

2. Tokyo's Urban Growth, Urban Form and Sustainability

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2.1 Introduction

Tokyo, the largest mega-region in the world so far with 35 million inhabitants in 2007, has experienced a rapid growth in the twentieth century with various issues associated with urban form and urban environment. Some issues were solved and others remain to be solved. If Tokyo is evaluated as one of the most efficient, productive and sustainable mega-regions in the world, it is the result of rapid urban growth and development in the twentieth century. After that, Tokyo has been facing new challenges as it left the phase of rapid growth and entered the phase of no- or low-growth, depopulating and aging society. In this respect, Tokyo is a leading or an instructive mega-region in the world. At the same time, Tokyo must take part in the global effort to achieve sustainability. This chapter focuses on the history of Tokyo's urban growth, the diversity of urban form issues in Tokyo, some previous successes in solving urban environmental problems and some new challenges facing efforts to enhance urban sustainability.

In this chapter, the term "Tokyo" refers to Tokyo region comprised of Tokyo Metropolitan Government (TMG) jurisdiction and the surrounding three prefectures of Kanagawa, Chiba and Saitama, covering 13,551 km² and accommodating 35 million inhabitants. As of January 2008, there were 23 wards, 26 cities, five towns and eight villages in TMG jurisdiction, and there were total of four designated cities, 91 cities, 59 towns and five villages in the three prefectures. "Central Tokyo" in this chapter roughly refers to central three wards of Chuo, Chiyoda and Minato, and inner five wards of Shibuya, Shinjuku, Toshima, Bunkyo and Taito. The 23-ward area is the former city of Tokyo before it was abolished in 1943, that now comprises the central city area of the current Tokyo metropolitan region, with a population of about 8.7 million.

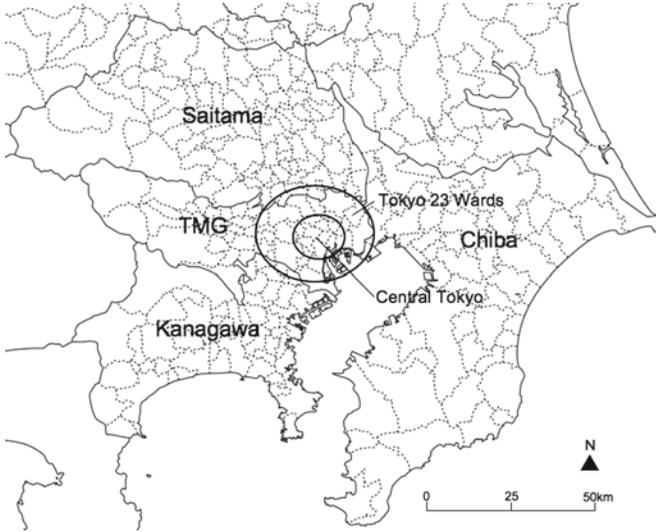


Fig. 2-1. Tokyo Metropolitan Government (TMG) jurisdiction, prefectural and municipal boundaries in Tokyo

Although there are governmental organizations for TMG, the three prefectures as well as wards, cities, towns and villages, there is no governmental organization or planning body for the whole Tokyo (region) (Fig. 2-1).

2.2 History of Tokyo's Urban Growth

During the twentieth century Tokyo experienced a significant urban expansion due to rapid population growth. Figure 2-2 shows the expansion of densely inhabited district with population of 40 persons/ha or more. The population of Tokyo grew from 7.5 million in 1920 to nearly 35 million in 2007. The major planning issue for twentieth century Tokyo was to expand and intensify the urban area in order to accommodate this rapid growth.

Tokyo began as the national capital city called 'Edo' which was constructed by the Shogun Tokugawa Ieyasu after 1600, and it grew to be one of the largest metropolises in the world by the early 1700s. After the imperial restoration in 1860s, when reformers overthrew the feudal system in a bid to modernize Japanese society and economy, Edo was renamed to Tokyo (East-Capital-City), and was remodeled into a modern city by introduction of railway, tram and trunk road network, modern water supply and modern parks until 1910s.

