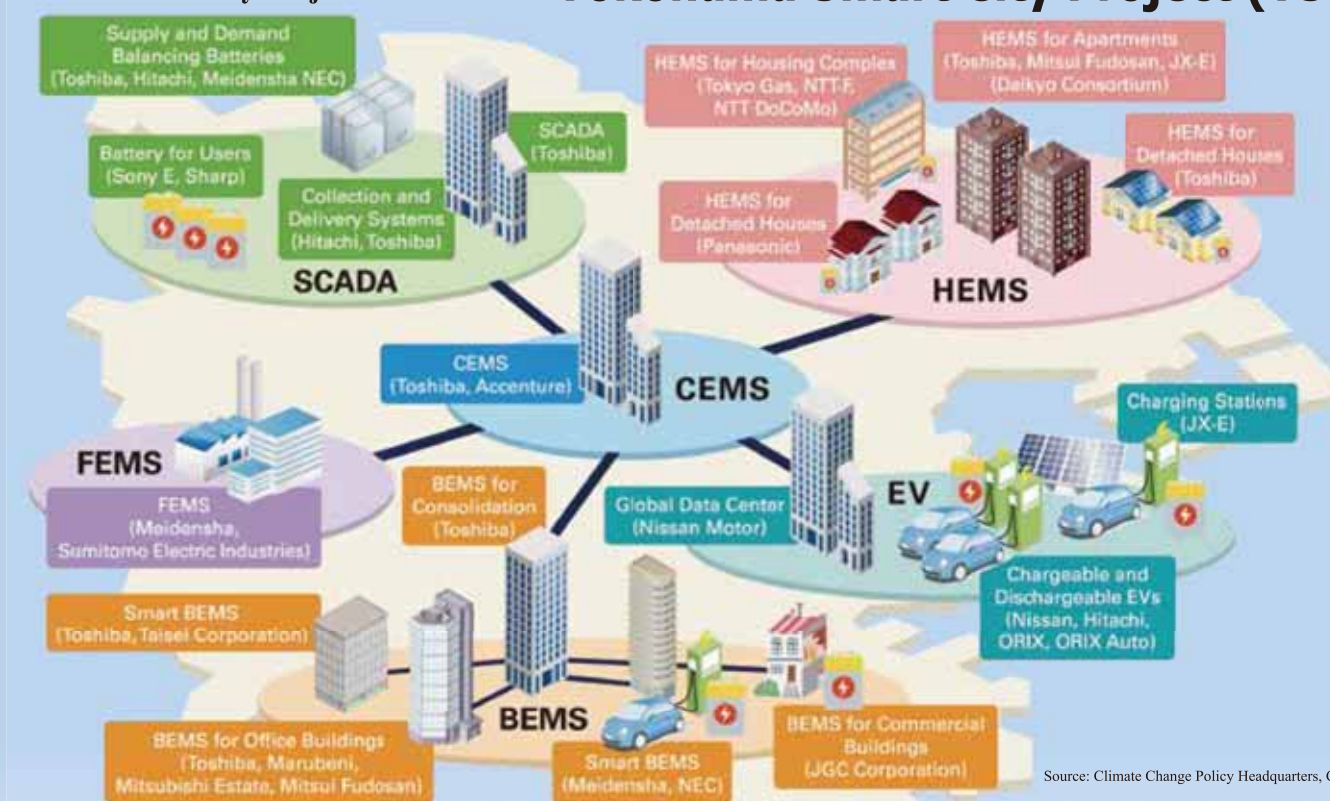
In addition, Yokohama has used environment-friendly technologies in its port facilities, such as hybrid cargo-handling machines, renewable energy, and LED lighting, among others.

Large Scale Demonstration with Citizens and Firms

Project Profiles No.13

Yokohama Smart City Project

- Yokohama Smart City Project (YSCP) -



Continuing pioneering experiments to achieve a Smart City

Project Summary

The New Midterm Four-Year Plan (2010-2013) of Yokohama City proactively revised its target to reduce green house gas (GHG) emissions by 25% and 80% by 2020 and 2050, respectively. To achieve this target, the City is pursuing an Eco-city strategy and is very eager to promote the Yokohama Smart City Project (YSCP).

