

**Information Collection and Confirmation Study  
on  
Planning and Implementation  
of  
Transit Oriented Development (TOD)  
for  
Sustainable Cities around the World  
  
Summary Report**

**September 2022**

**Japan International Cooperation Agency**

**Japan International Consultants for Transportation, Co., Ltd.**

**Oriental Consultants Global, Co., Ltd.**

**UR Linkage, Co., Ltd.**

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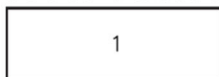


**September 2022**

**Japan International Cooperation Agency (JICA)**

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Oriental Consultants Global, Co., Ltd.  
UR Linkage, Co., Ltd.**

Cover Photos



1. Tokyo Station Marunouchi Station Building  
(Photo: JR East Design Corporation)
  2. Tokyo Marunouchi Station Plaza
  3. View of Osaka Station's Platform from North-South Bridge
  4. Tokyo Station Yaesu Exit at Dusk
  5. View of Himeji Castle from Himeji Station Building
  6. Shopping Center at Yokohama Station Building
- ※ Photos without credit are provided by Japan International Consultants for Transportation Co., Ltd.



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# 1 Introduction

This report proposes measures to solve metropolitan-wide issues and TOD (transit oriented development) development indicators.

## 1.1 Background of the Study

Developing countries have shown increased interest in urban development projects that incorporate TOD. This is due to the development of public transportation networks, such as urban railways and bus transportation, to meet the strong demand for urban transportation in developing countries.

In cities in developing countries, where population growth continues unabated, it is important to fully consider: 1) the role of the transportation network in the overall urban development plan and, 2) to develop the urban transportation network and transportation nodes in an integrated manner to ensure smooth and comfortable movement of people and to improve the urban environment.

The spatial scale for TOD implementation can be large or small. It can include planning and development that encompasses the basic transportation network of an entire urban area, regional development along an entire rail line, urban development within a station area, proximity to jobs and residences, integrated urban redevelopment of stations and station areas, development of station plazas as transportation nodes, and/or enhancement of transfer functions. Regardless of the scale, it is essential to collaborate with stakeholders in various fields and strengthen the government's urban management capabilities to implement TOD projects as sustainable urban development.

In recent years, Japan International Cooperation Agency (JICA) has been cooperating in TOD at various scales and stages of projects, but it is a relatively new field. As such, it is necessary to review past cases for more effective cooperation in the future. However, there are also many TOD projects of scales and stages that are not implemented by JICA nor located in Japan, and it is necessary to prepare for the formation of future cooperation projects by referring to such cases from around the world.

## 1.2 Objective of the Study

An objective of the study is to present solution approaches and performance indicators to smoothly plan and implement TOD. This includes possible cooperation schemes of Japanese public institutions such as JICA, Urban Renaissance Agency (UR), and Japan Overseas Infrastructure Investment Corporation for Transport & Urban Development (JOIN).

JICA also proposes future TOD cooperation approaches. This includes drawing on Japan's knowledge and experience, including how TOD cooperation strengthens the urban management capacity of developing countries' administrations and what kind of assistance is the most effective.

## 1.3 Definition of TOD

The concept of TOD was proposed by Peter Calthorpe, as part of the New Urbanism movement in the U.S. in 1993 as a scheme for new station placement following a new rail line (Figure 1- 2).

The basic idea is to develop residential areas within a semicircle of 2,000 feet (610 meters) radius of a rail station in the suburbs of a large city. Commercial facilities and public spaces are developed in the center to support residents' daily lives. The area is connected to the urban center by freeway and rail. For the rail, a portion of the excess freeway ROW will be converted and used for rail construction.

The total area is approximately 83 ha, which is about 60-70 % the size of the Otemachi-Marunouchi-Yurakucho area around Tokyo Station, or the total area around Shibuya Station. This concept was first proposed as a new station type of development but has since also been applied to existing stations.

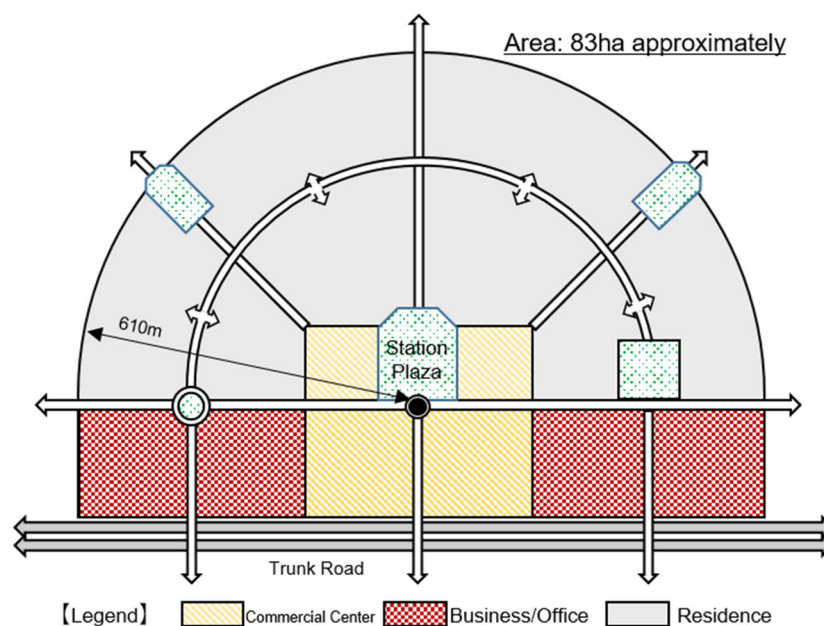


Figure 1-1 TOD Conceptual Design

Source: JICA Study Team based on Peter Calthorpe's concept

This concept was first proposed as a new station type of development but has since been applied to

existing station, and now the concept is spreading worldwide. Therefore, the definition of TOD is also modified according to each country's condition.

The important elements of TOD can be summarized as the followings.

- Development that is a combination of land-use and transportation policy.
- Transit hub as the center, followed by commercial, business/office facilities surrounding it and medium- to high-density residential area within walking distance (800m from the transit hub at most). In exchange of residential area, commercial / business facilities, industrial / logistic facilities, amusement facilities, and other type of land uses can also be implemented.
- Between the transit hub and residential area are comfortable and convenient pedestrian networks. Urban space that is comfortable for both resident and visitor are created along the development.
- Cooperation between government, transit operator, developer and resident to achieve sustainable urban development. Realized development profit are also distributed to the related parties.
- Strong linkage between mass transit and other transportation modes that increase convenience of residents can promote urban revitalization and suburban area regeneration, reduced reliance on automobiles, and improved overall Quality-of-Life (QoL).

In summary, TOD definition in this study is stated as below.

“Development that integrate land use and transportation around transportation hubs and a variety of medium- to high-density land uses, including residential areas. This promotes a walkable built environment and strengthens the linkage between mass transit and other transportation modes, which can result in urban revitalization and suburban area regeneration, reduced reliance on automobiles, and improved overall quality of life (QOL).”

Development similar to TOD began in the early 20<sup>th</sup> century. During that time, railway and streetcar are started to be built in the U.K, Japan, and the U.S., which mainstreamed the so called “transit-oriented development”.

After the World War 2, the mass uses of automobile gave effect to the mainstreaming of “mobility-oriented development”. Started in the U.S. and Australia, motorization then spread to both the developed and developing countries. As a result, traffic jam and vehicle emission worsen the urban environment, which caused the emergence of New Urbanism movement and the conception of TOD by Cathrope in 1993.

The followings are the history of TOD and similar developments and also the history of Bus Rapid Transit (BRT).

### 1.3.1 History of the Rail-integrated Urban Development (1) - Garden Cities, England

A concept similar to TOD was introduced in the early 20th century when Ebenezer Howard (1898-1902) of the U.K. proposed the Garden City, a 12,000-acre (about 4,900 ha) concept for development of urban areas that includes the construction of railways to link satellite cities around a central city.

In 1903, Letchworth City, 55 km north of London, was selected as a pilot and began its development in 1907. It seems that this was initially envisioned as the central city, but in the end, London took its place. Efforts to make Letchworth self-sustaining continued, however, and at present, the number of residents exceeds the planned population (32,000).

In 1920, work began on a second garden city, Welwyn, where located about 32 km north of London. The current population exceeded the planned population of 50,000 inhabitants. Although these two garden cities did not wholly fulfill the initial concept, they presented a model for self-sustaining urban construction that controlled urban sprawl and had a significant influence on the subsequent development of garden cities, new town development in postwar England, and the Tama Garden City and Senriyama residential areas in Japan, and others.

### 1.3.2 History of the Rail-integrated Urban Development (2) – Japan

In Japan, businessman Ichizo Kobayashi established the Minoo Arima Electric Railway (now Hankyu Corporation) in 1900 and began constructing a line with branches connecting Umeda, Osaka, and Takarazuka, all of which opened in 1910. In addition, development including residential areas was undertaken around new stations such as Ikeda Muro-machi, Minoh Sakurai, Toyonaka, and Shinyashiki. In addition, the New Takarazuka Hot Spring, Takarazuka Revue, and an amusement park were built to stimulate demand for railways and encourage two-way use. A department store was also constructed in 1929 to directly connect to Umeda Station, the line's starting point (example of existing station type of development).

In 1918, Eiichi Shibusawa established Denentoshi Corporation (now Tokyu Corporation). Following the Letchworth and others, Tokyu began constructing affluent residential areas with new stations in the suburbs of Tokyo to meet the strong demand for housing in the capital city (Senzoku Den-en-Toshi in 1922, followed by the Tamagawadai area the next year). 1923 saw the opening of the entire Mekama Line. In 1953, the Josai South District Development Prospectus was published, and in 1959, the Nogawa Dai 1 Land Readjustment Association was established to begin the development in the Tama area. Since then, the area has developed approximately 5,000 ha, including land readjustment projects in 58 districts, and has grown into an area with about 630,000 residents.

Railway development was done in two phases to reduce initial investment cost: Phase I was between Mizonokuchi Station and Nagatsuta Station (opened in 1966), and Phase II was

between Nagatsuta Station and Chuo Rinkan Station (opened in 1984). The line was then extended from Mizonokuchi Station to Shibuya Station in central Tokyo. The line was also connected to the intersecting railways, improving users' convenience (Figure 1-3).

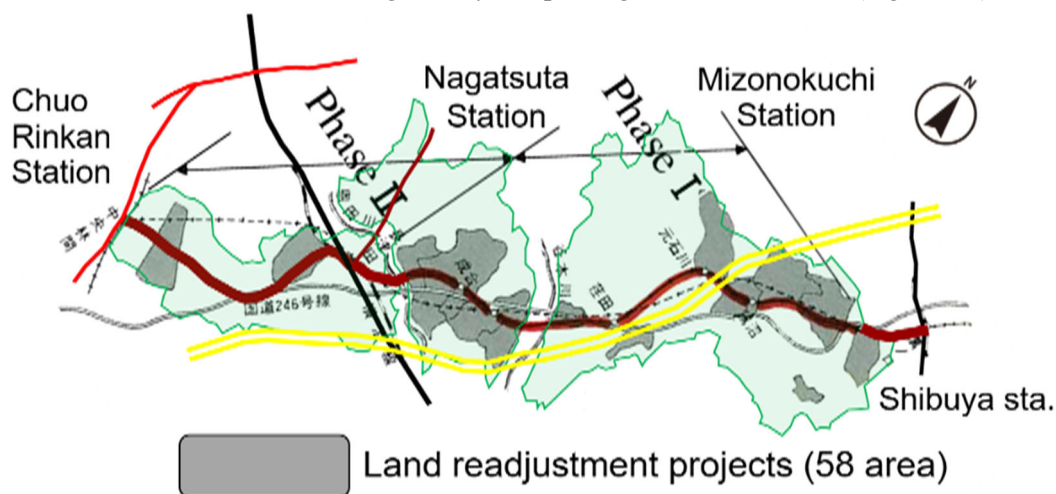


Figure 1-1 Gradual Development of Tama Den-en-Toshi

Source : S. Akimura, *JREA vol. 2, 2022年*

Later, the line started interconnecting with other lines, becoming a part of the Tokyo Metropolitan Area's rail network.

However, since the opening of the Tsukuba Express (“TX”; the segment between Akihabara and Tsukuba stations) in 2005, large-scale residential development has slowed due to the decline in Japan's population. As a result, the development of station areas is now mainly in the form of existing station redevelopment.

### 1.3.3 History of Bus Rapid Transit (BRT) and TOD

Bus Rapid Transit (BRT), a bus-based medium-volume transit system, was born in Curitiba, Brazil, South America, where it began operating in 1974 as Rede Integrada de Transporte (RIT). In 2000, TransMilenio opened in Bogota, Colombia. Both were introduced as inter-city transport but have since become popular in many countries as intra-city and inter-city transport.

As of October 2014, BRT operates in 186 cities worldwide, with a total route length of 4757 kilometers (averaging about 25.6 km/city). On average, the estimated daily ridership is about 170,000 passengers per day. For instance, Bogota averages around 2.15 million passengers per day in Bogota, whereas Kesen’numa-Ohfunato line in East Japan averages about 200.

As various BRT systems have been introduced in cities around the world, the Institute for Transportation and Development Policy (ITDP) proposed a BRT standard in 2011 (the "BRT Standard"), which attempted to create a singular definition (subsequently revised in 2013, 2014, and 2016). A scoring system was proposed in 2013, based on which the BRT systems of each city were classified into five levels: Gold, Silver, Bronze, Basic, and not BRT (see the **Material**



1 in the "Materials of the Study Results").