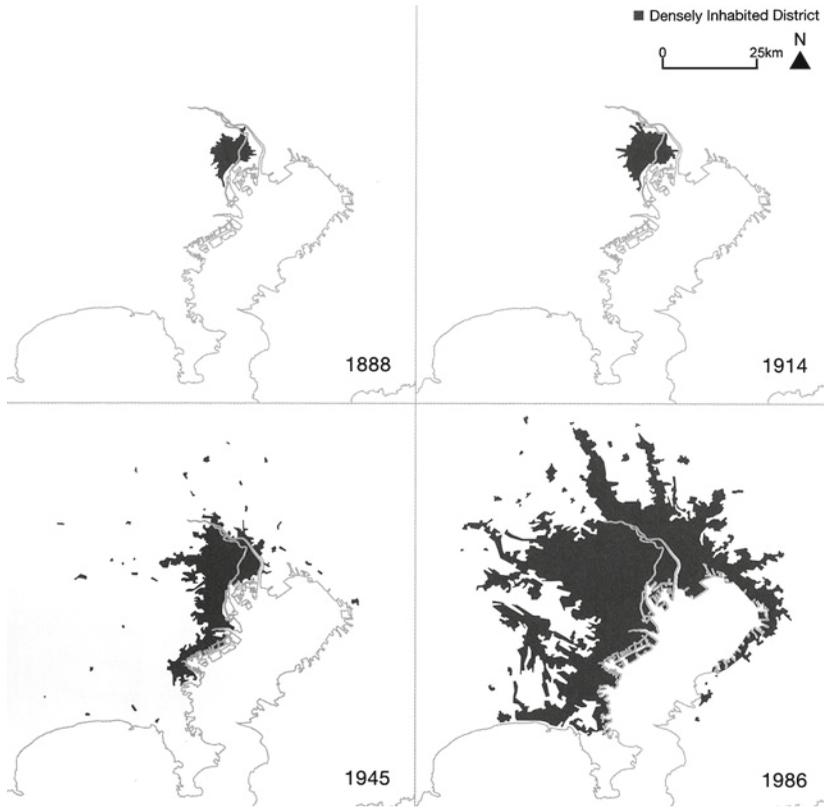


Fig. 2-2. Expansion of densely inhabited district (Okata et al. 2005)

In the middle of 1920s, Tokyo's urban area started to grow past the fringe of the former city of Edo's urban area, heavy industrial factories located in peripheral area of Tokyo, which caused severe conflict with local residents. The local government of Tokyo and the National Government needed to introduce a kind of subdivision control system or development control system to prevent un-planned and un-controlled suburban development, and use-zoning system for managing pollution/nuisance problems. A new City Planning Law was enacted in 1919, the main elements of which were a simple zoning system similar to New York City's and the designated building line system similar to the German district development plan system (Bebau-ungs Plan).

However, the designated building line system introduced in the 1919 Law did not work well in order to inhibit un-planned small scale sub-division or plot-by-plot development with insufficient infrastructure, because unlike

the German system, all roads wider than 2.7 m (4 m after revision in 1938), were automatically designated as building lines, enabling development on the lot attached to the road. Subsequently, small-scale development or plot-by-plot development spread over sub-urban area where very primitive road network existed for farming and rural life. But, the typical suburban development in Tokyo until 1950s was low dense single family housing for emerging middle class citizens, those sub-urban development generally provided decent or minimal living environment even if it had only self-supplied well water and no flush toilet. So, as many sub-urban railways were developed in the 1920s, rapid sub-urbanization started under very weak planning system introduced in 1919, and the big earthquake in 1923 accelerated the suburban development of Tokyo.

Since 1930s, ideas and plans for greenbelt that controls suburban expansion were developed until the late 1950s, but greenbelt was never implemented. Firstly, in late 1930s, the Tokyo Regional Greenbelt Plan was established and the land was purchased by local governments, but the major part of the land was sold to local farmers as the farming land reform initiative after the war. Secondly, 'Green Belt Zoning' that regulate coverage ratio under 10% was designated around existing urban area of Tokyo as a part of the post war restoration plan of Tokyo, but local building authorities failed to enforce such a strict regulation in the context of 'postwar liberalism' and rapid population growth. Thirdly, in the first National Capital Region's Development Plan established in 1958, a 'greenbelt and new towns' scheme similar to the Greater London Plan 1944 was introduced, but as the plan was only advisory, there was no effective action to implement the green belt. Thus, Tokyo's urban expansion was largely led by railway constructions and developments along railway lines without being controlled by a strong urban land use plan nor a greenbelt policy until the end of 1960s.

Before 1960, Japan was still a 'rural' country where over the half of households live in rural areas. In the 1960s, the post war baby boomers immigrated for job and higher education from rural area and provincial small towns into metropolitan regions including Tokyo, Osaka and Nagoya. They were accommodated in dormitories or lodgings at first, then moved to small wooden apartment houses, public or social housings, or small suburban single family housing if they were lucky enough. Also, condominium apartment houses became popular in Tokyo since 1970s. As the planning system and sub-division control system in 1960s was still very weak, the level of infrastructure of those housing was very poor. However minimum level of urban services such as water supply and elementary education were mandatory responsibilities of local governments (the idea of 'Civil Minimum' was very popular in late 1960s in Japan), Tokyo was

able to successfully accommodate the flood of immigrant population in not-informal settlement with no-less-than minimum level of living environment. It seems possible that if the planning power in Japan or Tokyo had been stricter before the 1960s, then more illegal or informal settlements lacking minimum levels of infrastructure and social services would have developed, and Tokyo might have experienced much more serious problems in the 1960s and would not have grown into the world's largest megacity. Finally, in 1968, City Planning Law was significantly revised and a kind of growth boundary system that controls expansion of urban area, more precise zoning system that may protect good residential environment, and the development permission system that ensures a certain level of infrastructure of development were introduced (Fig. 2-3).

Railway construction was one of the national modernization policies, and the national railway network connecting central Tokyo and other cities in Japan was established by the end of the nineteenth century. Beginning in the 1920s, private railway companies purchased huge areas of land in the suburbs of Tokyo and developed housing estates or garden suburbs. Private railway companies were able to pay for the railway constructions by the profits they made from selling or leasing the developed housing estates and