In April 2010, the smart city project was selected by the Ministry of Economy, Trade and Industry as a "Next Generation Energy Infrastructure and Social System Demonstration Area" to establish overseas expansion of Japan's smart grid.

The City is collaborating with the private sector (including Accenture, Tokyo Gas, Toshiba, Nissan Motor, Panasonic, Meidensha, TEPCO,

etc.) to work on various projects such as introduction of renewable energy, energy management of households, buildings and local communities, and next generation transportation systems.

The project demonstrates a large scale energy management system, demand response (DR) and 2,000 electric vehicles involving houses, residential complexes, buildings and factories. The project has started in three diversified areas within Yokohama City, namely the Kohoku New Town (residential area), Minato Mirai 21 (urban center), and the Yokohama Green Valley (industrial area). With these areas as the core experimental sites, the project is now gradually spreading to other areas in the City.

The energy management system consists of Home Energy Manage-

ment System (HEMS), Building Energy Management System (BEMS), Factory Energy Management System (FEMS), and Community Energy Management System (CEMS) which are typical but indispensable components of a smart city. In this project, HEMS is planned to be installed in 4,000 houses, and BEMS as well as FEMS will be applied to a total area of 1.6 million m² of buildings.

Yokohama Smart City Project

“Make a smarter city through regional energy management”

The city designed and implemented the G30 Plan jointly with the private sector and the citizenry based on the “polluter pays” principle and the concept of extended producer responsibility. The G30 Plan identified the responsibilities of stakeholders, i.e., the citizens, the private sector, and the government, and developed a strategy for collaboration among them in promoting the 3 Rs (reduce, reuse, recycle).

BEMS for Consolidation:

The group management system of various buildings can optimize allocation of energy availability and maximize capability for Demand Response (DR), which results in lower maximum energy demand than energy management systems of respective buildings.

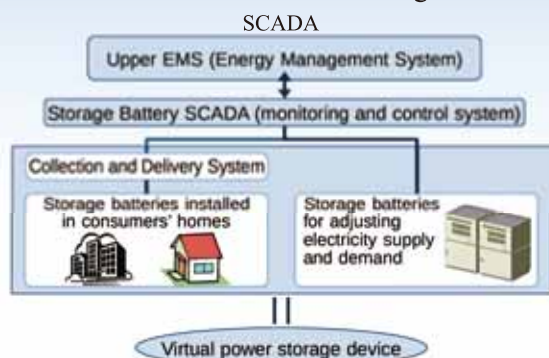
BEMS for Consolidation



Source: JICA Study Team based on information from Climate Change Policy Headquarters, City of Yokohama

SCADA:

Supervisory Control and Data Acquisition (SCADA) is a unified management system of demand side stored batteries and batteries for demand/supply adjustments in an area. In case adjustment of demand/supply of electricity is required, Upstream EMS, such as CEMS, has SCADA system control charging and discharging of stored batteries. By managing all batteries together, it is possible to utilize all batteries as a huge stored battery.

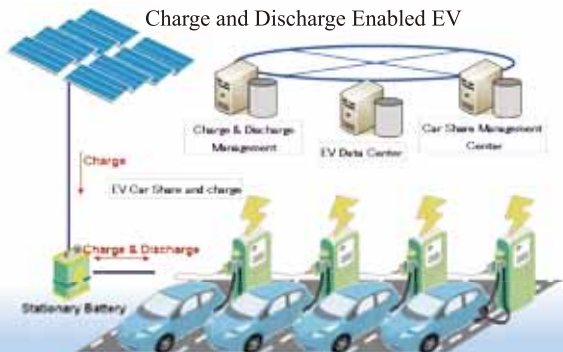


Source: JICA Study Team based on information from Climate Change Policy Headquarters, City of Yokohama

Charge and Discharge Enabled EV:

“Charge and Discharge enabled EVs” enable to increase the use of solar power and lower well to wheel EV CO₂ footprint and can be leveraged as clean energy storage.