Other organizations have similarly tried to categorize and define BRT-type systems. The Union Internationale des Transports Publics (UITP) has proposed the concept of BHLS (Bus with High-Level of Service) instead of BRT.

The Breakthrough Technologies Institute has proposed the concept of BRT in Brisbane, Australia, and five U.S. cities (Cleveland, Ohio; Boston, Massachusetts; Ottawa, Ontario; York Region, Ontario; and El Monte, California) to promote TOD.<sup>1</sup> It concluded that BRT can promote TOD and economic development.

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<sup>1</sup> [http://www.reconnectingamerica.org/assets/Uploads/brt\\_tod\\_report.pdf](http://www.reconnectingamerica.org/assets/Uploads/brt_tod_report.pdf)

## 2 TOD in Developing Countries, Japan and the World

As the first step in solving metropolitan area issues is to formulate masterplan of land use and corridor development (Comprehensive Development Masterplan; CDM). During the formulation, visualization of the issues and sharing with the stakeholders are essential. As the method, policy objectives, policy formulation and planning, organization and structure, institutions, and policy development are organized at each of the four levels: metropolitan area, corridor, station area, and site level, in which along the understanding of the current issues are the visualization of required plan, organization, framework, and development. A matrix for organizing these items is shown in Table 2-1.

Table 2-1 Metropolitan Area Issues Matrix

	Metropolitan Level	Corridor Level	Station Area Level	Site Level
Policy Objective (Development vision and indicator)				
Policy Plan (Plan to achieve the vision, sharing with related parties)				
Organization				
Framework (introduction of development approval process and development method)				
Policy Development (Infrastructure development, development management (regulation and guidance), development by various entities)				

Source: Japan International Cooperation Agency (JICA)

This matrix summarizes a series of initial steps to be taken when first planning a TOD project. The following metropolitan areas were chosen as examples of past projects from both developing and developed countries to help provide context for best practices:

- Tokyo Metropolitan Area, Japan (the Yamanote, Chuo, and Keiyo lines are taken as corridor examples)
- Sendai Metropolitan Area, Japan (Tohoku Main Line and Sendai Airport Access Line as corridor examples)
- Bangkok Metropolitan Area, Thailand
- Jakarta Metropolitan Area, Indonesia
- Paris Metropolitan Area, France (Grand Paris Express as corridor example)
- London Metropolitan Area, U.K. (Crossrail / Elizabeth Line as corridor example)

- Cleveland Metropolitan Area, U.S. (BRT HealthLine as corridor example)

## 2.1 Examples of TOD in Japan

### 2.1.1 Tokyo Metropolitan Area

In the Tokyo Metropolitan Area, the First National Capital Region Development Plan was formulated in 1958 to address the increasing concentration of population and industry in Tokyo that accompanied the postwar economic recovery. Since the concentration of population and industry in Tokyo did not improve after that, the Fourth National Capital Region Development Plan was formulated in 1986 to develop measures centering on the development of core business cities. The situation and issues in 1987 were summarized in Table 2-2.

Table 2-2 Tokyo Metropolitan Area Issues (Since 1987)

	Metropolitan Level	Corridor Level	Station Area Level	Site Level
Policy Objective	Realize the multi-polar and decentralized land use by fixing the concentration of population and urban functions in Tokyo.	Strengthen access between Tokyo and suburban core cities and between suburban core cities by road, rail, and others.	Upgrade urban functions, improve living environment, and develop internationally competitive hubs to deal with a declining birthrate and aging population.	
Policy Plan	The Fourth National Capital Region Development Plan (1986): Develop suburban cities, strengthen cooperation, and promote the relocation of population and urban functions from Tokyo to the suburban areas.		Establish the Advisory Council for the Promotion of Urban Renewal (2000).	
Organization	Establish the National Land Agency (1974)		Establish or expand relevant national departments (as needed).	
Framework	Multi-Polar Patterns National Land Formation Promotion Act (1988), Act on Special Measures concerning Comprehensive Advancement of Housing Development and Railway Construction in Metropolitan Areas (1989), and others. Flexible application of Factory Location Law and University Establishment Guidelines, etc.		Amendment of City Planning Act, etc. (Addition of Special Floor-Area-Ratio, City Plan Proposal System, etc.), Act on Special Measures concerning Urban Reconstruction (2002), and others.	
Policy Development	Promote the relocation of government research institutes (86 institutions), universities, and others to the Saitama New Urban Center, Makuhari New Urban Center, Minato Mirai 21, Chiba New Town, Tsukuba Science City, Tachikawa, Hachioji, and others.	Railway: Develop Tsukuba Express, Hokusō Line, Keiyo Line, Yokohama Municipal Subway, etc. Promote through service of different lines, etc. Roads: Develop Tokyo Outer Ring Road and Ken-O Expressway.	Designate Chiba, Tokyo, Yurakucho, Akihabara, Kanda, Shinjuku, Shinagawa, Osaki, Shibuya, Ikebukuro, Yokohama, and Kawasaki Station Area as Special District for Urban Regeneration that promote TOD. Develop new station and urban redevelopment of former rail yard between Shinagawa and Tamachi Station.	

Source: JICA Study Team

In the meantime, the Tokyo Metropolitan Area (Tokyo, Kanagawa, Saitama, Chiba, and southern Ibaraki prefectures) promoted the construction of railways and highways to cope with increasing automobile use in Tokyo. The following summarizes a series of reports from the Council on Railroads of the then Ministry of Transport and Ministry of Land, Infrastructure, Transport, and Tourism (MLIT) that identify issues and proposed solutions.

#### (1) Tenth Report of Urban Transportation Council (1968)

- Target year: 1975
- Main objectives: easing subway congestion in the city center due to the high concentration of population, responding to expansion of the city center to the west and the development of sub-centers.

- Proposed new lines: Subway Hanzomon Line, Oedo Line, etc.
- (2) Fifteenth Report of Urban Transportation Council (1972)
- Target year: 1985
  - Main objectives: responding severe commuting congestion and the long commute due to urban extension.
  - Proposed new lines: Subway Fukutoshin Line, new town lines, etc.
- (3) Seventh Report of Transport Council (1985)
- Target year: 2000
  - Main objectives: repending to population growth in the Chiba, Saitama, and Ibaraki areas, and improving airport access, etc.
  - Proposed new lines: New Joban Line (Tsukuba Express), Keiyo Line, Tokyo Monorail extension, Keiyo Airport Line extension, Minatomirai Line, etc.
- (4) Eighteenth Report of Transport Council (2000)
- Target year: 2015
  - Main objectives: ease congestion, improve travel speed, respond to changes in urban structure, and strengthen access to airport and Shinkansen station, barrier-free and seamless service promotion.

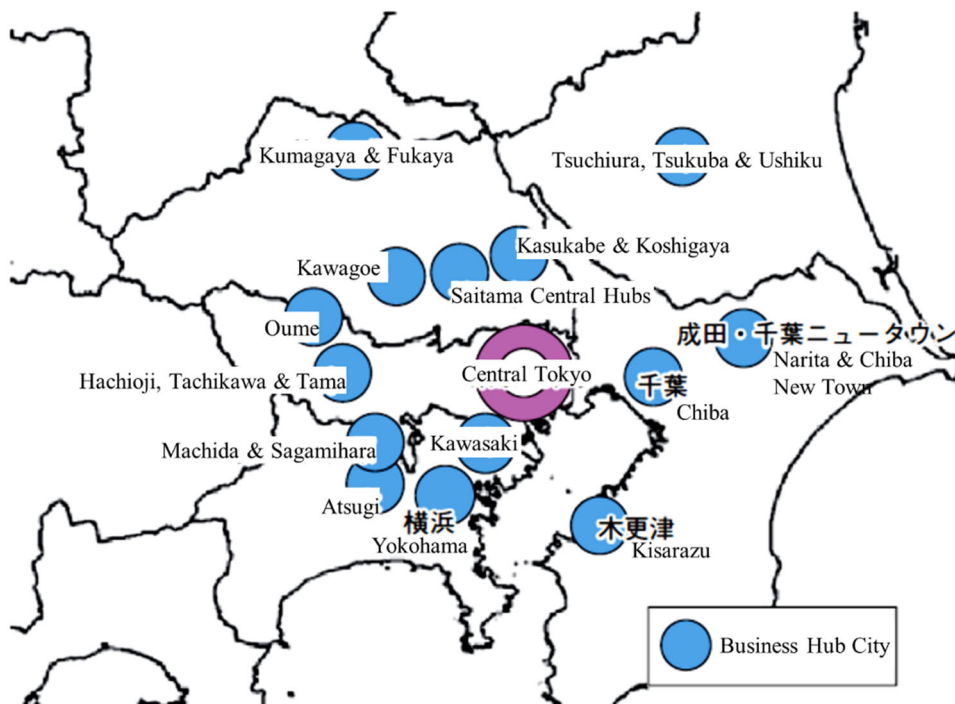


Figure 2-1 Suburban Core Cities According to Fourth National Capital Region Development Plan

Source: MLIT, Annual Report on National Capital Region Development in Fiscal 2020

Based on the Fourth National Capital Region Development Plan and the Multi-Polar Patterns National Land Formation Promotion Act for supporting the Plan implementation, the government relocated national administrative agencies (including research institutes) and other organizations outside Tokyo's 23 Wards as part of efforts to reduce Tokyo's concentration of government facilities and thus commuting workers (initially 86 organizations) to the dedicated business hub cities indicated in the Figure 2-1. As a means to accommodate these relocations, the government developed subcenter cities such as Tsukuba Science City, Saitama New Urban Center, Kaihin-Makuhari, and Minato Mirai 21, and connected them by building or extending railways and highways.

As a result of the integrated development of various policies, the population of Tokyo's 23 Wards began to decline for the first time, as did traffic volume (Table 2-3).

Table 2-3 Various Policies Impacts on Tokyo Metropolitan Area

**(1) Trend of population in the Central Tokyo and surroundings** (thousand)

	1985	1990	1995	2000	2005	2010
Central Tokyo (23 wards of Tokyo)	8,355	8,164	7,968	8,135	8,490	8,946
surroundings*	30,273	31,796	32,577	33,418	34,479	35,618

\* municipalities out of the central Tokyo, and prefectures of Saitama, Chiba and Kanagawa.

**(2) Shares of person trips by the O-D trip zones.**

	1988	1998	2008
within Central Tokyo (inside ⇔ inside)	25.6%	23.2%	23.4%
between Central Tokyo and surroundings (inside ⇔ outside)	11.1%	12.1%	13.0%

Source: JICA Study Team based on the National Sensus and Tokyo metropolitan area person trip survey

### 2.1.2 Sendai Metropolitan Area

Sendai City implemented a land readjustment project for reconstruction of the area west of Sendai Station, which suffered damage soon after the war, and redeveloped it into an economic center for the Tohoku region and the Sendai Metropolitan Area.

Around 1970, the city began redevelopment of the east side of Sendai Station (now Miyagino-ku), which had survived the war. The area had a high concentration of temples and cemeteries, and was also a relocation area for those who had lost their homes during the war. Because of this division of uses, the city of Sendai decided to split the land readjustment project into two zones. The temples and cemeteries were relocated to suburban areas, with the land then being used to build Miyaginodori, a 55-meter-wide boulevard in front of the station, and the Senseki Line was brought underground to make effective use of the space.

Moreover, JR East, redeveloped Sendai Station and its surrounding area, directly connecting

the east and west sides of the station via a passageway, and constructing hotels, station buildings, and other facilities

In addition, the Senseki Line was extended underground to the west side of the station by utilizing the central government's grade separation project, and a connecting passageway was constructed with the Sendai Subway Namboku Line and Tozai Line to facilitate connections with the JR Line (conventional lines and Tohoku Shinkansen)

In the Sendai Metropolitan Area, residential development progressed along the Tohoku Main Line, Joban Line, Senseki Line, Sennan Line, two Sendai subway lines, and the Sendai Airport Access Line. In the Izumi district, the terminus of the Sendai Subway Namboku Line, a subcenter was developed, and nearby municipalities such as Natori City and Tagajo City also developed along these corridors.

Table 2-4 Sendai Metropolitan Area Issues (Since 1979)

	Metropolitan Level	Corridor Level	Station Area Level	Site Level
Policy Objective	Ensure its position as the largest economic center in the Tohoku region.	New construction and extension of rail lines and roads to accommodate the expansion of residential areas.	Implementation of urban development as the largest economic center in the Tohoku region. Re-development of the east side of the Sendai station following the post-war land readjustment of the station's west side.	
Policy Plan	Following the "Settlement Concept" proposed in The Third Comprehensive National Development Plan (1977), the goal is to establish a stable living area based on the development of a settlement area while taking into account the role of the Tohoku region. Also, it improved its independence as an integrated area by maintaining connection with Tokyo and revitalizing intra-regional connection.		Began redevelopment of the entire east side of Sendai Station, which was burned down during the war. Began land readjustment projects in the Sendai Station East District (From 1973) and Sendai Station East District 2 (From 1988).	
Organization	Establish the National Land Agency (1974).		Sendai became an ordinance-designated city (1989).	
Framework	Implementation of Three Northeast Development Laws (1957), The 3rd Comprehensive National Development Plan (1977), Multi-Polar Patterns National Land Formation Promotion Act (1988), Act on Special Measures concerning Urban Reconstruction (2002).		Utilization of existing system (land readjustment, continuous multi-level crossing, etc.), designation of Sendai urban area as Special District for Urban Renaissance (2020), etc.	
Policy Development	Development and extension of the Tohoku Shinkansen line (started in 1982 between Morioka and Omiya). Development of Tohoku Expressway (started from Iwatsuki IC in Saitama, opened to Izumi IC in Sendai in 1975, opened to Aomori IC in 1979).	Rail: relocation, undergrounding, and extension of the Senseki Line west of the station; construction of the subway Namboku Line (opened in 1987), Airport Access Line (opened in 2007), and subway Tozai Line (opened in 2015) Roads: Highways improvement (e.g., East-West North-South Road, etc.).	Land readjustment projects in the Sendai Station area, continuous multi-level crossing projects, etc. Sub-center development in the Izumi-Chuo district, redevelopment of the Nagamachi district, large-scale residential land development along the Airport Access Line, etc. Renovation and expansion of Sendai Station and its surrounding area (development of the East-West Passageway, hotels, etc.).	

