BARTLETT SCHOOL OF PLANNING

UCL

PROJECT PROFILE

Japan

C2 Shinjuku Route

omega centre

Centre for Mega Projects in Transport and Development

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This project profile has been compiled by the Japanese OMEGA Team, Tokyo Institute of Technology.

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A INTRODUCTION

Type of project

This 6.7km section of Metropolitan Expressway, the Central Circular (C2) Shinjuku Route (Nishishinjuku Junction – Kumanocho Junction) (known as the 'Yamate Tunnel'), opened in December 2007.

The design standard of the section of the C2 Shinjuku Route is as follows:

- Road classification: second category, second class (urban expressway in metropolitan area);
- Number of lanes: two in each direction;
- Design speed: 60km/h;
- Number of entry/exit points: three points including Takamatsu;
- Number of ventilation stations: six locations.

(see Figures 1 and 2).

Overview

The parent project is the Metropolitan Expressway Central Circular (C2) Route (Kasai Junction – Oi Junction, 47km) (see Figure 1).

The remaining section of the C2 Shinjuku Route (Nishishinjuku Junction – Ohashi Junction, 4.3km) is under construction and is planned to open in 2009. The remaining section of the C2 Shinagawa Route (9.4km) is also under construction and is planned to open in 2013, while the other sections of C2 (Kasai Junction – Nishishinjuku Junction, 33km) were opened between 1982 and 2002.

The upgrading of the 6th Circular Highway (known as 'the Yamate Dori') is a major associated development. The widening of that surface road from 22m to 40m width enabled the C2 Shinjuku Route to be accommodated under the road (see Figure 3).

A section of the No.12 (Oedo) Subway Line (Shinjuku – Nerima), which goes through the space below the tunnel for the Metropolitan Expressway C2 Shinjuku Route (3.3km), opened in 1997 (see Figure 5).

Ohashi Urban Redevelopment Project (3.8ha), currently implemented with the project for the Ohashi junction building of the Metropolitan Expressway C2 Shinjuku Route (Nishishinjuku Junction – Ohashi Junction), is also noted. Please see Figure 4.

Location

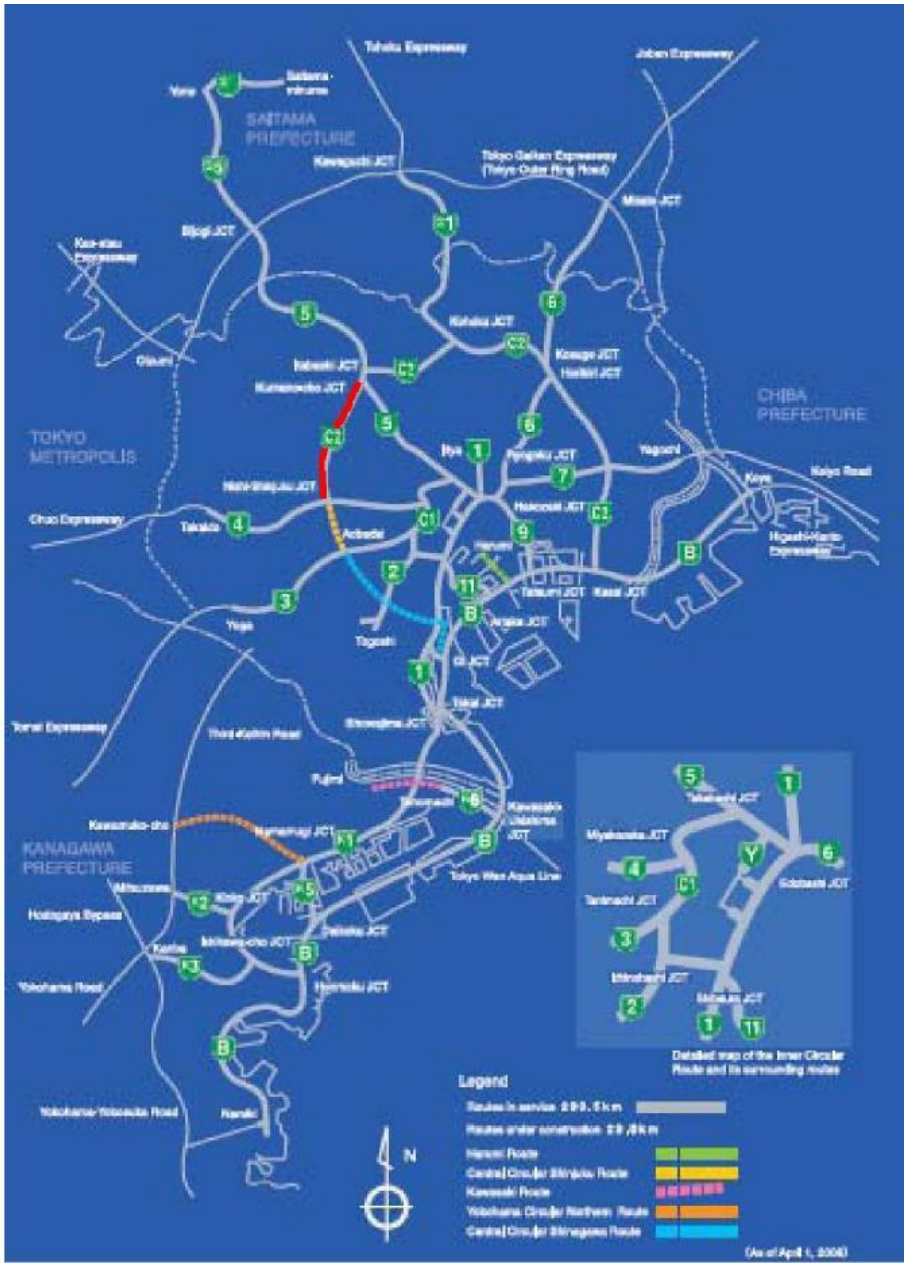
The Metropolitan Expressway C2 Shinjuku Route (Nishishinjuku Junction – Kumanocho Junction) is located about 8km from the center of Tokyo within the area of Tokyo 23 Ward in Japan. The section of the C2 Shinjuku Route (Nishishinjuku Junction – Kumanocho Junction) is the northern part of the western section of the Metropolitan Expressway C2 Route which goes through the densely populated wards of Itabashi, Toshima, Shinjuku, Nakano, Shibuya and Meguro.

The section of the C2 Shinjuku Route (Nishishinjuku Junction – Kumanocho Junction) links two radial Metropolitan Expressways: Route 4 (Shinjuku Line) and Route 5 (Ikebukuro Line), while the remaining section of the C2 Shinjuku Route connects another two radial Metropolitan Expressways: Route 3 (Shibuya Line) and Route 4 (Shinjuku Line).

Current status

The section of the Metropolitan Expressway C2 Shinjuku Route (Nishishinjuku Junction – Kumanocho Junction) opened in December 2007. According to the latest traffic count, the section (Nakanochojyabashi – Nishiikebukuro) carries an average of 34,000 vehicles including passenger cars and trucks per weekday.

Figure 1: Metropolitan Expressway Network as of April 2008



Note: The section of the Metropolitan Expressway C2 Shinjuku Route (Nishishinjuku Junction – Kumanocho Junction) is coloured red.

Figure 2: Outline of Metropolitan Expressway C2 Shinjuku Route

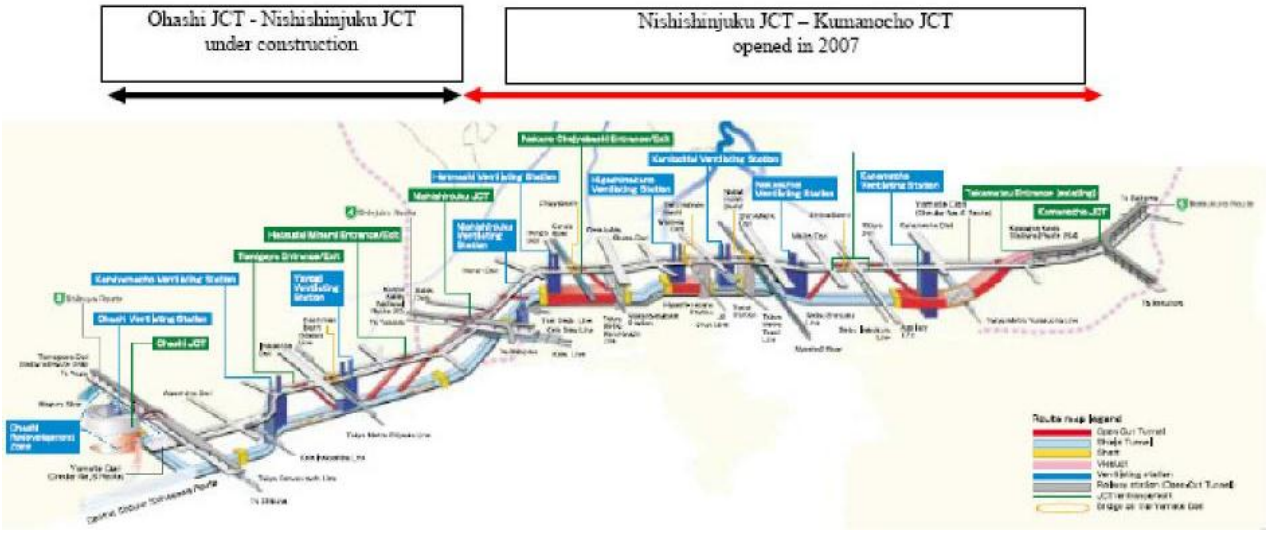
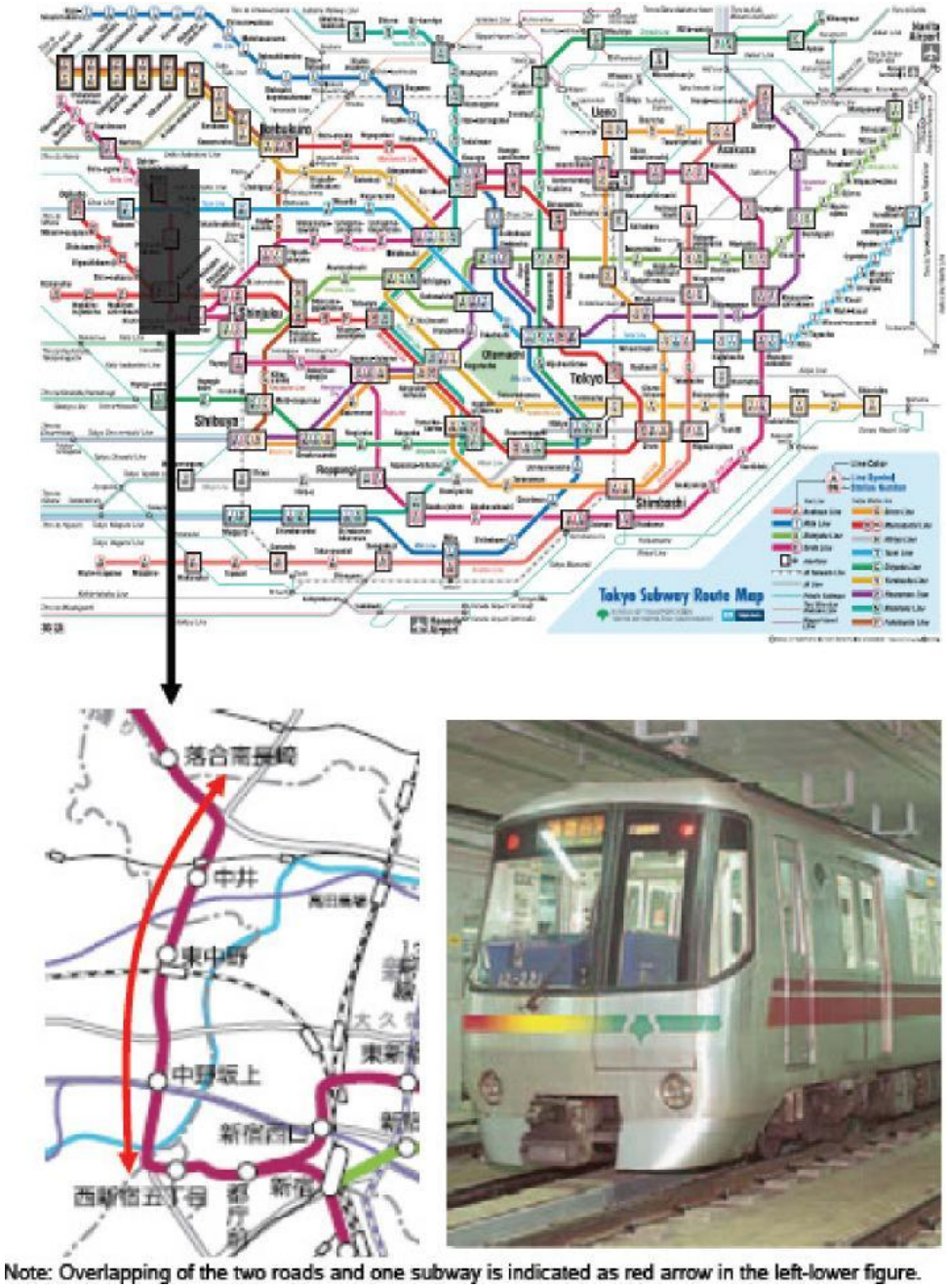


Figure 3: Upgrading of the 6th Circular Highway ('the Yamate Dori', 8.8km) from 22m to 40m width

Figure 4: The Ohashi Urban Redevelopment Project - implemented with the project for the Ohashi junction building of the Metropolitan Expressway C2 Shinjuku Route (Nishishinjuku Junction – Ohashi Junction)

Figure 5: Location of the No.12 (Oedo) Subway Line



Note: Overlapping of the two roads and one subway is indicated as red arrow in the left-lower figure.

Sources: Bureau of Transportation, Tokyo Metropolitan Government, 'Tokyo Subway Route Map http://www.kotsu.metro.tokyo.jp/english/images/pdf/rosen_e.pdf,' 2008; Bureau of Transportation, Tokyo Metropolitan Government, 'Toei Subway System http://www.kotsu.metro.tokyo.jp/english/images/pdf/subway_system.pdf,' 2008; Kanto Regional Development Bureau, Ministry of Land, Infrastructure and Transport, 'Metropolitan Expressway the Central Circular Route http://www.ktr.mlit.go.jp/3kanjo/chuokanjo/,' 2008 (in Japanese); Metropolitan Expressway Co.,Ltd, 'Corporate Profile 2008,' 2008; Metropolitan Expressway Co.,Ltd, 'Tokyo Smooth,' 2007; Metropolitan Expressway Co.,Ltd, 'Tokyo Smooth,' 2007 (in Japanese); Urban Redevelopment Office, Tokyo Metropolitan Government, 'Ohashi Urban Redevelopment Project http://www.toshiseibi.metro.tokyo.jp/saikaihatu_j/newpage8.htm,' 2008 (in Japanese).

B BACKGROUND TO PROJECT

Principal project objectives

The 1960s and 1970s

The planning of the Metropolitan Expressway C2 Route dates back to the note issued by the Ministry of Construction on the Plan for Street Network within the area of Tokyo 23 wards in 1960, and to the Plan for the Metropolitan Expressway Extensions by Tokyo Metropolitan Government in 1968. One of the major agendas during the 1960s was the direct connections of the Metropolitan Expressway Network with Inter-city Expressways such as the Tomei Inter-city Expressway between Tokyo and Nagoya. The Tokyo Metropolitan Government as the planning body, the Metropolitan Expressway Public Corporation as the principal constructor and operator, and Ministry of Construction as the overseeing body of national government were all concerned about the capacity problem of the Metropolitan Expressway Network when the direct connections were implemented, because the Network had only one circular route, the Inner Circular (C1) Route, with eight radial routes.

The Metropolitan Expressway Public Corporation conducted traffic demand forecasting studies for 1965 and 1970 based on the Vehicle Origin-destination Survey in 1958. It applied traffic assignment methods for the first time and produced estimates of traffic volume on each section of the Expressway Network. The study found that traffic demand would reach the capacity of most sections of the Network (two lanes in each direction), and exceed the capacity of several sections of the Inner Circular (C1) Route. The results of the study led to concerns about the capacity of the Metropolitan Expressway Network.

Behind these circumstances, the major objective of the Metropolitan Expressway C2 Route was to expand the capacity of the Metropolitan Expressway Network and mitigate serious congestion expected in the future when the Inter-city Expressways were connected with the Metropolitan Expressway Network.

While the public sector was concerned about the capacity problems of the Network, the general public became aware of environmental issues more sensitively by experiencing some serious cases such as Minamata disease. Tokyo Metropolitan Government and the Metropolitan Expressway Public Corporation prepared the process for the City Planning Decision, the first legal step for the construction of the western and southern sections of the Metropolitan Expressway C2 Route. However, they faced many objections from local people because of environmental concerns during the early 1970s.

Ryokichi Minobe, who advocated on environmental policy, was elected as Governor of Tokyo in 1967 and he stopped most of the planning and construction of major roads including the Metropolitan Expressway C2 Route within the Tokyo Metropolitan Area during his governorship until 1979.

The 1980s and 1990s

Tokyo Metropolitan Government and the Metropolitan Expressway Public Corporation changed the way and gave priority to the construction of the eastern section of the C2 Route where space above a large river was available. However, during the process for the City Planning Decision for the northern section with elevated structure in 1986, they faced serious objections from local people again as the route went through a densely inhabited area.

Finally, Tokyo Metropolitan Government and the Metropolitan Expressway Public Corporation decided to adopt an underground structure instead of the originally planned

elevated structure for the western section, the Metropolitan Expressway C2 Shinjuku Route, in order to persuade local people who were concerned about environmental impacts of the project such as air pollution and noise. According to the document for the Environmental Impact Assessment of the project in 1990, the objectives of the Metropolitan Expressway C2 Shinjuku Route are:

- Efficient use of the Metropolitan Expressway Network – the project enables operation of the Metropolitan Expressway Network to be more efficient by diverting congested traffic on the Inner Circular Route and by promoting efficient use of radial routes.

- Mitigation of congested circular highways and radial highways between the circular highways – the project mitigates traffic congestion on the 5th, 6th and 7th Circular Highways as well as on the radial highways between the circular highways by attracting traffic.

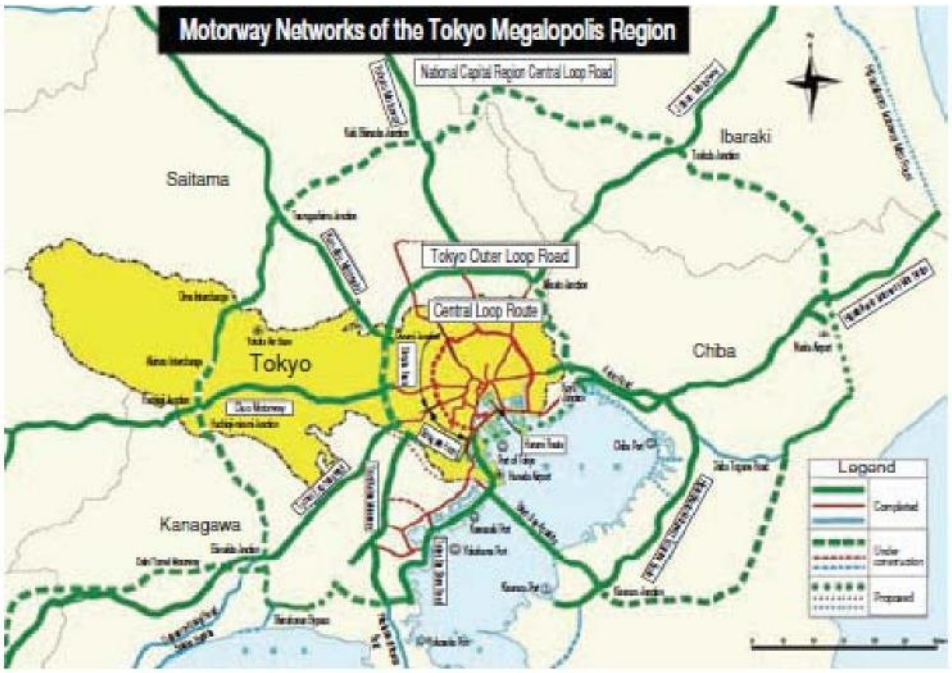
- Reinforcement of subcenter functions - the project reinforces the functions of subcenters (Ikebukuro, Shinjuku and Shibuya), stimulates economic activitiy and contributes to local development along the project by building entry/exit points near subcenters and by connecting subcenters in a more collaborative way.

During the 1980s, there was serious congestion on the Metropolitan Expressway Network despite mitigation measures. Economic development of the three subcenters was so advocated by Tokyo Metropolitan Government that the relevant item was also included. Concerning the change from elevated to underground structure, while local people accepted it positively from the environmental viewpoint, the Ministry of Construction was not so supportive because of much higher costs and the effects on similar projects in other areas.

The 2000s

According to the document issued by the Metropolitan Expressway Co. Ltd (former Metropolitan Expressway Public Corporation) in 2007, the objectives of the Metropolitan Expressway C2 Shinjuku Route are almost the same as in 1990. In addition, the Company emphasizes the environmental effects of the project by improving traffic flow on the Metropolitan Expressway and general highways, as well as the effects of provision of alternative routes, congestion mitigation and travel time savings. It is expected that the opening of the Metropolitan Expressway C2 Route as a whole will contribute to improvements to the environment by reducing 400,000t of CO_2, 4,000,000t of NOx and 300,000t of SPM emissions annually.

Figure 6: Three circular expressways under construction or planning in the Tokyo megalopolis region



Note: The Metropolitan Expressway C2 Route is indicated as 'Central Loop Route.'

The Tokyo Metropolitan Government and Ministry of Land, Infrastructure and Transport (former Ministry of Construction) share the same project objectives as the Metropolitan Expressway Co. Ltd, and are also interested in the Expressway Network as a whole, especially three circular expressways under planning or construction including the Metropolitan Expressway C2 Route, in the Tokyo Megalopolis Area and the National Capital Region (Figure 6). According to the city planning document issued by Tokyo Metropolitan Government, by achieving shorter driving times and lower operations costs, the construction of these three expressways is anticipated to have a large economic impact. This will also strengthen collaborative activities with neighbouring cities and contribute to the sharing of functions throughout the megalopolis of Tokyo, and will thus greatly benefit the urban functions of Tokyo and the Tokyo Megalopolis Region. This will also contribute to the improvement of the environment through substantial reduction of vehicle emissions from the higher speeds achieved by automobiles.

Key enabling mechanisms and decision to proceed

For the section of Metropolitan Expressway C2 Shinjuku Route (Nishishinjuku Junction – Kumanocho Junction), neither project-specific legislation nor institutional settings have been conducted. The project passed through the process prescribed by the City Planning Act. Important decisions are indicated in Table 1. The planning and other institutional steps for the Metropolitan Expressway C2 Shinjuku Route will be indicated in detail in section D.

Table 1: Decision Making for the Metropolitan Expressway C2 Shinjuku Route

Year	Month	Content of Decision Making
1967	4	Ryokichi Minobe was elected to be the Governor of Tokyo who stopped the construction of the Central Circular Expressway Route.
1968	3	Special Committee for the Study of Tokyo City Planning Expressway deliberated on the Plan for Metropolitan Expressway Extensions. The Committee proposed the Plan for Metropolitan Expressway Extensions including the Central Circular Route and the Plan was approved.
1970	3	National Capital Region Development Plan included the Central Circular Expressway Route as being promoted.
1979	4	The term of Ryokichi Minobe as the Governor of Tokyo ended.
1982	3	The first section of Metropolitan Expressway C2 Route (Senjushinbashi - Horikiri Junction) was opened.
1990	8	Environmental Impact Assessment was conducted by Tokyo Metropolitan Government (Aobadai, Meguro Ward - Minaminagasaki, Toshima Ward, 8.7km).
1990	8	City Planning Decision of Metropolitan Expressway C2 Shinjuku Route was made by Tokyo Metropolitan Government (Aobadai, Meguro Ward - Minaminagasaki, Toshima Ward, 8.7km).
1991	3	Project Validation was made by Ministry of Construction for the section between Aobadai, Meguro Ward and Minaminagasaki, Toshima Ward.
1993	2	City Planning Decision of Metropolitan Expressway C2 Shinjuku Route was made by Tokyo Metropolitan Government (Minaminagasaki, Toshima Ward - Nakamarucho, Itabashi Ward, 1.7km).
1994	3	Project Validation was made by Ministry of Construction for the section between Aobadai, Meguro Ward and Nakamarucho, Itabashi Ward.
2007	12	Metropolitan Expressway C2 Shinjuku Route (Nishishinjuku JCT - Kumanocho JCT) was opened.