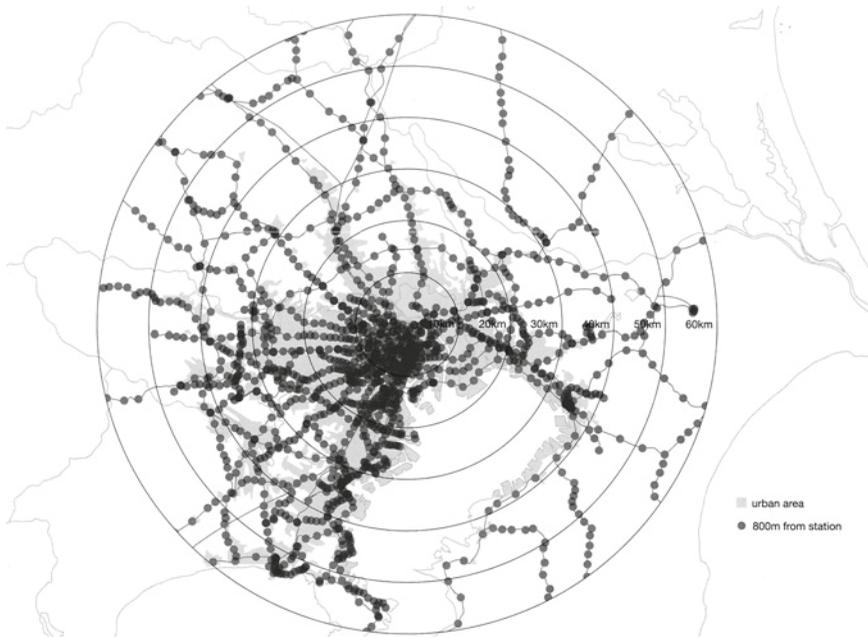


Fig. 2-3. Railway network and stations (Okata et al. 2005)

commercial areas around the stations. Public corporations also developed large-scale housing estates along railway lines in the suburbs starting in the 1960s such as Tama New Town and Chiba New Town. These new towns were developed as garden suburbs or “bed towns” of Tokyo. On the other hand in central Tokyo, the subway network has been developed continuously since 1927. As a result, nearly 73% of morning commuters to Tokyo 23 Wards used railway lines while only 9% of them used private automobiles in 1998 (Nakamura et al. 2004). Others used bus, bicycle or foot. Not only the railway system is well equipped, but also the season ticket discount for commuter was introduced since before the war, employers usually pay commuting cost to employees, major companies often inhibit employees to commute by a private car because of limitation of parking place and reparations risk for car accidents caused by employees, and traffic congestion in commuting time in Tokyo is so terrible that makes commuting to central Tokyo from suburb impossible in fact. Thus, Tokyo is clearly one of the world’s most public transportation oriented megacities (Cervero 1998).

With the high concentration of office and commercial functions in central Tokyo and the development of housing estates along railway lines in the suburbs, Tokyo has grown to a transit-oriented, mono-centric region at least from a macroscopic point of view. The daytime and nighttime population density by distance from Tokyo station clearly show this pattern. In the future, with the decrease of working population, it may become more difficult to maintain today’s sophisticated railway system and a mono-centric spatial structure. In addition, suburbs without sufficient public transit services have already become automobile-oriented.

Regarding the current land use planning of Tokyo, Urban Area, Agricultural Area, Forestry Area, Natural Park Area and Natural Reserve Area are designated based on National Land Use Planning Act and the five land use related laws: City Planning Law, Law Concerning the Improvement of Agricultural Promotion Areas, Forest Law, Natural Park Law and Nature Conservation Law. Land use in these areas is controlled by the regulations of their respective laws. In fact, this land use plan is not really a plan with particular visions or strategies but merely a map showing where each law is effective. Some areas overlap. The land use related laws are administered by different sections of the national government, and at the local level do not provide an effective land management system (Sorensen 2002) (Fig. 2-4).

Land use in Urban Area (and only in Urban Area) is controlled by the regulations of the City Planning Law. Urban Area is divided by a kind of urban growth boundary line into Urbanization Promotion Area (UPA) and Urbanization Control Area (UCA) in principle. Besides those ‘divided’ Urban Areas, Undivided Urban Areas exist as small provincial towns

Area of Land Use Designation (ha)

	Area (ha)	Percentage
Urban Area	1,439,960	73%
Urbanization Promotion Area	421,619	29%
Urbanization Control Area	663,549	46%
Agricultural Area	1,108,269	56%
Forestry Area	646,664	33%
Natural Park Area	379,676	19%
Natural Reserve Area	14,911	1%
Undesignated Area	6,634	0%
Total	3,596,114	183%
Actual Land	1,964,722	100%

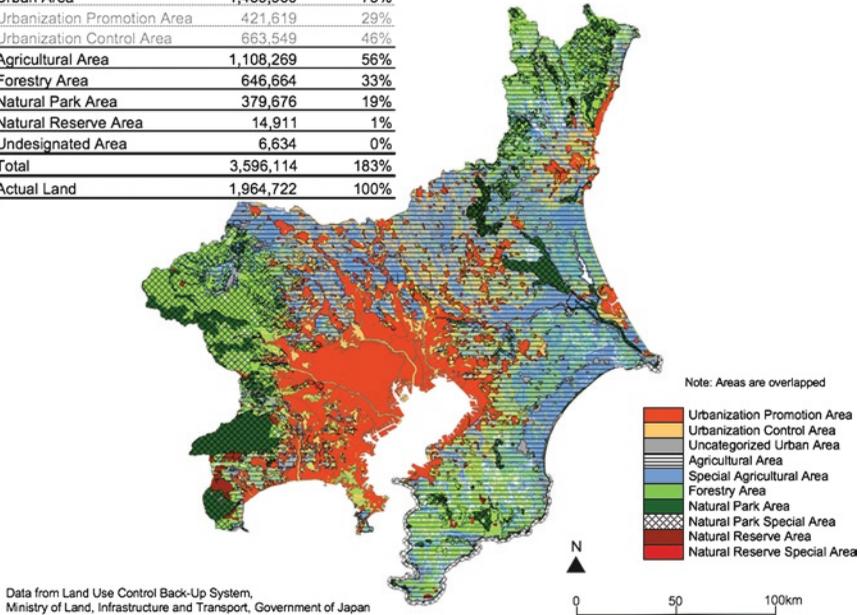


Fig. 2-4. Land use plan of Tokyo (The figure includes Ibaraki Prefecture north of Chiba Prefecture) (Ministry of Land, Infrastructure and Transport, Government of Japan)