Source: JICA Study Team



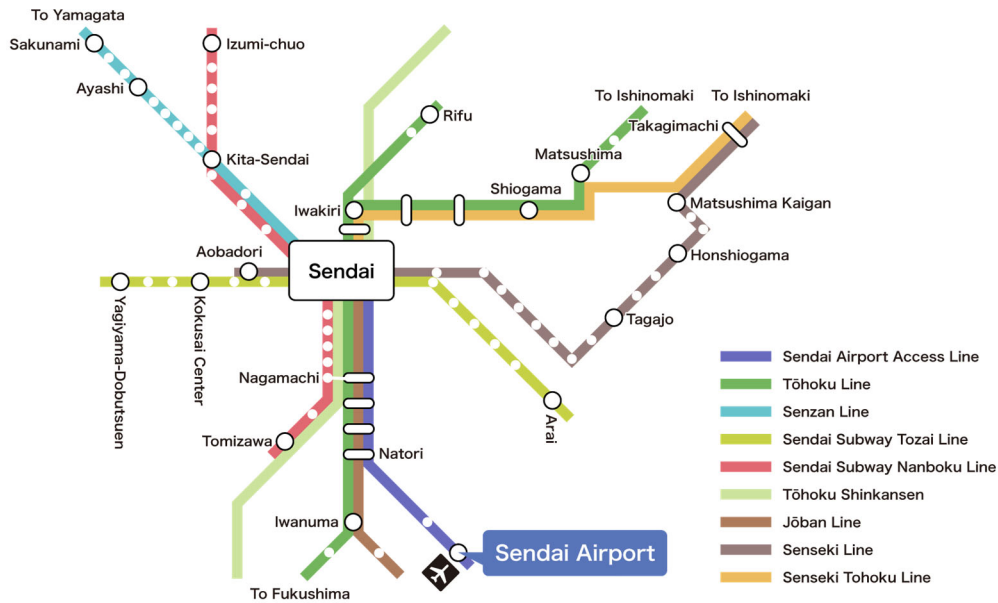


Figure 2-2 Sendai Suburban Railway Map

Source: Sendai International Airport Co., Ltd.; <https://www.sendai-airport.co.jp/en/access/train/>

## 2.2 Examples of TOD in Developing Countries

### 2.2.1 Bangkok Metropolitan Area, Thailand

In the Bangkok Metropolitan Area, population and urban functions are increasingly concentrated in the city center built-up area which caused many issues such as traffic jam and others. In response, Thai government has formulated policy to stipulate social economy development four times since the 1980. The latest “Thailand 4.0” policy was introduced in 2018 and includes the following five issues of the Bangkok Metropolitan Area:

- Mitigation of traffic jam
- Flood protection
- Barrier-free for all people under aged society
- Greenhouse effect gas
- Respond to innovation (AI, ICT/IOT, etc.)

The effort to develop rail-based transit systems in the Bangkok Metropolitan Area has been made even before Thailand 4.0. Development of railway systems was considered in the 1970s, and after a series of funding difficulties and changes in political leadership, now, besides the State Railways of Thailand (SRT) conventional lines, there are also 4 Lines of BTS Skytrain (elevated railway), 6 Lines of MRT (subway and elevated railway), 2 Lines of SRT, Airport Rail Link (ARL), in a total of 13 Lines, shaping the rail network of the metropolitan area.

Under these circumstances, the Bangkok Central Station in Hua Lamphong was losing its functionality due to age and the station’s location, which the Ministry of Transportation and the

State Railways of Thailand responded by building a new central station in the Bang Sue district with multiple train lines arriving and departing. At the same time, the Thai government was also promoting the smart city project, the Bang Sue area was selected as a pilot project. The area around the station (372 ha) is being developed with the aim of achieving Thailand 4.0 (Table 2-5).

Table 2-5 Bangkok Metropolitan Area Issues (Since 2000)

	Metropolitan Level	Corridor Level	Station Area Level	Site Level
Policy Objective	Solution to the population and urban functions concentration in the Bangkok's built-up area.	Starting with the connection of the Blue Line (Hua Lamphong to Bang Sue) in 2004, several lines will be consolidated at Bang Sue, making it the new central station of Bangkok.	The station area will be developed as a smart city (372 ha), aiming to create a diverse city with business, shopping, residential, cultural and tourist facilities to become the hub of Bangkok as an international city.	
Policy Plan	Implement Thailand 4.0, which will accelerate the digitalization of the economy and society. Break out of the "middle-income trap" and become a developed country in 20 years.		Introduce advanced technology and ICT in smart cities to avoid concerns about future urban problems.	
Organization	National Digital Economy Commission (chaired by the Prime Minister; Members include experts) Smart Cities Commission (chaired by the Deputy Minister of Transportation)		Organizational development for smart city implementation in Bang Sue.	
Framework	Seven smart criteria were established. Working groups were established for each standard, with the Office of Transportation Policy and Planning (OTP) as the secretariat.		Because is it the first time, technical assistance from Japan's JICA and UR are requested.	
Policy Development	To avoid risks associated with operation and maintenance, the private sector, which is the contractor, assumes the risk. Fares are determined by the government's upper and lower limits, and contractor operates within the limits.	Railway: Development and connection of BTS Line, Purple Line, Red Line, Yellow Line, and Airport Link line. Utilize Japanese government loans and others for the development.	The project is implemented in three phases of 5 years each: short, medium, and long term. The project is planned to be completed by 2032 and will be financed by Japanese government loans and others.	

Source: JICA Study Team

As the first implementation of the smart-city concept under Thailand 4.0, Bang Sue district development is highly expected to solve the urban issues.

Although the Bang Sue development has created a new urban center in the Bangkok Metropolitan Area, it cannot solve the central issue of population and urban functions concentration. Second and third Bang Sue developments should be immediately considered, along with the organizational capability development of the Thai Central Government or the Local Government as the initiator of TOD projects, as well as the stipulation of legal and business support systems.

### 2.2.2 Jakarta Metropolitan Area, Indonesia

In Jakarta metropolitan area, or "JABODETABEK", the internal transportation rate in the central five municipalities dropped from 44% in 2002 to about 30% in 2018, while the public transportation uses dropped from 60% to about 10%. The causes of such phenomena are the movement of residents to the suburban areas, while offices remain in the metropolitan center. Residential development is being implemented in the surrounding areas that progress without connecting to the existing rail network, and caused worsening traffic jams on the trunk roads



connecting both areas. At the same time, rail transit development gradually progresses. In 2019, other than the MRT that runs from Bundaran Hotel Indonesia Station to Lebak Bulus Station, the development of LRT lines is also progressing. Views of people climbing on the top of train cars of heavily crowded KAI's commuter train ten years ago are no more along the increases in carrying capacity of the public transportation system.

However, along with the adequate development of rail networks, the transfer between MRT and KAI's line with BRT TransJakarta and other modes of transportation that uses the adjacent road, and the transfer between rail and BRT to city bus, taxi, paratransit, and other feeder modes need to be improved. In the future, residential development type of TOD that integrated with rail and BRT in the suburban area, and the improvement of transfer between urban transportation modes and utilization of unused public land type of TOD are expected. Issues in the Jakarta Metropolitan Area are as the followings.

Table 2-6 Jakarta Metropolitan Area Issues (Since 2022)

	Metropolitan Level	Corridor Level	Station Area Level	Site Level
Policy Objective	Improve the quality of life and reduce road traffic congestion.	The challenge is to improve the public transportation utilization rate (60% in 2002 → about 10% in 2018).	Various conditions need to be established to facilitate TOD implementation.	
Policy Plan	Update of the Metropolitan Area Transportation Master Plan (conversion to an effective plan) is an issue.	Improve the rail network, increase transportation capacity, and facilitate of transfers.	Strengthening local government's ability to plan and implement TOD is an issue (integration of TOD systems of various ministries).	
Organization	Improve cooperation between urban development and urban transportation.	Strengthen the organizational capacity of railroad operators and operators.	Strengthening collaboration among ministries and departments in charge of TOD is an issue.	
Framework	Need to establish a national-level model project to support coordinated planning and project development by urban development and urban transportation and a new system to support project financing.		Need to establish organizations to support TOD development. Enhancement of legal system (e.g., legalization of land readjustment outline, application to existing urban areas).	
Policy Development	Collaborative organizations are key to TOD implementation. Need to strengthen cooperation between public and private sectors.			

Source: JICA Study Team

## 2.3 Examples of TOD in Other Countries

### 2.3.1 Paris Metropolitan Area, France

The Paris Metropolitan Area is currently undergoing a major transformation called the Grand Paris project, which involves the construction of a new subway network in the suburbs of Paris and the redevelopment of the area around its stations. The Grand Paris Act was enacted in 2010 under the presidency of Nicolas Sarkozy, and the construction project was launched in earnest with the aim of creating a strategically advanced metropolitan area for the next era. The objectives of this plan are:

- Promote sustainable economic growth in competition with other large cities in the world; and
- Fix the administrative inefficiencies of the capital, which had separated the city of Paris, the surrounding Paris Metropolitan Area, and other municipalities.

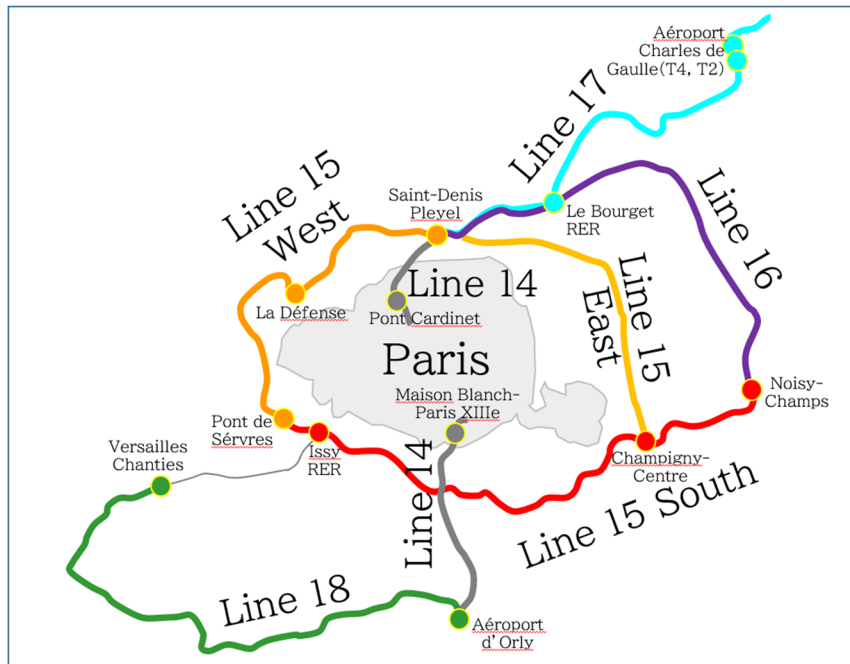


Figure 2-3 Grand Paris Plan and Grand Paris Express Route Map

Source: JICA Study Team based on the following figure

[https://www.apur.org/dataviz/observatoire\\_des\\_gares/index.html](https://www.apur.org/dataviz/observatoire_des_gares/index.html)

Table 2-7 Paris Metropolitan Area Issues (around 2009)

	Metropolitan Level	Corridor Level	Station Area Level	Site Level
Policy Objective	Compete with the world's largest cities and promote sustainable economic growth. Fix administrative inefficiencies in the capital city, in the City of Paris, and in other municipalities in the metropolitan area.	Reinforce the public transportation system that connects the entire Paris metropolitan area as an integrated region with the city of Paris at its core.	Promote urban (re)development linked to the metropolitan level and the corridor level policy.	
Policy Plan	Establish a public corporation that will effectively lead the project as a higher-level organization of the local government and will also be in charge of redevelopment and subway construction.		Redevelopment along the subway line to improve the impact of subway development.	
Organization	Establish Société du Grand Paris (SGP).		Strengthen organizational capability of administration in each region.	
Framework	Grand Paris Act (2010) and increased lodging and business taxes.			
Policy Development	Tax increase (120 million €/year) to be provided to SGP, the operator.	Subway construction by SGP. Construction below 30m below ground level, where no compensation for subway construction is required.	Dozens of station areas were redeveloped at the same time as the subway construction.	

Source: JICA Study Team

Until then, the Paris Metropolitan Area had two different administrative entities in parallel: the City of Paris and the rest of the surrounding area in the Ile-de-France. The city planning and policymakers that supported urban administration as a practical matter also worked separately for the City of Paris and the Paris region, adapting to the direction of the administration at the time, maintaining continuity in data and urban planning, and conducting the work necessary to implement policies at a very high level under a rational and substantive system not seen in Japan.