Main organisations involved

The Metropolitan Expressway C2 Shinjuku Route was planned and implemented by the close relationship among three main organizations: Tokyo Metropolitan Government as a local planning body, the Metropolitan Expressway Co. Ltd (former Metropolitan Expressway Public Corporation) as an implementing body, and; Ministry of Land, Infrastructure and Transport (former Ministry of Construction) as a national highway planning body. The role and influence in the project of the three main organizations and others are explained below.

Metropolitan Expressway Co. Ltd (former Metropolitan Expressway Public Corporation)

Metropolitan Expressway Co. Ltd is the principal constructer and operator of the Metropolitan Expressway Network. The Metropolitan Expressway Co. Ltd was established in 2005 by the four Acts of legislation regarding privatization of the four highway-related public corporations in 2004. The company uses the assets of the Metropolitan Expressway Network by lease from the Japan Expressway Holding and Debt Repayment Agency, collects tolls from the users of the Network, and pays rents to the Agency based on the agreement between the Agency and the Company. The Metropolitan Expressway Co. Ltd also constructs or improves sections of the Metropolitan Expressways, and operates and maintains the Network according to the agreement. After the construction or improvement of sections of the Metropolitan Expressway Network, the Agency takes over the assets of the new sections and the requisite cost (liabilities). The Company must obtain the consent of the assembly of the relevant local governments such as Tokyo Metropolitan Government and permission from the Minister of Land, Infrastructure and Transport for its business operation programmes. Please see section F for general and financial aspects of the privatization in detail.

Since the construction of the section of the Metropolitan Expressway C2 Shinjuku Route (Nishishinjuku Junction – Kumanocho Junction) by the Metropolitan Expressway Co. Ltd was completed in 2007, the Company has operated and maintained the new section, while the Japan Expressway Holding and Debt Repayment Agency took over the new asset and liability.

Metropolitan Expressway Public Corporation was established in 1959 by the Metropolitan Expressway Public Corporation Act of the same year. The main objective of establishing the Corporation was to mitigate chronic traffic congestion on the general highways in the Tokyo Metropolitan Area by constructing toll expressways. The toll road was institutionalized by the Act for the Special Measures for Road Improvement in 1952 to promote the construction of roads in Japan.

Following the City Planning Decision for the planned route within the framework of the City Planning Act by the relevant local government such as Tokyo Metropolitan Government, the Metropolitan Expressway Public Corporation Act prescribed that the Minister of Construction should make a Basic Plan, including the name, number of lanes, design speed, locations and planned facilities to be connected, and an outline of the construction cost of the Route, based on consultations with Tokyo Metropolitan Government and the Minister of Finance, and that the Minister of Construction should designate the Basic Plan to the Corporation. The Act for the Special Measures for Road Improvement then prescribed that the Minister of Construction should validate the Corporation's construction work plan, based on the consent of Tokyo Metropolitan Government, and that the validation should enable the Corporation to start construction work. The Act for the Special Measures for Road Improvement also prescribed that the Minister of Construction should inspect the completion of the construction work, and should validate the rate and term of tolls proposed by the Corporation based on the consent of Tokyo Metropolitan Government, and that the validation should enable the Corporation to start operation and the collection of tolls on the route.

After the City Planning Decision for the first 71km of Metropolitan Expressways by Tokyo Metropolitan Government in 1959, the Metropolitan Expressway Public Corporation constructed, maintained and operated the Metropolitan Expressway Network. The Corporation also collected tolls, and repaid the debt by which the expressways were built. The first City Planning Decision for the Metropolitan Expressway C2 Shinjuku Route was made in 1990, and the Metropolitan Expressway Public Corporation constructed the section as principal constructor until its privatization in 2005. The planning and other institutional steps for the Metropolitan Expressway C2 Shinjuku Route will be explained in detail in the next item and also in section D.

Tokyo Metropolitan Government

Japan has a three-layer structure of administration: nation-prefecture (-to/-do/-fu/-ken), municipality (-shi/-ku) and ward (-machi/-mura), each of which has its own assembly and government. The governor and mayor of each prefecture and municipality respectively are selected by election. For the Metropolitan Expressway C2 Shinjuku Route project, or the Metropolitan Expressway Network in general, Tokyo Metropolitan Government as a prefectural government plays multiple roles, including the planning body within the framework of city planning, a body for Environmental Impact Assessment of the project, an overseeing body of the Metropolitan Expressway Co. Ltd (former Metropolitan Expressway Public Corporation).

While most of the city planning prescribed by the City Planning Act is implemented by the municipal government, large projects such as the Metropolitan Expressway C2 Shinjuku Route project are dealt with by the prefectural government. Before the City Planning Decision by Tokyo Metropolitan Government, the Government also must obtain consent from

the Ministry of Land, Infrastructure and Transport in the case of large projects, in order to check the suitability of plans with national legislation so as to accordingly adjust national and local interests.

The Metropolitan Expressway C2 Shinjuku Route project is categorized within City Planning of Public Facilities in the framework of the City Planning Act. The system aims to decide, by city planning, planned public facilities such as public roads and parks to facilitate their construction in the future. Once Tokyo Metropolitan Government makes a City Planning Decision for the planned public facility, it takes legal effect as follows:

- building activities can be restricted in areas where public facilities have been decided. This is referred to as City Planning Restriction;
- the implementing body is empowered to execute projects such as the exercise of the Land Expropriation Act;
- once the future location of facilities is determined, landowners/leaseholders can prepare an appropriate land use plan in accordance with the facility plan.

In the case of the Metropolitan Expressway C2 Shinjuku Route, the first City Planning Decision was made by Tokyo Metropolitan Government in 1990 for the section between Aobadai, Meguro Ward and Minaminagasaki, Toshima Ward, 8.

After the City Planning Decision, the planned public facility should be implemented as the City Planning Project. The City Planning Projects are, in principle, executed by municipalities after approval by the prefectures. When necessary, however, prefectural and national agencies can implement a City Planning Project upon Project Validation by the Minister of Land, Infrastructure and Transport. This was the case for the Metropolitan Expressway C2 Shinjuku Route project whose implementing body was the Metropolitan Expressway Co. Ltd (former Metropolitan Expressway Public Corporation). Upon the Project Validation, an implementing body shall have vested rights as follows:

- exercise of compulsory land expropriation: compulsory purchase requires justification of a project plan and just compensation. Once a project is already validated, justification of the plan becomes unnecessary;
- in a Project Area, development activities are prohibited.

For the case of the Metropolitan Expressway C2 Shinjuku Route, the first Project Validation was made by the Ministry of Construction in 1991 for the section between Aobadai, Meguro Ward and Minaminagasaki, Toshima Ward, 8.7km.

Tokyo Metropolitan Government is a body for Environmental Impact Assessments of projects such as the Metropolitan Expressway C2 Shinjuku Route project. The process is prescribed by the ordinance of Tokyo Metropolitan Government. The Environmental Impact Assessment for the Metropolitan Expressway C2 Shinjuku Route project was conducted in a coordinated way with the process of the City Planning Decision and completed with the Public Review of the Environmental Impact Assessment in 1990.

Tokyo Metropolitan Government also oversees Metropolitan Expressway Co. Ltd according to the Act for the Special Measures for Road Improvement and the Expressway Company Act (former Metropolitan Expressway Public Corporation Act), which was explained in the case of the Metropolitan Expressway Co. Ltd.

<u>Ministry of Land, Infrastructure and Transport (formerly Ministry of Construction)</u>

One of the major roles of the national government's Ministry of Land, Infrastructure and

Transport is to oversee the Expressway Companies including the Metropolitan Expressway Co. Ltd according to the Expressway Company Act, after the privatization of the four highway-related public corporations in 2004. Before the privatization, the Ministry oversaw the highway-related public corporations including the Metropolitan Expressway Public Corporation according to the Act for the Special Measures for Road Improvement and the former Metropolitan Expressway Public Corporation Act, which was explained in the case of the Metropolitan Expressway Co. Ltd.

The Ministry also oversees the framework of city planning. The City Planning Act grants the authority of City Planning Decision to local government. However, the Consent by the Minister is required for city planning of metropolitan areas and large-scale public facilities under national management, such as the Metropolitan Expressway C2 Shinjuku Route project in the Tokyo Metropolitan Area. The Minister's Consent in the case was obtained in 1990.

The Ministry produces the National Capital Region Development Plan within the framework of national land planning. The National Capital Region is defined by the National Capital Region Development Act as the area of Ibaraki, Tochigi, Gunma, Saitama, Chiba, Tokyo, Kanagawa and Yamanashi Prefectures. The National Capital Region Development Plan consists of three plans, the Basic Plan, the Development Plan and the Project Plan. The Basic Plan is the Development Plan's foundation. For example, the Fifth Basic Plan, whose term is 1999 to 2015, characterizes the ideal structure of the area as a 'network structure of the dispersion type,' and the basic regional development approach is to promote the development of the five areas according to their individual characteristics. The Development Plan defines the development of residential lands, roads, and others every fifth year, while the Project Plan defines the projects for each fiscal year required for the implementation of the Development Plan. The development of the three Circular Expressways in the Tokyo Metropolitan Area, consisting of the Metropolitan Expressway C2 Route (about 8km from the city center), the Outer Circular Expressway (about 15km from the city center), and the Metropolitan Inter-city Expressway (about 40-50km from the city center), is also promoted by the National Capital Region Development Plan. Because the City Planning Act prescribes that the Plans of the higher categories, such as the National Capital Region Development Plan, should regulate city planning by local governments, the inclusion of the Metropolitan Expressway C2 Route into the National Capital Region Development Plan by the Ministry has pressed relevant local governments, such as Tokyo Metropolitan Government, to develop the Route since 1970.

<u>Local government (Itabashi, Toshima, Shinjuku, Nakano, Shibuya and Meguro Ward governments)</u>

Within the Tokyo Metropolitan Area, the 23 wards, such as Shinjuku Ward, are also given administrative power comparable to municipalities. Each ward has its own Local City Planning Council, which delivers the opinions of the ward to the City Planning Council of Tokyo Metropolitan Government. In the case of the section of the Metropolitan Expressway C2 Shinjuku Route (Aobadai, Meguro Ward and Minaminagasaki, Toshima Ward), the City Planning Councils of Toshima, Shinjuku, Nakano, Shibuya and Meguro Wards were held in 1990 and the the opinions were delivered to the City Planning Council of Tokyo Metropolitan Government.

<u>Contractors (Private Construction Companies)</u>

The Metropolitan Expressway Public Corporation divided the Metropolitan Expressway C2 Shinjuku Route project into several engineering components, and private construction companies tendered for the components. Because the project provided good opportunities for private construction companies, they developed many innovative civil engineering

methods while reducing costs. The main engineering features of the project will be summarized in detail in Section C.

The Japan Expressway Holding and Debt Repayment Agency

The Japan Expressway Holding and Debt Repayment Agency was established in 2006 after the privatization of the four highway-related public corporations. The objectives of the Agency are to reduce the burden on the general public of financing expressways and to support the successful operation of expressway business activities by the Expressway Companies, through holding and leasing highway assets related to expressways and repaying debts in a secure manner at an early opportunity. Please see section F for general and financial aspects of the privatization in detail.

Planning and environmental regime

For the section of Metropolitan Expressway C2 Shinjuku Route (Nishishinjuku Junction – Kumanocho Junction), neither project-specific legislations nor institutional settings have been conducted. The project passed through the process of the City Planning Decision by Tokyo Metropolitan Government, prescribed by the City Planning Act. Tokyo Metropolitan Government also implemented the Environmental Impact Assessment for the Metropolitan Expressway C2 Shinjuku Route project in coordination with the process of the City Planning Decision, according to the ordinance of the Government.

The processes of the City Planning Decision and Environmental Impact Assessment for the section of Metropolitan Expressway C2 Shinjuku Route (Aobadai, Meguro Ward – Minaminagasaki, Toshima Ward, 8.7km) are indicated in Figure 7. It is noted that the Metropolitan Expressway Public Corporation decided to change the original plan of 10.1km of the Metropolitan Expressway C2 Shinjuku Route (Aobadai, Meguro Ward – Nakamarucho, Itabashi Ward) in 1988 because the Corporation experienced many objections from residents at the northern part of the Route where an elevated structure was proposed to connect the elevated structure of the radial Metropolitan Expressway Route 5 and the underground structure of the southern part of the Shinjuku Route. Figure 7 shows the process of the first City Planning Decision of 8.7km of the southern part of the Shinjuku Route in 1990. The City Planning Decision of the remaining 1.7km of the amended northern part was made in 1993 after major amendments to the original plan by minimizing the part of the elevated structure. The original and amended plans for the northern part of the Shinjuku Route are indicated in Figure 8.

As for consensus building in the process of the City Planning Decision, in the process of formulating draft plans, Public Hearings and Explanation Meetings were held for the case of the Metropolitan Expressway C2 Shinjuku Route project to promote residents' participation in the planning process. Public Hearings are not obligatory, but in the case of an important City Planning Decision, they become necessary. Before prefectures decide the plan under City Planning, residents are notified and the plans are made available for citizens to review. Concerned residents can submit their opinions on such plans in writing to the local governments. These are then reviewed and feedback provided on the plans when adopted, after the examination by City Planning Council. Plans prepared by local governments are presented to the City Planning Council of the local government. The opinions of the people concerned are presented to the government and the summaries to the Council. The Council discusses the validity of the presented plan and the summarized opinion of the citizens. Each local government sets up a City Planning Council. The members of the Council are chosen from different sectors to represent different viewpoints, including representatives from academia, local government, the City Council, the Parliament or prefectural assembly, and officials from related local authorities.

The Environmental Impact Assessment for 8.7km of the southern part of the Metropolitan Expressway C2 Shinjuku Route by Tokyo Metropolitan Government was completed in 1990, in coordination with the Public Review of the City Planning Decision, as demonstrated in Figure 7. The Assessment covered air quality, noise, vibration, low-frequency vibration, water pollution, soil pollution, land subsidence, geography and geology, plants, impediment of sunlight, impediment of radio waves, wind damages, landscape and historical sites and cultural properties. The summary of the Assessment's conclusions is indicated in Table 2. The impacts were mostly assessed as small, on the basis that appropriate measures, including the adoption of an underground structure, would be taken. However, several local residents and the Environmental Agency expressed concerns about the impact on air quality, in relation to the locations and design of ventilation stations. In response to these opinions, the Metropolitan Expressway Public Corporation changed the locations of ventilation stations from roadside sites to sites in the center of the Route, and developed more efficient and well-designed ventilation systems. The engineering features of the ventilation systems will be explained in section C.

The Assessment process also included consensus building measures such as Explanation Meetings after the draft of the Environmental Impact Assessment was opened and the Public Hearing was held, and after the Public Review of the Summary of the Opinions. Tokyo Metropolitan Government accepted about 4,000 opinions from concerned residents and opinions from six mayors of the relevant wards during the process.

Land acquisition

Land acquisition was conducted in relation to the widening of the 6th Circular Highway from 22m to 40m width (8.8km, including the section Nishishinjuku Junction – Ohashi Junction). The details are as follows:

- Area: 130,000 square meters;
- Buildings: 1,000;
- Land lots: 1,500;
- Contracts: 5,700 cases;
- Compensation cost: USD 5.7bn (1USD=100JPY);
- Land takings: 25 cases.

Sources: Furukawa, H, 'History of Improvement of Metropolitan Expressway Network (1),' Expressways and Automobiles 2007; 50(8): 30-34 (in Japanese); Furukawa, H, 'History of Improvement of Metropolitan Expressway Network (2),' Expressways and Automobiles 2007; 50(9): 38-43 (in Japanese); Kitagawa, H, 'Metropolitan Expressway C2 Shinjuku Route,' 2008 (in Japanese); Kanto Regional Development Bureau, Ministry of Land, Infrastructure and Transport, 'Metropolitan Expressway the Central Circular Route http://www.ktr.mlit.go.jp/3kanjo/chuokanjo/' 2008 (in Japanese); Metropolitan Expressway Co.,Ltd, 'Metropolitan Expressway C2 Shinjuku Route,' 2007 (in Japanese); Road Bureau, Ministry of Land, Infrastructure and Transport, 'Outline of Japanese Toll Expressways http://www.mlit.go.jp/road/yuryo/outline/index.html,' 2008 (in Japanese); Tachimori, T, 'From Shinjuku Route to Shinagawa Route,' Advanced Construction Technology Center 2007 (in Japanese) Tokyo Metropolitan Government, 'Urban Development in Tokyo 2007, 2007; Tokyo Metropolitan Government, 'Environmental Impact Assessment for Metropolitan Expressway the Central Circular Shinjuku Route,' 1990 (in Japanese); Yoji, N, 'A Historical Review of Metropolitan Expressway Route Plans 1,' Expressways and Automobiles 1980; 23(1) (in Japanese); Yoji, N, 'A Historical Review of Metropolitan Expressway Route Plans 2,' Expressways and Automobiles 1980; 23(3) (in Japanese).

Figure 7: Processes for City Planning and Environmental Impact Assessment for the Metropolitan Expressway C2 Shinjuku Route

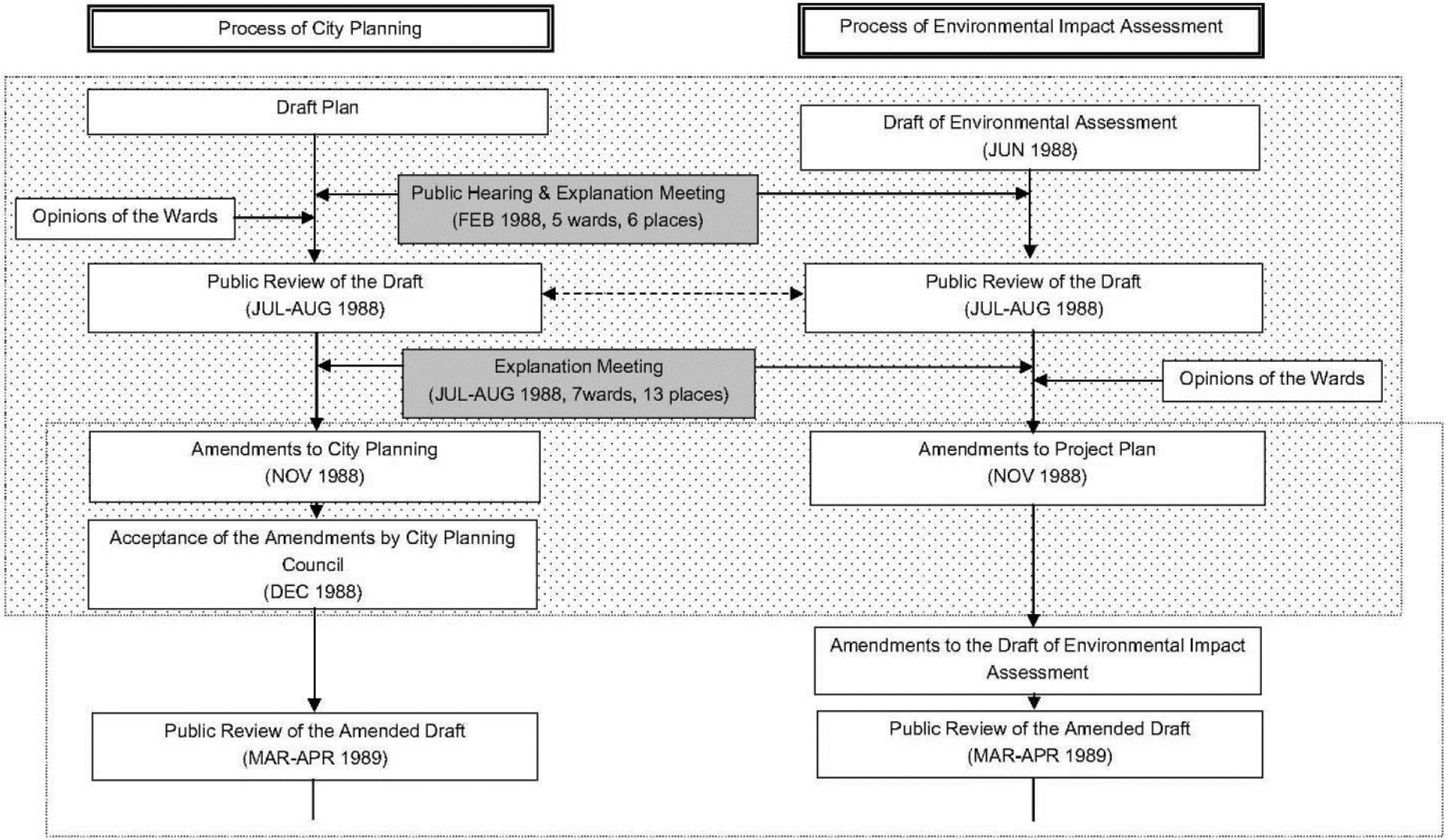


Figure 8: Processes for City Planning and Environmental Impact Assessment for the Metropolitan Expressway C2 Shinjuku Route

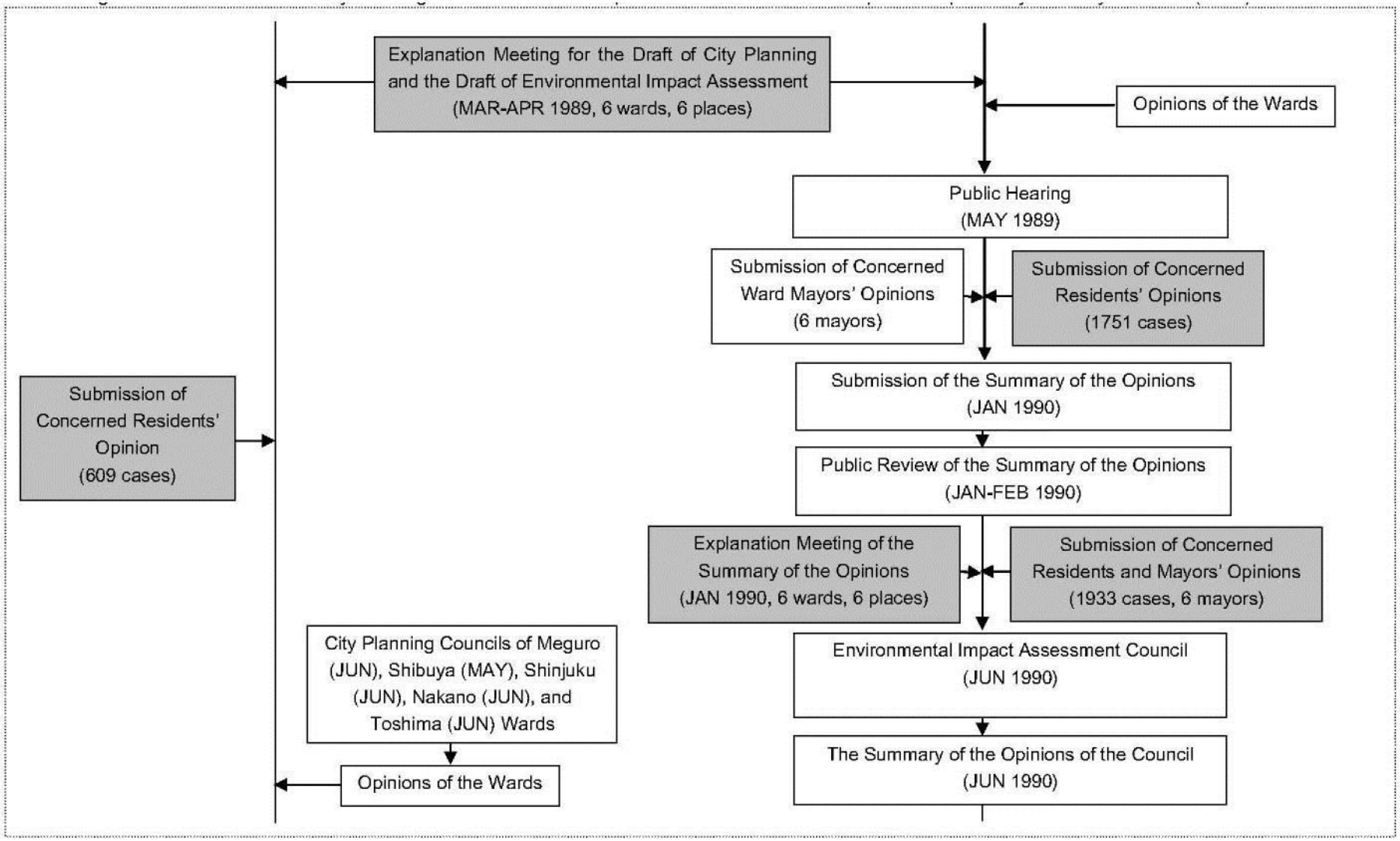


Figure 9: Processes for City Planning and Environmental Impact Assessment for the Metropolitan Expressway C2 Shinjuku Route