Charge and Discharge Enabled EV



Source: Climate Change Policy Headquarters, City of Yokohama

“Yokohama City aims to effectively reduce CO₂ emissions.”

To reduce CO₂ emissions in the city, YSCP sets a specific goal for each tool of the project, namely: installation of HEMS in 4,000 homes; installation of BEMS in buildings with a total area of 1.6 million m²; and creating infrastructure for supporting 2,000 Electric Vehicles within the city.

Plan Image for Reduction of CO₂ Emission



Source: JICA Study Team based on information from Climate Change Policy Headquarters, City of Yokohama

“Maximum 22% peak power reduction achieved with BEMS for Consolidation.”

YSCP tested the effect of DR on six large buildings for a week in winter utilizing BEMS for Consolidation.

Although the goal of the DR was 20%, it achieved a maximum of 22% reduction in peak energy consumption and proved BEMS for Consolidation is effective.

Similarly, the operational experiment of HEMS, which are installed in around 1,900 houses and linked to CEMS, has also started. The experiment aims to reduce the peak energy consumption by about 20%; 10% by visualization of energy usage and 10% by practice of DR.

“Demonstration with citizens and private companies.”

Yokohama City led the YSCP demonstration and facilitated the consortium which consists of 34 private firms. In addition, the City made the project acceptable for citizens through direct communication. Without that, it was not possible to conduct such a large scale experiment. This shows strong ties and collaboration between the local government and private firms and citizens.

The research and development phase of the project commenced in the mid-FY2010 and finished in the mid-FY2012, followed by the second phase of the project in which the demonstration is conducted and will be finalized by the end of FY2014.

Use of Technology to Reduce Waste Disposal Volume and Generate Renewable Energy

Project Profiles No.14

- Incineration Plant -

Kanazawa Incineration Plant

Development of Incineration Plants using Japan's Highly Advanced Technology



Project Summary

Source: Resources and Waste Recycling Bureau, City of Yokohama

From the sixties up to the eighties, Yokohama City experienced rapid population growth due to urbanization. To cope with the resulting increase in municipal waste generated every day, the city government established a solid waste management program that focused on reducing the amount of wastes for final disposal.

Because waste incineration is the most effective method to reduce waste disposal volume, Yokohama City built incineration plants and required sorting of combustible waste and other materials at source.

By the seventies, the city's incineration plants could burn almost all waste collected from the city. By 2001, the city's seven incineration plants, with a total capacity of 7,740 tons per day, were fully operational.

Currently, the city operates only four incineration plants handling

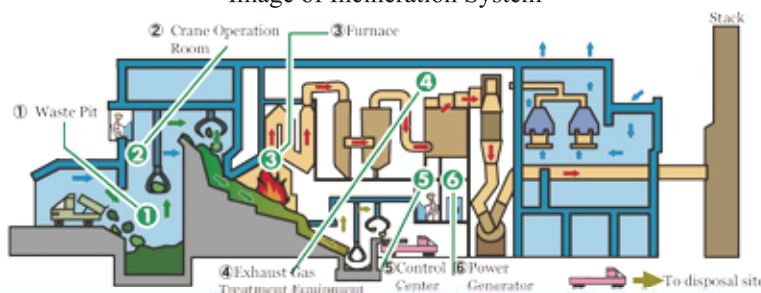
about 4,140 tons of waste a day due to reduced waste, a result of the widespread practice of the 3 Rs (reduce, reuse, recycle) by the public, business establishments, and the city government.

These incineration plants were designed as waste-to-energy plants and have been operated and maintained using an appropriate treatment system not only to meet international emission standards but also to recover renewable energy, thereby establishing it as environment-friendly plants. Consequently, these plants have dramatically reduced final disposal

volumes and have helped prolonging the life of landfills, in addition to reducing greenhouse gases and detoxifying or stabilizing residual ashes for final disposal.

Nowadays, the waste-to-energy scheme is widely practiced in waste disposal in Yokohama City through the development and application of modern incineration systems. This has minimized the costs of construction, operation, and maintenance and has mitigated negative environmental impact, while generating electricity from municipal waste.