However, the government made a political judgment that it was necessary to take a scalpel to

the urban administration for the Paris Metropolitan Area as a whole.

The Grand Paris project is a large-scale, high-standard, and short time frame project to ensure an even more effective and high-quality urban life for the population, even though the Paris Metropolitan Area is already mature. Almost ten years have passed since the start of the project, and despite its unimaginably large scale, the institutional and financial systems are in place, and construction is proceeding in various locations.

The Société du Grand Paris (SGP), a public facility corporation, was established as the project entity authorized to implement public projects to ensure smooth implementation.

The core project of the Grand Paris Plan, the Grand Paris Express, is to complete a 200 km, ring-shaped urban rail network (two new lines and two extensions) by 2030, beginning with the extension of existing lines and the completion of new lines within Paris in 2010. The plan calls for the completion of a 200-kilometer, circular urban rail network (two new lines and two extensions) with 68 stations by 2030. Since most of the lines will pass through urbanized areas, 90% of the lines are planned to be laid underground. The total impact of the development is expected to cover 140,000 km<sup>2</sup> and serve 2 million passengers daily.

In addition, dozens of station-area redevelopment projects were started at the same time as the subway construction, creating a chain of TOD that is unprecedented in the history of the world.

Most of the planned lines will be constructed below 30 meters underground, so it will not be required to pay compensation to the landowners.

The total construction cost increased from € 21.4 billion (2013) to € 23.5 billion (2017).

The hotel tax and business establishment tax were increased to secure the expenses. Specifically, an additional 15% hotel tax (€ 20 million per year) and a 10% increase in taxes on business establishments in Paris and the Hauts-de-Seine (€ 120 million per year) will be provided to the Grand Paris Authority, which is the primary operator of the project.

Note that the project connecting the Paris Metropolitan Area suburban hubs, three airports, eight TGV (French bullet train) stations, five RER (existing suburban high-speed rail) stations, etc., was initially included but was separated from the project.

## 2.3.2 London Metropolitan Area, United Kingdom

### 2.3.2.1 London Transport Plan (2000) and Road Pricing Implementation

Following the return of "Greater London" in 1999, a "London Transport Strategy" was formulated in 2000 to address the urgent issues of reducing road congestion and increasing the capacity, reliability, and connectivity of rail, bus, and other public transportation systems. Based

on this strategy, Transport for London decided to expand the subway network in preparation for the 2012 Olympic Games, including improving access to airports and Olympic-related facilities.

On the other hand, a "congestion tax" was introduced in 2003 to reduce road congestion. In principle, cars entering the city center during the daytime on weekdays must pay 8 pounds per vehicle per day (approximately 1,240 yen; as of 2022, 15 pounds per day, about 2,000 yen). The payment record will be checked against license plate information captured by surveillance cameras installed throughout the city. This measure has improved traffic congestion in the city, and the tax revenue will be used to expand the city's transportation infrastructure.

#### 2.3.2.2 Spatial Development Strategy "London Plan"

The City of London develops a spatial development strategy, the London Plan, every few years, considering the National Land Planning Policy Framework. The 2016 edition, targets 2031 and outlines strategies for addressing economic and population growth, strengthening international competitiveness, addressing climate change, urban planning, and transportation planning. The main items are:

- (1) Main measures related to urban planning
  - Development of housing that meets both quality and quantity requirements (including low-income housing)
  - Promotion of mixed-use development and harmony with the community
  - Securing green spaces (including greening of public spaces as well as existing parks)
  - Preservation of historic landscapes
  - Environmental preservation
  - Restrictions on construction of high-rise and large buildings
  - Strategies for each district
- (2) Main measures related to railways and stations
  - Increase in transportation capacity of each line to meet increased demand (facilities expansion, increase in rolling stock, etc.)
  - Development of new line (Crossrail project), various extension projects, etc.
  - Improvement of transportation connectivity (interconnection of medium- and long-distance railways, subways, buses, cabs, water transportation, walking, bicycles, and airplanes)
  - Improvement of terminal stations (e.g., reducing congestion, barrier-free access, etc.)
- (3) Major measures related to bicycling and walking

- Bicycle share of transportation of 5% by 2026
- Establishment of bicycle lanes
- Promotion of bicycle parking facility placement
- Deployment of shared bike ports
- Development of pedestrian network that spans the City of London

Table 2-8 London Metropolitan Area Issues (around 1999)

	Metropolitan Level	Corridor Level	Station Area Level	Site Level
Policy Objective	Respond to economic and population growth, strengthen international competitiveness, and address climate change.	Relieve road congestion and increase transportation capacity, reliability, and connectivity of railways, buses, and other public transportation.	Improvement in urban planning, rail station, and bicycle / pedestrian access.	
Policy Plan	London Transport Strategy (2000), The London Plan (spatial development strategy; revised 2016)		Strategic implementation of the objectives above based on The London Plan.	
Organization	Establish Greater London (Greater London Authority, London Assembly, Mayor of London; 1999)		Strengthen organizational capability of administration in each region.	
Framework	Greater London Authority Act (1999)	Congestion Charge (2003), Crossrail Act (2008), Business Rates Supplements Act (2009; used to pay for Crossrail construction)	Utilize existing systems to promote urban planning (e.g., mixed-use development), rail station-related (e.g., improvement of transportation connectivity), and bicycle/pedestrian-related (e.g., development of pedestrian networks).	
Policy Development		Develop new line development (Crossrail) and extension, transit capacity expansion, and improvements according to the London Transport Strategy.	Other than as stated above, there are station area developments at 5 Crossrail stations (development profits to be used for Crossrail construction).	

Source: JICA Study Team

### 2.3.2.3 Major Line Development Plan: Crossrail

#### (1) Development Background

The annual number of passengers carried by the London subways has reached 1,384 billion (2018). While congestion, especially during rush hours, is so severe that drastic measures are needed. Especially, the Central line runs east-west through central London, are extremely congested, and the construction of a bypass line has been under consideration for many years.

The idea for the East-West Crossing was conceived shortly after World War II but never implemented due to huge construction costs, and only after Congress passed the "Crossrail Act" in 2008 did the Crossrail construction project begin in earnest.

#### (2) Development Outline

The Crossrail line will interconnect the east and west National Rail lines, running underground across central London. Six stations will be built in the tunnel section in central London. After the entire line opens, it will be called the "Elizabeth Line". The Crossrail line will have the following specifications.

- Total length: 118km (42 km tunnel length)
- Number of stations: 41 (10 new stations)
- Expected number of passengers: 100 million annually (average of 550,000/day)
- Operator: Transport for London

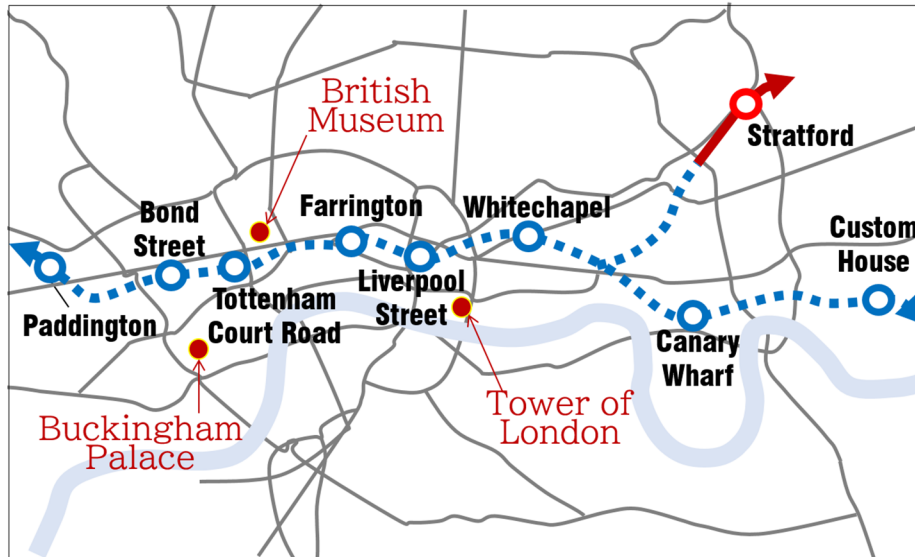


Figure 2-4 Crossrail (Elizabeth Line) Route Map

Source: JICA Study Team based on the following figure: <https://www.crossrail.co.uk/route/maps/>

### (3) Construction Funds

As of 2019, total construction costs amounted to £ 17.8 billion, and are expected to increase. The majority of the funds are financed by public funds, but some private development profit returns are also being utilized. One of these is based on the beneficiary-pays approach by increasing the taxation rate in the area. Based on the "Business Rate Supplement Act" enacted in 2009, the Greater London Authority raised property taxes on non-residential property by 2% to fund Crossrail construction. In addition, real estate development revenues from land adjacent to the station will be returned to rail construction.

Table 2-9 Sources of Fund of Crossrail Construction

Funding Source	Value (in mill. £)	%
Department for Transport	7,985	42.5
Business rate supplement, infrastructure levy, etc.	4,400	23.4
Network Rail	2,980	15.9
Transport for London	2,050	10.9
Sales of surplus land and property	550	2.9
Greater London Authority	350	1.9
Developers	300	1.6
London businesses	100	0.5
Heathrow Airport Limited	70	0.4
Total	18,785	100

Source: JICA Study Team based on the following data <https://www.crossrail.co.uk/about-us/funding>

#### (4) Station Area Development (Real Estate Development in Central London)

The stations in Central London and other areas will be underground stations, with the real estate income from the construction of office, commercial, and residential buildings in the above-ground areas used to fund the construction of the railway system. Ten commercial buildings are planned to be developed at five stations in the central area and one commercial building at one station in the redevelopment area, with expected revenues of approximately £ 500 million (approximately 70 billion yen).

### 2.3.3 Cleveland Metropolitan Area, United States

As an example of TOD by BRT, we examine the Cleveland metropolitan area and the BRT HealthLine in Ohio, USA, which was ranked Silver by ITDP and is the best BRT in North America. The BRT, HealthLine, was named after two major local hospitals (Cleveland Clinic Hospital and University Hospital) that purchased the naming rights to the BRT (\$6.25 million over 25 years).

A summary of BRT Health Line is provided below.

#### (1) Development Background

Euclid Boulevard, where the BRT was introduced, was converted to electric streetcars in the 1890s and to buses in 1952. The decline of the downtown area, and its high vacancy rate made it urgent to revitalize the line by introducing high-speed public transportation.

In 1985, in order to facilitate and revitalize mobility on Euclid Avenue, the City of Cleveland considered building a new subway or Light Rail Transit (LRT), but the cost was estimated at \$1 billion for the subway and \$750 million for the proposed 4-mile LRT. In 1993, the plan was revisited and considering the cost and the benefit, BRT was selected.

Table 2-10 Issues of Cleveland Metropolitan Area (around 1985)



	Metropolitan Level	Corridor Level	Station Area Level	Site Level
Policy Objective	Improve regional access to employment, health care, education, and cultural destinations.	Improve service, convenience, and accessibility of public transportation within the metropolitan area; reduce travel time and on-board congestion; improve quality of life for people who visit, work, and live along the BRT corridor.	Sustained economic and community development and growth on "Euclid Avenue" and adjacent areas served by BRT; promotion of private economic activity near transit stations; improved livability through streetscape, amenities, and public safety improvements; and improved local air quality.	
Policy Plan	Dual Hub Corridor Alternatives Analysis/Draft Environmental Impact Statement implementation (1985; recommended introduction of subway and LRT); reexamined (1993; recommended cheaper, more effective BRT).			
Organization	City of Cleveland, Greater Cleveland Regional Transit Authority (GCRTA).			
Framework		The federal government funded 80% of the approximately \$210 million costs of the BRT improvements.		
Policy Development		Two major local hospitals support BRT by purchasing naming rights to BRT ("Health Line").	Investments were made mainly by local hospitals and companies, developing approximately 213.7 ha (more than 8,800 housing units, 1,800 dormitories, and 1,300 hotel rooms) and creating 13,000 new jobs.	

*Source: JICA Study Team*

## (2) Development Overview

Cleveland's HealthLine, a 6.8-mile (10.9 km; 36 stops) BRT line that uses a dedicated central bus lane on Euclid Boulevard to connect the city's central business district with University Circle, a medical and cultural district, began service in October 2008. It has been in service since October 2008. Current ridership is approximately 16,000 passengers/day (2014: approximately 13,900 passengers/day; 2018: approximately 10,100 passengers/day).

## (3) Project Financing

The BRT cost approximately \$210 million (of which the federal government funded 80% of the cost), which was about one-fifth of the cost of the subway system initially considered, and the line was able to be extended by 70% longer.

## (4) Station Area Development

Over \$5 billion in real estate development, both new construction and renovation, has occurred along the BRT corridor, with 2018 estimates showing an economic impact of over \$9.5 billion, or approximately 190 times the cost of the BRT improvements. Note that the BRT's direct contribution to development impact is unknown, as a number of parking spaces were also constructed along the line.

### 2.3.4 BRT and TOD

In the literature examining the relationship between BRT and TOD case studies of Bogota, Colombia and Ahmedabad, India are presented. Based on the results of these two studies, urban

and transit planners in 50 cities around the world that have implemented BRT were surveyed<sup>2</sup>. A summary of them is described below.