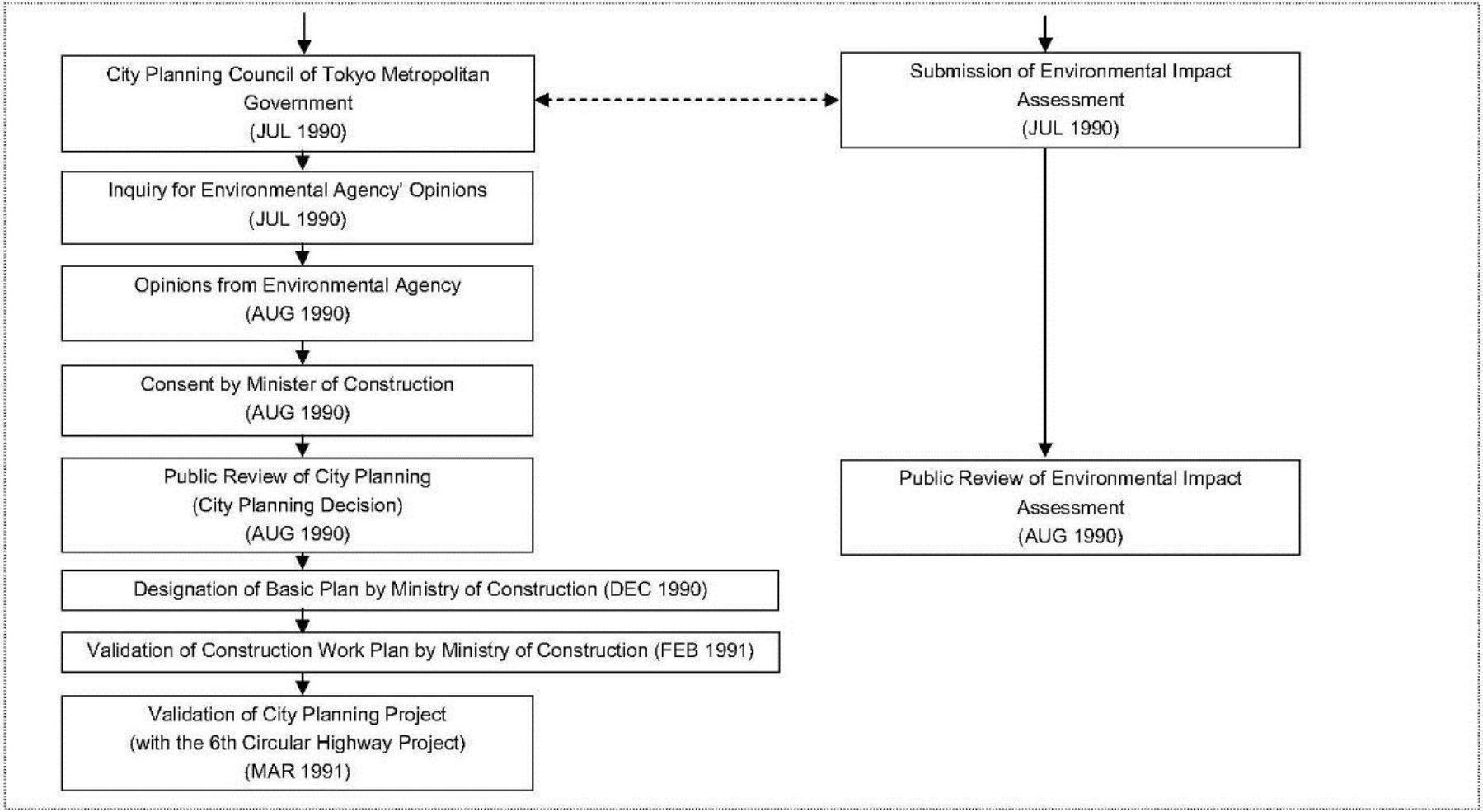


Figure 10: The original (upper) and amended plans (lower) for the northern part of the Shinjuku Route

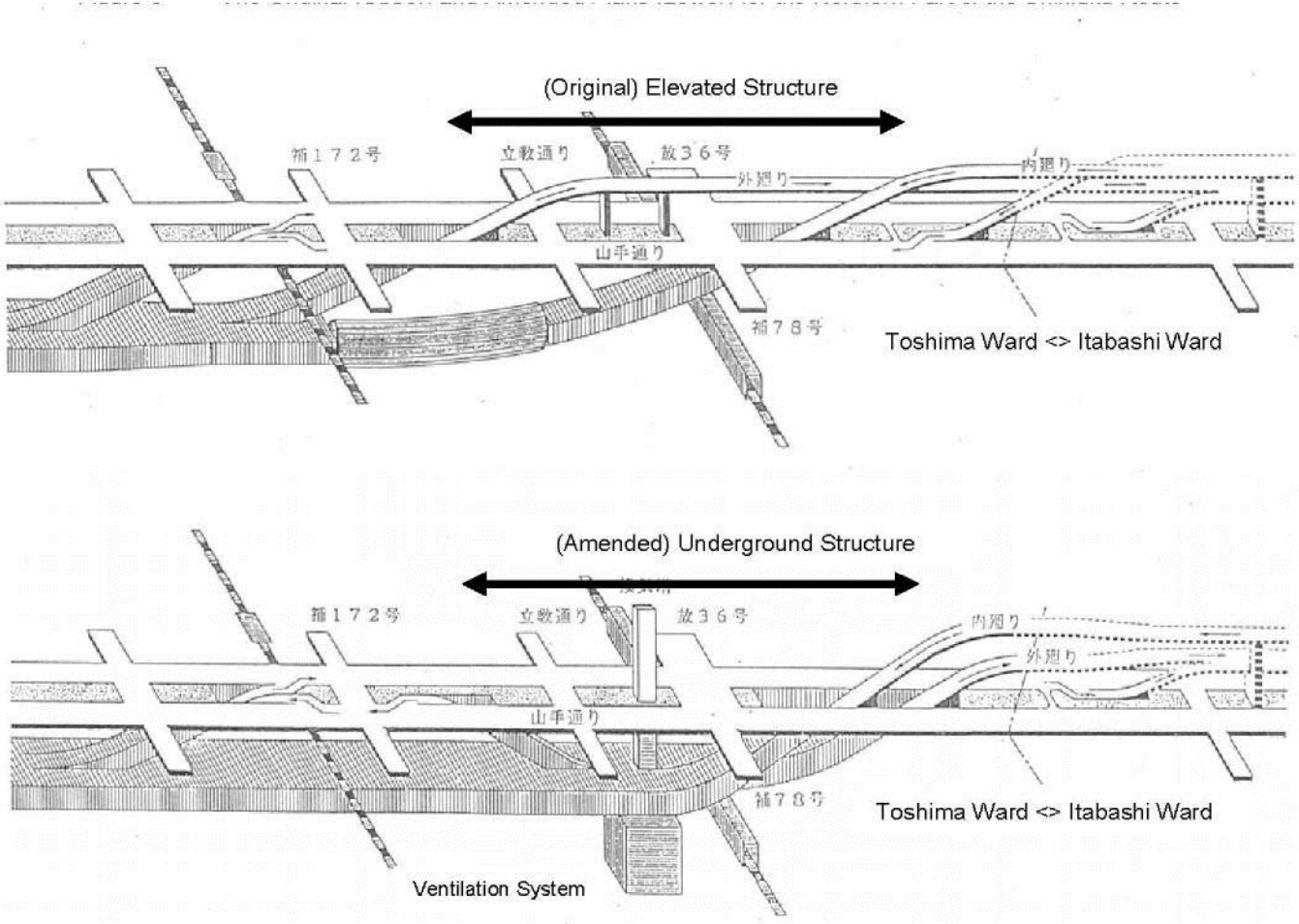


Table 2: Summary of conclusions of Environmental Impact Assessment

Prediction / Evaluation Items	Conclusions of Assessment
1. Air quality	Because the contribution of operations of trucks induced by construction works to air quality will be very small, the impact is assessed as small. After the construction, because most of the Route will be built with tunnel structure, the impact on air quality (NO_2, CO, and SO_2) along the Route is assessed as small. While the assessment standard for NO_2 will be exceeded by about 0.002ppm to 0.007ppm at some of the interchanges in 1995, the contribution of the Route for this will be small. The standard will also be exceeded by 0.001ppm in 2000, however, because reinforcement of protection measures for the environment will lower the level of air pollution than the assessment standard, the impact on air quality is assessed as small.
2. Noise	During the construction works, because most of the Route will be built with tunnel structure, major works will occur underground and the impact on the ground is assessed as small. Moreover, because noise of construction activities induced by construction works will not exceed the assessment standard, the impact is assessed as small. Because the contribution of operations of trucks to the surrounding areas will be less than 1dB(A), the impact is assessed as small. After the construction, the impact of road traffic noise for the tunnel section is assessed as nothing. The level of noise will exceed the assessment standard at some of the entries of the tunnel and interchanges, however, the impact of the planned Route is assessed as small. The impacts of the ventilation stations are also assessed as small.
3. Vibration	During the construction works, because most of the Route will be built with tunnel structure, major works will occur underground and the impact on the areas along the Route is assessed as small. Moreover, because vibration of construction activities induced by construction works will not exceed the assessment standard, the impact is assessed as small. Because the contribution of operations of trucks to vibration on the surrounding areas will be less than 1dB, the impact is assessed as small. After the construction, because the level of road traffic vibration will not exceed the assessment standard, the impact is assessed as small.
4. Low-frequency vibration	Judging from the existing sources, because the level of low-frequency vibration in the surrounding areas along the planned Route will be within the level of sound pressure prevailing in urban daily life, the impact on the surrounding areas is assessed as small.
5. Water pollution	For the construction works, if the coagulant for the ground is used, because it will be implemented as the guidelines of Ministry of Construction and Tokyo Metropolitan Government prescribe, the impact on underground water quality is assessed as small.
6. Soil pollution	For the construction works, if the coagulant for the ground, because it will be implemented as the guidelines of Ministry of Construction and Tokyo Metropolitan Government prescribe, the impact on soil pollution is assessed as small. Because there was no record in the past that heavy metals were dealt with on the land the planned Route goes through, soil pollution caused by the construction will not happen.
7. Land subsidence	For the construction works, because the level of underground water will be protected from lowering by adopting the water-proof retaining wall method, the impact on land subsidence is assessed as small.
8. Geography and geology	For the construction works, because the level of the ground will be protected from lowering by adopting appropriate methods such as the inelastic retaining wall method for open cut method and the closed shield method for shield method, the impact on the surrounding grounds is assessed as small. Concerning the level of underground water, because of the adoption of water proof method for open cut or shield methods, the impact is assessed as small. After the construction, because appropriate measures for protecting underground water will be taken for planning and design of the structure of the planned Route, the impact on the level of underground water is assessed as small.

Table 2: Summary of Conclusions of Environmental Impact Assessment (cont.)

Prediction / Evaluation Items	Conclusions of Assessment
9. Plants	During the construction works, the plants impacted by land development will be temporarily transplanted or transplanted in sufficient consultation with relevant organizations. Because the contributions to the impact on the level of underground water and the impact on air quality by trucks will be small, the impact on living environment on plants is assessed as small. After the construction, because most of the planned Route will be built with tunnel structure, air quality will be the same as current level and the impact on living environment for the plants along the Route is assessed as small. The highway that will be simultaneously built with the planned Route should be greened by planting trees.
10. Impediment of sunlight	Because most of the planned Route will be built with tunnel structure, the impact of impediment of sunlight is assessed as small. For the areas where impediment of sunlight newly occurs by this project, it will be dealt with according to the notice on 'Cost allocation for the damages of impediment of sunlight caused by the location of pubic facility' on 23 February 1976 issued by the Administrative Vice-Minister of Ministry of Construction. Concerning the ventilating stations that will be built off the 6th Circular Highway, because they will be satisfied with the regulations on mid/high rise buildings due to the impediment of sunlight prescribed by the Building Standard Act, the impact is assessed as nothing.
11. Impediment of radio waves	Because most of the planned Route will be built with tunnel structure, the impact of impediment of radio waves is assessed as small. For the areas where impediment of radio waves newly occurs by this project, because it will be dealt with according to the guidance on 'Cost Allocation for the damages of impediment of radio waves caused by the location of pubic facility' on 12 October 1979 issued by the Administrative Vice-Minister of Ministry of Construction, the impact is assessed as small.
12. Wind damages	In some of the surrounding areas of the ventilating stations, increase in wind speed will occur, however, because it will not exceed the assessment standard, the impact is assessed as small.
13. Landscape	Because most of the planned Route will be built with tunnel structure, the existing local landscape will not be changed significantly. Concerning ventilating stations and interchanges that will be built on the ground, because they will be harmonized with the surrounding landscape by taking care of shape and color, the impact of is assessed as small.
14. Historical sites and cultural properties	For the designated cultural properties along the planned Route, because the measures such as low vibration method will be taken for the construction works, the impact is assessed as small. For the protected area for the deposited cultural properties within the project area, in consultation with relevant organizations, it will be dealt with by the procedure prescribed by the Act for Protection of Cultural Properties to conduct excavation and record if needed, the impact is assessed as small.

C PRINCIPAL PROJECT CHARACTERISTICS

Route and alignment

The map of the northern part of the section of the Metropolitan Expressway C2 Shinjuku Route (Nishishinjuku Junction – Kumanocho Junction) is shown in Figure 9 and the map of the southern part in Figure 10. Figure 10 also indicates the section of the Shinjuku Route (Ohashi Junction and Nishishinjuku Junction) which is planned to open in 2009.

From the northern end of the Kumanocho Junction in Itabashi Ward, where the section of the Metropolitan Expressway C2 Shinjuku Route (Nishishinjuku Junction – Kumanocho Junction) is connected with the Radial Expressway Route 5 above the 6th Circular Highway, the Shinjuku Route goes through Takamatsu entry point in Itabashi Ward in a southward direction and down into the tunnel under the 6th Circular Highway. After crossing with the Yuraucho Subway Line, the Shinjuku Route goes through Nishiikebukuro entry/exit points in Toshima Ward. The Shinjuku Route then goes through the crossing with the Seibu Railway Ikebukuro Line, and starts sharing the underground space under the 6th Circular Highway with the No.12 (Oedo) Subway Line (3.3km) in Shinjuku Ward. The Shinjuku Route, together with the No.12 Subway Line, goes through the crossing points with the Seibu Railway Shinjuku Line, the Tozai Subway Line in Nakano Ward, the East Japan Railway Chuo Line, and Marunouchi Subway Line. After going through Nakanochojyabashi entry/exit points, the No.12 Subway Line is separated from the Shinjuku Route and the 6th Circular Highway, and the Shinjuku Route reaches the southern end of Nishishinjuku Junction where the underground Shinju Route is connected with the elevated Radial Expressway Route 4 at the boundary between Shinjuku and Shibuya Wards. The Shinjuku Route also crosses the Keio Railway New Line at this point. The remaining section of the Shinjuku Route goes in a southward direction further through Hatsudaiminami and Tomigaya entry/exit points and reaches Ohashi Junction where the underground Shinju Route is connected with the elevated Radial Expressway Route 3 in Meguro Ward.

While the upgraded 6th Circular Highway (8.8km) goes through densely inhabited areas, the Shinjuku Route goes under the Highway except for the northern end of the Route and the entry/exit points. The section of the Metropolitan Expressway C2 Shinjuku Route (Nishishinjuku Junction – Kumanocho Junction) does not directly connect two subcenters around Ikebukuro and Shinjuku Stations, however, it is likely that the connection between the two subcenters will be reinforced. There are no specific sites of natural beauty or cultural property along the Route.

Main and intermediate hubs, nodes and termini

Because Kumanocho Junction and Takamatsu entry point was constructed separately from the section of the Metropolitan Expressway C2 Shinjuku Route (Nishishinjuku Junction – Kumanocho Junction), there are two entry/exit points and one junction built with the section. No significant urban development was implemented in a coordinated way with the Route except the Ohashi Urban Redevelopment Project, which is still under construction.

- Nishiikebukuro entry/exit points (entry point for southward direction, exit points for both directions).

- The Nishiikebukuro entry/exit point connects the underground Shinjuku Route with the surface 6th Circular Highway. The connecting lanes for both the Route and the

Highway are located at the center of the roads. These points provide better access to the radial highway of the Mejiro Street (Figure 11).

- Nakanochojabashi entry/exit points (entry point for northward direction, exit point for southward direction). The Nishiikebukuro entry/exit point also connects the underground Shinjuku Route with the surface 6th Circular Highway. The connecting lanes both for the Route and the Highway are located at the center of the roads. These points provide better access to the Nishishinjuku Junction – at the Nishishinjuku Junction, the underground Shinjuku Route is connected with the elevated Radial Expressway Route 4 (the westard directions only) at the boundary between Shinjuku and Shibuya Wards.

The junction was built with seven multi-storey structures where the Shinjuku Route, the Route 4, two connectors, the Koshu Street and its Underpass under the 6th Circular Highway, and the underground Keio Railway New Line by maximizing the use of limited urban space (Figure 13).

Figure 11: Map of the northern part of the Shinjuku Route (coloured red)

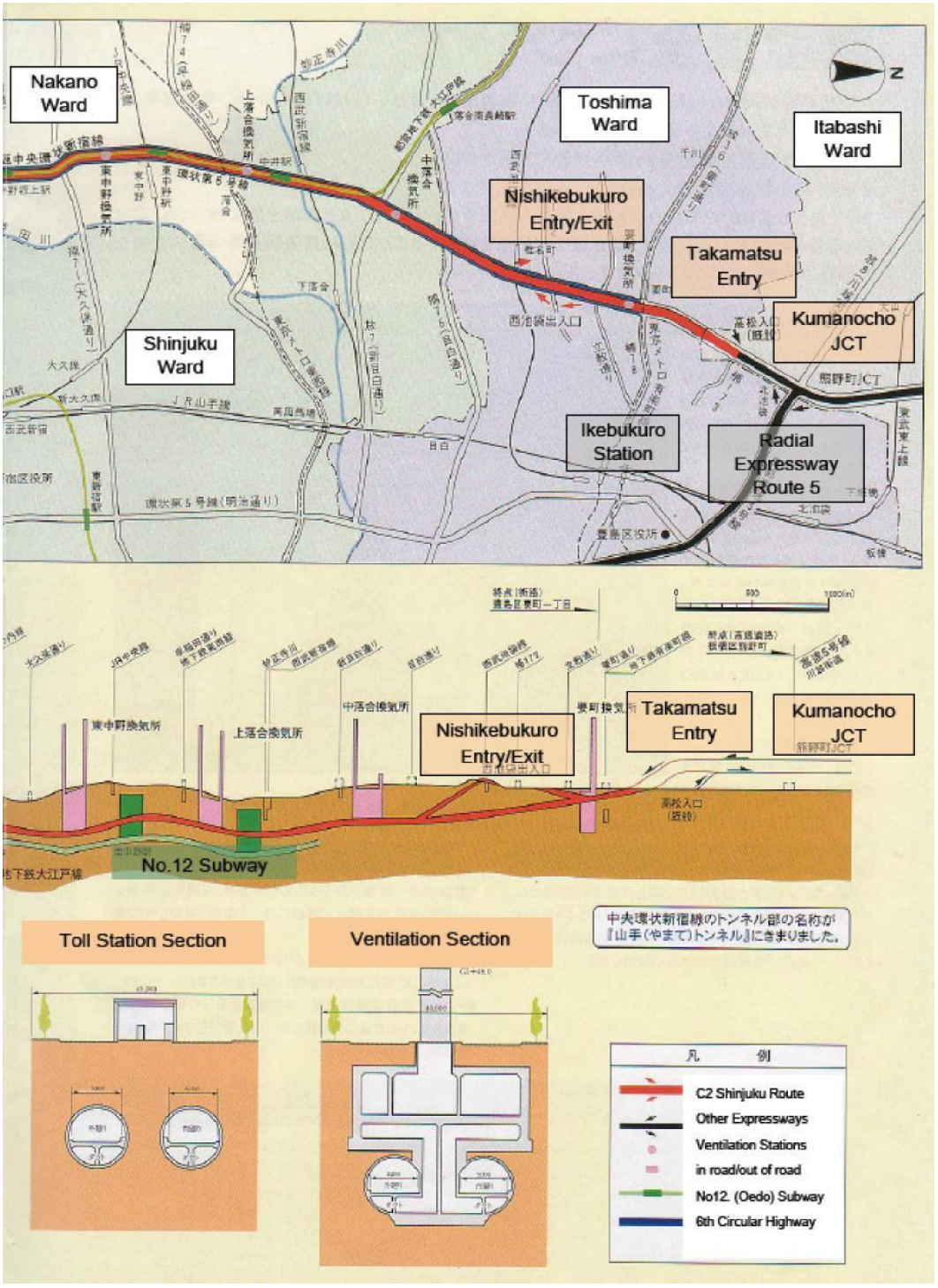


Figure 12: Map of the southern part of the Shinjuku Route (coloured red)