peripheral or outside of metropolitan regions. Twelve category ‘basic’ zoning zone must be designated in UPA, regulating use, building coverage ratio, floor area ratio, building height, etc. in conjunction with the Building Standard Law. Agricultural, Forestry, Natural Park and Natural Reserve Areas have “special areas” within themselves to further strengthen land use restrictions. Roughly, natural resources and farmlands are protected in the “special areas”. On the other hand, developments that meet certain conditions are permitted in areas outside “special areas”, often causing the destruction of natural resources or farmlands.

Although Tokyo left the phase of rapid growth, transportation infrastructures, both roads and railways, are continuously developed. The completion of the three express ring roads (Central Circular Route, Tokyo ‘Gaikan – Outer Circular’ Expressway and Metropolitan Inter-city Expressway) first planned around 40 years ago are long-awaited for to mitigate traffic congestions in central Tokyo and to connect suburban cities. Other arterial roads are also proposed. Railway projects include constructing new lines and

elevating existing railway lines to reduce level road crossings that became increasingly congested as trains became more frequent.

From 2000 to 2005, population growth was observed in selected areas of Tokyo. Growing areas include waterfront areas (Minato, Chuo and Koto Wards), residential areas within Tokyo 23 Wards (Nerima, Setagaya, etc.) and suburban residential areas (Machida City and Aoba-Ku, Yokohama City). Condominiums (“mansion” or apartment for sale, not for rent) are built in larger scale in these areas: the share of condominiums with more than 100 units/building increased from 14% in 1995 to 58% in 2005, and the share of apartments with more than 200 units/buildings is as high as 38% in 2005. On the other hand, population decline was observed in the outer suburbs. People are coming back to the selected areas of Tokyo including central Tokyo. (Ministry of Land, Infrastructure and Transport, Government of Japan 2007).

2.3 Diversity of Urban Form Issues in Tokyo

As a result of rapid urban growth and a relatively weak planning system, Tokyo is a patchwork of various types of urban space with diverse urban form issues. Some of the major issues are as follows.

2.3.1 Several Kinds of Urban Sprawl

Most of Urban Areas in the mega-regions in Japan are divided into Urbanization Promotion Area (UPA) where development is promoted and Urbanization Control Area (UCA) where urban development is not permitted in principle. Some Urban Areas called Undivided Urban Areas (UUA) are not divided into UPA and UCA. There are several kinds of urban sprawls in Urban Area, somewhat different from urban sprawl in North America where it is generally considered as the expansion of urban area with insufficient urban infrastructure such as streets, parks and utilities.

Firstly, in UPA, not only large-scale planned developments but also small-scale or ‘single lot’ developments are permitted as long as each building lot is attached to a street which width is 4 m or wider in principle, causing urban sprawl by incremental accumulation of small scale ‘mini-developments’ and ‘plot-by-plot’ developments. Secondly, in UCA, certain developments such as housing for farmers’ sons, retail facilities for the locals or public facilities are permitted, contributing to urbanization. Thirdly, in UUA where land use regulation is generally loose, various kinds



Fig. 2-5. Mini-development

of developments including large-scale commercial developments were possible. Thus, urban sprawl can be observed both in UPA, UCA and UUA. Urbanization in UCA and UUA has been controlled mainly by Agricultural Land designation in Agricultural Area where agricultural land is protected to promote productive agriculture (Figs. 2-5 and 2-6).

As a response to continuing urban sprawl and downtown decline, City Planning Law was recently amended to permit large-scale commercial developments exclusively in commercial, neighborhood commercial and quasi-industrial zoning zones, that are to be designated by a local government with consent of its higher government which is responsible for regional location management of major commercial centers. This response might have been too late since many large-scale commercial developments have already occurred in urban fringe areas since the early 1990s.

2.3.2 Transit-Oriented Development (TOD)

As explained in the previous section, Tokyo is transit-oriented in terms of a regional structure. Urban areas around railway stations are generally high density and pedestrian-oriented. Major transit terminals such as Tokyo,



Fig. 2-6. Development in UCA

Ueno, Ikebukuro, Shinjuku, Shibuya, Shinagawa, Kawasaki, Yokohama, Omiya and Chiba stations are surrounded by high-density mixed-use area of retail, commercial and office uses, and suburban stations often have supermarkets and shopping streets around them (Fig. 2-7).

However, road infrastructure around many of the suburban stations is not well provided, resulting in narrow sidewalks unfriendly to baby strollers and wheelchairs, and small rotaries difficult to access by buses, taxis and private automobiles. In addition, lack of reasonable bicycle parking facilities often leads to illegal bicycle parking on narrow sidewalks (Fig. 2-8).