Bogota's BRT carries 45,000 passengers per hour in one direction, indicating a capacity comparable to rail-based transportation. Municipalities along the BRT lines focus only on the volume of traffic and pay little attention to the development along the lines (TOD). In fact, the revised FAR between 2004 and 2010 shows that the BRT line (within a 1km radius) and other areas are 5-7% compared to 10% in the other areas.

The main reason is that the Bogota BRT stations (stops) are mainly located in the middle of the road and connected to both sides by pedestrian bridges, making them inaccessible for pedestrians and problematic in terms of accessibility.

In Ahmedabad, the Town Planning Scheme (TPS) and the Local Area Plan (LAP) have been used for urban development, but there are no examples of their application (master planning) around BRT stations (stops). Land prices around BRT stations (stops) doubled between 2006 and 2011. This resulted from individual real estate developers' efforts to develop real estate individually; since there were no TOD projects planned around the BRT stations (stops), there was no collective effect on the surrounding area.

The most common issues, in order of importance, addressed by local governments and other organizations in the vicinity of BRT stations (stops) were (1) improvement of infrastructure such as sewers and sidewalks (60% of respondents), (2) land use, and (3) financial resources. The most common issues in promoting development along BRT lines, in order of importance, were (1) financial resources (return of development profits and use of official development assistance, or ODA), (2) absence of neighborhood planning including access improvements, and (3) lack of coordination among related agencies.

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<sup>2</sup> Robert Cervero and Danielle Dai; "BRT TOD: Leveraging transit oriented development with bus rapid transit investments"; ELSEVIER, Transport Policy, Volume 36, November 2014, Pages 127-138

## 2.4 Typology of TOD Projects

This section provides a typology of the cases described in the previous section and other TOD cases collected.

### 2.4.1 Typology at the metropolitan area level and corridor level

Based on the matrix of issues for the seven metropolitan areas discussed in Chapter 2, a typology of TOD at the metropolitan area level is developed. Since it is common for TOD to be studied at the corridor level simultaneously with the planning stage at the metropolitan area level, these two levels are treated and categorized together.

First, the seven metropolitan areas are categorized according to whether urban development, the construction of new public transportation lines, and the expansion of transportation capacity have been or will be integrated into the planning and implementation phases.

In the Jakarta Metropolitan Area, urban development is being led by the private sector, and public transportation is being planned and implemented later.

In contrast, in the other six metropolitan areas, urban development and public transportation development are being carried out in an integrated manner, although to varying degrees.

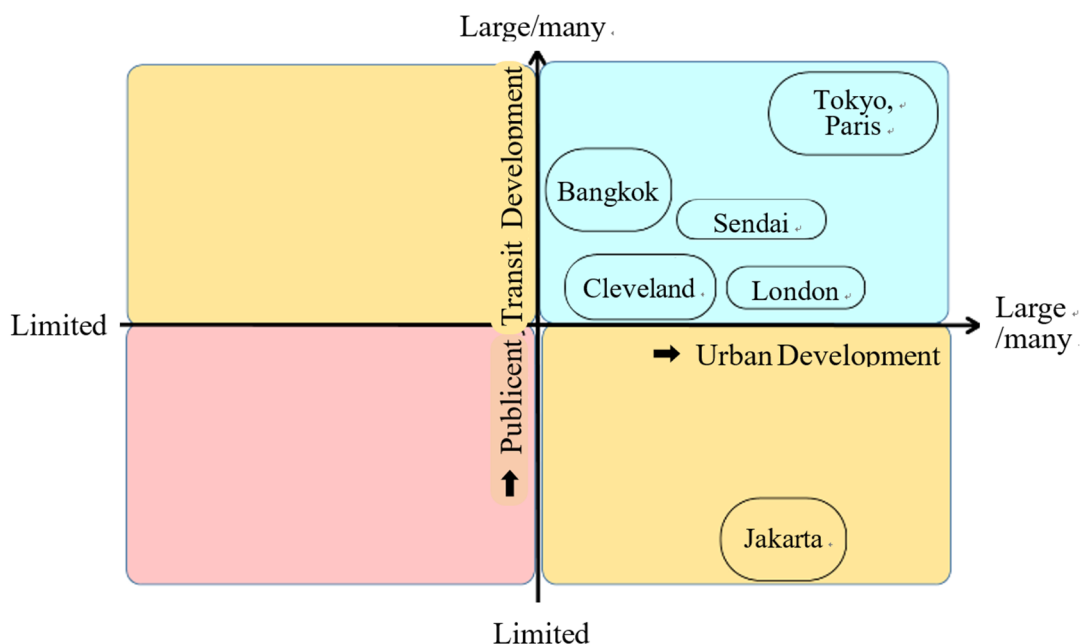


Figure 2-5 Typology Based on State of Integration of Urban Development and Transportation

Source: JICA Study Team

Next, TOD is categorized by who took the lead in planning and implementation. In the Bangkok, Paris, and London metropolitan areas, the national government took the lead in both planning and implementation, while in the Tokyo Metropolitan Area, local governments, national and local public agencies, and transportation operators took the lead after the national government had developed a plan and a legal system to facilitate implementation of various

projects.

On the other hand, in the Sendai and Cleveland metropolitan areas outside the capital area, both planning and maintenance were led by local governments.

In sum, in capital city or other region deemed important by the central government, the central government leads, while for regional cities, there is tendency for the local government to lead TOD planning and implementation.

However, neither of the two types of TOD are applicable to the Jakarta Metropolitan Area in Indonesia, where urban development and public transportation enhancements have been carried out separately.

Table 2-11 Typology by TOD Initiator

Metropolitan Area	Country	Metropolitan Level TOD Initiator		Notes
		Planning	Implementation	
Bangkok	Thailand	National gov.	National gov.	Assistance from JICA, UR, etc.
Jakarta	Indonesia	Urban development by private sector is taking the lead, while public transportation development by the national government is following		
Tokyo	Japan	National gov.	Local gov. / Public institution / Transit operator	
Sendai	Japan	Local gov.	Local gov.	
Paris	France	National gov.	National gov.	
London	United Kingdom	National gov.	National gov.	
Cleveland	United States	Local gov.	Local gov.	

Source: JICA Study Team

#### 2.4.2 Results of TOD at the Corridor Level –Tokyo Metropolitan Area and Sendai Metropolitan Area

The results of TOD at the corridor level are discussed using the Tokyo Metropolitan Area and the Sendai Metropolitan Area as examples. As an indicator for evaluating results, we use "nighttime population," which encompasses social, economic, and environmental changes in the municipalities along the lines.

##### 2.4.2.1 Tokyo Metropolitan Area (1) – Yamanote Line

In the Yamanote Line, the nighttime population of municipalities along the Yamanote Line decreased by about 14% from 1985 to 1995 due to the policy of correcting the concentration of people in Tokyo based on the Fourth National Capital Region Development Plan. Later, the national government turned its attention to the policy of strengthening international

competitiveness, and from 1995 to 2020, the population increased by about 29%.

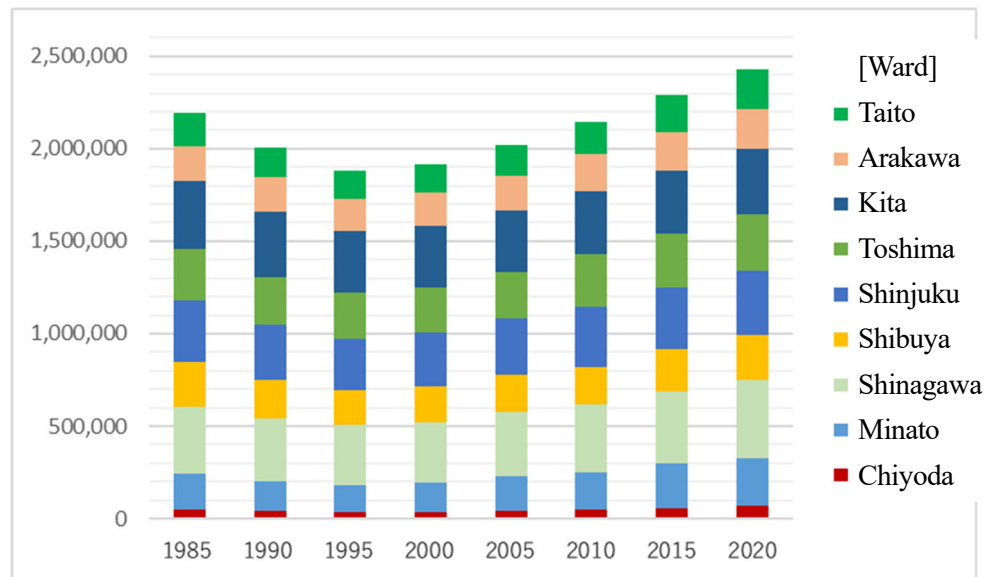


Figure 2-6 Population of Municipalities along the Yamanote Line

Source: JICA Study Team based on census data

#### 2.4.2.2 Tokyo Metropolitan Area (2) – Chuo Line

Along the Chuo Line, the nighttime population of municipalities along the line has consistently increased since 1985, benefiting from the relocation of metropolitan functions to suburban cities (including the relocation of the university and junior college campuses) during the Fourth National Capital Region Development Plan. From 1995 to 2020, the nighttime population increased by about 15%. During this period, the Tokyo Metropolitan Government, East Japan Railway Company, and other entities have relieved road traffic congestion and increased transportation capacity through projects such as the continuous grade separation.

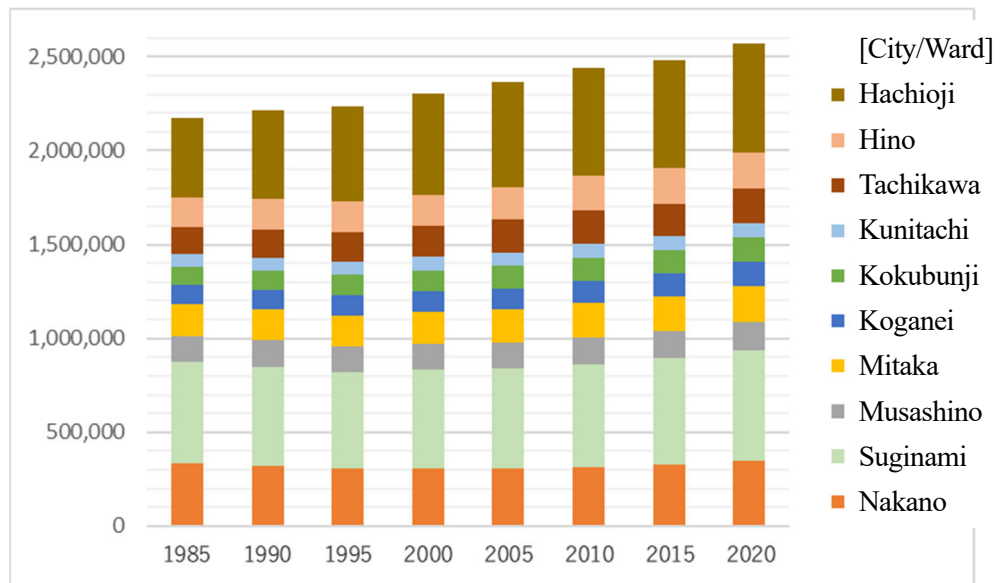


Figure 2-7 Population of Municipalities along the Chuo Line

Source: JICA Study Team based on census data

### 2.4.2.3 Tokyo Metropolitan Area (3) – Keiyo Line

The Keiyo Line was developed by Chiba Prefecture and others to address the concentration of people in Tokyo, and development along the line was integrated. The nighttime population increased by about 8% from 1985 to 1995, and by about 23% from 1995 to 2020.

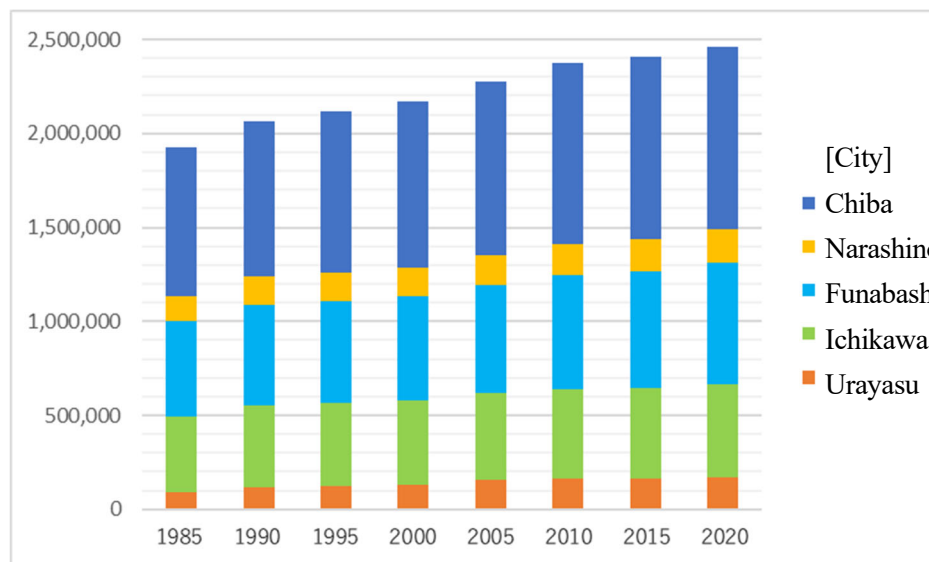


Figure 2-8 Population of Municipalities along the Keiyo Line

Source: JICA Study Team based on census data

### 2.4.2.4 Sendai Metropolitan Area – Tohoku Main Line and Sendai Airport Access Line

In the Sendai Metropolitan Area, the Tohoku Shinkansen and highways have been constructed to strengthen inter-city transportation. Within the urban area, the nighttime population increased by about 14% from 1985 to 1995 and by about 14% from 1995 to 2020 as a result of the construction of the Sendai Municipal Subway (Namboku Line and Tozai Line) and the Sendai Airport Access Line, as well as residential development along the lines.