Image of Incineration System



Source: Resources and Waste Recycling Bureau, City of Yokohama

From Waste to Energy

Development of Waste to Energy Plants

In the early seventies, Yokohama City built seven incineration plants with capacity for power generation. As of 2013, only four waste-to-energy plants are in operation, with a total rated capacity of 4,140 tons/day for the incinerators and 78 MW for the power generators.

Waste to Energy Plant	Operation Start (year)	Plant Capacity (t/d)	Generator Capacity
Konan (demolished)	1974	900	2,800
Sakae (demolished)	1976	1,500	5,100
Hodogaya (suspended)	1980	1,200	4,200
Tsuzuki (in operation)	1984	1,200	12,000
Tsurumi (in operation)	1995	1,200	22,000
Asahi (in operation)	1999	540	9,000
Kanazawa (in operation)	2001	1,200	35,000

Source: Resources and Waste Recycling Bureau, City of Yokohama

Financial Sources for the Plants

The total cost of constructing these four plants, which have been in operation since 1984, reached JPY170.3 billion. More than 50% of this cost was covered by city bonds, followed by central government subsidy in the range of 20 to 30% and by the city's annual budget, which varied by year.

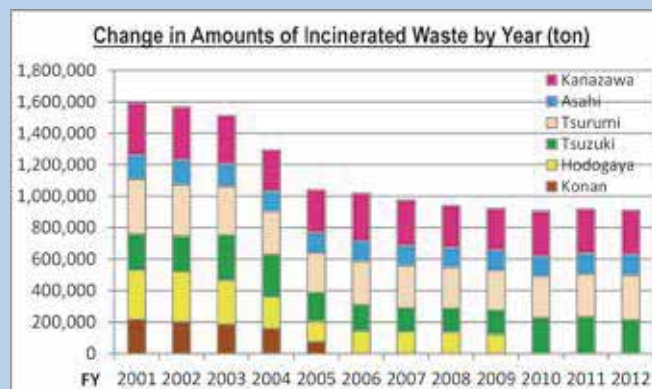
Waste to Energy Plant	Construction Cost Mil. Yen (%)	Central Government Mil. Yen (%)	Prefectural Government Mil. Yen (%)	City Bond Mil. Yen (%)	Annual City Budget Mil. Yen (%)
Tsuzuki	28,683 (100.0)	8,044 (28.0)	0	16,428 (57.3)	4,211 (14.7)
Tsurumi	51,778 (100.0)	12,450 (24.0)	0	27,532 (53.2)	11,797 (22.8)
Asahi	27,289 (100.0)	4,633 (17.0)	96 (0.4)	13,911 (51.0)	8,649 (31.6)
Kanazawa	62,594 (100.0)	11,030 (17.6)	47 (0.1)	43,344 (69.2)	8,173 (13.1)

Source: Resources and Waste Recycling Bureau, City of Yokohama

Amount of Incinerated Waste

In FY2012, the amount of incinerated waste was 912 thousand tons or 2,499 tons/day, representing a 43%

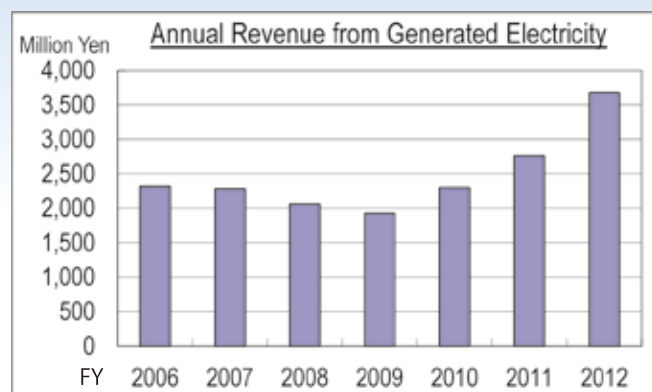
reduction from the incinerated amount of 1.59 million tons in 2001. The smaller amount of waste for final disposal has extended the life span of offshore waste disposal facilities, which started operation in 1993. From a planned life span of only 10 years, the landfill is still in service today because of the implementation of a comprehensive approach to reduce waste, which includes incineration and the adoption of the 3Rs.