Recently, there are controversies regarding TOD visions, for example, in Shibuya and Shimokitazawa station areas. While the governments try to promote functional TOD with large-scale redevelopment and modern infrastructure, many people including local people and urban professionals emphasize the importance of vernacular urban form and pedestrian-oriented environment.

2.3.3 Intensification of Urban Centers

The population of central Tokyo had increased continuously since the end of World War II until 1986, but decreased from 1987 to 1996 due to



Fig. 2-7. Major transit terminal area



Fig. 2-8. Suburban station area

skyrocketing land value by the bubble economy and its aftereffect. Since 1997, population of central Tokyo has been recovering, activating various housing developments.

Significant among those are super-high-rise residential towers and small-size three-story single-family housing. Super-high-rise residential towers are often developed on former industrial sites in the Tokyo Bay waterfront, or on large lots (sometimes assembled from several smaller lots) in existing urban areas. In some cases, the former is accompanied with the issues of insufficient infrastructure and public services particularly public schools, and the latter by neighborhood conflicts provoked by the destruction of valued landscapes and by buildings that block sunlight (Fujii et al. 2007). Also very common is the redevelopment large single-family dwellings into small-size three-story single-family housing is often developed after a large property was divided into smaller pieces, leading to fragmentation and the loss of large single-family housing properties in central Tokyo (Figs. 2-9 and 2-10).

Constructions of one-room (studio) apartments, both high-rise and low-rise, are active in central Tokyo, in response to the increasing number of single person households. Residential apartments for families are being



Fig. 2-9. Super-high-rise residential tower



Fig. 2-10. Small-size three-story housing

constructed in suburban centers around railway stations for people who put high priority on the convenience of commuting (Fig. 2-11).

Many mixed-use (mix of office and commercial with or without residential uses) redevelopment projects mostly planned during the bubble economy in the 1980s have been completed in recent years such as Roppongi Hills, Shiodome Sio-Site and Tokyo Midtown (Fig. 2-12).

2.3.4 Redevelopment of Brownfields

In the Tokyo region, industrial areas of various sizes are dispersed throughout the region, but the largest concentration is in Tokyo Bay Waterfront Area that holds Keihin Industrial Area (4,400 ha) and Keiyo Industrial Area (4,700 ha). These industrial areas were the engines of Japan's economic growth in the twentieth century, but they are now experiencing a gradual change as they entered the globalizing twenty-first century (Fig. 2-13).

Recently, there has been a drastic movement among companies in these industrial areas such as the mergers of oil and steel companies or relocation of plants to foreign countries, which result in the generation of potential



Fig. 2-11. One-room apartment tower

sites for redevelopment. On the other hand, research and development institutions have been located, introducing new land uses to the industrial areas. Thus, these areas call for the integrated methodology of brownfield regeneration and planning, including remediation of contaminated soil, as they gradually evolve from the heavy industrial base to a new urban area that potentially accommodates research and development institutions, light industry, business and commercial facilities, housing and other uses.



Fig. 2-12. Mixed-use redevelopment



Fig. 2-13. Keihin Industrial Area

2.3.5 Conservation of Historic Areas

Based on the Law for the Protection of Cultural Properties, preservation districts for groups of historic buildings can be designated by local municipalities to provide technical and financial support from government. There are only two preservation districts in Tokyo region: Sawara in Chiba Prefecture (7.1 ha) and Kawagoe in Saitama Prefecture (7.8 ha), both developed as merchant towns in the pre-modern period (Denkenkyo; Hiramoto 2005).

While these districts are well conserved, there are many other areas in Tokyo that are not eligible to be designated as preservation districts but have certain levels of historic or vernacular environment. These areas often confront with high pressure of redevelopment since land use and building regulations in Japan are generally loose, and neighborhood conflicts never stop. Such examples are Yanaka and Kagurazaka in central Tokyo. In these areas, attempts are being made to create future visions based on local consensus and implementation measures including regulations or incentives by City Planning Law, the recently enacted Landscape Law or local ordinances as necessary.

2.3.6 Improvement of Vernacular or Popular Settlements

Population growth and urban expansion of Tokyo in the twentieth century was so rapid and sub-division control system (or detailed district development planning system) was so weak that most of the inner urban areas are not provided with sufficient infrastructure such as well-planned streets and parks, and still occupied by mainly low-rise high-density obsolete wooden housings. The improvement of such vernacular unplanned settlements continues to be a great challenge, particularly as although they provide convenient and affordable housing for both young and aged people they are highly vulnerable to earthquake and fire disasters.

Tokyo Metropolitan Government has designated 11 major improvement areas totaling around 2,400 ha where improvement projects are promoted to mitigate potential earthquake disasters in low-rise high-density wooden housing areas. In Higashi Ikebukuro, one of the designated major (Department of Urban Development, Tokyo Metropolitan Government 2003) improvement areas, the collaborative work of residents, consultants and government officials since the mid-1980s has been able to complete ten plaza projects with fire extinguishers and hydrants, several fire-proof cooperative housings and one 6 m-wide disaster-proof street as an emergency escape route in case of disaster (Fig. 2-14).

Dealing with continued building of “mini-development” urban areas presents another set of issues. For ongoing “mini-developments” in



Fig. 2-14. Designated improvement area

residential–agricultural mixed-use areas such as Tagara in Nerima Ward, Tokyo, a district plan that designates future streets, wall setbacks, minimum lot sizes, building design and fence structure seems to be the most effective approach. On the other hand, it is very difficult and expensive to improve an established or already built-up “mini-development” urban area such as Takashina in Kawagoe City, Saitama Prefecture, because of the severe lack of public space and facilities (Fig. 2-15).