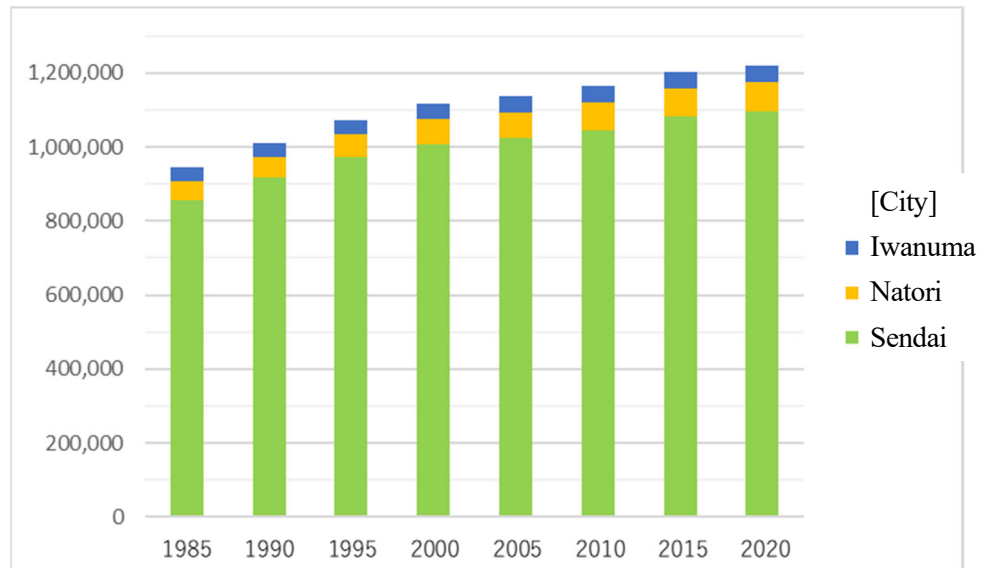


Figure 2-9 Population of Municipalities along the Tohoku Main Line and Sendai Airport Access Line

Source: JICA Study Team based on census data

### 2.4.3 Station Area and Site Level Typologies

The following items will be categorized at the station area and site level.

- TOD characteristic: existing station or stop (terminal) / station area (re-)development, new station, stations integration.
- TOD scope: station area, station-plus, in-station; can be more than one.
- Land characteristic: high intensity built-up area, low intensity built-up area, greenfield area (development already started), greenfield area (not developed),
- TOD stage: conceptual stage (policy objective and framework formulation), masterplan formulation stage, operational planning stage, design & contract stage, implementation stage, operation & maintenance stage, redevelopment consideration stage.
- Land acquisition method: currently unused railway land, high intensity use of space in existing rail facility (space above or below station building, artificial deck above rail tracks, track elevation and space under viaduct, space above undergrounded track), former railway land (stabling yard, etc.), adjacent land/building (purchase, rent, joint-development, redevelopment; uses of vacant land or development land), land far from rail station, overall development.
- Types of measures by transportation company: rail/BRT improvement (capacity enhancement, new route (route change, including change in platform location) or through operation, new line or connection, removal of bay platform and through operation, station renovation and others; also included is the detail of the financing

(financing by transit operator, government, or non-transit private sector, etc.)

- Types of measures by non-transportation company (in cooperation with transportation company and others): Station building renovation (Ekinaka), lifestyle business in the station building, transit-related business around the station (parking, logistics, and others).
- Urban development (by other than transportation company; public or private; individual or in cooperation): public transportation-related facility (station plaza, bus terminal, parking (bicycle, motorcycle, automobile), access road, pedestrian road), open space (public and private), other public facilities (park, government office, tourist information center), private buildings (commercial or office buildings, hotel and leisure facilities, residence, others).
- Financing method: transportation company's fund (corporate financing, including by group company), cross subsidy through fare increases, incentives/subsidy from the government (including local gov.), public financing scheme, contribution from private sector, sales of FAR and other development rights, value increase of owned asset due to development, land procured from the private sector (through land consolidation or others).
- Legal scheme used: rail infrastructure improvement-related scheme (e.g., continuous multi-level crossing), urban planning / development related scheme (e.g., land readjustment, district planning, FAR-related scheme), utilization of private sector's finance / capability (public private partnership (PPP), land value capture (LVC), other tax-related scheme), others.

Based on the aforementioned items, the types of TOD at the station and site levels are shown in the Material 2 in the "Materials of the Study Results".

## 2.5 Issues and Countermeasures at Each Stages of TOD Project

In this section, collected case studies were analyzed, and problem solving approach for each stages' issues are formulated. Issues that exist during the conception, plan formulation, construction, and operation and maintenance stages of TOD are explained in the figure below.



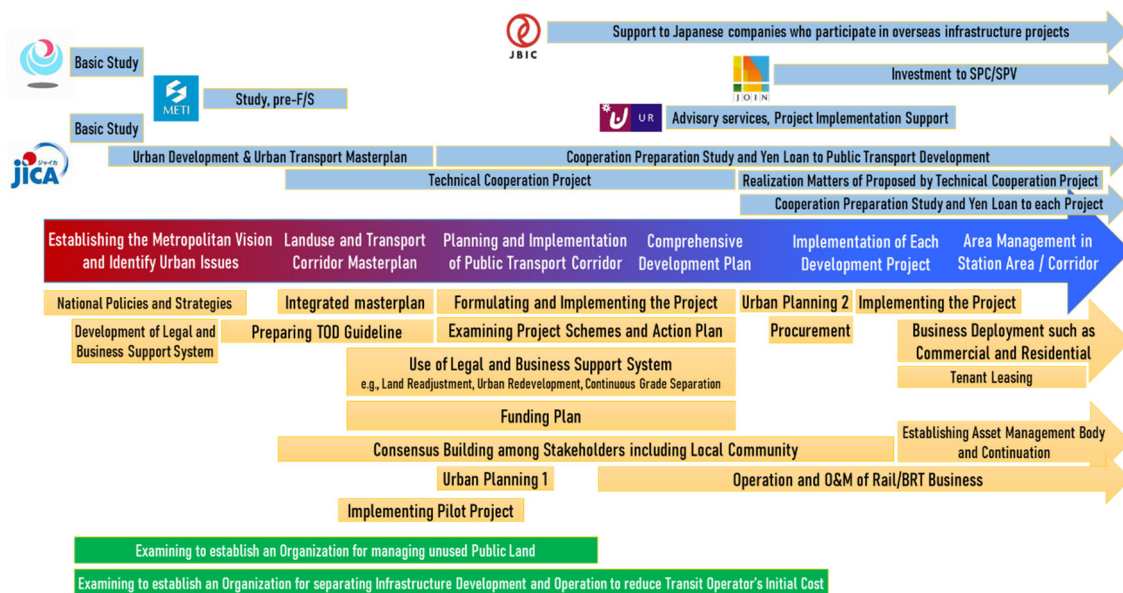


Figure 2-10 Issues at Each Stages of TOD Project; *Source: JICA Study Team based on JICA document*

There are various issues to be solved at the level of the base line, district, and station/station area when implementing TOD in developing countries (see the Table below). These are the same issues that Japan used to face, and we believe that Japan's problem-solving process can serve as a reference for developing countries.

Table 2-12 TOD Implementation Challenges in Developing Countries

	Built-up Area (Brown field)	Suburban/New Town (Green field)
Existing lines	<ol style="list-style-type: none"> <li>(1) In many developing countries, land readjustment, urban redevelopment, and continuous multi-level crossings measures do not exist. The challenges are to improve the legal system and to secure land (former rail yards, public land, and other unused land).</li> <li>(2) Many intercity trains do not pass through urban centers and have long distances between stations.</li> <li>(3) National railways in developing countries are generally inefficient. Need to explore solutions such as vertical separations, privatization, etc.</li> </ol>	<ol style="list-style-type: none"> <li>(1) It is necessary to understand the methods and conditions of urban area development in each country, identify issues, and consider improvement measures.</li> <li>(2) Many intercity trains operate infrequently. It is necessary to improve connection with the urban centers and increase the urban development potential along the railway lines.</li> <li>(3) National railways in developing countries are generally inefficient. Need to explore solutions such as vertical separations, privatization, etc.</li> </ol>
New lines	<p>In addition to the three items for 'Existing lines',</p> <ol style="list-style-type: none"> <li>(1) Especially in developing countries in Asia, it is expected to be difficult to secure land for new line construction due to high population density. It is necessary to consider three-dimensional land use, including below and above the ground.</li> <li>(2) The cost of constructing new line will likely be higher and linkage with urban development around the new station/station area, i.e., TOD, should be considered. In the case of an elevated new line, it is necessary to use the area under it.</li> </ol>	<p>In addition to the three items for 'Existing lines',</p> <ol style="list-style-type: none"> <li>(1) The construction of a new line is an upfront investment in anticipation of future urbanization and there is also demand risk. It is necessary to consider measures to reduce the initial investment by railway operators, such as by vertical separations.</li> <li>(2) If there is demand risk, phased development (e.g., new BRT line that will be upgraded to MRT later) would also be effective.</li> </ol>

Source: JICA Study Team

## 2.6 Proposed TOD Development Indicators

In this section, for each of the items and issues categorized in the previous sections, the effects of their solution on urban development are explained and are proposed as quantitative and qualitative indicators that can be used in the future.

To develop an indicator that accurately expresses TOD, it is important to correctly represent the relationship between the railway operation and urban development aspects. To this end, the following two methods will be used to examine the relationship between operation and development, and develop quantitative indicators that can be used in the future.

First, we analyze Japan. For the urban development aspect, the analysis will focus on municipalities with rail stations (total number (the sample size for the analysis): 847). For the railway operation aspect, the closest stations to the respective municipal offices (town halls) in these municipalities are selected. The data used in the analysis is based on the 2015 census year, before the impact of the Coronavirus pandemic, and for which various data are available.

The stations' ridership (in the case of stations where only the number of boarding are available, it is doubled and considered as the ridership) as data reflecting the railway operation and treated as the explained variable.

As for data reflecting the urban development, certain data shall be selected from the following data in the subject municipality and treated as explanatory variables: Population Census data (14 types), Economic Census data (6 types), Basic School Survey and Social Education Survey data (4 types), Social Indicators data (10 types), others (16 types).

### 2.6.1 Correlation Analysis

#### 2.6.1.1 Correlation Analysis (1) – Case of Japan

In order to make comparisons between Japan and other countries possible, in other words, in consideration of data available in other countries as well In other words, this subsection will conduct a correlation analysis while narrowing down the explanatory variables from 53, taking into consideration data that are also available in other countries.

First, the results of the correlation analysis for Japan, using two arbitrary explanatory variables from among the six explanatory variables and considering data errors, are as follows.

Table 2-13 Correlation Analysis Result (Japanese samples)

	Nighttime Population				
Nighttime Population		Area			
Area	0.718		Density		
Density	0.717	0.703		Retail sales	
Retail sales	0.510	0.708	0.726		Average car ownership
Average car ownership	0.635	0.385	0.633	0.641	

【Coefficient of determination ( $R^2$ ) when daytime population is used】

	Daytime Population				
Daytime Population		Area			
Area	0.734		Density		
Density	0.731	0.703		Retail sales	
Retail sales	0.527	0.708	0.726		Average car ownership
Average car ownership	0.654	0.385	0.633	0.641	

Source: JICA Study Team

As shown in Table 2-25, there are six cases of combinations of two explanatory variables with coefficients of determination exceeding 0.7.

The six explanatory variables used in all sections were daytime population/nighttime population, area, population density (using nighttime population), retail sales, and number of vehicles per capita, but it should be assumed that three of these variables, daytime population, retail sales, and number of private vehicles per capita are difficult to obtain in foreign cities.