Source: Resources and Waste Recycling Bureau, City of Yokohama

Revenue from Electricity

In FY2012, the total power generated by the plants reached 344 million kWh. About 115 million kWh was used in plant operation, and the balance of 229 million kWh was sold to an electric company, which generated an income of JPY3.7 billion. This amount covered a significant portion of the operation and maintenance cost of the plants.



Source: Resources and Waste Recycling Bureau, City of Yokohama

Use of Technology to Build a “Future City” for Environment

Initially, the residents were concerned that the waste-to-energy plants would become sources of pollutants, especially dioxins. To assure them of the plants' safety, the city government held dialogues with residents, explaining the project in detail from the planning stage to the implementation of environmental impact assessment.

Using highly advanced technology developed in the country, the plants to this day are able to properly treat exhaust gas, fly ash, and wastewater, among others. To keep the generation and emission of potential pollutants, especially dioxins, at minimum levels, Yokohama City adopted combustion control technologies to maintain fur-

nace temperatures between 800 and 950 degree. In addition, plant operation is monitored and controlled from a central control room to maintain stability. Results of plant operation are disclosed to the public through a website.

Waste to Energy Plant	No.1 Furnace	No.2 Furnace	No.3 Furnace	Emission Standard
Tsuzuki	0.051	0.085	0.022	1 ¹
Tsurumi	0.0065	0.0011	0.004	1 ¹
Asahi	0.000035	0.00015	0.00064	1 ¹
Kanazawa	0.0000063	0.000008	0.00013	0.1 ²

Note: 1¹ for existing plant, 0.1² for new plant

Source: Resources and Waste Recycling Bureau, City of Yokohama

Comprehensive Assessment System for the Promotion of Green Buildings - CASBEE Yokohama -

Project Profiles No.15



Yokohama Dia Building



Collaboration Complex at Keio University's Hiyoshi Campus
(1st building certified as CASBEE Yokohama)



CASBEE Yokohama
image character
"Casbippi"



Minato Mirai Center Building

**By promoting eco-friendly building designs,
this program has helped reduce
4,500 tons of CO₂ a year.**

Source of Photos: Institute for Building Environment and Energy Conservation

Background and Objective

CASBEE or Comprehensive Assessment System for Built Environment Efficiency is a mechanism for evaluating and rating the environmental performance of buildings. It was developed in 2001 through joint efforts between industry and academia with the support of the Japanese government. In July 2005, Yokohama City developed the "Reporting System for Environment-conscious Buildings" to encourage building owners to prepare reports on environment-conscious building which consists of building designs and their environmental performance based on CASBEE. The system requires building owners to submit such reports when constructing buildings with floor areas of more than 2,000 m² (before March 2010, it was 5,000 m²). Since 2010, owners also have had to show the CASBEE label (see image at right)

when advertising the building for selling/leasing. In Yokohama, CASBEE rating emphasizes the: 1) prevention of global warming, 2) mitigation of the heat island effect, 3) extension of service life, and 4) respect for townscape. The reporting is optional but encouraged when constructing buildings with less than 2,000 m² floor areas or detached houses. The city also offers a certification system for eco-friendly buildings based on evaluations done by special academic advisers at the request of building owners. This system intends to promote corporate social responsibility among building owners.

Impact of CASBEE

In 2005–2012, reports for approximately 970 buildings were submitted, about 80% of which were assessed highly (with S, A, or B+ rating), indicating that the evaluation system has motivated building owners to adopt greener designs. In particular, after the introduction of the label, the percentage of buildings with higher ratings has increased. Based on submitted reports on collective housing in 2011 alone, it is estimated that the system contributed to CO₂ reduction of 4,446.5 tons.