Recently, illegal “Blue Tent” settlements can be observed in large parks and riverbanks in central Tokyo. They started as homeless concentrations but now are becoming increasingly permanent, and form a new type of informal settlement. So far, no effective measure has been found for this kind of settlement.

2.3.7 Maintenance and Improvement of the Suburbs

As Tokyo entered the phase of no- or low-growth, depopulating and aging society, with people moving back to central Tokyo after the collapse of the bubble economy, maintenance and improvement of the suburbs has become a new issue. Many suburban housing estates, both multi-family and single family, were developed in the 1960s and the 1970s, the age of



Fig. 2-15. Built-up mini-development area

rapid growth. Baby-boomers who purchased housing in those estates are now retiring and most of their children have already left home. Decline of schools and shops, and growing demand for social services mean that it is questionable if these suburbs will be socially and economically sustainable in the future. Measures to maintain the suburbs might include provision of various community services to support the lives of the aged population, regeneration of multi-family housing estates to attract diverse population and local management of vacant properties (Fig. 2-16).

Parts of Tokyo suburbs not well served by public transit have automobile-oriented urban structure and landscape. Improvement of landscape in commercial strips along arterial roads, for example, might be an issue particularly from the aesthetic point of view (Fig. 2-17).

2.4 Previous Successes in Solving Urban Environmental Problems

Tokyo has experienced various urban environmental problems due to the rapid growth and concentration of population and industries. The problems include environmental pollution such as air pollution, water pollution and ground subsidence, delays in providing sewage systems and the limitation of waste disposal sites. Tokyo Metropolitan Government (TMG) has successfully



Fig. 2-16. Suburban housing estate



Fig. 2-17. Commercial strip along arterial road

solved many of these problems, taking creative measures ahead of the national government and leading other prefectures in the region. It is useful to examine some examples.

2.4.1 Fighting Against Environmental Pollution in the 1970s

In the late 1950s, with the growing concentration of population and industries in TMG jurisdiction, environmental pollution increasingly became a serious problem. The air pollution caused by sulfur dioxide (SO₂) generated by burning heavy oil that had become the main energy source replacing coal.

Responding to the problem, the national government enacted the Air Pollution Control Law and started to take various measures. The measures were, however, emissions regulations based on “Diffusion Theory” where higher stacks would diffuse the pollutants more widely with less impact at ground. These regulations are effective for pollutions in large industrial areas. However, in areas like Tokyo where urban environmental pollution is caused by numerous concentrated sources such as small and medium-sized factories and building heating systems, such regulations were not effective and higher stacks would simply spread the pollution to surrounding residential areas.

To solve this air pollution problem in Tokyo, TMG introduced its original regulations on fuel use to reduce the emissions of sulfur dioxide instead of merely diffusing it. It was estimated that burning heavy oil caused about 150,000 tons of sulfur content per year in 1970. The “Program to Protect Residents of Tokyo from Environmental Pollution” had a target to reduce the emissions to 80,000 tons per year, or 1964 level, that generally satisfied the Environmental Quality Standard.

Besides these regulations on fuels based on the Pollution Prevention Ordinance of 1969, TMG implemented measures such as the promotion of fuel shift to electricity and gas, and the introduction of district heating and cooling systems. As a result, sulfur dioxide concentrations in Tokyo started to decrease. The Environmental Quality Standards were achieved at all general air pollution monitoring stations in 1983 and also at all roadside air pollution monitoring stations in 1985 and thereafter (source of data?).

In addition to regulations on fixed generation sources such as factories, TMG established measures for air pollution caused by the rapid increase of automobiles. TMG established the system of giving instructions and advice on the installation of exhaust gas reduction devices (catalyst re-combustion devices) for in-use vehicles. The goal was to reduce carbon monoxide that was highly concentrated at intersections.

Thus, TMG in the 1970s developed various measures leading Japan's environmental administration for both fixed and mobile sources.

2.4.2 Reducing and Recycling Waste in the 1990s

The issue of waste became increasingly serious in the 1970s with the spread of lifestyles based on mass production, mass consumption and mass disposal. After the World War II, constructing waste incineration plants and securing landfill sites had always been big issues. The delay in the development of facilities was often seen as a restricting factor of urban sustainability.

The amount of waste in Tokyo 23 wards was reduced due to the two oil shocks in 1974 and 1979, and was stable until the middle of the 1980s. However, the output of waste per capita began to increase again in the bubble economy of the late 1980s. The amount of waste increased by more than a million tons from 3.79 million tons in 1984 to 4.90 million tons in 1989.

On the other hand, the final landfill disposal site for Tokyo 23 Wards was filled close to its total capacity. Under such critical circumstances, TMG decided to transform the concept of measures from the prompt disposing of generated waste to reducing and recycling waste.

In 1989, TMG clarified the critical situation of waste disposal and started the "Tokyo Slim" campaign. The campaign asked residents of Tokyo to take actions on their own to reduce waste. With the increasing interest in the issue of waste through "Tokyo Slim" campaign, TMG introduced a variety of measures and programs to reduce and recycle waste. In the "Tokyo Waste Conference" in 1991, action plan to reduce waste was drawn up and the "My Bag Campaign" was developed to reduce packaging waste. In the same year, on-site instructions were started in order for owners of a building within Tokyo 23 wards with a total floor area of 3,000 m² or more to select a person responsible for waste management and submitting a waste reuse plan. In 1995, TMG set up a "Discussion Group Considering 'Tokyo Rules' for Waste Reduction" to establish its original rules. Tokyo rules included the proposal to collect PET bottles at retail outlets, measures for collecting and recycling used paper, bottles and cans included in household waste and measures to charge all commercial waste.