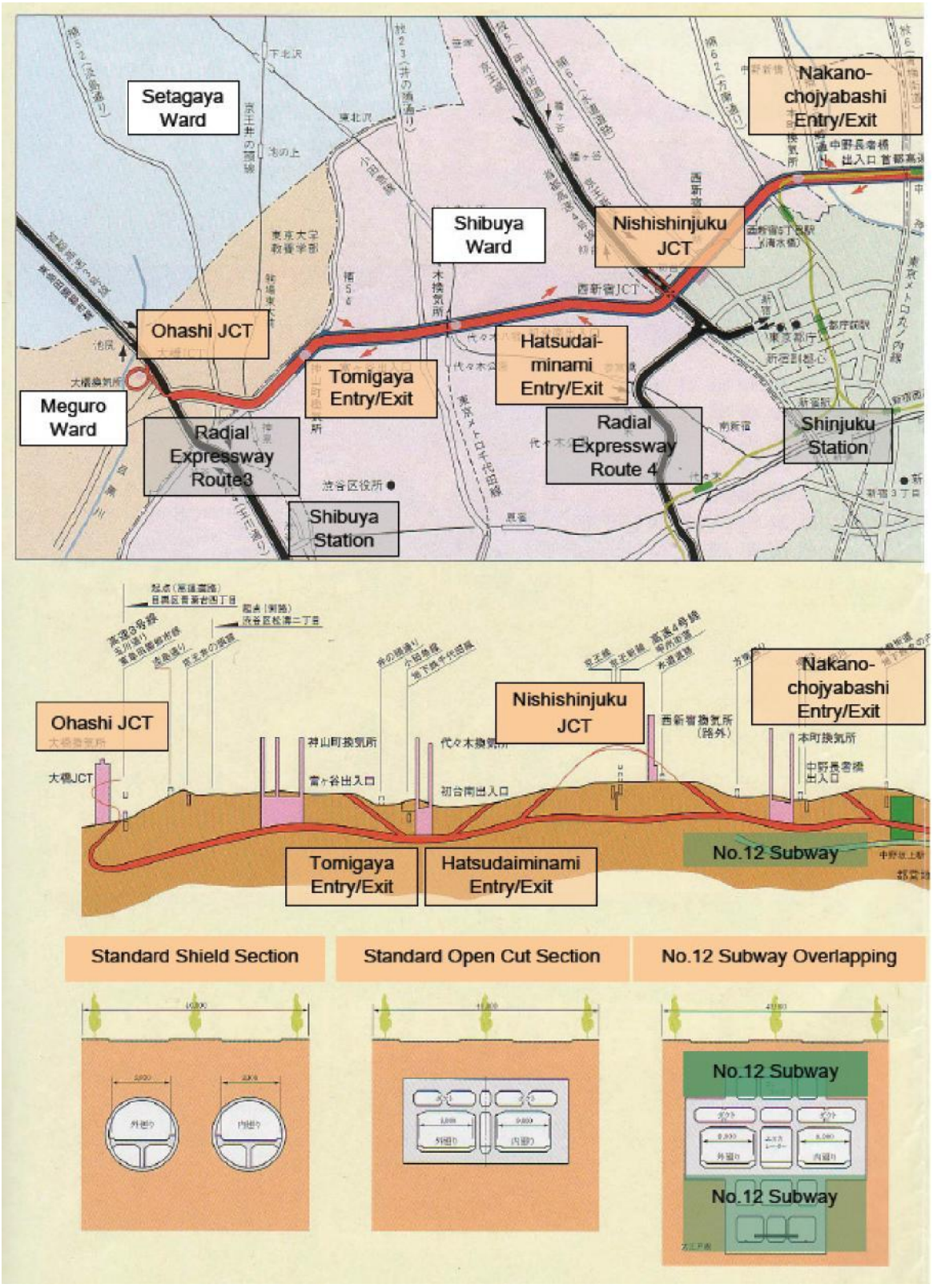


Figure 13: Nishiikebukuro entry/exit points

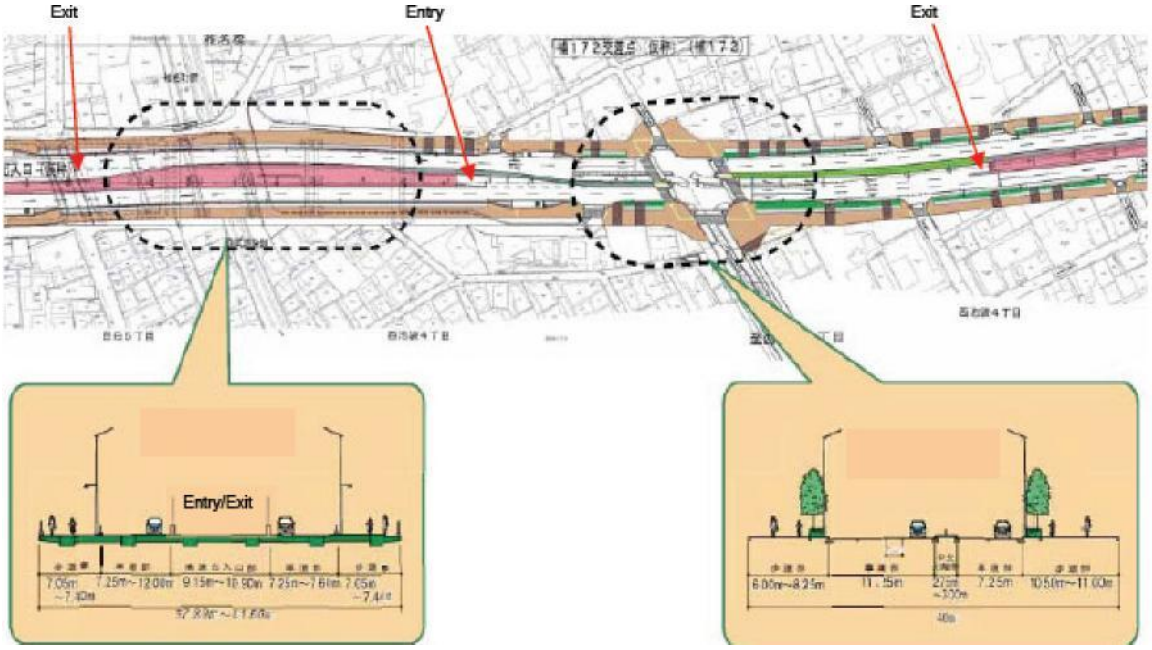


Figure 14: Nakanochojabashi entry/exit points

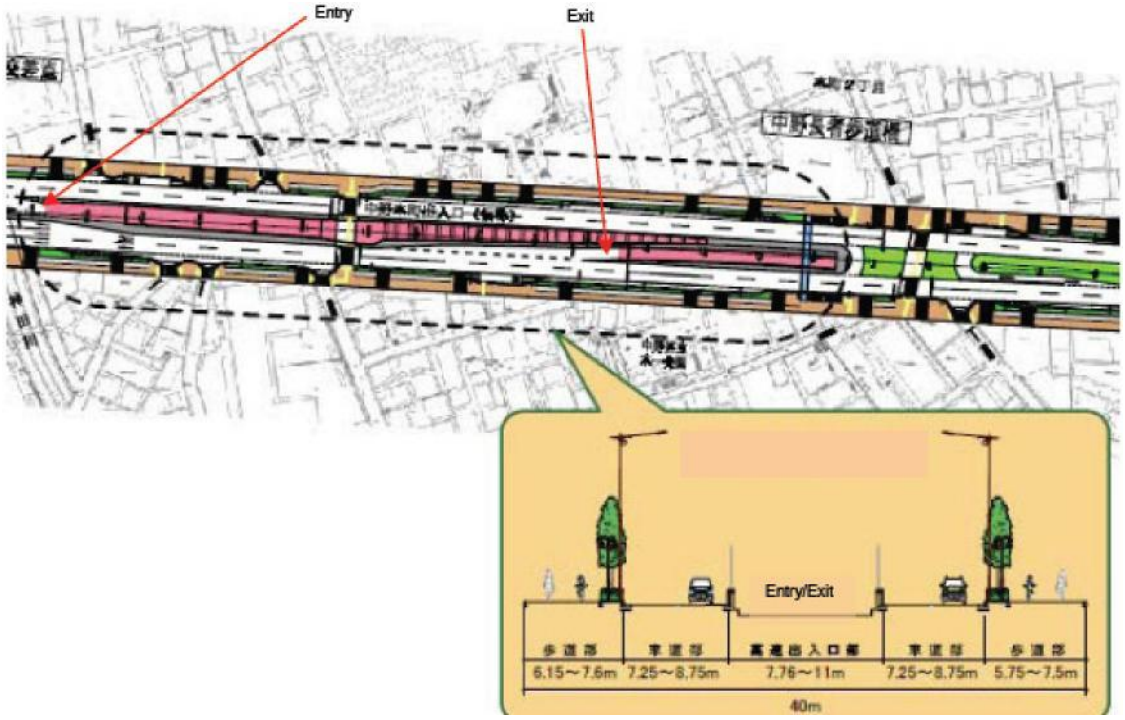
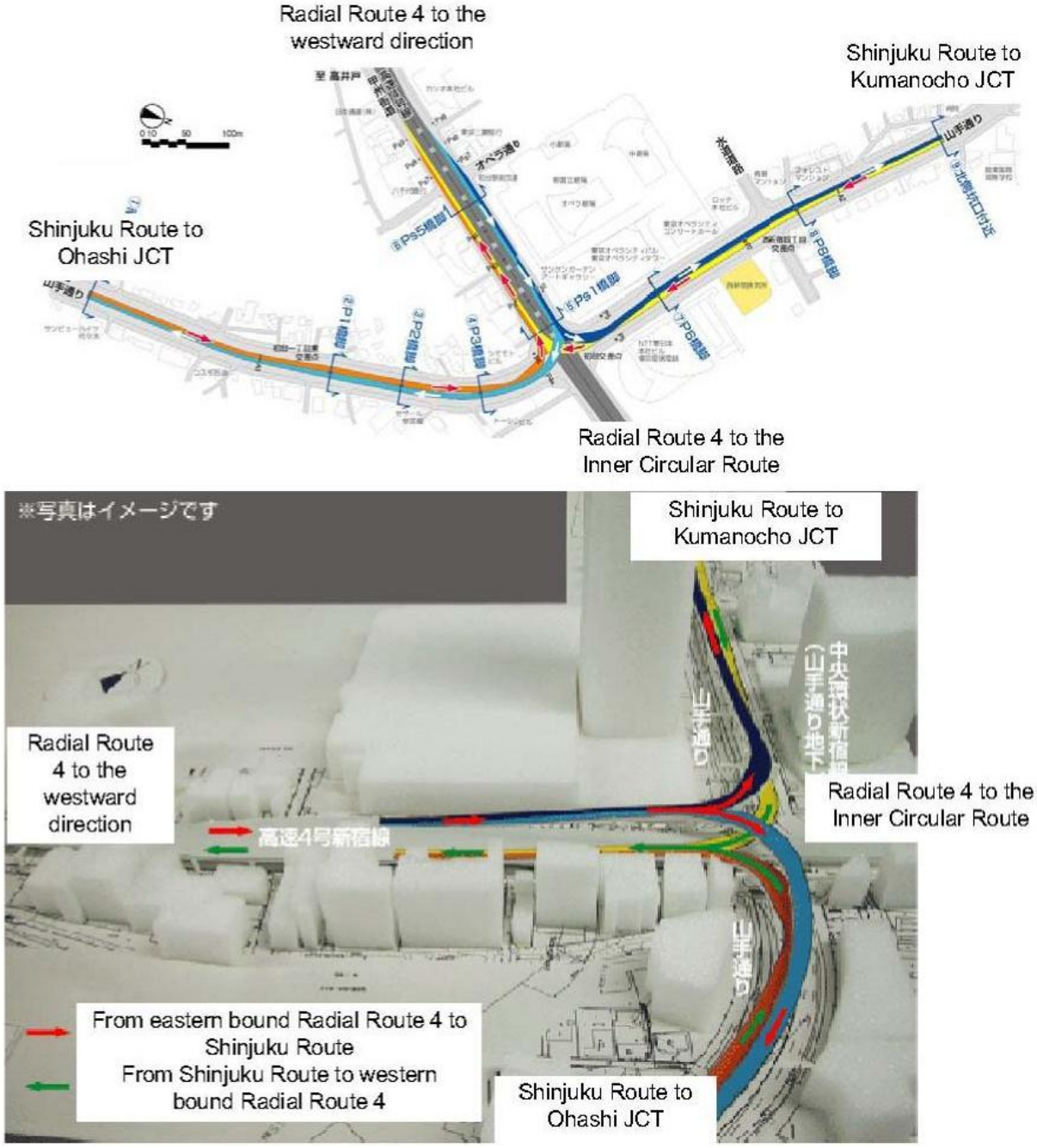


Figure 15: Nishishinjuku Junction



Project costs

The cost of the Metropolitan Expressway C2 Shinjuku Route (Nishishinjuku Junction – Kumanocho Junction) was USD 4.6bn (1USD=100JPY), most of which was used for construction. The cost of the Metropolitan Expressway C2 Shinjuku Route (Ohashi Junction – Kumanocho Junction) was estimated to be USD 13bn, of which USD 7bn was used for the Metropolitan Expressway C2 Shinjuku Route and USD 6bn was used for the upgrading of the 6th Circular Highway.

It is noted that the adoption of a tunnel instead of the originally planned elevated structure for the Route by Tokyo Metropolitan Government and the Metropolitan Expressway Public

Corporation in the late 1980s considerably increased the project cost. In addition, when the Metropolitan Expressway Public Corporation started the construction of the Route by buying lands for the project in 1991, the Japanese economy was in the bubble economy and land prices were extremely high, which pushed the project cost up significantly. After the bubble economy had ended and land prices dropped drastically, some landowners accepted the price offered by the Corporation, but others refused and insisted on the purchase of their lands at the prices offered during the bubble economy, which delayed the project schedule.

Although it was likely that cost estimates changed considerably until the final costs, relevant information was not available from the organizations.

Project delivery timeline

The project delivery timeline for the Metropolitan Expressway C2 Shinjuku Route (Nishishinjuku Junction – Kumanocho Junction) is briefly indicated in Table 3. It is noted that when the Metropolitan Expressway Public Corporation started construction of the Route in 1991, it assumed that most of the tunnel parts would be constructed by the open cut method. However, private construction companies developed highly innovative shield methods during the 1990s, leading the corporation to change its policy and adopt the shield method for as long as possible in 1999.

Table 3: Project delivery timeline for the Metropolitan Expressway C2 Shinjuku Route

Year	Project Programme
1991	The Metropolitan Expressway Public Corporation started the purchase of land for the project.
1992	The ceremony for the start of the construction was held at Nishishinjuku where the shield method was undertaken.
1995	The construction work started at the crossing with the Marunouchi Subway Line and the Oume Street.
1996	The Metropolitan Expressway Public Corporation designed the construction works by assuming the open cut method for the most part of the project.
1997	The construction work for Nishishinjuku Junction started.
1997	The construction work for ventilation station at Kamiyamacho started.
1999	The Metropolitan Expressway Public Corporation changed the policy and designed the construction works by assuming the shield method for the most part of the project.
2000	The shield machine at Nishishinjuku started the construction of the tunnel.
2001	The shield machine at Nishishinjuku made the U-turn.
2003	The 6 shield machines started the constructions of the tunnels. (Nakaochiai (two ways), Kamiochiai, Higashinakano, Yoyogi (two ways))
2004	The shield machine at Honcho started the construction of the tunnel.
2005	All the tunnels by the shield method between Nishishinjuku Junction and Kumanocho Junction were completed.
2006	The construction work for Nishishinjuku Junction completed.
2007	The section between Nishishinjuku Junction and Kumanocho Junction opened.

Main engineering features

The tunnel for the Metropolitan Expressway C2 Shinjuku Route is one of the longest road tunnels in urban areas. While underground structures are often adopted in urban areas, the construction needs to overcome several limitations aside from cost. After the Aqualine

Expressway project in 1997, the Metropolitan Expressway C2 Shinjuku Route provides major opportunities for innovations in tunneling technology.
The Metropolitan Expressway C2 Shinjuku Route runs under the 6th Circular Highway, which is lined with office buildings, high-rise condominiums, and commercial facilities. To construct this by the shield tunneling method would mitigate traffic disruption, noise and other adverse impacts on the surrounding area.

In addition, a vast network of electrical power, gas, communications, water supply and sewage, and other important lines were buried underground along the 6th Circular Highway. If the Metropolitan Expressway Co. Ltd had built this tunnel using the open cut method of construction, these lines would have to be relocated during construction. Moreover, it was determined that this tunnel should be built more than thirty meters below the ground, in part to avoid disruption to eleven railway lines intersecting parts of the tunnel. Consequently, the shield tunnel method was employed for approximately seven of eleven kilometers, encompassing all sections of the Metropolitan Expressway C2 Shinjuku Route.

The shield tunneling method is a method by which segments used to support the tunnel are constructed inside the Tunnel Boring Machine (TBM) while the tunnel is being dug by the TBM. The advantage of employing the shield tunneling method for tunnel construction is that it can be cost effective alongside minimal disruptions to the surrounding area.

The Earth Pressure Balance Shield Method

According to the Japan Tunneling Association, the Nakaochiai shield tunnel extends approximately 2.02km from the vertical departure shaft at Rikkyo Street in Toshima Ward as far as the Nakai station of No.12 (Oedo) Subway Line building in Shinjuku Ward, and is constructed by the earth pressure balance shield method. This shield has an outer diameter of the machine of 12.02m, making it the largest diameter earth pressure balance shield in the world. The outer diameter of the segmental lining is 11.8m. With an earth coverage of 9m-24m, and running underneath some major city center trunk roads as well as being constructed adjacent to important structures such as railway lines and bridge pier foundations, these make the construction conditions extremely challenging. The earth pressure balance shield method requires less working space than other methods such as the slurry shield method, which is also important for construction works in urban areas. Please see Figure 14.

Shield Machine U-turn

Taking full advantage of its expertise in the management of all phases from planning to design and construction, Metropolitan Expressway Co. Ltd made rigorous repeated studies to identify workable means of cost reduction. The concept of Shield Machine U-turn also comes from the need for cost reduction. The shield tunneling method is less costly than the open-cut tunneling method, but the cost is still so high that each machine should be used for at least 1km of the tunnel from the economic point of view. While the construction of the Metropolitan Expressway C2 Shinjuku Route was divided into several civil engineering components some of which are less than 1km in length, Shield Machine U-turn was applied to these short sections where the shield machine was used for both expressway directions by making it turn at the end of the section. The U-turn of the shield machine, whose weight is 2,000-3,000 tons and diameter is about 13m, in a very limited underground working site, was made possible by cutting-edge technology well founded on practical experiences. Please see Figure 15.

Enlargement of Shield Tunnel

The entry/exit ways between the underground expressways and roads on the ground were

constructed by cutting parts of the shield tunnel. The entry/exit ways had usually been constructed by the open-cut method, considering the structural stability of shield tunnel and other practical concerns for cutting 'shield' segments. However, if the shield tunneling method is used as long as possible, it makes it possible to minimize the working site for the open-cut method and disruptions to surface traffic and underground utilities. The enlargement of the shield tunnel was adopted for the construction of five entry/exit ways and four ventilation stations, and was also applied to the section (Ohashi Junction – Nishishinjuku Junction) where the enlargement of the shield tunnel was done without the open-cut method. Please see Figure 16.

Work in proximity managed in units of millimetres

In legs where subways run above and below the expressway, the tunnel construction proceeded in very close proximity (with separations between the two ranging from two to six metres). At such spots, the subsidence of the subway structures was measured and managed in units of millimeters to prevent any significant influence from the construction. This is the case for the Nakanosakaue construction site under a major intersection of the 6th Circular Highway and Oume Street where the Metropolitan Expressway C2 Shinjuku Route shares the underground space with two Subway Lines, No.12 (Oedo) Line and Marunouchi Line. The Marunouchi Subway Line and the utility lines were sustained by the underpinning method without interrupting the subway service. The allowable movement was controlled within only 1.2mm for the box containing the subway line. Please see Figure 17.

State-of-the-art low-concentration denitration equipment and ventilation station

Vehicle emissions are diluted with air from the ventilating stations, directed up 45m-high towers to a height of approximately 100m above ground at a speed of approximately 10m/s and then diffused. These towers were designed to blend in with the surrounding environment and to be considered a benefit to the community. NO_2 emissions measure less than one-hundredth of the accepted environmental quality standard and have a negative impact only on roadside areas. Two types of equipment have been developed and are installed in all ventilation stations. The first is a low concentration denitration device designed to remove over 90% of the NO_2 passing through it, and the second is an electrostatic precipitator used to filter out over 80% of the suspended particulate matter (SPM) passing through it. Please see Figure 18.

Comprehensive measures for noise suppression

Noise suppressors are incorporated into the ventilating stations. The noise level near the ventilating stations meets mandated standards by a considerable margin and is approximately equivalent to the noise level in libraries. In addition, noise barriers, rear-side acoustic absorbing panels, low-noise pavement, and other innovations are also introduced to entry/exit points and junctions to further suppress noise. Please see Figure 19.

Main contracts and contractors

Although the items were inquired of the organizations, relevant information was not available because of confidentiality. Table 4 shows the information available on contracts and contractors from secondary sources.

Major civil engineering components

There were 17 major civil engineering components. Please see Table 4 and Figure 20.

Table 4: Major civil engineering components

Component	Direction	Construction Companies	Methods	
SJ32				
SJ33				
SJ34(1-3)		Toa/Asanuma/Tokura JV	(Open Cut)	Junction
SJ35				
SJ41	Both	Hazama/Sumitomo Mitsui JV	Open Cut	Underpining
SJ42				
SJ43(2-3)		Kumagai/Penta Ocean/Fukuda JV	(Open Cut)	Ventilation System
SJ44				
SJ45				
SJ46(2)	Both	Nishimatsu/Tekken/Aisawa JV	Shield (Kamiochiai)	U-turn
SJ47				
SJ51	North	Obayashi/Daiho/Tokyu JV	Shield (Nakaochiai)	Earth Pressure Balance Shield
SJ51	South	Okumura/Zenitaka/Omoto JV	Shield (Nakaochiai)	Earth Pressure Balance Shield
SJ52	North	Obayashi/Daiho/Tokyu JV	Shield (Nakaochiai)	Earth Pressure Balance Shield
SJ52	South	Okumura/Zenitaka/Omoto JV	Shield (Nakaochiai)	Earth Pressure Balance Shield
SJ52(2-2)		Daiho/Asunaro Aoki/Mori JV	(Open Cut)	Ventilation System
SJ53	North	Obayashi/Daiho/Tokyu JV	Shield (Nakaochiai)	Earth Pressure Balance Shield
SJ53	South	Okumura/Zenitaka/Omoto JV	Shield (Nakaochiai)	Earth Pressure Balance Shield
SJ61				
SJ62	Both	Fujita/Rinkai Nissan JV	Open Cut	
SJ63				

Sources:

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Konda, T., 'Technologies for Urban Road Tunnels,' Advanced Construction Technology Center 2007 (in Japanese).

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Metropolitan Expressway Co.,Ltd., 'SJ51-SJ53 Section Tunnel Works,' 2007.

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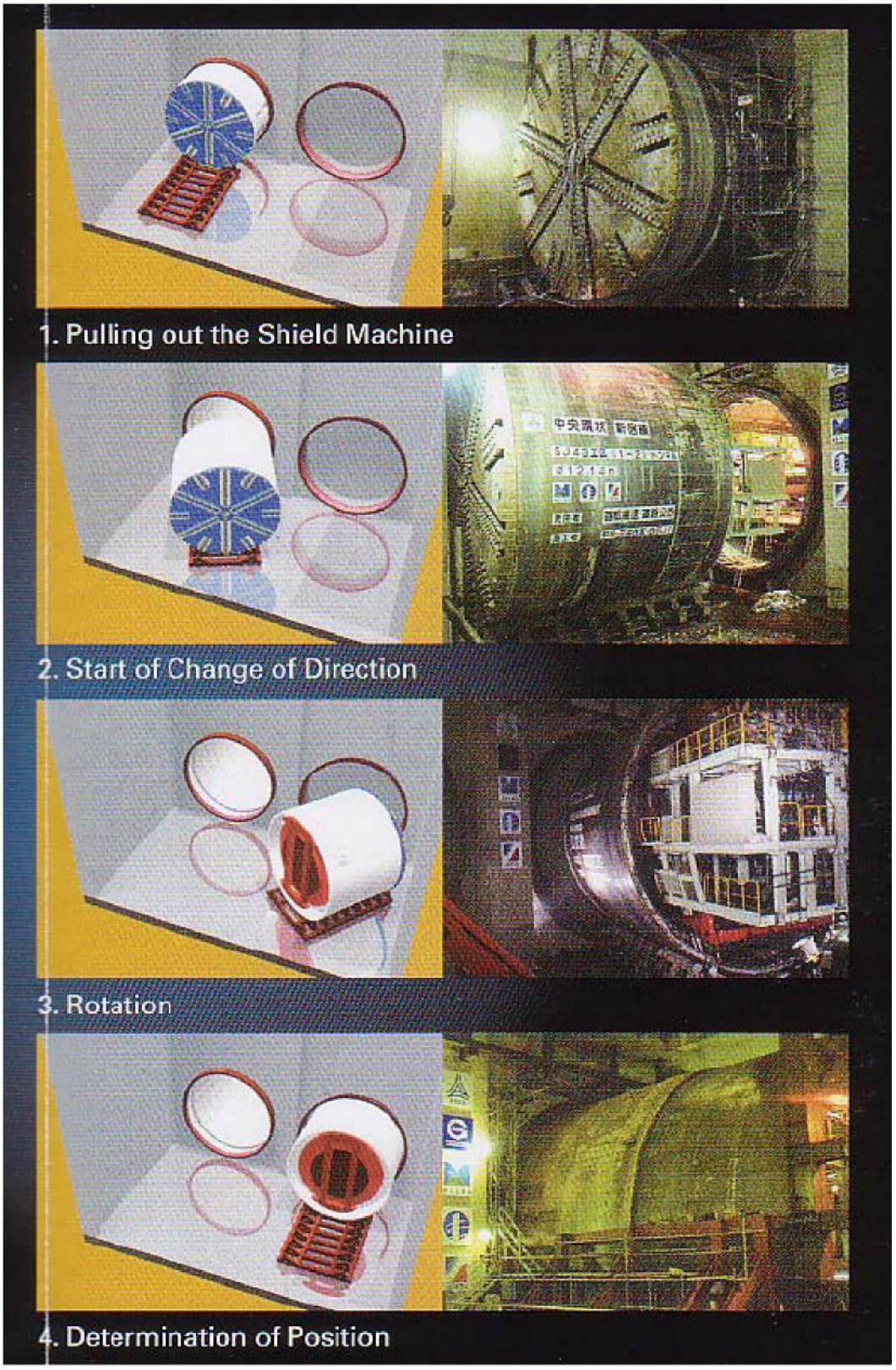
Tachimori, T., 'From Shinjuku Route to Shinagawa Route,' Advanced Construction Technology Center 2007 (in Japanese).