Source: Housing and Architecture Bureau, City of Yokohama

City of Yokohama website—CASBEE (JAPANESE)

<http://www.city.yokohama.lg.jp/kenchiku/center/kankyo/casbee>

CASBEE Methodology

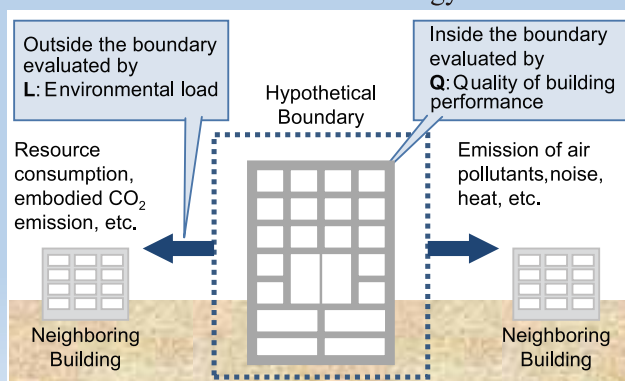
Built environment efficiency (BEE) is an indicator of CASBEE calculated from built environment quality like habitability, green coverage, and built environment load such as the application of renewable energy and recycling of resources.

$$BEE = \frac{Q \text{ (Built Environment Quality)}}{L \text{ (Built Environment Load)}}$$

Q: represents improved living amenity for building users and for the surrounding area.

L: represents the building's negative environmental impact on its surrounding area.

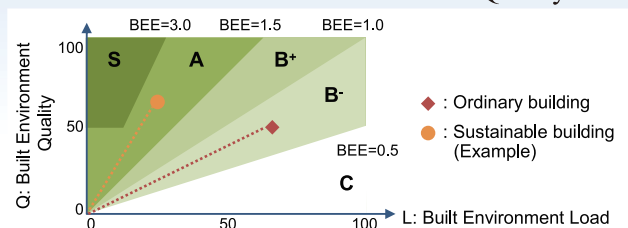
CASBEE Methodology



Source: JICA Study Team based on information from Housing and Architecture Bureau, City of Yokohama

The higher the Q value and the lower the L value, the higher the BEE value is. The assessment result is based on the five categories listed below.

Assessment of Built Environment Quality



Rating	Assessment	BEE Q Value	Expression
S	Excellent	$BEE \geq 3.0, Q \geq 50$	★★★★★
A	Very Good	$3.0 > BEE \geq 1.5$	★★★★
B+	Good	$1.5 > BEE \geq 1.0$	★★★
B-	Slightly Poor	$1.0 > BEE \geq 0.5$	★★
C	Poor	$BEE < 0.5$	★

Source: JICA Study Team based on information from Housing and Architecture Bureau, City of Yokohama

Iconic Sustainable Buildings

Below are three buildings certified by CASBEE Yokohama (photos on page 1).

Yokohama Dia Building

- ✓ One of the largest solar panels in Japan (approx. 1,500 m²) installed on the exterior wall of the office tower.

Keio University Hiyoshi Campus Collaboration Complex

- ✓ Equipped with cogeneration and ice thermal storage systems, the building is highly efficient in energy and power consumption in summer.

Minato Mirai Center Building

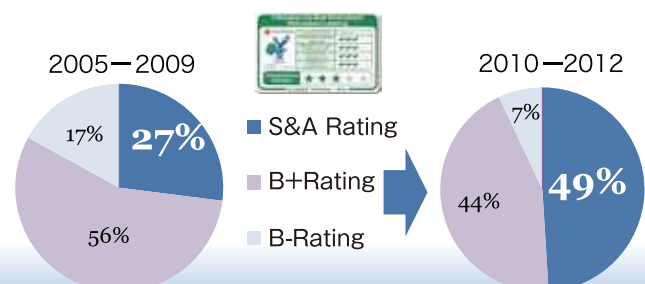
- ✓ Distinctive exterior design in harmony with the buildings in the same block.
- ✓ Safe and durable due to the combined use of seismic isolation and seismic response control systems.
- ✓ Daylighting system (T-Soleil) installed in an atrium in the common office area.
- ✓ Automatic blinds controlled by sunlight tracking sensors and lighting control systems.



Source: Institute for Building Environment and Energy Conservation

Interview -Voice of the Yokohama City Government

Before 2010, S and A ratings for large collective housing with floor areas of more than 5,000 m² accounted for 27% of submitted reports. After the labeling system was introduced, the share of such ratings increased to 49%. The labels are shown in magazine and newspaper advertisements of properties for lease/sale, allowing interested parties to compare CASBEE ratings. It is assumed that this has motivated building owners to pursue greener designs and has also improved the environmental awareness of people who rent/purchase such properties.