Considering this, and in consideration of comparisons with other countries, the regression equation for the case of the combination of "nighttime population" and "area," which has the highest coefficient of determination, is shown below, excluding the three factors of daytime population, i.e., retail sales, and number of private vehicles per capita. The regression equation for the case using the combination of "daytime population" and "area," which is suitable for representing large terminal stations, is shown for reference.

$$Y (\log_{10} \text{ of } \underline{\text{stations' ridership}}) = -0.21364 + 0.59608X_1 (\log_{10} \text{ of } \underline{\text{nighttime population}}) - 0.27479X_2 (\log_{10} \text{ of } \underline{\text{area}})$$

※ Coefficient of determination  $R^2 = 0.718$  (Correlation coefficient  $R = 0.848$ )

【Reference】

$$Y (\log_{10} \text{ of } \underline{\text{stations' ridership}}) = -0.21304 + 0.59581X_1 (\log_{10} \text{ of } \underline{\text{daytime population}}) - 0.27456X_2 (\log_{10} \text{ of } \underline{\text{area}})$$

※ Coefficient of determination  $R^2 = 0.734$  (Correlation coefficient  $R = 0.857$ )

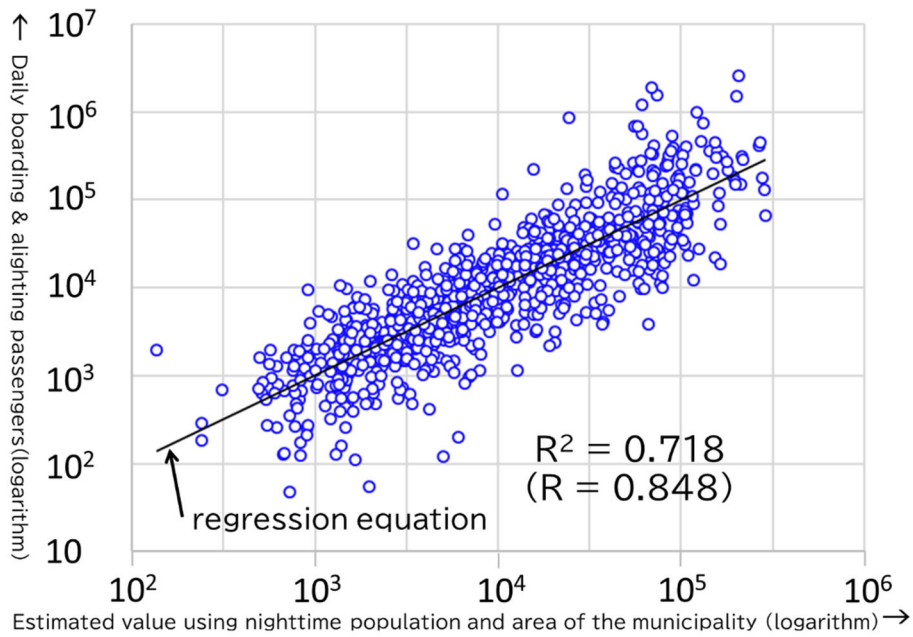


Figure 2-11 Correlation Analysis Result and Regression Equation (Japan)

Source: JICA Study Team

### 2.6.1.2 Correlation Analysis (2) – Case of Europe, North America and Australia

In overseas cities, data on variables that were considered significant in the Japanese analysis described in the previous subsection (explained variable: number of passengers at stations, explanatory variables: nighttime population, area, etc.) are published mainly in Europe and North America (U.S. and Canada), as well as in Australia. On the other hand, data on the number of passengers at stations/stops are often not publicly available in developing countries. For this reason, in this subsection, correlation analysis was conducted for major stations in European and North American countries and Australia. Based on the size of the country, the analysis was divided into two groups: Europe (sample size  $n=158$ ) and North America and Australia (sample size  $n=48$ ). As in Japan, nighttime population and area of municipalities were used as explanatory variables. The results of the analysis are as follows.

【Europe ( $n=158$ )】

$$Y (\log_{10} \text{ of } \underline{\text{stations' ridership}}) = 0.81080 + 0.92547X_1 (\log_{10} \text{ of } \underline{\text{nighttime population}}) - 0.34015X_2 (\log_{10} \text{ of } \underline{\text{area}})$$

※ Coefficient of determination  $R^2 = 0.501$  (Correlation coefficient  $R = 0.708$ )

【North America & Australia ( $n=48$ )】

$$Y (\log_{10} \text{ of } \underline{\text{stations' ridership}}) = 2.31919 + 1.27075X_1 (\log_{10} \text{ of } \underline{\text{nighttime population}}) - 1.23177X_2 (\log_{10} \text{ of } \underline{\text{area}})$$

※ Coefficient of determination  $R^2 = 0.529$  (Correlation coefficient  $R = 0.727$ )

Although the coefficient of determination for both groups is somewhat low, around 50%, Figure 2-12 shows that they fall within the Japanese analysis' distribution range and the regression lines are almost identical.

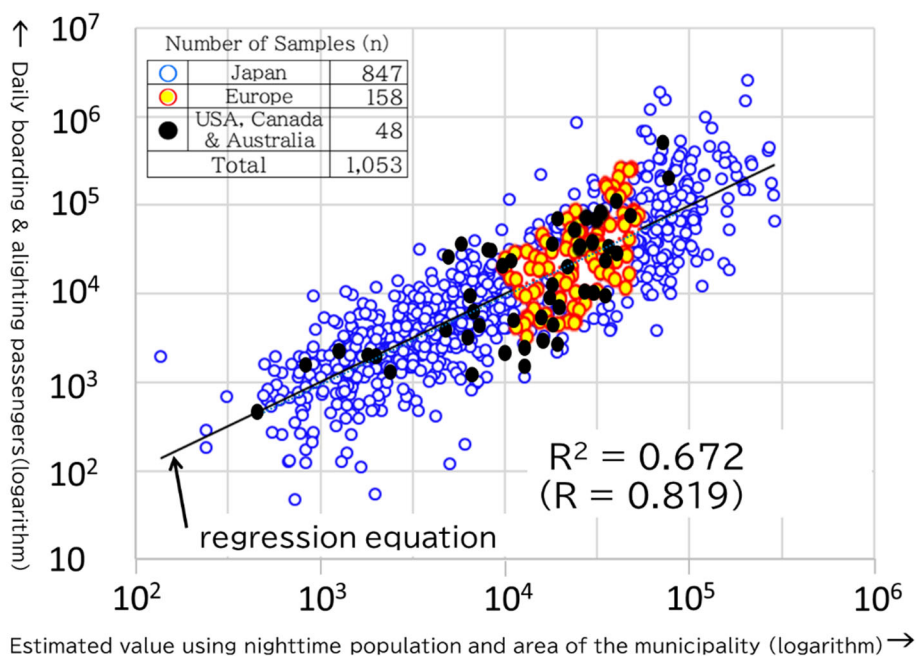


Figure 2-12 Correlation Analysis Result and Regression Equation (Japan, Europe, North America/Australia)

Source: JICA Study Team

### 2.6.1.3 Correlation Analysis (3) – Combination of 3 Regions

Finally, we analyzed the case where data from Japan, Europe, and North America/Australia were combined, resulting in the following regression equation

$$Y (\log_{10} \text{ of stations' ridership}) = 0.93456 + 1.15969X_1 (\log_{10} \text{ of nighttime population}) - 0.66575X_2 (\log_{10} \text{ of area})$$

※ Coefficient of determination  $R^2 = 0.672$  (Correlation coefficient  $R = 0.819$ )

Since the coefficient of determination exceeds two-thirds, we believe that it can be used as a common regression equation for the three regions and can be tentatively applied mutatis mutandis to other countries, including developing countries.

Therefore, to calculate Y and  $X_2$  from  $x_1$  (nighttime population; real number of  $X_1$ ), the following formula can be used:

$$x_1 = 10^{\alpha}; \alpha = \{ (Y (\log_{10} \text{ of stations' ridership}) - 0.93456 + 0.66575 X_2 (\log_{10} \text{ of area}) \} / 1.15959$$

The following table summarizes the intercepts and constants of the explanatory variables for the above four cases (Japan, Europe, North America/Australia, and the integration of the three regions).

Table 2-14 Intercepts and Constants for the Explanatory Variables

Country/Region	intercept	a <sub>1</sub>	a <sub>2</sub>	R <sup>2</sup>	R
Japan	-0.21364	0.59608	-0.27479	0.718	0.848
Europe	0.81080	0.92547	-0.34015	0.501	0.708
USA, Canada, Australia	2.31919	1.27075	-1.23177	0.529	0.727
Combined all	0.93456	1.15969	-0.66575	0.672	0.819

Source: JICA Study Team

The a<sub>1</sub> (nighttime population coefficient) and a<sub>2</sub> (area coefficient) are different for Japan, Europe, and North America/Australia, indicating that the three regions have different trends. Details of the data used for the correlation analysis are included in the **Material 3 in the "Materials of the Study Results"**.

It should be noted that a lack of collected and/or published ridership data from developing countries is an issue that needs to be addressed in promoting TOD.

## 2.6.2 Scope of Utilization of TOD Development Indicators

The indicators developed in the previous subsection can be used in many phases of a project. For example, even at the negotiation, project agreement, and procurement (contracting) stages, it is possible to explain the significance of project implementation by presenting to the counterparty, either orally or in writing, the effects of TOD development summarized in the planning stage (Table below).

Table 2-15 Scope of Application of the TOD Development Indicator

Fact finding/ Identification	Preparation	Appraisal	Negotiation	Loan/Grant Agreement	Procurement	Implementation & Supervision	Evaluation
---	○	○	○	○	○	○	○

Source: JICA Study Team

### 3 Proposal for JICA's TOD Cooperation Approach

In this chapter, based on the information presented and analyzed in the previous chapters, we will organize and propose the metropolitan visions that JICA aims to achieve through TOD promotion, present development guidelines, the approach methods and contents that should be focused on to concretely realize TOD, application stages, preconditions, external conditions, and points to note.

#### 3.1 Metropolitan Visions Achieved through TOD Promotion by JICA

TOD is a development concept based on the premise that urban development and urban transportation are planned and implemented as an integrated whole, from the city area level to the station and station area level. For this reason, it is necessary to clarify the direction of development that the urban area is aiming for, the public transportation axis within the structure of the urban area, and the ideal state and positioning of the district level and the station/station area level.

The vision of the metropolitan to be achieved through the promotion of TOD will vary depending on the size of the urban area. In the case of large urban areas such as the Tokyo Metropolitan Area and the Jakarta metropolitan area, it is important to establish "core business cities" as adopted in the Tokyo metropolitan area, and to develop a network of key axis lines (railways and BRT) and motorways that radiate and link them to the center of the urban area. In this context, measures to promote the independence of individual core business cities are also indispensable to solve various problems faced by the metropolitan area.

On the other hand, it can be assumed that a ring-shaped key axis line, as seen in the Tokyo metropolitan area, may not be necessary in regional metropolitan cities from the viewpoint of scale. In the Sendai metropolitan area, the railroad network is basically radial in form, with the Shinkansen bullet train running from Sendai Station at the center of the network and the Sendai International Airport connecting to other regions by air (see "Figure 2-11 Sendai Suburban Railway Network Map").

A metropolitan area is an aggregate of a central city and the surrounding areas affected by the central city, and is an area with wide-ranging social and economic connections. The urban area component of a metropolitan area consists of commercial and business districts, residential districts, industrial and logistics districts, entertainment and amusement districts such as theme parks, and axis lines that connect these districts. The first step toward successful TOD is to consider the arrangement and combination of these points and lines based on future population forecasts and other factors.

Specifically, at each stage from planning to implementation, the TOD lead will develop and enhance policy objectives, policy formulation and planning, organization and structure, and institutions that encompass both urban development and urban transportation at the metropolitan area level and at the base line level (upstream stage), and TOD at the district level and station/station area level. The project also includes coordinating the interests of all parties involved in the implementation of the project, formulating a project plan, positioning the project in the city plan, procuring project funds, managing

the progress of the project, and establishing an asset management organization at the district level after the project (the downstream phase). This series of processes is proposed as JICA's TOD cooperation approach. The elements of the TOD cooperation approach are proposed below.

### 3.1.1 JICA's Framework for Metropolitan Vision Achieved Through TOD

Proposed JICA's framework for the vision of the metropolitan that JICA aims to achieve through TOD promotion be composed of the following three items.

- Goals Achieved Through TOD Promotion
  - Metropolitan structure that solves social and environmental issues
  - Economic and quality-of-life (QOL) improvement of metropolitan area
  - Comfortable urban space based on local history and culture
- TOD Triggers
  - Timeliness (All aspects are ready to implement TOD, especially related to Key 1 and 2 of TOD success)
  - Land (Land is secured to implement TOD. Establishing an organization to manage unused public land should be considered (e.g. Japanese National Railways Settlement Corporation))
  - Teamwork (Stakeholders are united to implement TOD. Especially related to Key 3 of TOD success)
- Six Keys to TOD Success
  - Legal and Business Support System
  - Variety of Financing Schemes
  - Organizational Capability
  - Smooth Transfer with Urban Transit Modes
  - Importance of Non-Rail Business
  - Understanding of Station Area and Site Level

The above framework is illustrated in the following diagram.



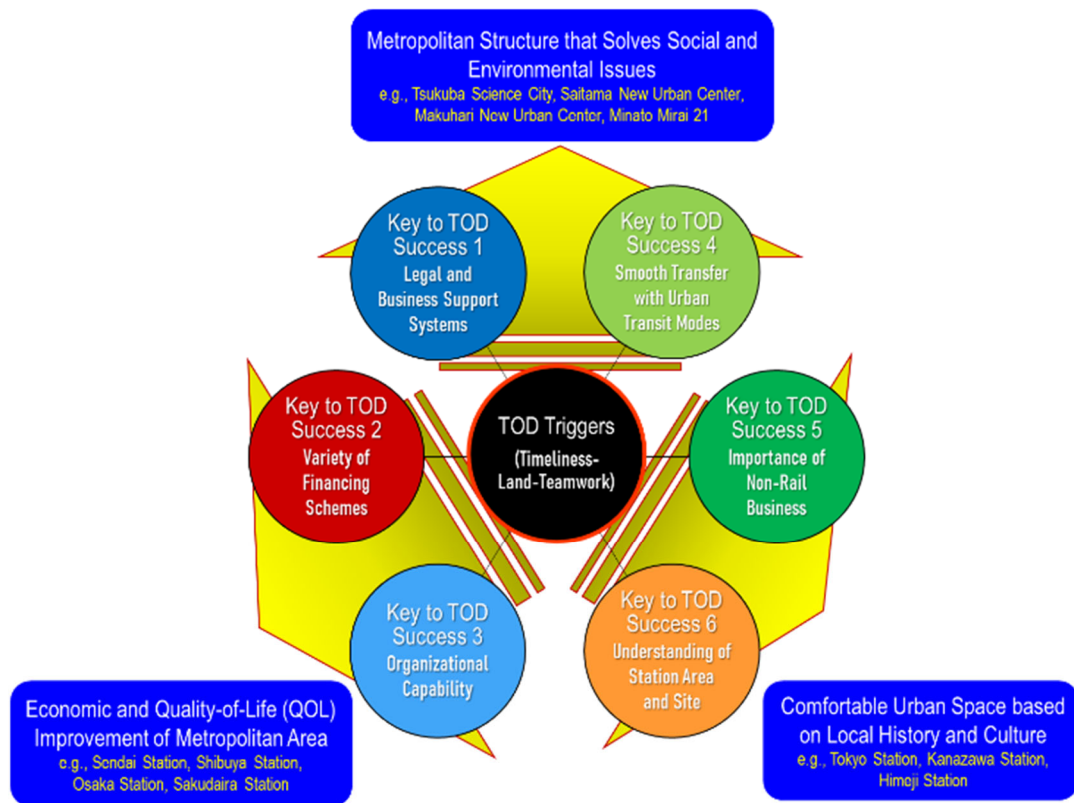


Figure 3-1 JICA's Framework for Metropolitan Visions Achieved Through TOD

Source: JICA Study Team

The three items are described as below.