Figure 16: The earth pressure balance shield method

(Upper: Tunneling Boring Machine, Middle: Finish, Lower: Construction of Segments

Figure 17: The process of shield machine U-turn



(Upper: Cutting Parts of the Shield, Lower: The Image of Enlargement of Shield Tunnel)

Figure 18: Enlargement of shield tunnel

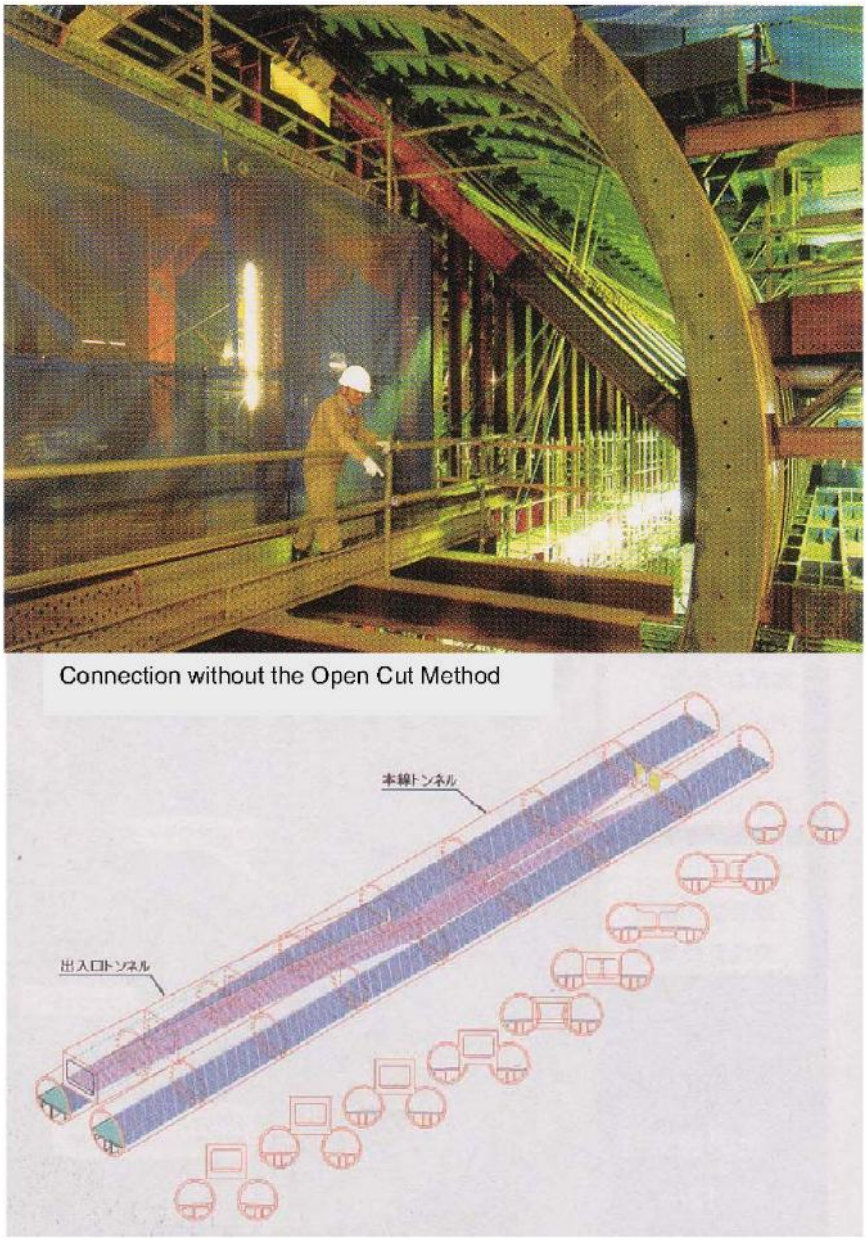
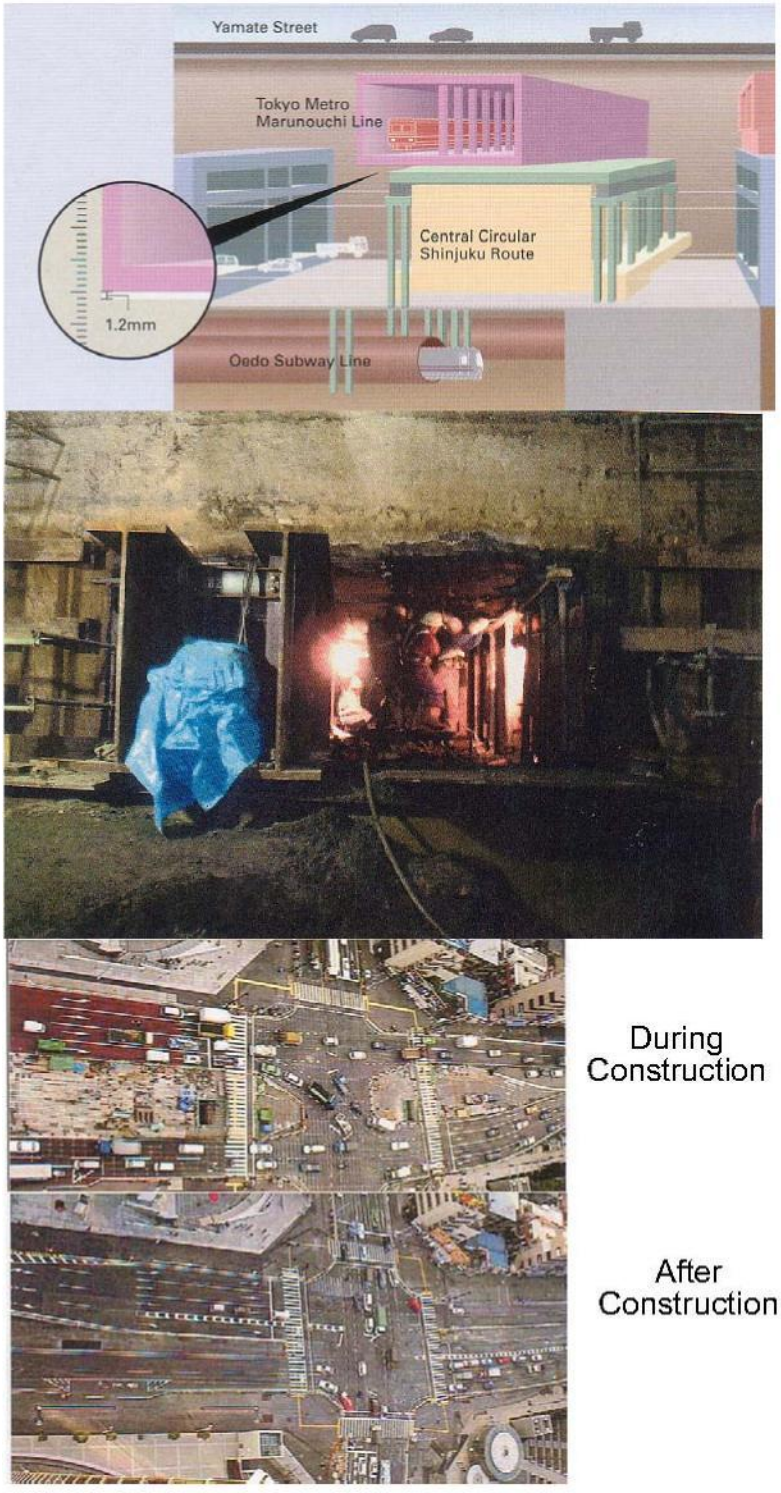


Figure 19: Work in proximity managed in units of millimetres



(Upper: The Section of Nakanosakaue Working Site, Middle: The Subway Line was Sustained, Lower: The Surface Intersections during/after Construction Works)

Figure 20: Denitration equipment and ventilation station

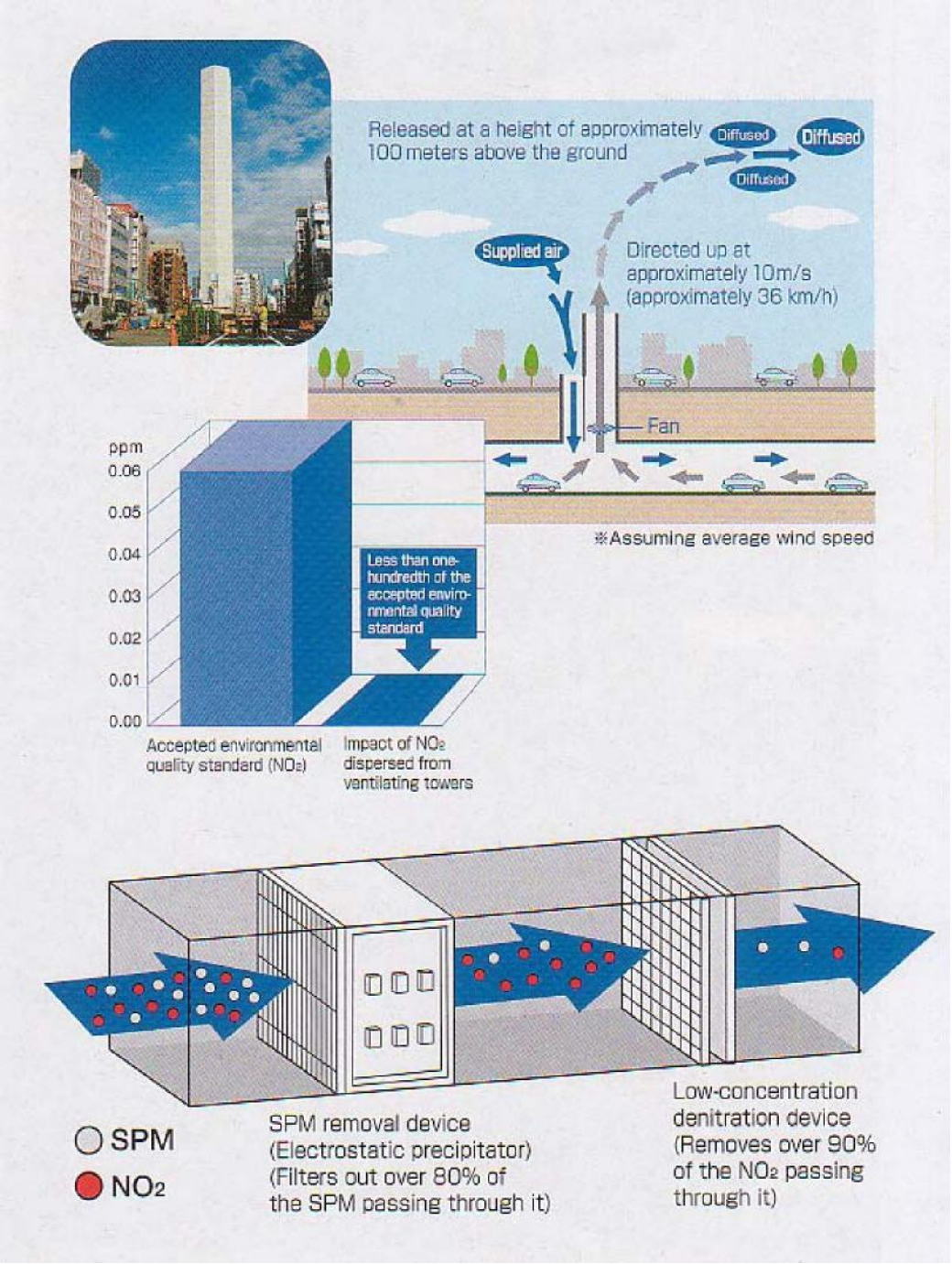


Figure 21: Noise suppression measures

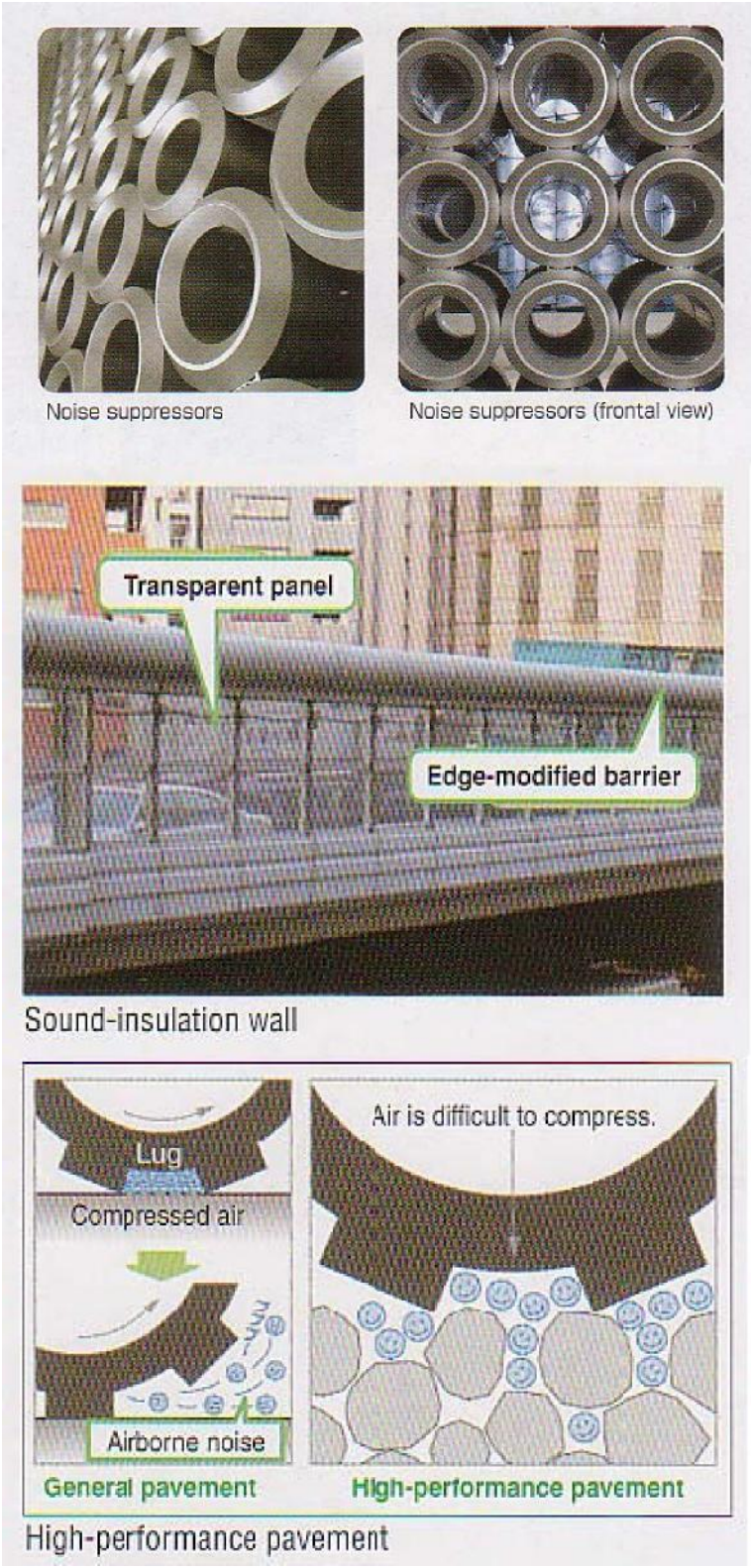
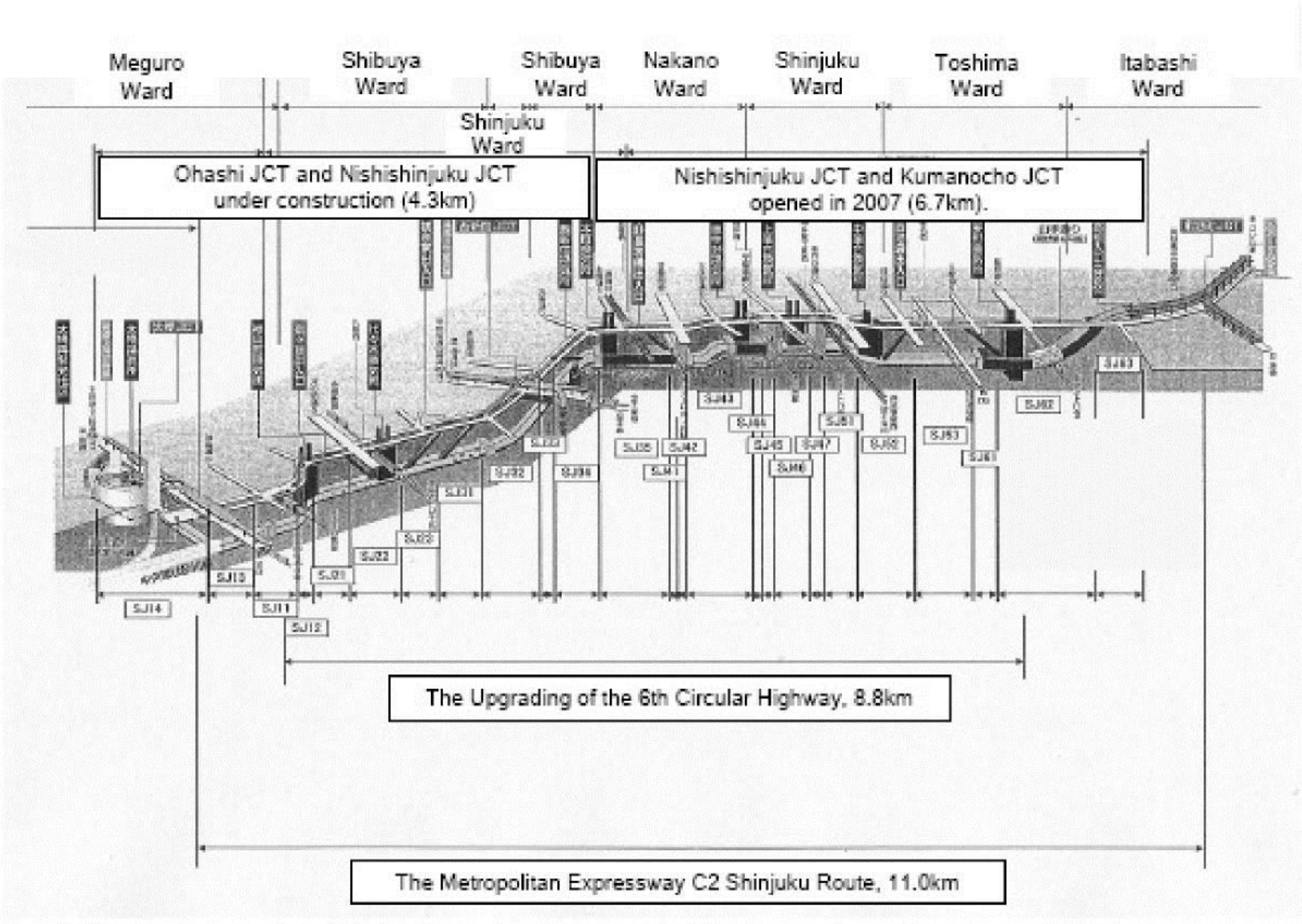


Figure 22: Major civil engineering components



D PROJECT TIMELINE

Year	Month	Type of Decision/Event	Key Decision/Event
1923	9		The Great Kanto Earthquake
	12		Special City Planning Act for rebuilding the areas destroyed by the Great Kanto Earthquake
1930			Kenzaburo Kondo experienced traffic congestion on his way to the Ceremony for the Tokyo Earthquake Rebuilding Project. In 1932, He stated that city planning for at-grade intersections was outdated, and needed to start planning for grade-separated intersections.
1938		Planning Initiation	**Masao Yamada at Home Ministry proposed 'the Plan for High Speed Road Network in Tokyo', which was the oldest plan of metropolitan expressway network.**
1939			Hideaki Ishikawa stated the concept of expressways in 'the Concept of Tokyo Metropolitan Area.'
1940			Hideaki Ishikawa indicated the concept in 'Tokyo Metropolitan Local Plan and High Speed Motorways.'
1943			Hideaki Ishikawa deepened the concept of high speed roads, and proposed that the roads should be located on either side of the existent street, and that the structure under the roads should be used for houses. He recommended his concept because it would promote fireproof buildings and improve urban aesthetic views.
1945	8		The End of the Second World War
1946	9		Special City Planning Act for rebuilding the areas destroyed by the Second World War
			Hideaki Ishikawa at Tokyo Metropolitan Government proposed high speed road network in 'the Post-war Tokyo Reconstruction Plan.'
1948	7		Act for Establishment of Ministry of Construction
1949			Kenzaburo Kondo proposed the concept of grade-separated roads.
1950	5		Comprehensive National Land Development Act
1951	6		Road Transport Act, Road Vehicles Act
			Kenzaburo Kondo with his colleagues asked the Ministry of Construction and the Ministry of Transport to grant the license to construct 24.65km of 4 lane expressways, but gave up.
1952	6		Act for the Special Measures for Road Improvement, which legalized toll roads
	6		Road Act
			Tamotsu Machida, the Secretary General of National Capital Construction Committee called for the Expressway Design Study Committee at City Panning Institute of Japan, chaired by Kenzaburo Kondo, and the Committee produced the guideline for the structural design of expressways.