Since the start of the "Tokyo Slim" campaign in 1989, the series of measures taken for over 10 years have resulted in the increase of the annual amount of recycling in Tokyo 23 wards from 300,000 tons to about one million tons. These efforts by TMG were again ahead of the national government and other large cities in policy-making.

2.4.3 “No Diesel Strategy” Campaign Since 1999

Although TMG significantly reduced sulfur dioxide and carbon monoxide pollutions, the concentration of nitrogen dioxide and suspended particle matter generated mainly by automobiles still failed to meet the Environmental Quality Standards. Particularly, particulate matter (PM) generated from diesel engines had been pointed out to have an adverse impact on health.

As a response, in the summer of 1999, TMG started the “No Diesel Strategy” campaign asking residents and businesses in Tokyo to intensively discuss the possible measures to be taken. The campaign initially proposed the following five measures:

1. No diesel vehicles to be driven, sold, or bought in TMG jurisdiction
2. Obligation to replace commercial diesel vehicles with an alternative gasoline vehicle
3. Development of an exhaust gas purifying device and obligation to install it on diesel vehicles
4. Correction of the preferable tax rate on diesel fuel
5. Early development of vehicles meeting the new long-term regulations

In December 2000, these draft measures were incorporated into the “Tokyo Metropolitan Environmental Security Ordinance”, an overall revision of the Tokyo Metropolitan Pollution Prevention Ordinance of 1969. The new ordinance was enforced in 2003. Three prefectures neighboring to TMG jurisdiction, namely, Saitama, Chiba, and Kanagawa prefectures, established similar ordinances, and the regulations on the operation of diesel vehicles were implemented comprehensively in Tokyo.

In TMG jurisdiction alone, there were 202,000 diesel vehicles subject to the regulations to be enforced in October 2003. However, neither the installation of particulate matter reduction devices or the replacement of unqualified diesel vehicles had made much progress as of a year before the enforcement of the regulations. So, TMG began the “Illegal Diesel Vehicle Elimination” campaign to smoothly implement the regulations.

Before starting the “No Diesel Strategy” campaign, the Environmental Quality Standards for suspended particulate matter was not achieved in any of the roadside air pollution monitoring stations. However, after the implementation of the measures, significant achievements were realized so that the Environmental Quality Standards were achieved in all stations except one.

Starting in January 2005, all gasoline and diesel fuel was made sulfur-free by the decisive step taken by the Petroleum Association of Japan.

2.5 New Challenges to Enhance Urban Sustainability

2.5.1 Energy-Saving and a Shift to Renewable Energy

Energy is the most fundamental element needed to support urban activities. The limitation of energy resource and global/urban warming caused by excessive use of energy are considered as the most important issues in enhancing urban sustainability. TMG started to take comprehensive measures on global warming issue (“Stop Global Warming, Tokyo Strategy”) after developing the current Tokyo Metropolitan Environmental Master Plan in 2002. To realize an energy-saving city and a shift to renewable energy, TMG started the following measures (Bureau of Environment, Tokyo Metropolitan Government 2006).

The first measure was taken to reduce greenhouse gas emissions from existing facilities. TMG introduced the Tokyo CO₂ Emission Reduction Program where large-scale factories, offices, commercial facilities and public facilities were obligated to develop a 5-year plan for greenhouse gas reduction. These facilities were responsible for about 40% of CO₂ emissions in industrial and business sectors in Tokyo. Their activities were then evaluated and announced to the public. This program was implemented in April 2005 and more than 1,000 facilities submitted their plans.

It is also important to improve the energy-saving performance of newly constructed buildings. Since those buildings constructed in the era of rapid growth in the 1970s are now being demolished and reconstructed, there are opportunities to construct energy-saving buildings. TMG started to implement the Tokyo Green Building Program in 2002 to obligate large-scale building owners to develop and submit their plans for improving environmental performance when reconstructing or expanding. Since condominiums account for more than 50% of newly built large-scale buildings, the Tokyo Metropolitan Condominium Environmental Performance Indication Program was also started in 2005.

CO₂ emissions in the domestic sector account for a quarter of the total, and 70% of CO₂ emissions in the domestic sector are by the use of electricity. TMG has introduced the Energy Efficiency Labeling System for Home Appliances to promote the purchase of energy-saving home appliances. The display of energy efficiency labels in shops started in 2002 as a voluntary measure, with the cooperation of large home appliance retailers. It was institutionalized in 2005 based on a new Ordinance. The display of energy efficiency labels in shops initiated by TMG has already spread to 22 prefectures.

CO₂ emissions from vehicles account for about 20% of the total. Tokyo Environmental Distribution Project, including traffic demand reduction

through the joint delivery of goods for department stores, is being promoted. In 2006, the Revision of Vehicle Emission Reduction Program was introduced, which promotes well-planned actions for reducing CO₂ emissions by businesses that use vehicles. Other new measures will also be developed, including the promotion of using public transportation instead of private automobiles and the enhancement of environmentally conscious driving technology.