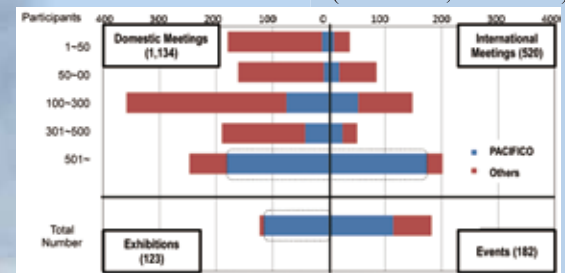
Pacifico Yokohama



Source: PACIFICO Yokohama

- PACIFICO Yokohama -

MICE Events held in Yokohama (cumulative, 2007-2009)



Source: Yokohama Convention & Visitors Bureau

Strengths of MICE in Yokohama



Source: JICA Study Team

As of 2011, PACIFICO Yokohama hosted 69 international events with 143,000 participants from worldwide*.

* Source: Annual Report 2012, PACIFICO Yokohama

Background and Objectives

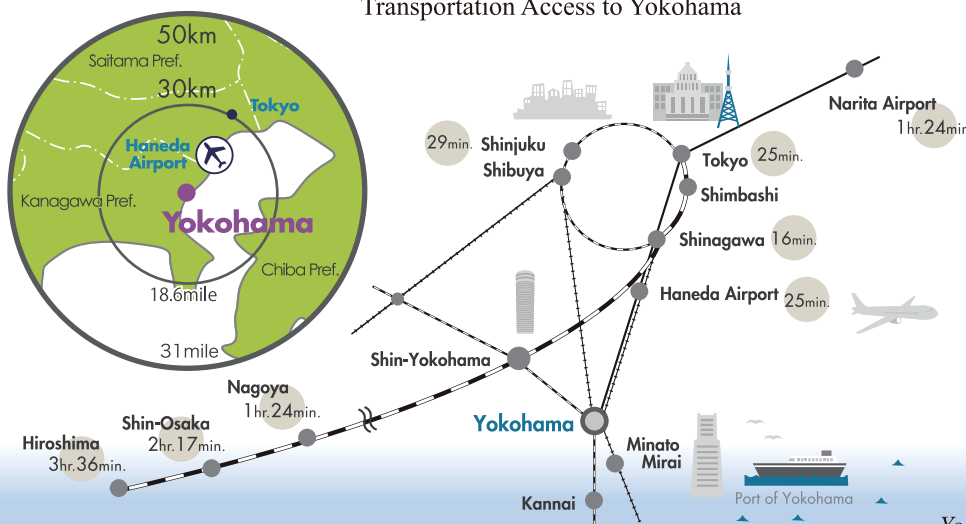
The global market for MICE (meetings, incentives, conferences, and exhibitions) is rapidly growing; however, the competition with major cities in neighboring Asian countries is increasingly becoming intense. Hence, it has always been important for Yokohama to maximize its advantages to elevate its profile in the international MICE industry.

Yokohama City has a favorable environment for MICE in terms of access, being a mere 30 km southwest from Tokyo. The availability of modern train and expressway lines has encouraged the flow of goods and people between Yokohama and Tokyo. Through the Metropolitan Expressway Bay Shore Route, the city is linked directly to Haneda Airport, which is increasing its function as a new international

hub airport. By car, Yokohama City is just a half hour away from the center of Tokyo.

Building on these advantages, Yokohama City has aimed to establish its own brand as an international MICE city. The most important factor for MICE promotion is not only the hardware but also the contents of the MICE program, the overall hospitality of the host region, and the attractiveness of the city itself. Yokohama City has tried to meet these criteria through the active participation of the public and private sector.