Year	Month	Type of Decision/Event	Key Decision/Event
1952	8		A private company, Tokyo Expressway (Tokyo Kosoku Doro) Company, was licensed to construct 1.4 km grade-separated road that was financed by leasing rooms under the road based on the Road Transport Act. The company started construction works in 1953.
	12		The First Vehicle Origin-destination Survey conducted by Tokyo Metropolitan Government
1953	4	Planning Initiation	**National Capital Construction Committee proposed the Plan for 49.0km of Metropolitan Expressways, which was the start of planning of metropolitan expressways by the government. The Plan included 5 radial routes that connected the center of Tokyo with the 6th Circular Highway except Route 2 with Tokaido (Inter-city) Expressway (Tomei Expressway) under study. Please see Figure 21.**
	7		Act Concerning Provisional Measures for Highway Construction, which legalized earmarking of gasoline tax
1954			First Five-Year Road Improvement Program (1954-1958)
1956	4		National Capital Region Development Act
	4		Japan Highway Public Corporation Act
	4		Establishment of Japan Highway Public Corporation
1957	4		Act for Construction of Arterial Motorways for National Development
	4		National Expressway Act
	12	Planning Initiation	**Tokyo City Planning Local Committee established Special Committee for the Study of Tokyo City Planning Expressway, chaired by Genichiro Kaneko, and the Committee proposed the Plan for 62.5km of Metropolitan Expressway Network. The Plan included 8 radial routes and 7 additional comments including the addition of the circular routes, the first proposal for the circular expressways. Please see Figure 22.**
1958	3		Act Concerning Emergency Measures for Highway Construction
	3		Road Improvement Special Account Act
	7	Planning Initiation	**National Capital Region Development Committee proposed the Plan for 91.0km of Metropolitan Expressways based on National Capital Region Development Act. The Plan included 8 radial routes. The Committee also proposed continuation of investigation for circular routes.**
	7		The First National Capital Region Basic Plan

Year	Month	Type of Decision/Event	Key Decision/Event
1958	8		Road Design Standards
	11		The Vehicle Origin-destination Survey
			National Capital Region Development Plan
1959	6	Legal Decision	**Metropolitan Expressway Public Corporation Act**
	6	Legal Event	**Establishment of Metropolitan Expressway Public Corporation, for mitigating chronic traffic congestion**
	6		Opening of a section of Tokyo Expressway (Tokyo Kosoku Doro) (Dobashi - Shirobebashi)
	8	Planning Decision	**Planning Decision for 71km of Metropolitan Expressways (8 routes) including about 2km of Tokyo Expressway Company road. The Plan included 8 radial routes (2 lanes for each direction) that connected the center of Tokyo with the 6th Circular Highway going through the subcenters (Shibuya, Shinjuku and Ikebukuro) of Tokyo. While the Inner Circular Route (2 lanes for each direction) was located within 2 to 4 km from the center, the Central Circular Route was not included that would go along the 6th Circular Highway by which most of the radial routes ended. The limited capacity of the Inner Circular Route in comparison with the 8 radial routes was discussed, however, the connections with the Inter-city Expressways beyond the 6th Circular Highway were not included. The Plan adopted the design concept of continuously grade-separated intersections with crossing highways, maximum use of public lands such as wide highways and rivers even when alignment is compromised, and design speed of 60 km/h (2 lanes for each direction). The use of the space under the Expressways was not promoted. Please see Figure 23.**
	10	Implementation Decision	**Minister of Construction designated the Basic Plan based on Metropolitan Expressway Public Corporation Act.**
	12	Implementation Decision	**Decision of Project Validation for about 71km of Metropolitan Expressways (8 routes) including about 2km of Tokyo Expressway Company road.**
			Second Five-Year Road Improvement Program (1958-1962)
1960	5	Planning Initiation	**Ministry of Construction issued the note on the Plan for Street Network within the Tokyo Ward Area in relation to the Plan for the Daisan Keihin Motorway (3 lanes for each direction) connecting Tokyo and Yokohama. The note pointed out the needs for the Central Circular Expressway Route along the 6th Circular Highway and the extensions of the radial expressways to the Outer Circular Expressway Route located along the 8th Circular Highway or beyond it.**

Year	Month	Type of Decision/Event	Key Decision/Event
1960	6		Shinjuku Subcenter Development Plan by Tokyo Metropolitan Government
	6		Road Traffic Act
		Planning Initiation	Metropolitan Expressway Public Corporation conducted traffic demand forecasting study for 1965 and 1970 based on the Vehicle Origin-destination Survey in 1958. It applied traffic assignment method for the first time and produced the estimate of traffic volume on each section of the Expressway Network. The study found that traffic demand would reach the capacity of most sections of the Network (2 lanes for each direction), and exceed the capacity of several sections of the Inner Circular Route. The results of the study lead to the extension plan for the Metropolitan Expressway Network.
1961	3		Metropolitan Transport Policy Committee, called for by the Governor of Tokyo Metropolitan Government, proposed new Outer Circular Expressway Route that connected long-distance (inter-city) expressways with Metropolitan Expressway Network, the second Inner Circular Expressway Route that complemented the first Inner Circular Expressway Route, and other extensions.
			Third Five-Year Road Improvement Program (1961-1965)
1962	1		The Director of City Bureau, Ministry of Construction advised the Governor of Tokyo Metropolitan Government to amend the current plan significantly for meeting future traffic demand, while Ministry of Construction immediately made an extension plan of Metropolitan Expressway Network in order to mitigate serious traffic congestion in urban areas.
	5		Hanshin Expressway Public Corporation Act
	5		Establishment of Hanshin Expressway Public Corporation

Year	Month	Type of Decision/Event	Key Decision/Event
1962	9	Planning Initiation	**Metropolitan Expressway Public Corporation called for the Committee for the Study on Connections between Metropolitan Expressways and Inter-city Expressways for 1980, chaired by Yoshinosuke Yasoshima at City Planning Association of Japan in 1966, and the Committee proposed the Extension Plan for 161km of Metropolitan Expressway Network including two new circular routes and 11 extended radial routes in 1962. The Plan included the Central Circular Route as well as the Second Inner Circular Route, while the Committee did not include the Outer Circular Route within the scope of the Study. As of design speed, the Committee proposed 60km/h for the area surrounded by the Central Circular Route including the Route itself, and 80km/h for the area beyond the Central Circular Route, considering the connections between Metropolitan Expressways and Inter-city Expressways whose design speed ranged from 80 to 120km/h. The Committee also proposed 3 lane expressways for each direction for some sections of the Metropolitan Expressway Network. Please see Figure 24.**
	10		Comprehensive National Development Plan
	12	Implementation Event	**The First Opening of a 4.5km section of Metropolitan Expressway Route 1 (Kyobashi - Shibaura)**
			National Capital Region Development Plan
1963	7		Opening of a section of Meishin Expressway (Ritto - Amagasaki), which was the first Inter-city Expressway
1964	9	Planning Initiation	**The Director of City Bureau, Ministry of Construction committed 'the Large City Major Highway Study' to Tokyo Metropolitan Government. Based on the Study by City Planning Association of Japan in 1962, the study included 145km of new routes of two Circular Routes and 12 Radial Routes in 1962 and 1963, while it included 118km of new routes of two Circular and 9 Radial Routes in 1964. The Study included the Central Circular Expressway Route and proposed 2 lanes for each direction for the Routes. The Study also confirmed that the capacity of new routes would meet the demand for most of the sections. Please see Figure 25.**
	10		Tokyo Olympic Games for which the construction of Metropolitan Expressways was accelerated
			Fourth Five-Year Road Improvement Program (1964-1968)
1965	7		Opening of Meishin Expressway between Nagoya and Kobe (Komaki - Nishinomiya), which was the first Inter-city Expressway

Year	Month	Type of Decision/Event	Key Decision/Event
1966	7		Major Amendments to Act for Construction of Arterial Motorways for National Development. The Cabinet approved construction of 'Arterial Motorways for National Development' (32 routes, 7600km).
	7		Opening of Tokyo Expressway (Tokyo Kosoku Doro) (Horaibashi - Shinkyobashi)
1967	4	Political Event	**Ryokichi Minobe became the Governor of Tokyo who stopped the construction of the Central Circular Expressway Route as well as the Outer Circular Expressway Route because of environmental issues.**
	7		Metropolitan Expressway Inner Circular Route was finished upon completion of the section between Shiba Koen Park and Kasumigaseki.
			Fifth Five-Year Road Improvement Program (1967-1971)
1968	3	Planning Decision	**Special Committee for the Study of Tokyo City Planning Expressway, chaired by Genichiro Kaneko, deliberated on the Plan for Metropolitan Expressway Extensions. The Committee proposed the extensions of Route 3 and Route 4 as well as the Outer Circular Route, which would pass through the process of Planning Decision by Tokyo City Planning Local Committee in 1966. The Committee proposed the Plan for Metropolitan Expressway Extensions including the Central Circular Route and the Plan was approved in 1968. Please see Figure 26.**
	6		Major Amendments to City Planning Act
	7		Opening of Metropolitan Expressway Kanagawa Routes
	10		The Second National Capital Region Basic Plan
1969	5		New (Second) Comprehensive National Development Plan
	5		Opening of Tomei Expressway between Tokyo and Nagoya (Tokyo - Komaki)
	6		Urban Redevelopment Act
1970	3	Planning Decision	**National Capital Region Development Plan included the Central Circular Expressway Route as being promoted.**
			Sixth Five-Year Road Improvement Program (1970-1974)
1971	12		Metropolitan Expressway Route 3 (Shibuya Line) opened between Shibuya and Yoga and was connected with Tomei (Inter-city) Expressway.
1973			Seventh Five-Year Road Improvement Program (1973-1977)
1976	5		Metropolitan Expressway Route 4 (Shinjuku Line) was connected with Chuo (Inter-city) Expressway.

Year	Month	Type of Decision/Event	Key Decision/Event
1976	11		The Third National Capital Region Basic Plan
1977	3		National Capital Region Development Plan included the Central Circular Expressway Route as being promoted.
	11		Third Comprehensive National Development Plan
1978			Eighth Five-Year Road Improvement Program (1978-1982)
1979	4	Political Event	**The term of Ryokichi Minobe as the Governor of Tokyo ended.**
	7		Fire at Nihonzaka Tunnel of Tomei Expressway
1981	3		National Capital Region Development Plan included the Central Circular Expressway Route as being promoted.
1982	3	Implementation Event	**Opening of a section of Metropolitan Expressway C2 Route (Senjushinbashi - Horikiri JCT)**
	12	Planning Decision	**Tokyo Metropolitan Government Long-term Plan included the Central Circular Expressway Route as being planned.**
1983	11	Implementation Event	**Opening of a section of Metropolitan Expressway C2 Route (Yotsugi - Horikiri JCT)**
			Ninth Five-Year Road Improvement Program (1983-1987)
1985	1		Opening of Tokyo 7th Circular Highway
	12		Japan National Railways Reconstruction Promotion Special Measures Act
1986	1		The Committee for Construction of Arterial Motorways for National Development decided a new Plan for Arterial Motorways for National Development (Basic Route Plan, 7122km, and Construction Plan, 6411km)
	6		The Fourth National Capital Region Basic Plan
	11	Planning Decision	**The Second Tokyo Metropolitan Government Long-term Plan included the Central Circular Expressway Route as being promoted.**
	12		National Capital Region Development Plan included the Central Circular Expressway Route as being implemented.
1987	4		Privatization of Japan National Railways, based on Japan National Railways Restructuring Act in 1986
	6		Fourth Comprehensive National Development Plan
	9	Implementation Event	**Opening of sections of Metropolitan Expressway C2 Route (Yotsugi - Kasai JCT, Senjushinbashi - Kohoku JCT)**
1988			Tenth Five-Year Road Improvement Program (1988-1992)

Year	Month	Type of Decision/Event	Key Decision/Event
1990	2		Amendments to City Planning Decision of No.12 (Oedo) Subway Line by Tokyo Metropolitan Government (Shinjuku - Nerima)
	7	Planning Decision	Environmental Impact Assessment by Tokyo Metropolitan Government (Aobadai in Meguro Ward - Minaminagasaki in Toshima Ward, 8.7km)
	8	Planning Decision	**City Planning Decision of Metropolitan Expressway C2 Shinjuku Route by Tokyo Metropolitan Government (Aobadai in Meguro Ward - Minaminagasaki in Toshima Ward, 8.7km), by which C2 Shinjuku Route was determined to be built with underground rather than elevated structure.**
	11	Planning Decision	**The Third Tokyo Metropolitan Government Long-term Plan included the Central Circular Expressway Route as being promoted and completed within the 20th Century.**
	12	Implementation Decision	Minister of Construction designated the Basic Plan for Metropolitan Expressway C2 Shinjuku Route (Aobadai in Meguro Ward - Minaminagasaki in Toshima Ward, 8.7km)
1991	2		The End of Bubble Economy in Japan
	2	Implementation Decision	Approval of Construction Work Plan for Metropolitan Expressway C2 Shinjuku Route by Ministry of Construction (Aobadai in Meguro Ward - Minaminagasaki in Toshima Ward, 8.7km)
	3	Implementation Decision	Decision of Project Validation for Metropolitan Expressway C2 Shinjuku Route by Ministry of Construction (Aobadai in Meguro Ward - Minaminagasaki in Toshima Ward, 8.7km)
	9		National Capital Region Development Plan included the Central Circular Expressway Route as being implemented.
1992	8	Implementation Event	**Ceremony for the start of Metropolitan Expressway C2 Shinjuku Route construction at Nishishinjuku**
	11		Opening of a section of the Outer Circular Expressway (Misato - Wako)

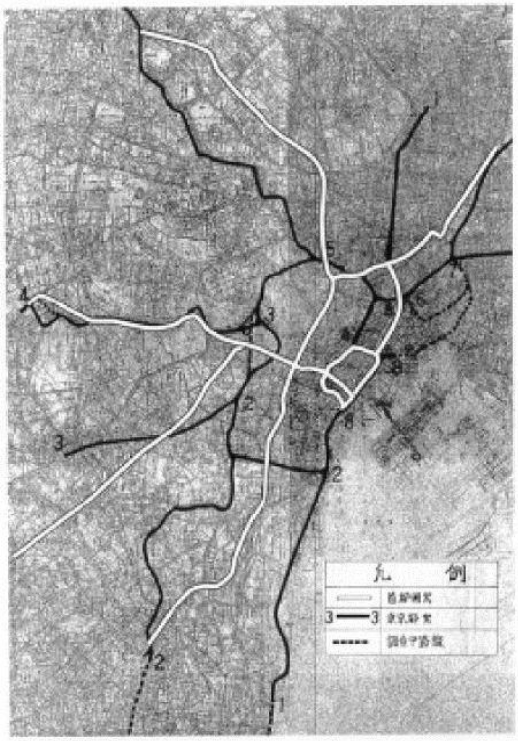
Year	Month	Type of Decision/Event	Key Decision/Event
1993	2	Planning Decision	**City Planning Decision of Metropolitan Expressway C2 Shinjuku Route by Tokyo Metropolitan Government (Minaminagasaki in Toshima Ward - Nakamarucho in Itabash Ward, 1.7km), by which the section near Takamatsu entry was also determined to be built with underground rather than elevated structure. The section would have been determined to be built with elevated structure for the first City Planning Decision.**
	8	Implementation Decision	Minister of Construction designated the Basic Plan for Metropolitan Expressway C2 Shinjuku Route (Aobadai in Meguro Ward - Kumanocho in Itabashi Ward, 11.0km)
	10		Metropolitan Expressway Route 5 (Ikebukuro Line) was connected with the Outer Circular Expressway.
	11		Environmental Basic Act
			Eleventh Five-Year Road Improvement Program (1993-1997)
1994	3	Implementation Decision	Approval of Construction Work Plan for Metropolitan Expressway C2 Shinjuku Route by Ministry of Construction (Aobadai in Meguro Ward - Kumanocho in Itabashi Ward, 11.0km)
1994	3	Implementation Decision	Decision of Project Validation for Metropolitan Expressway C2 Shinjuku Route by Ministry of Construction (Aobadai in Meguro Ward - Nakamarucho in Itabashi Ward, 10.4km)
	5		Opening of Euro Tunnel
1995	1		The Great Hanshin-Awaji Earthquake
	5		Metropolitan Expressway Public Corporation started the reinforcement of bridge piers according to the lessons from the Great Hanshin-Awaji Earthquake.
1996	8		National Capital Region Development Plan included the Central Circular Expressway Route as being implemented.
			Recovery of Hanshin Expressway Service from the Great Hanshin-Awaji Earthquake
1997	6		Environmental Impact Assessment Act
	12	Implementation Event	Opening of Aqualine Expressway, which crossed the Tokyo Bay
	12		Opening of a section of No.12 (Oedo) Subway Line (Shinjuku - Nerima), which went through the space below the tunnel for Metropolitan Expressway C2 Shinjuku Route.

Year	Month	Type of Decision/Event	Key Decision/Event
1998	3		Fifth Comprehensive National Development Plan
			New Five-Year Road Improvement Program
1999	3		The Fifth National Capital Region Basic Plan
	4	Planning Decision	Amendments to City Planning Decision of Metropolitan Expressway C2 Shinjuku Route by Tokyo Metropolitan Government (Aobadai in Meguro Ward - Takamatsu in Toshima Ward, 10.1km), by which the route between Tomigaya entry/exit and Ohashi JCT was changed.
2000	8	Implementation Decision	Minister of Construction designated the Amendments to the Basic Plan for Metropolitan Expressway C2 Shinjuku Route (Aobadai in Meguro Ward - Kumanocho in Itabashi Ward, 11.0km)
2001	10		National Capital Region Development Plan included the Central Circular Expressway as being primarily promoted.
2002	1	Implementation Decision	Approval of Amendments to Construction Work Plan for Metropolitan Expressway C2 Shinjuku Route by Ministry of Land, Infrastructure and Transport (Aobadai in Meguro Ward - Kumanocho in Itabashi Ward, 11.0km)
	12	Implementation Event	**Opening of a section of Metropolitan Expressway C2 Route (Itabashi JCT - Kohoku JCT)**
2004	1	Planning Decision	City Planning Decision of Ohashi Urban Redevelopment Project by Tokyo Metropolitan Government (3.8ha)
	4	Implementation Decision	Decision of Amendments to Project Validation for Metropolitan Expressway C2 Shinjuku Route by Ministry of Land, Infrastructure and Transport (Aobadai in Meguro Ward - Nakamarucho in Itabashi Ward, 10.4km)
	11	Planning Decision	City Planning Decision of Metropolitan Expressway C2 Shinagawa Route by Tokyo Metropolitan Government
2005	7		National Spatial Planning Act
	10	Legal Decision	**Metropolitan Expressway Co.,Ltd. was established, the privatization of Metropolitan Expressway Public Corporation.**

Year	Month	Type of Decision/Event	Key Decision/Event
2006	3		Agreement with Japan Expressway Holding and Debt Repayment Agency was concluded, and license to operate was granted by Ministry of Land, Infrastructure and Transport.
	3	Implementation Decision	Minister of Land, Infrastructure and Transport approved the project of Metropolitan Expressway C2 Shinjuku Route (Honcho 3chome in Shibuya Ward - Kumanocho in Itabashi Ward, 11.0km)
	11		The start of Metropolitan Expressway C2 Shinagawa Route construction
	12	Planning Decision	Amendments to City Planning Decision of Metropolitan Expressway C2 Shinjuku Route by Tokyo Metropolitan Government (Aobadai in Meguro Ward - Takamatsu in Toshima Ward, 10.1km)
2007	3	Implementation Decision	Approval of Amendments to Project Validation for Metropolitan Expressway C2 Shinjuku Route by Tokyo Metropolitan Government (Aobadai in Meguro Ward - Kumanocho in Itabashi Ward, 10.4km)
	7		Metropolitan Expressway Co.,Ltd. named the tunnel of Metropolitan Expressway C2 Shinjuku Route as 'Yamate Tunnel.'
2007	12	Implementation Event	**Opening of a section of Metropolitan Expressway the Central Circular (C2) Shinjuku Route (Nishishinjuku JCT - Kumanocho JCT, 6.7km), linking Metropolitan Expressways Route 4 (Shinjuku Line) and Route 5 (Ikebukuro Line).**
2008	7		First National Spatial Plan (National Plan)
2009	-	Implementation Event	Opening of a section of Metropolitan Expressway C2 Shinjuku Route (Nishishinjuku JCT - Ohashi JCT, 1.7km), completing Shinjuku Route and linking Metropolitan Expressways Route 4 (Shinjuku Line) and Route 3 (Shibuya Line)
2013	-	Implementation Event	Opening of Metropolitan Expressway C2 Shinagawa Route (Ohashi JCT - Kumanocho Junction part, 7km), completing Metropolitan Expressway the Central Circular (C2) Route (49.9km)

Figure 23: National Capital Construction Committee proposed the plan for 49km of Metropolitan Expressways in 1953

Figure 24: Special Committee for the Study of Tokyo City Planning Expressway proposed the plan for 62.5km of Metropolitan Expressway Network in 1957



Note: The white lines show the Plan indicated in Figure 21.

Figure 25: Planning decision for about 71km of Metropolitan Expressways (eight routes) in 1959

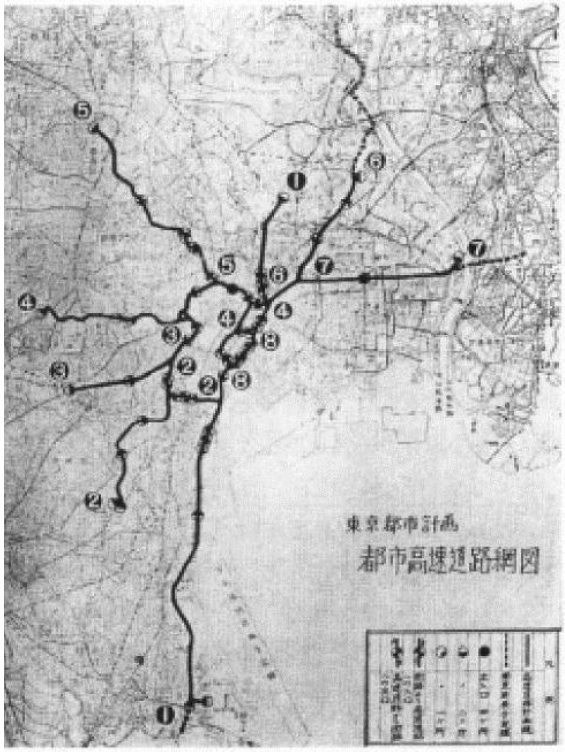


Figure 26: City Planning Association of Japan proposed the Extension Plan for 161km of Metropolitan Expressway Network in 1962

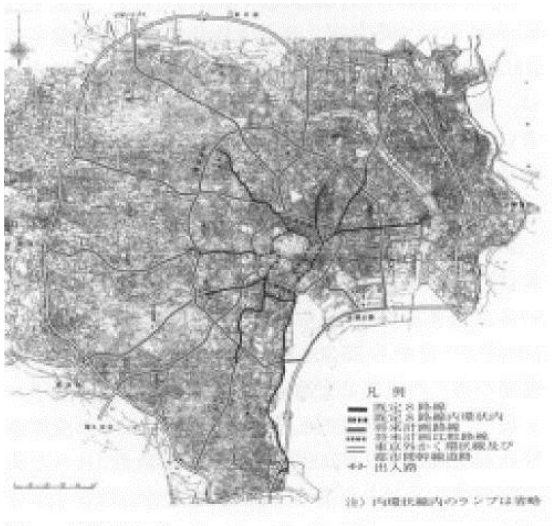
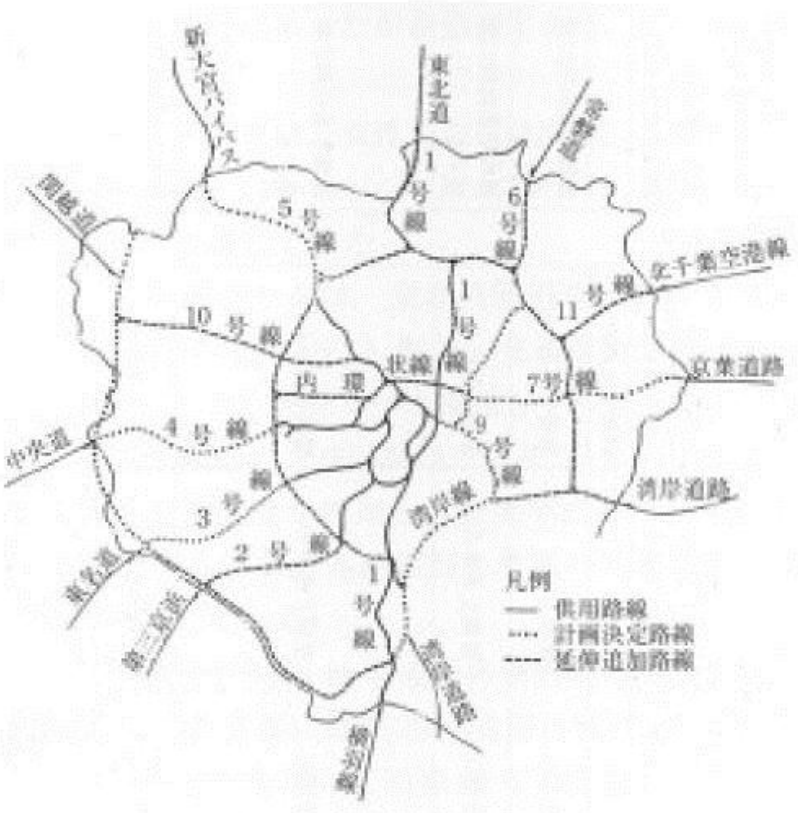


Figure 27: Tokyo Metropolitan Government proposed 118km of new Metropolitan Expressway routes of two circular and nine radial routes including the central circular Expressway Route in 1964

Figure 28: Special Committee for the Study of Tokyo City Planning Expressway proposed the plan for 335.79km of Metropolitan Expressway Extensions including the Central Circular Route in 1968



Key timeline issues

Since the first section of the Metropolitan Expressway was opened in 1962, the Metropolitan Expressway Co. Ltd (former Metropolitan Expressway Public Corporation) had adopted elevated structure for building expressways in principle because of cost. However, when the Metropolitan Expressway C2 Route was included in the Plan for Metropolitan Expressway Extensions in 1968, the Metropolitan Expressway Public Corporation experienced many objections from residents living along the western and southern sections of the Metropolitan Expressway C2 Route because of environmental concerns during the early 1970s. The Corporation also experienced serious objections from the local people again during the process for the City Planning Decision of the northern section with elevated structure in 1986 that went through the densely inhabited area. Finally the Metropolitan Expressway Public Corporation in consultation with Tokyo Metropolitan Government decided to adopt underground instead of originally planned elevated structure for the western section, the Metropolitan Expressway C2 Shinjuku Route, and obtained the first City Planning Decision for the western section by Tokyo Metropolitan Government in 1990, which was one of the most important key timeline issues.

To adopt underground structure is one thing, to construct it is another. When the Aqualine Expressway that went underground and crossed the Tokyo Bay opened in 1997, the project provided good opportunity for research and development of the shield tunnel method for the expressway project. The Metropolitan Expressway Public Corporation designed the construction works by assuming the open cut method for the most part of the project in the early 1990s; however, it was extremely difficult to implement the open cut method under the 6th Circular Highway because of space constraints and interruptions in surface traffic and living environment. The Corporation changed the policy and designed the construction works by assuming the shield method in the late 1990s. In the 2000s, private construction companies developed innovative shield tunnel methods further and they contributed to shortening the schedule and reducing the cost for the construction of the Metropolitan Expressway C2 Shinjuku Route. It is also noted that safety and environmental measures for road tunnels have been developed and implemented in the project.