The Tokyo Green Energy Program, a program started in Japan targeting electric power suppliers, started in 2005, obligating them to take measures to reduce the CO₂ emissions and to develop a plan to introduce renewable energy. In order to clarify the strategy to expand renewable energy use to a full-scale, TMG developed the Tokyo Renewable Energy Strategy and proposed a target to increase the ratio of renewable energy to the total energy consumed in TMG jurisdiction to about 20% by 2020.

2.5.2 Tokyo After 10 Years Plan

Tokyo After 10 Years Plan, published in the end of 2006 by Tokyo Metropolitan Government, set a near future vision of Tokyo growing to a higher level in the fields of urban infrastructure, environment, security, culture, tourism and industry. The plan presented the following eight goals to be accomplished in the next 10 years. (Headquarters of the Governor of Tokyo, Tokyo Metropolitan Government 2006)

1. Recover Beautiful Tokyo Embraced by Water and Green Corridors
2. Tokyo will be Reborn by the Three Ring Roads
3. Realize the City with Least Environmental Load in the World
4. Reinforce Reliance on Tokyo by Creating Disaster-Proof City
5. Create the World-Leading Urban Model for Hyper Aged Society
6. Establish the Presence of Tokyo by the City's Attractiveness and Industry
7. Create a Society that Any High-Motivated People can Challenge
8. Provide a Dream for Children of the Next Generation through Sports

In order to implement the plan speedy and surely, interdepartmental "Joint Strategic Meeting for Environmental City Building" was established within TMG. Under the meeting, two headquarters were established, namely "Carbon Minus City Building Promotion Headquarters" and "Green City Building Promotion Headquarters". The two headquarters launched their 10 years projects (Tokyo Metropolitan Government 2007).

Carbon Minus Tokyo 10 Years Project is an effort to realize a city with least environmental load in the world. It will establish a new urban model

in the twenty-first century and spread it to Asia and rest of the world. The project consists of the following five parts: The development of Tokyo-Originated Energy Strategy Using World-Class Energy Saving Technologies, Realization of a City with the Most Renewable Energy Use, Realization of Sustainable Transportation Network, Development of New Environmental Technologies and Creation of Environmental Businesses and Carbon Minus Movement.

On the other hand, Green Tokyo 10 years project is an effort to recover beautiful Tokyo embraced by water and green corridors. It will promote the networking of existing greenery and the provision of new greenery. The project consists of the following five parts: Shaping Green Road Network, Creation of Greenery in the Gaps of Urban Space, Creating Green Center in Neighborhood, Conservation of Existing Greenery and Creation of High Quality Greenery and Green Movement that Involves Local Governments and Businesses.

2.6 Conclusion

The major planning issue of the twentieth century Tokyo was to expand and intensify the urban area in order to accommodate rapid growth. Until the 1960s urban expansion was controlled neither by a strict planning system nor by a greenbelt but by developments around railway stations. Though experiencing very rapid urban growth and with a relatively weak planning system, Tokyo had barely accommodated the flood of immigrant population and had provided not less than minimum level of living environment and social services. From the viewpoint of urban form, Tokyo is a patchwork of various types of urban space with diverse urban issues. As Japan entered the phase of no- or low-growth, depopulating and aging society, it is not possible or not necessary to change the current spatial structure of Tokyo so drastically. It is more realistic to improve or conserve existing urban spaces incrementally to enhance quality of life in a sustainable manner. As there is a diversity of urban issues, diverse and creative approaches are needed. The major problem of Tokyo's planning is that so many areas have no clear future vision of urban space. Mixed use and vibrant looking vernacular urban places, often praised by European and American planners and urban designers, are merely the incidental results of market economy and loose land use/building regulations, and are actually vulnerable in many ways. In order to shape attractive urban space through the regeneration of existing urban space, it is important in each area to establish a future vision and to implement measures for realization. The high-density mixed-use "urban village" concept now becoming popular worldwide, might give hints to many areas in Tokyo.

Tokyo has experienced various urban environmental problems since the 1970s due to the rapid growth and concentration of population and industries. Tokyo Metropolitan Government (TMG) has successfully solved many of these problems, taking creative measures ahead of the national government and leading other prefectures in Tokyo Region. With the recognition of the limitation of energy resource and global/urban warming caused by excessive use of energy being the most important urban sustainability issues, TMG has started to work on some new measures related to the efficient use of energy. “Carbon Minus Tokyo 10 Years Project” and “Green Tokyo 10 Years Project” are new official initiatives to pursue a sustainable city. It should be noted that this chapter focused on the efforts of Tokyo Metropolitan Government and did not look in to the efforts of other prefectures and local governments.

In Tokyo, urban growth and urban form issues have not been considered explicitly in relation to environmental issues or sustainability issues. Rather, environmental issues were tackled with mainly technological improvements and promotion of eco-life-style. Also, greenery issues were tackled with enhancing and improving existing greenery structure. There is no explicit policy to reorganize or redesign the existing urban form or land use pattern in order to enhance the sustainability of Tokyo.

Since the level to be accomplish is not so high, it might be easy to accomplish current ‘improving and enhancing’ approach. However, If we must reach higher goal in respect with environmental issues and ‘hyper aged society’ issues, we cannot help but adopt more ambitious and difficult approach that reorganize spatial form and infrastructures including innovative public transportation system, comfortable and easy-to-access public spaces and pedestrian environment, and effective and efficient social service system especially for aged people and working mothers.

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