Transportation Access to Yokohama



Source: "Yokohama - Gateway to Japan", Economic Affairs Bureau, City of Yokohama

Pacifico Yokohama Website
<http://www.pacifico.co.jp/english/index.html>
 Yokohama Convention & Visitors Bureau Website
<http://www.welcome.city.yokohama.jp/eng/travel/>

Ready High-tech Facilities

Yokohama City is one of the few cities in the world with a highly sophisticated infrastructure for MICE. The city has strategically been investing in this sector to further provide good hardware and attract MICE visitors from all over the world. PACIFICO Yokohama, which is the main convention center in the city, is a third-sector project (a joint corporation invested in by both by the public and private sector), with major investments coming from Yokohama City, Kanagawa Prefecture, Development Bank of Japan, and other big private companies.

MICE Facilities
in Yokohama

Facility	Maximum Capacity
PACIFICO Yokohama	
National Hall	5,002 persons
Meeting Rooms	1,440 persons
Main Hall	1,002 persons
Exhibition Hall	20,000 m ²
Yokohama Minato Mirai Hall	2,020 persons
Yokohama Royal Park Hotel	1,500 persons
Pan Pacific Yokohama Bay Hotel Tokyu	1,400 persons
Yokohama Grand Intercontinental Hotel	700 persons
Landmark Hall	522 persons
Hamagin Hall Via Mare	517 persons
Nisseki Yokohama Hall	360 persons
Red Brick Warehouse Building No. 1	380 m ²
Yokohama World Porters	198 persons
Navios Yokohama	185 persons

Source: Yokohama Convention & Visitors Bureau

Software is Even More Important

The key to the successful promotion of Yokohama City as MICE location has been the software it continues to provide, together with the aforementioned hardware. It exerted great efforts to acquire the know-how for MICE operation such as strengthening secretariat functions and supporting human resource development, among others. Although many other cities have good hardware, Yokohama's experience says that software is actually the key to successful MICE activities.

The city has also served as secretariat for CITYNET since its establishment 25 years ago, which helped the city expand its network of international societies and cities abroad.

Interaction with residents is also important, such as dialogues on certain issues or introduction of Japan's culture.

All-in-One Strategy

The feature of Yokohama City's MICE is its "All-in-One Strategy," which refers to the fact that convention halls, exhibition centers, hotels, amusement parks, and tourism destinations within the city are all located close to each other. Being multifunctional is precisely the strategy that has led to the city's success in the MICE industry.

Genuine Hospitality

Hospitality has two sides, i.e., one is in terms of hardware (e.g., amenity of facilities and hotels) and the other in terms of software and humanware. Yokohama City Hall, the Convention Bureau, facilities such as PACIFICO, and residents as volunteers all contribute in providing a truly conducive environment for MICE participants. For example, citizens hold traditional Japanese musical performances as after-convention entertainment.

Starting Small, Growing Big

Many users of PACIFICO are repeat clients who attest to the usefulness and convenience of PACIFICO's facilities—there are few facilities which house both convention and exhibition halls—and the warm hospitality of PACIFICO staff. Some guests even cite their previous experiences of holding small meetings at PACIFICO as reasons or incentives for coming back as organizers of, or sponsors for, large international events.

Linking Urban Design

Few people are aware that the location of PACIFICO is quite strategic, too; walking from the station, it is at the very end of the Queen's Axis, one of the three main urban design axes in Yokohama City. With such a layout, people can shop and dine on their way to and from PACIFICO.

Queen Mall



Source: Urban Development Bureau,
City of Yokohama

Recent Undertakings...Yokohama has come this far.

2010 APEC Meeting

The 18th APEC Economic Leaders' Meeting was held at PACIFICO Yokohama in 2010 with the theme "Change and Action" to articulate the vision of further building and integrating the Asia-Pacific region in the twenty-first century and the paths to realize that vision.

Representatives from APEC member countries issued a joint statement entitled "The Yokohama Vision – Bogor and Beyond."

2013 TICAD V

The 5th Tokyo International Conference on African Development (TICAD), which is held every five years, was held at PACIFICO Yokohama on 1–3 June 2013 with the theme "Hand in Hand with a More Dynamic Africa." TICAD V was co-organized by the Government of Japan along with the U.N., Office of the Special Advisor on Africa, UNDP, African Union Commission, and the World Bank.