Learning lessons from the experiences in the 1970s and 1980s, the Metropolitan Expressway Public Corporation paid much respect to the opinions from the public. It is noted that the Metropolitan Expressway Public Corporation decided to change the original plan of 10.1km of the Metropolitan Expressway C2 Shinjuku Route in the late 1980s because the Corporation experienced many objections from residents at the northern part of the Route where elevated structure was proposed to connect the elevated structure of the radial Metropolitan Expressway Route 5 and the underground structure of the southern part of the Shinjuku Route. The Corporation conducted the process of the City Planning Decision of 8.7km of the southern part of the Shinjuku Route in 1990 and later obtained the City Planning Decision of the remaining 1.7km of the amended northern part in 1993 by minimizing the part of the elevated structure. During the construction works of the Shinjuku Route, the Metropolitan Expressway Public Corporation tried best to collect opinions and requests from the residents along the Route.

Sources: Furukawa, H., 'History of Improvement of Metropolitan Expressway Network (1),' Expressways and Automobiles 2007; 50(8): 30-34 (in Japanese); Furukawa, H., 'History of Improvement of Metropolitan Expressway Network (2),' Expressways and Automobiles 2007; 50(9): 38-43 (in Japanese); Metropolitan Expressway Co. Ltd, 'Corporate Profile 2007,' 2007; Morichi, S. and Yai T., 'Future of Social Infrastructure,' Nikkei Publishing Inc. 1999 (in Japanese). Ohta, K., ‘The Development of Japanese Transportation Policies in the Context of Regional Development,’ Transportation Research 1989; 23A(1): 91–101; Yoji, N, 'A Note on some Concepts before Metroplitan Expressway Plans,' Expressways and Automobiles 1979; 22(7) (in Japanese); Yoji, N, 'A Historical Review of Metropolitan Expressway Route

Plans 1,' Expressways and Automobiles 1980; 23(1) (in Japanese); Yoji, N, 'A Historical Review of Metropolitan Expressway Route Plans 2,' Expressways and Automobiles 1980; 23(3) (in Japanese).

E PROJECT FUNDING/FINANCING

Introduction

The Metropolitan Expressway Co. Ltd is in charge of the construction, maintenance and administration of the Metropolitan Expressway, including the Metropolitan Expressway C2 Shinjuku Route. Under the motto “Networking People, Communities and Daily Lives,” the company is making effort to ensure that the Metropolitan Expressway forming the transportation artery for the Tokyo Metropolitan Area can be used more safely, smoothly and comfortably. The profile of the Metropolitan Expressway Co. Ltd is shown in Table 5. The stocks are owned by relevant national and local governments. Because the Metropolitan Expressway C2 Shinjuku Route is only a section of the 293.5km Metropolitan Expressway Network, some aspects of funding/financing for the project are hard to retrieve from the company funding/financing record.

The Metropolitan Expressway Co. Ltd was established by the privatization of the former Metropolitan Expressway Public Corporation in 2005. While the Metropolitan Expressway Public Corporation, as well as other highway-related public corporations such as the Japan Highway Public Corporation and the Hanshin Expressway Public Corporation, owned expressway infrastructure (assets), the infrastructure belongs to the Japan Expressway Holding and Debt Repayment Agency after the privatization. In the next section, background of the privatization and the organizational/financial relationships among the Metropolitan Expressway Co., Ltd, the Japan Expressway Holding and Debt Repayment Agency and others are explained.

Background to funding/financing

When Junichiro Koizumi became the Prime Minister in 2001, the privatization of the four highway-related public corporations including the Metropolitan Expressway Public Corporation was one of the major agendas for his cabinet as a part of the Cabinet Decision of the Reorganization and Rationalization Plan for Special Public Institutions in 2001 for overcoming prolonged economic slump. The Prime Minister established the Promotion Committee for the Privatization of the Four Highway-related Public Corporations, based on the Promotion Committee for the Privatization of the Four Highway-related Public Corporations Establishment Act in 2002. The objective of the Committee was to examine as a whole both new organizational modalities premised on the privatization replacing the Japan Highway Public Corporation, the Metropolitan Expressway Public Corporation, the Hanshin Expressway Public Corporation and the Honshu-Shinkoku Bridge Authority, and ways to ensure the economic viability, based on the Reorganization and Rationalization Plan for Special Public Institution. The Committee discussed many issues such as huge amount of debt owed by the corporations, construction of new expressways whose traffic forecasts were low and inefficient management of the corporations. The Committee finally proposed the privatization of the four highway-related public corporations in 2002. The four Acts regarding the privatization of the four highway-related public corporations were legislated in 2004 and the corporations were actually privatized and the six private Expressway Companies as well as the Japan Expressway Holding and Debt Repayment Agency were established in 2005. The outline of the privatization is indicated in Figure 27.

According to the Ministry of Land, Infrastructure and Transport, the privatization of the four highway-related public corporations would contribute to securing repayment of interest-bearing debts, about USD 400bn in total and about USD 50bn for the Metropolitan Expressway Public Corporation (1USD=100JPY), to construction, without delay, of genuinely needed expressways with a minimum burden on the general public, while paying due

respect to the autonomy of the Companies, and to offering of diverse and flexible prices and services by utilizing the private sector's know-how.

After the privatization, the ownership of the expressway infrastructure was separated from the Metropolitan Expressway Co., Ltd, and given to the Japan Expressway Holding and Debt Repayment Agency in 2006. The objectives of the Japan Expressway Holding and Debt Repayment Agency are to reduce the burden on the general public concerning expressways and to support successful operation of expressway business activities by the Expressway Companies through holding and leasing highway assets related to expressways and repaying debts in a secure manner at an early opportunity. The debts inherited from the public corporations and new debts acquired from the Expressway Companies are supposed to be fully repaid within 45 years from the privatization of four highway-related public corporations with the rent paid by the Expressway Companies. Upon full repayment of the debts, the expressways will belong to the respective highway administrators. The Agency executes part of the authority as a proxy instead of the respective highway administrator. The flow of highway assets debts is shown in Figure 28.

The scope of the Agency's business in relation to the Metropolitan Expressway Co. Ltd Includes:

- Holding of highway assets relating to expressways and their leasing to the Companies;
- Repayment of inherited debts (including repayment of debts relating to money borrowed to effect repayment);
- Acceptance of debts borne by any of the Companies to pay the costs of new construction, reconstruction, repair or restoration from disaster of expressways under the Agreement, and repayment of such debts (including repayment of debts relating to money borrowed to effect repayment);
- Provision of interest-free loans, financed with subsidies granted by the national government or local public entities prescribed by Cabinet order, to Metropolitan Expressway Co., Ltd or Hanshin Expressway Co. Ltd to cover part of funds to pay the costs of new construction or reconstruction of the Metropolitan Expressway or Hanshin Expressway;
- Provision of interest-free loans, financed with subsidies granted by the national government, to the Companies to cover part of funds to pay the costs of restoration of expressways after disasters;
- Provision of interest-free loans, financed with subsidies granted by local public entities prescribed by Cabinet order, to Metropolitan Expressway Co. Ltd or Hanshin Expressway Co. Ltd to cover part of funds to pay the costs of new construction, reconstruction, repair or restoration from disaster of the Metropolitan Expressway or Hanshin Expressway;
- Subsidization necessary to facilitate a reduction in costs of new construction, reconstruction, maintenance, repair and other aspects of management of expressways by the Companies' own efforts;
- Where any of the Companies is to engage in new construction work, reconstruction, maintenance, repair or perform other aspects of expressway management, the exercise of authority on behalf of the pertinent highway administrator and other related action to be exercised regarding pertinent expressways under the Act concerning Special Measures for Highway Improvement.

As a rule, highway assets constructed by the Company shall belong to the Agency after the completion of construction, and, at the same time, the debts borne by the Companies for construction shall be accepted by the Agency.

The Agency, when intending to undertake a business operation, is required to enter in advance into an agreement with the Expressway Company concerned, prescribing in total the conditions of lease regarding the highway assets the Agency is to lease to the Expressway Company for each expressway belonging to the national highway network, the regional highway network such as the Metropolitan Expressway Network, or independent general toll roads. When an agreement has been entered into, the Agency is required to formulate a business operation program that specifies details of the income and expenditure budget (debt repayment plan) of the Agency in addition to the items prescribed in the agreement (except the sums of tolls to be collected by the Expressway Company and the duration of collection), and submit it to the Minister of Land, Infrastructure and Transport for his or her approval. In addition, the Expressway Company that enters into an agreement with the Agency is required to operate its business under the agreement subject to permission by the Minister of Land, Infrastructure and Transport.

The Agency has formulated a debt repayment plan under which it will repay within 45 years, without fail, the debts that will arise from the construction or reconstruction of new expressways and the repair of existing ones as well as the debts inherited from the four defunct public corporations. The Agency, by using the latest expertise and information, has made a reasonable and conservative forecast on both the growth rate of the economy that constitutes a major premise of the lease income and the long-term interest rates that vitally affect its outlays. By doing so, it has formulated a highly reliable debt repayment plan.

As one of the Expressway Companies, the Metropolitan Expressway Co. Ltd must conclude an agreement with the Japan Expressway Holding and Debt Repayment Agency in advance to execute a project. The agreement covers items including an outline of the work, the ceiling amount of liabilities underwritten by the Agency, the assortment of road assets loaned, the loan fee and term, the tolls to be collected by the company, and the collection term.

On the occasion of opening, the Agency takes over the expressway (assets) newly constructed or improved by the Metropolitan Expressway Co. Ltd and the requisite cost (liabilities), and loans the assets to the Metropolitan Expressway Co., Ltd. The Metropolitan Expressway Co. Ltd pays toll revenue as a loan fee to the Agency after subtracting expenses of maintenance and management, and the Agency pays off the debt from this fee.

As of the permission of operation and approval of business operation programs, after obtaining the consent of the road administrator (consent must be determined by the assembly of the local government in question), the Metropolitan Expressway Co., Ltd must obtain permission of the operation from the Ministry of Land, Infrastructure and Transport, who also must approve the business operation programs submitted by the Agency.

The Japan Expressway Holding and Debt Repayment Agency and the Metropolitan Expressway Co. Ltd concluded an agreement on 31 March 2006. The Agency obtained approval of business operation programs and the Metropolitan Expressway Co. Ltd obtained permissions of their operations from the Minister of Land, Infrastructure and Transport. The scheme of implementation of expressway business by the Agency and the Metropolitan Expressway Co. Ltd is indicated in Figure 29.

Table 5: Profile of the Metropolitan Expressway Co. Ltd as of 31 March 2008

Name		Metropolitan Expressway Co., Ltd.
Address of Head Office		100-8930 1-4-1 Kasumigaseki, Chiyoda Ward, Tokyo
Date of Establishment		1 October 2005
Capital		135 million USD (1USD=100JPY)
Operating Income	(Consolidated)	4.44910 billion USD
	(Non-consolidated)	4.43158 billion USD
Asset	(Consolidated)	4.54814 billion USD
	(Non-consolidated)	4.49063 billion USD
Number of Employees	(Consolidated)	2621
	(Non-consolidated)	1158
Major Stock Holders		Minister of Land, Infrastructure and Transport 49.99% Tokyo Metropolitan Government 26.72% Kanagawa Prefecture 8.28% Saitama Prefecture 5.90% Yokohama City 4.45% Kawasaki City 3.82% Chiba Prefecture 0.80%

Figure 29: Outline of the privatization of the four highway-related public corporations

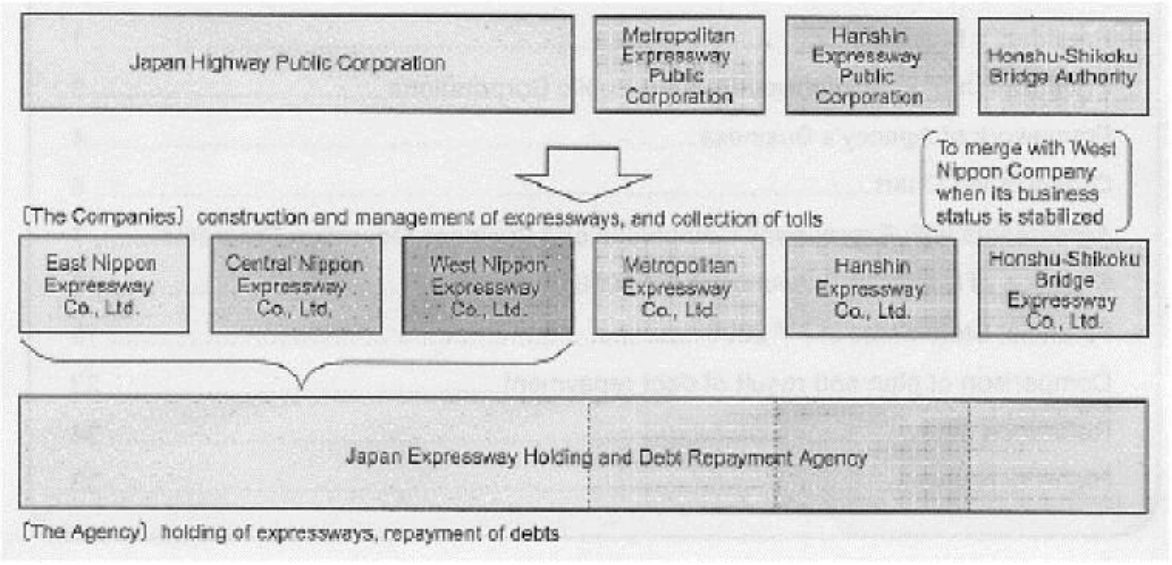


Figure 30: Highway assets debts flow

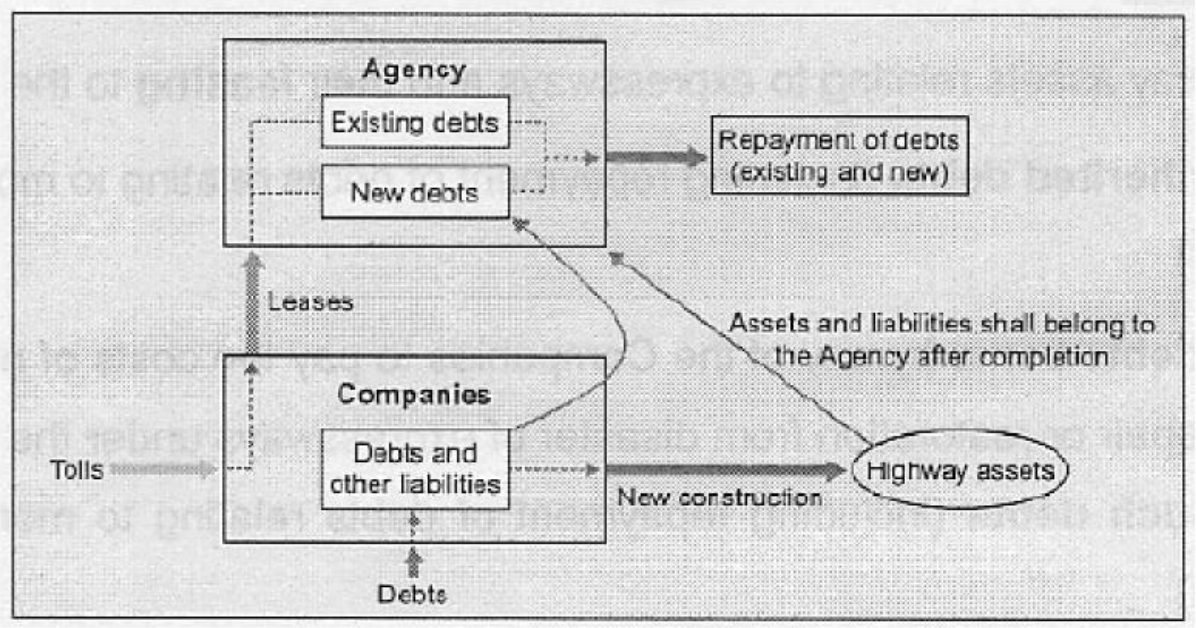
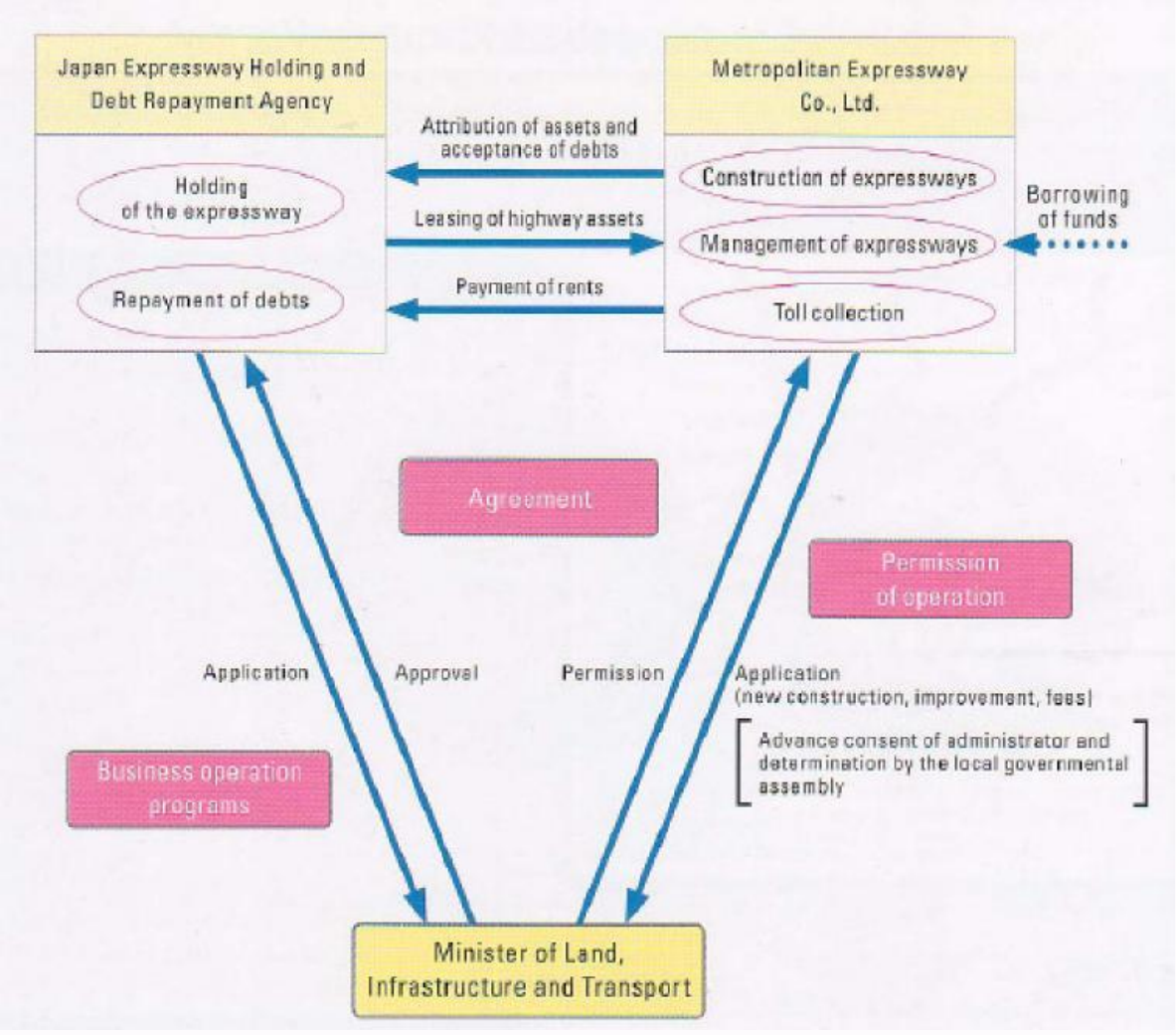


Figure 31: The scheme of implementation of Expressway business by the Japan Expressway Holding and Debt Repayment Agency and the Metropolitan Expressway Co. Ltd



Role of traffic forecasts

After the Government Policy Evaluations Act was legislated in 2001, an administrative organ must study and acquire information on the effects of policy under its jurisdiction at the appropriate time, and on the basis of such study, evaluate own policy from the standpoints of necessity, efficiency, effectiveness, or other standpoints as special characteristics of the policy may require, and appropriately reflect results of such evaluation in the planning and development of the policy. Road projects such as expressway projects must also be exposed to evaluation procedure before accepting/rejecting possible projects and re-evaluation procedure when ten years pass after the project commences. The volume of forecast traffic is one of the major inputs on which calculation of benefits including travel time savings, reduction in traffic accidents and reduction in operational costs are dependent.

According to the re-evaluation report of the Metropolitan Expressway C2 Shinjuku Shinjuku Route (Ohashi Junction – Kumanocho Junction, 11km) published by the Ministry of Land, Infrastructure and Transport in 2005, the traffic volume was planned to be 49,000 to 80,000 per day and cost benefit ratio was calculated as 2.3 and net present value as USD 10.866bn (1USD=100JPY). The base year was set in 2004 and the evaluation term from 1990 to 2046, 40 years after the opening in 2006 (later re-scheduled in 2009 following the opening of the section between Nishishinjuku Junction and Kumanocho Junction in 2007) with social discount rate of 4%. Total cost was estimated to be USD 8.477bn, while total benefit was estimated to be USD 19.343bn. Out of the total benefit, the shares of travel time savings, reduction in traffic accidents and reduction in operational costs were 93.9%, 4.3% and 1.7% respectively. The total cost was divided into two items, construction and maintenance costs, the shares of which were 93.0% and 7.0%.

The flows of benefit and cost over the evaluation period from 1990 to 2046 are indicated in Table 6. It is noted that maintenance cost per km is set to be relatively high because the Metropolitan Expressway C2 Shinjuku Shinjuku Route mostly goes through an underground tunnel. According to the comparison between elevated and underground structures in terms of expressway construction and maintenance costs per km, underground structure is higher by about 1.7 to 3.0 times for construction cost (excluding land acquisition) and by about 4.4 times for maintenance cost than elevated structure. Major reasons are that ventilation and safety facilities are necessary and constructions of on/off ramps become complicated for underground expressways. However, the cost benefit ratio and the net present value are still supportive for accepting the project.

In addition to cost benefit ratio and net present value of the project as the premises for accepting/rejecting possible projects, there are several qualitative indices based on which the effectiveness and necessity of the project are evaluated. The results for the Metropolitan Expressway C2 Shinjuku Route were indicated in Table 7. The indices are categorized into five major items: activity, living, safety, environment and others. The Metropolitan Expressway C2 Shinjuku Route was expected to contribute to most of the items especially in the activity item because the section would constitute a major part of circular road network in the Tokyo Metropolitan Area and mitigate congestion and environmental problems on the Inner Circular Route and existing general highways.

As of the traffic forecast method, the Ministry of Land, Infrastructure and Transport used the three step travel forecasting method based on the Road Traffic Census in 1999, and followed the Cost Benefit Analysis Manual issued by the Ministry in 2003. The study area contained 1,527.0km major highways and 9,597.2km minor highways as well as the 11.0km Metropolitan Expressway C2 Shinjuku Route (Ohashi Junction – Kumanocho Junction) within the area of Tokyo 23 wards. The Ministry adopted diversion functions predicting the split between expressway and highway trips and equilibrium assignment method with link performance functions. In order to calculate the benefit of travel time savings, they used

forecast traffic volume and travel time calculated from the equilibrium assignment method. The Ministry forecast the traffic volume for both with/without cases at the planned opening year in 2006. For the benefit of travel time savings, the Ministry estimated 0.944bn USD for the opening year (USD 317.184bn for the without-case and USD 316.240bn for the with-case).

Table 6: Flows of benefit and cost over the evaluation period from 1990 to 2046

	Construction Cost		Maintenance Cost		Benefit	
(billion USD)	Value	Present Value	Value	Present Value	Value	Present Value
1990	0.041	0.071	0.000	0.000	0.000	0.000
1991	0.052	0.086	0.000	0.000	0.000	0.000
1992	0.057	0.092	0.000	0.000	0.000	0.000
1993	0.134	0.207	0.000	0.000	0.000	0.000
1994	0.204	0.302	0.000	0.000	0.000	0.000
1995	0.119	0.170	0.000	0.000	0.000	0.000
1996	0.115	0.157	0.000	0.000	0.000	0.000
1997	0.163	0.215	0.000	0.000	0.000	0.000
1998	0.201	0.255	0.000	0.000	0.000	0.000
1999	0.201	0.245	0.000	0.000	0.000	0.000
2000	0.353	0.414	0.000	0.000	0.000	0.000
2001	0.581	0.654	0.000	0.000	0.000	0.000
2002	0.649	0.702	0.000	0.000	0.000	0.000
2003	0.660	0.686	0.000	0.000	0.000	0.000
2004	1.287	1.287	0.000	0.000	0.000	0.000
2005	0.840	0.807	0.000	0.000	0.000	0.000
2006	1.503	1.390	0.000	0.000	0.000	0.000
2007	0.202	0.180	0.032	0.029	1.005	0.894
2008	0.044	0.038	0.032	0.028	1.015	0.867
2009	0.011	0.009	0.032	0.027	1.024	0.842
2010	0.000	0.000	0.032	0.026	1.033	0.816
2011	0.000	0.000	0.032	0.025	1.039	0.789
2012	0.000	0.000	0.032	0.024	1.044	0.763
2013	0.000	0.000	0.032	0.023	1.049	0.737
2014	0.000	0.000	0.032	0.022	1.055	0.713
2015	0.000	0.000	0.032	0.021	1.060	0.689
2016	0.000	0.000	0.032	0.020	1.066	0.666
2017	0.000	0.000	0.032	0.019	1.071	0.643
2018	0.000	0.000	0.032	0.019	1.077	0.622
2019	0.000	0.000	0.032	0.018	1.082	0.601
2020	0.000	0.000	0.032	0.017	1.088	0.581
2021	0.000	0.000	0.032	0.017	1.087	0.558
2022	0.000	0.000	0.032	0.016	1.087	0.536
2023	0.000	0.000	0.032	0.015	1.086	0.516
2024	0.000	0.000	0.032	0.015	1.086	0.496
2025	0.000	0.000	0.032	0.014	1.085	0.476
2026	0.000	0.000	0.032	0.014	1.085	0.458
2027	0.000	0.000	0.032	0.013	1.084	0.440
2028	0.000	0.000	0.032	0.013	1.084	0.423
2029	0.000	0.000	0.032	0.012	1.083	0.406
2030	0.000	0.000	0.032	0.012	1.083	0.391
2031	0.000	0.000	0.032	0.011	1.079	0.374
2032	0.000	0.000	0.032	0.011	1.075	0.358
2033	0.000	0.000	0.032	0.010	1.071	0.343
2034	0.000	0.000	0.032	0.010	1.067	0.329
2035	0.000	0.000	0.032	0.010	1.063	0.315
2036	0.000	0.000	0.032	0.009	1.058	0.302
2037	0.000	0.000	0.032	0.009	1.054	0.289
2038	0.000	0.000	0.032	0.009	1.050	0.277
2039	0.000	0.000	0.032	0.008	1.046	0.265
2040	0.000	0.000	0.032	0.008	1.042	0.254
2041	0.000	0.000	0.032	0.008	1.039	0.243
2042	0.000	0.000	0.032	0.007	1.035	0.233
2043	0.000	0.000	0.032	0.007	1.031	0.223
2044	0.000	0.000	0.032	0.007	1.028	0.214
2045	0.000	0.000	0.032	0.006	1.024	0.205
2046	-0.405	-0.078	0.032	0.006	1.021	0.197
Total	7.013	7.886	1.293	0.591	42.340	19.343

Table 7: Qualitative indices for evaluation of effectiveness and necessity of the project

Policy Objectives		Indices (+: applicable)		Evidences for Indices
1.Activity	Provision of Smooth Mobility	+	Annual congestion loss time and the rate of reduction on parallel sections	congestion loss time: 341million person hour per year, the rate of reduction in congestion loss: 4.7%
		+	Expected improvements to the sections with less than 20km/h travel speed during congestion time on parallel sections	travel speed: 10.5 - 16.8km/h during congestion time, travel time between Shibuya Station and Nishisugamo decrease from 60 to 45 minutes
		+	Expected improvements to the existing bus services or new bus services on parallel sections	expected improvements to bus services: Meiji Street, the 6th Circular Highway and the 7th Circular Highway
		+	Expected Improvements to access Shinkansen stations	Shinkansen stations: Tokyo, Ueno and Shinagawa stations by alleviating congestion on Metropolitan Inner Circular Route
		+	Expected Improvements to access Class 1, 2, 3 or shared airports	airports: Haneda Airport by alleviating congestion on Metropolitan Inner Circular Route
	Support for Efficient Goods Movement	+	Expected improvements to access the designated major ports or ports along the international container routes	airports: Haneda Airport by alleviating congestion on Metropolitan Inner Circular Route
			Expected better physical distribution from the areas dependent on agriculture, forestry and fishery to large metropolitan areas	
	Urban Regeneration	+	Support for Urban Regeneration Project	The construction of circular roads in Tokyo Metropolitan Area is included in Urban Regeneration Project.
		+	Formation of circular roads in three large metropolitan areas	formation of one section of Metropolitan Expressway Central Circular Route
		+	Coordination with urban development along the route such as urban redevelopment and land adjustment	coordinated urban redevelopment and land adjustment projects: Ohashi Urban Redevelopment Project
	Construction of National and Regional Network	+	Designation of Regional Highclass Road	The route is designated as Regional Highclass Road.
		+	Provision of the shortest route between central cities of daily activity bounded on each other	central cities of daily activity: Tokyo and Saitama City
		+	Expected improvements to access central city of daily activity	reduction in travel time between Ikebukuro and Shibuya from 50 to 20 minutes
	Formation of Individual Regions		Breaking barriers of integrated development for isolated areas by rails and rivers	

Table 7: Qualitative indices for evaluation of effectiveness and necessity of the project (cont.)

Policy Objectives		Indices (+: applicable)		Evidences for Indices
1.Activity		+	Support for major development, regionally coordinated project and large event	The construction of circular roads in Tokyo Metropolitan Area is included in Urban Regeneration Project.
		+	Improvements to access major tourist spots from interchanges	Expected better access to major tourist spots: Ikebukuro, Shinjuku and Shibuya
		+	Direct access road to new public facilities	Tokyo Opera City
2.Living	Provision of safe and secure living	+	Expected improvements to Class 3 medical facilities	Class 3 medical facility: Tokyo Medical University Hospital
	Provision of safe living environment		Expected improvements to safety of the section by reduction in traffic volume, provision of pedestrian pavement and improvements to geometrical design where there exists the parallel section with more than 500 serious traffic accidents per 100 million vehicle kilometers	
3.Safety	Preparedness for disaster	+	Designated as prefectural disaster prevention plan, emergency transportation road network plan, or emergency construction plan against earthquake, or designated as five-year emergency construction plan for earthquake disaster prevention (referred to emergency transportation road)	Metropolitan Expressway is designated in regional disaster prevention plan.
		+	Formation of an alternative route without making a considerable detour when emergency transportation road becomes out of use	emergency transportation road: an alternative route to Metropolitan Expressway Inner Circular Route
			Function as an alternative route to parallel expressway network	
4.Environment	Preservation of global environment	+	Reduction in CO2 emissions from automobiles by construction of the road	reduction in CO2 emissions: 17000t-C per year
	Improvement and maintenance of living environment	+	Reduction rate of NO2 emissions from automobiles on existing roads	designated area for Automobile NOx PM Act (Capital Region), the number of monitoring stations that meet environmental quality standard for NO2: 60 out of 85 stations in Tokyo 2003, estimated reduction in NO2 emissions by 100t per year or 0.6 percent

Table 7: Qualitative indices for evaluation of effectiveness and necessity of the project (cont.)

Policy Objectives		Indices (+: applicable)		Evidences for Indices
4.Environment		+	Reduction rate of SPM emissions from automobiles on existing roads	designated area for automobile NOx PM Act (Capital Region), the number of monitoring stations that meet environmental quality standard for SPM: 19 out of 86 stations in Tokyo 2003, estimated reduction in SPM emissions by 5t per year or 0.5 percent
			Expectation of new sections whose current nighttime noise levels are above the request limit, but will become lower than the limit	
		+	Other expected effects in terms of environment and landscape	adoption of tunnel structure for all sections, integrated project with widening of the 6th Circular Highway
5.Others	Relationship with other projects	+	Designated as a coordinated program by other organizations	integrated project with widening of the 6th Circular Highway
			Other specific reasons for the region or the project that are not reflected by the items above	

Funding sources

Because the Metropolitan Expressway C2 Shinjuku Route is only a section of the 293.5km Metropolitan Expressway Network, a specific funding/financing source for the project is not applicable. According to the agreement between the Japan Expressway Holding and Debt Repayment Agency and the Metropolitan Expressway Co. Ltd, the budget for the construction of the section of Metropolitan Expressway C2 Shinjuku Route (Nishishinjuku Junction – Kumanocho Junction, 6.7km) was USD 4.58202bn (1USD=100JPY). The maximum debt for the section accepted by the Agency was USD 2.00826bn, out of which USD 1.99820bn was subsidized. For a reference, the budget for the construction of the remaining section (Ohashi Junction – Nishishinjuku Junction, 4.3km) was USD 5.93074bn and the maximum debt accepted was 2.84350bn USD, out of which USD 2.82814bn was subsidized.

Main elements and structure of financing package

As the outline of Consolidated Closing in 2008 is shown in Table 8, the Metropolitan Expressway Co. Ltd as a whole collects USD 2.558bn as tolls, and pays USD 1.934bn to the Agency as highway assets leasing expenses in FY2007. The Agency takes over the road asset completion amount, and leases the infrastructure to the Company. The Financial Plan of Business Operation Programs for FY2008 summarized in Table 9 shows that the Metropolitan Expressway Co. Ltd will also apply for public sector sources such as Government guaranteed bonds, Fiscal Investment and Loan Program agency bonds, and interest-free debt from the JEHDRA as well as for private sector sources.

Commentary on funding/financing approach

The Metropolitan Expressway Co. Ltd currently applies flat tolls of 7 USD to ordinary vehicles and 14 USD to large vehicles in the Tokyo Metropolitan Area (Table 10). Because large discrepancies in distances traveled occur as the Metropolitan Expressway Network expands, the Company is moving ahead with preparations for a shift to distance-based tolls on the Metropolitan Expressway Network, which will alleviate the inequality inherent in charging flat tolls regardless of the distance traveled. The provisions of the sections of the Metropolitan Expressway C2 Route and other circular expressways as alternative routes and more than 80% use of the electronic toll collection (ETC) system on the Metropolitan Expressway also ease the shift to distance-based tolls. The distance-based toll system is the first step in making the Metropolitan Expressway Network more efficient and easy to use.

To promote more efficient use of the Metropolitan Expressway Network is one thing, to increase the number of vehicles on the Network and tolls collected is another. As indicated in Figure 30, the trend of the average daily traffic volume and tolls collected on the Metropolitan Expressway have flattened since the 1990s despite the additions of new sections to the Network over the same period. The Metropolitan Expressway Co. Ltd, as well as the Agency, needs to seek the best allocations of the resources to the existing and future Metropolitan Expressway Networks.

Table 8: Outline of consolidated closing at the end of March 2008 (million USD)

Consolidated Results (million USD)	At the end of March 2007	At the end of March 2008
Operating expenditures	2882	4423
Highway assets leasing expenses	1944	1934
Operating income	2923	4449
Toll income	2547	2558
Road asset completion amount	289	1828
Operating profit	40	25
Ordinary profit	42	31
Net income	27	20
Consolidated Balance Sheet (million USD)	**At the end of March 2007**	**At the end of March 2008**
Current assets	4411	3890
Fixed assets	615	658
Total Assets	5047	4548
Current liabilities	1095	1100
Fixed liabilities	3650	3142
Total liabilities	4765	4241
Capital	135	135
Capital surplus	135	135
Retained earnings	11	31
Total shareholders' equity	281	301
Total liabilities and share holders' equity	5047	4548

Table 9: Financial plan of business operation programs for FY2008 (million USD)

Financial Plan of Business Operation Programs for FY2008 (million USD)	Total	Expressway program only
Operating income		
Toll income	2764	2764
Other income	136	
Loans		
Government guaranteed bonds	185	185
Fiscal Investment and Loan Program agency bonds	200	200
Debt from JEHDRA (interest free) 1)	284	284
Debt from private sector	844	844
Balance brought forward profit	464	354
Total income	4877	4630
Operating expenditures		
Expressway maintenance	596	596
Highway assets leasing expenses	2070	2070
Other expenditures	129	
Capital expenditures		
Expressway construction and reconstruction	1219	1219
Expressway repairs	380	380
Other construction	3	
Redemption of corporate bonds	16	9
Balance carried forward profit	464	357
Total expenditures	4877	4630

Note 1): The Japan Expressway Holding and Debt Repayment Agency

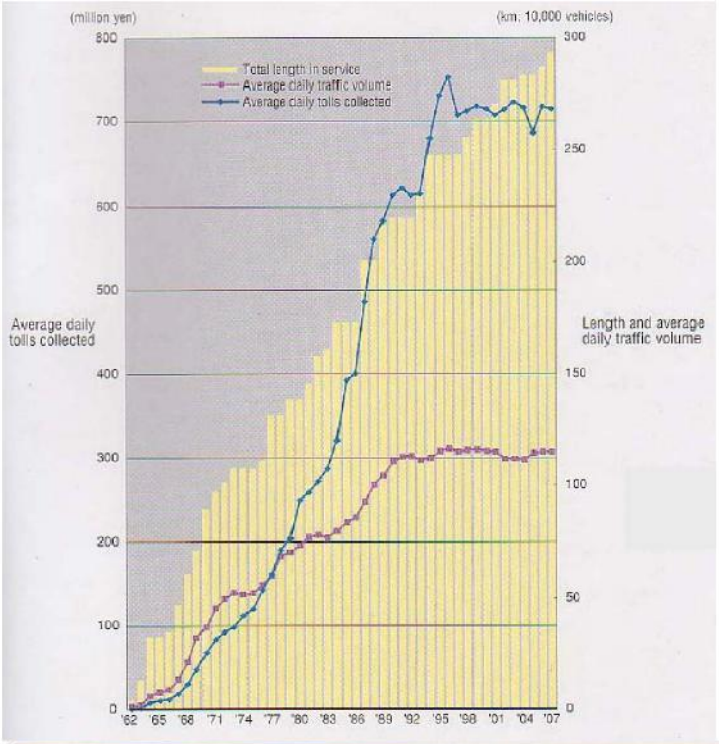
Table 10: Tolls of the Metropolitan Expressway as of April 2008

Vehicle Categories		Ordinary Vehicles: Ordinary cars, compact cars, small buses (29 passengers or less, gross weight of less than 8 tons), ordinary trucks, small trucks, motorcycles (except under 125cc), light cars, small special vehicles	Large Vehicles: Large buses (30 passengers or more, or gross weight of more than 8 tons), large trucks (freight capacity of 5 tons or more, or gross weight of more than 8 tons), large special vehicle/ three-axle tractor (trailer)
Ordinary tolls	Tokyo Routes	¥700	¥1,400
	Kanagawa Routes	¥600	¥1,200
	Saitama Routes	¥400	¥800
	Special toll sections	¥300	¥600

(As of April 1, 2008)

- Ordinary tolls are tolls paid in cash or by handing an ETC card to the tollbooth attendant. Various toll discounts are given if the wireless ETC system is used during transit.
- Special toll sections are located in the following places.
  Tokyo Route: Heiwajima to Haneda, Honcho to Iriya (outbound), Ertuku to Chuo Expressway interchange (outbound), Haneda Airport to Kawasaki-Ukishima JCT
  Kanagawa Route: Daishi to Haneda, Sugita to Namiki (westbound)
  Saitama Route: Urawa-Minami to Bijogi JCT

Figure 32: Trends in traffic volume and tolls collected (per day)



Vehicle Categories		Ordinary Vehicles: Ordinary cars, compact cars, small buses (29 passengers or less, gross weight of less than 8 tons), ordinary trucks, small trucks, motorcycles (except under 125cc), light cars, small special vehicles	Large Vehicles: Large buses (30 passengers or more, or gross weight of more than 8 tons), large trucks (freight capacity of 5 tons or more, or gross weight of more than 8 tons), large special vehicle/ three-axle tractor (trailer)
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	Saitama Routes	¥400	¥800
	Special toll sections	¥300	¥600

(As of April 1, 2008)

- Ordinary tolls are tolls paid in cash or by handing an ETC card to the tollbooth attendant. Various toll discounts are given if the wireless ETC system is used during transit.
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  Kanagawa Route: Daishi to Haneda, Sugita to Namiki (westbound)
  Saitama Route: Urawa-Minami to Bijogi JCT

Sources: Kakumoto, R., 'Three Cases of Privatization – Expressway Public Corporations, Japan Post, and Japan National Railways-,' Ryutsu Keizai University Publishing 2005 (in Japanese); Japan Expressway Holding and Debt Repayment Agency, 'Japan Expressway Holding and Debt Repayment Agency 2007,' Japan Expressway Holding and Debt Repayment Agency 2007. Japan Expressway Holding and Debt Repayment Agency, 'The Conclusions of the Agreement between the Japan Expressway Holding and Debt Repayment Agency and Metropolitan Expressway Co. Ltd,' Japan Expressway Holding and Debt Repayment Agency 2006; Japan Expressway Holding and Debt Repayment Agency, 'Document for Closing for FY2007,' Japan Expressway Holding and Debt Repayment Agency 2008; Metropolitan Expressway Co.,Ltd, 'Construction of Metropolitan Expressway,' 2007. Metropolitan Expressway Co. Ltd, 'Corporate Profile 2008,' 2008; Metropolitan Expressway Co. Ltd, 'Corporate Profile 2007,' 2007; Metropolitan Expressway Co. Ltd, 'Documents for the 3rd Annual General Meeting of Shareholders http://www.shutoko.jp/company/ir/financial/document/gm3.pdf' 2008 (in Japanese); Metropolitan Expressway Co. Ltd, 'Documents for the 2nd Annual General Meeting of Shareholders http://www.shutoko.jp/company/ir/financial/document/gm2.pdf,' 2007 (in

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F OPERATIONS

Traffic volume

Since the opening of the section of the Metropolitan Expressway C2 Shinjuku Route (Nishishinjuku Junction – Kumanocho Junction) in December 2007, the Metropolitan Expressway Co. Ltd has conducted monitoring of traffic volume on the section continuously. Immediately after the opening, the average traffic volume was 30,000 per day for both weekday and weekend. Because the average weekday traffic volumes from January to February and from January to March were 31,000 and 34,000 respectively, the number of vehicles taking the section has increased over time.

Metropolitan Expressway Co. Ltd also indicated the results of before/after surveys that compared the traffic conditions after the opening with the conditions one year before. According to the latest report, the new section contributed to reduction in congestion length within the Tokyo Area of the Metropolitan Expressway Network by 22%, travel time from Takaido Junction of Chuo Expressway to Misato Junction of Joban Expressway by 26 minutes, and travel time from Takaido Junction to Kasumigaseki by eight minutes on average for the weekday peak hour (11AM). The section also contributed to reduction in fuel consumption by 0.5litre and CO_2 emissions by 1.3kg for a passenger car.

As of the 6th Circular Highway (the Yamate Street), underground of which the Metropolitan Expressway C2 Shinjuku Route goes through, traffic volume decreased by 1,000 vehicles per day after the opening. Travel time from Ikebukuro Station to Shinjuku Station, both of which are located at the ends of the new section, decreased by seven minutes for weekday morning peak hour (8AM), while travel time from Shinjuku Station to Ikebukuro Station decreased by 17 minutes for weekday evening peak hour (5PM).

The Metropolitan Expressway C2 Shinjuku Route is only a section of the Metropolitan Expressway Network; however, the impacts of the opening of the new section are not limited to the parallel highways such as the 6th Circular Highway. Through the Network, the impacts are distributed over the Tokyo Metropolitan Area. The summary of the reports in relation to traffic volumes and others issued by the Metropolitan Expressway Co. Ltd is indicated in Table 11.

Table 11: Summary of the reports in relation to traffic volumes

monitoring term excluding snowing days (after the opening) (before the opening)	weekday traffic volume per day (vehicle)	congestion length during weekday peak hour (11AM) (km)	congestion loss time per day (vehicle hours)	travel time from Takaido JCT-Misato JCT (minutes)	travel time from Takaido to Kasumigaseki (minutes)
7 January-28 March 2008	34000	44.0	67000	51	24
9 January-30 March 2007	-	56.3	93000	77	32
8 January - 15 February 2008	31000	36	50000	50	20
9 January - 16 February 2007	-	46	67000	75	30
8-11, 15-18 January 2008	1)2) 30000	23-40		40-55	20-25
9-12, 16-19 January 2007	-	40-68		55-80	20-45

Note 1): weekday traffic volume per day averaged over one month after the opening

Note 2): Weekend traffic volume per day was also 30,000.

Note : Metropolitan Expressway Tokyo Routes as a whole except 'weekday traffic volume per day' on the C2 Shinjuku Route

Safety measures

If underground structure is compared with elevated structure for building expressways from the viewpoint of safety, underground structure needs more safety measures than elevated structure. Metropolitan Expressway Co. Ltd has accumulated the lessons from the past accidents such as the Nihonzaka Tunnel Fire in 1979 and the Mont Blanc Tunnel Fire in 1999 for more than ten years, and introduced the most innovative available measures for improving safety of the Metropolitan Expressway C2 Shinjuku Route. Learning from the lessons, Metropolitan Expressway Co. Ltd pays attention to the evacuation within four, ten, 30 and 60 minutes after the fire happens, and especially focuses on the evacuation within ten minutes.

Metropolitan Expressway tunnels feature various sophisticated disaster prevention equipment to help people evacuate in a safe and secure fashion in the event of a tunnel fire. Moreover, the tunnels are monitored 24 hours a day from a central control room as backup. A state-of-the-art of the system is demonstrated in Figure 32.

For the Metropolitan Expressway C2 Shinjuku Route, a Metropolitan Expressway motorcycle patrol – the first emergency designated motorcycle squad operation by a private company in Japan – was formed to ensure rapid initial responses to accidents and other emergencies (Figure 31). Teamed up with a conventional patrol car fleet, this motorcycle brigade further raises the safety of this long urban tunnel. Once the serious accident happens, the motorcycle brigade reaches the spot immediately and blockades the entry of the vehicles into the spot.

The warning message signs in the tunnel and the warning message boards at the entry of the tunnel are also helpful for stopping the coming vehicles flowing into the accident spot. In addition, because emergency ventilation systems, sprinklers, traffic signs, CCTV cameras, message signs, vehicle detectors and lightings are all dependent on power supply, the power supply system is designed in a doubly fail-safe way.

Figure 33: Metropolitan Expressway Motorcycle Patrol

Commentary

It is noted that the observed traffic volume is less than the planned traffic volume of 49,000 to 80,000 per day partly because the planned traffic volume is assumed for the completion of the Metropolitan Expressway C2 Shinjuku Route (Ohashi Junction – Kumanocho Junction). In August 2008, the Route is shut down because a serious accident happens at the end of the Route and considerably damages the expressway infrastructure. Increase in the observed traffic volume on the Route might take much more time to reach the planned traffic volume.

As of the safety measures, Metropolitan Expressway Co. Ltd considered the risk of the approximately 10km underground structure for building expressways very seriously, and introduced a dozens of disaster prevention measures into the Metropolitan Expressway C2 Shinjuku Route. While the innovative measures improve the level of safety, Metropolitan Expressway Co. Ltd (or the Japan Expressway Holding and Debt Repayment Agency) must accept the cost for the improvements.

Figure 34: A 'state of the art' disaster prevention system for Metropolitan Expressways

Sources: Konda, T., 'Technologies for Urban Road Tunnels,' Advanced Construction Technology Center 2007 (in Japanese); Metropolitan Expressway Co. Ltd, 'Tokyo Smooth,' 2007; Metropolitan Expressway Co. Ltd, 'Corporate Profile 2008,' 2008; Metropolitan Expressway Co. Ltd, 'Press Release http://www.shutoko.jp/info/,' 2007/2008 (in Japanese); Tachimori, T., 'From Shinjuku Route to Shinagawa Route,' Advanced Construction Technology Center 2007 (in Japanese).

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