### 3.1.1.1 Goals Achieved Through TOD Promotion and the Major Successes

Three goals achievable through TOD promotion and corresponding examples of major successes are described below.

- Metropolitan Structure that Solves Social and Environmental Issues:
  - Efficient decentralized urban structure through the formation of subcenters that share the functions concentrated in the city centers
  - Formation of sustainable compact urban areas that are not dependent on automobiles by improving pedestrian and public transport access

Major success cases: Saitama New Urban Center, Minato Mirai 21, Makuhari New Urban Center, and Tsukuba Science City (Japan); Gare du Nord and Gare de l'Est (France); King's Cross Station (U.K.); Bang Sue Grand Station (Thailand)
- Economic and Quality-of-Life (QOL) Improvement of Metropolitan Area:
  - Stimulation of economic activity through the formation of business centers where is highly convenient, brisk and attractive
  - Improvement of the residential environment and easy access to commercial facilities

- Improvement of public transportation convenience and safety , including improvement of the pedestrian environment and increased barrier-free access  
Major success cases: Sendai Station, Shibuya Station, Osaka Station, and Sakudaira Station (Japan); Gare de Lyon-Part-Dieu (France)
- Comfortable Urban Space Based on Local History and Culture:
  - Station facades and urban spaces rooted in local history and culture and in harmony with the surrounding landscape  
Major success cases: Tokyo Station and Kanazawa Station (Japan); Gare de Strasbourg (France); CSMT Station (India)

### 3.1.1.2 TOD Triggers

There are two types of triggers to commence TOD. The first is the triggers to commence the conception and plan of TOD, while the second is the triggers to commence the implementation of TOD. The first triggers differ for each region, while the second ones have a lot in common.

As a reference, the examples of triggers to commence the conception and plan of TOD are as the the table below.

Table 3-1 Examples of Triggers to Commence the Conception and Plan of TOD

Station Area	Triggers to Commence the Conception and Plan of TOD
Sendai Station	Commencement of Tohoku Shinkansen construction work (1971)
Tokyo Station	Presentation of plan to restore Marunouchi Station Building by (at that time) Tokyo Governor Shintaro Ishihara and (at that time) JR East President Masatake Matsuda (1999)
Sakudaira Station	Announcement of Nagano as the venue for 1998 Winter Olympic (1991)
Kanazawa Station	Formation of council to promote the construction of northbound (Hokuriku) Shinkansen (1967)
Osaka Station	Transfer of the ownership of Umekita Freight Terminal to the Japanese National Railway Settlement Corporation following the privatization of Japanese National Railways (JNR) that started the study on the utilization of the unused land
Himeji Station	The opening of Sanyo Shinkansen (1972) that includes the Himeji Station

Source: JICA Study Team

The three triggers to commence TOD (timeliness, land, and teamwork) can also be described as "Ten, Chi, and Jin" (the heavenly time, the earthly advantages, and the harmony among people).

"Ten-chi-jin" was originally taught by Mencius and quoted by Uesugi Kenshin and Naoe Kanetsugu, and is very helpful in understanding how things started, including for TOD. Regarding the three triggers, in terms of importance, "land" (earthly advantage) is more important than "timeliness" (heavenly time), and "teamwork" (harmony among people) is even more important than that. The following is an example from the Tokyo Metropolitan Area and

other regions.

- **Timeliness (heavenly time):** The central government's policy of decentralization of population and various functions based on the Fourth National Capital Region Development Plan resulted in the relocation of central government agencies, research institutes, and university campuses from Tokyo to the surrounding areas (see Figure 2-4). This created the conditions for TOD using the surplus space created by the relocation in Tokyo, and the time was ripe to promote the new policy to make an internationally competitive Tokyo. Indonesia plans to relocate its capital from Jakarta to "Nusantara" in the eastern part of Kalimantan (Borneo). In line with this plan, some of the country's administrative functions and civil servants will be relocated in stages, and as in the case of the Tokyo metropolitan area, it is expected that there will be an opportunity to utilize the surplus space after the relocation.
- **Land (earthly advantages):** In July 1988, the Cabinet decided to sell the former sites created by the relocation of government administrative agencies to secure financial resources for the relocation, on the premise that the sites would be used and disposed of in an appropriate manner, such as for public and charitable use as much as possible. The December 1996 report of the then Ministry of Finance's (MOF) Central Council on National Property stated the basic policy of using the property to contribute to the improvement of the urban and living environment in the Tokyo metropolitan area, based on the principle of giving priority to official and public use, and in accordance with the aim of reducing the concentration of property in Tokyo. The utilization of former Japanese National Railways (JNR) sites by JR companies and local governments following the division and privatization of JNR in 1987, along with the Tokyo metropolitan area, was another event that had a nationwide impact and triggered the promotion of urban development, including TOD.
- **Teamwork (harmony among people):** Even if heavenly time and earthly advantages are in place, TOD will not proceed unless there is harmony among people functions. For example, TOD in and around Tokyo Station was made possible through the development of a special Floor-Area Ratio system by the government and the Tokyo Metropolitan Government. For TOD projects at Shibuya Station, Osaka Station, and many other railway stations, the government has institutionalized urban planning proposals and Floor-Area Ratio allocations applicable to special urban revitalization districts under the Act on Special Measures Concerning Urban Reconstruction, and has moved toward implementation. Smooth planning and implementation of TOD will be possible only through cooperation between the government and the private sector, including railway operators.

As an example of securing land, when JNR was split up and privatized in 1987, the fixed assets (land) held by JNR were sold under the collective control of JNR, and the Japanese National Railway Settlement Corporation was established as a new organization to redeem the

huge long-term debts of JNR and to promote the redeployment of surplus personnel. The JNR Settlement Corporation was established as a new organization to redeem the huge long-term debt of JNR and to promote the re-employment of surplus personnel, and took over 9,238 hectares of land.

In developing countries where there is a large amount of unused land, ofen of which is mainly state-owned land, in the center of metropolitan area, it would be beneficial to consider establishing an organization similar to the JNR Settlement Corporation.

### 3.1.1.3 Six Keys to TOD Success

As a development guideline, the following are six keys to TOD success. On a side note, what constitutes a “success” are the achievement of goals as stated in the Comprehensive Metropolitan Development Plan, Comprehensive Corridor Development Plan, and each area’s development plan while for the goals at metropolitan level are as stated before in 3.1.1.1. For the goals at the station area and site level, not only hard aspect (e.g., construction of railway, renovation of station building and building around the station, construction of station plaza and other connecting facilities), but also on the soft aspect (e.g., ridership of the newly built railway, establishment of organization to maintain and promote the area, revenues of the commercial facilities, and number of residence in the residential area). Although the details of each goals should be adjusted to the condition of each area, the overall aim to achieve both the soft and the hard aspect is important.

#### (1) Key to TOD Success 1: Legal and Business Support System

For smooth implementation of TOD, it is essential to enhance legal regulations and institutions at various levels. The national government is responsible for enhancing institutions from the metropolitan area level to the site level to solve issues. Local governments need to introduce or revise ordinances that establish procedures for the smooth implementation of TOD at both the corridor and site level.

- Metropolitan Level

In the Tokyo Metropolitan Area, the government introduced the “Multi-Polar Patterns National Land Formation Promotion Act” (1988) and the "Act on Special Measures concerning Promotion of Supply of Houses and Housing Lands in Urban Districts" (1991) to reduce the concentration of population and urban functions in the central Tokyo area, and build up the surrounding suburbs.

In France, the country introduced the “Grand Paris Act” (2010) to put the Paris Metropolitan Area in competition with other world’s major cities and improve the capital’s administrative efficiency.

In the U.K., the “Greater London Authority Act” (1999) reinstated the “Greater London” administrative area. The following year, the government formulated the “London Transport Strategy” to address the issues of congestion and public transport capacity, reliability, and connectivity.

- Corridor Level

In the Tokyo Metropolitan Area, the government introduced the “Act on Special Measures concerning Comprehensive Advancement of Housing Development and Railway Construction in Metropolitan Areas” (1989) to support TOD’s use as a relocation mechanism for parts of the population and urban functions. This Act includes special measures for land readjustment to facilitate land acquisition for a railway connecting central Tokyo and Tsukuba Science City.

With the enactment of the Grand Paris Act, France launched the Grand Paris Express, the core project of the Grand Paris Plan, a wide-area metro network that will complete a 200 km ring-shaped urban rail network (two new lines and two extensions) with 68 stations by 2030. 90% of the lines will be built underground, and 2 million passengers per day are expected to use the system.

In the U.K., the Crossrail project was initiated with the introduction of the Crossrail Act (2008). The total length of Crossrail is 118 km, with 41 stations (10 new stations) and an estimated 550,000 passengers per day. The project will be operated by Transport for London.

- Station Area and Site Level

In the Tokyo Metropolitan Area, the central government revised the City Planning Act and the Building Standards Act and established a new system of special Floor-Area Ratio (FAR) in 2001, allowing for the transfer of FAR in Tokyo Station and the surrounding areas. In response, the Tokyo Metropolitan Government introduced the “Special Floor-Area-Ratio Designated Districts and Guidelines” (2002). Also introduced was the “Act on Special Measures concerning Urban Renaissance” (2002), establishing a system under which private companies can propose changes in city plans and receive increased FAR in designated districts. For example, along the Yamanote Line, which connects central Tokyo in a loop, nine stations (Tokyo, Yurakucho, Akihabara, Kanda, Shinjuku, Shinagawa, Osaki, Shibuya, and Ikebukuro) and the surrounding areas have been included as designated districts. These institutional expansions have created an environment that makes it easier for railway operators and private developers to implement TOD independently.

In the Paris metropolitan area, the redevelopment of dozens of station districts has just

begun in conjunction with the Grand Paris Express project. The London metropolitan area is also planning to develop 10 buildings at five central stations and one building at one station in a redevelopment area along the Crossrail project.

In developing countries, there are many cases where local companies that own land or hold development rights for residential development in new urban areas (suburban areas) conduct projects alone or jointly with foreign companies, including Japanese companies. However, car-dependent development is the norm, and in some cases, after development, the resulting arterial roads between the city center and the development site are heavily congested, resulting in a deteriorating quality of life (QOL).

To avoid such a situation, we believe that it would be effective to realize TOD if the government regulates residential development where no corridor line exists or no new station is planned to be built, and supports projects that develop the station and surrounding area in an integrated manner.

## (2) Key to TOD Success 2: Variety of Financing Schemes

An obstacle to TOD promotion in developing countries is financing. This paragraph describes the various financing methods in Japan, France, and the U.K.

- Land Value Capture (LVC)

This approach can be divided into three main types of timing of return of development profits (pre-project, during project, and post-project).

- (i) Pre-project: These are contributions collected from specific regions or entities. In Japan, contributions were collected from companies expanding into the city of Kobe to fund the construction of artificial islands and the Port Liner (AGT). This approach is unique in that it is also possible for local governments to implement.
- (ii) During Project: These are land readjustment, urban redevelopment, or other similar methods. In Japan, the development of the new area in the west of Hiroshima was done via land readjustment to fund the construction of the Astram Line (AGT), which will connect the area with central Hiroshima. To construct the Tsukuba Express (TX) line connecting Tsukuba Science City and central Tokyo, the company did land readjustment projects in 17 locations, or about half of the total 58.3 km length, receiving land for free from landowners via land readjustment and exchanging land purchased in advance by local governments and others for railway land.

In France, to secure the project cost of the Grand Paris project, the lodging tax and business establishment tax were increased and provided to the newly

established project entity.

In the London metropolitan area, property taxes on non-resident property were increased by 2% based on the Business Property Tax Supplement (BRS) Act to cover the construction costs of Crossrail.

In the U.S., almost all states have a land value increment financing tax (tax increment financing) as part of state law. This tax is levied on the expected increase in real estate values due to the construction of roads and other social infrastructure.

- (iii) Post-Project: These include property, business, and residential taxes in general, as well as the return of property development revenues next to train stations. In many cases existing tax rates are raised, or new taxes are introduced. Also, development revenues from land adjacent to the station are to be used for rail construction. In countries with low tax revenue rates, it is not advisable to rely on this approach. In Japan, the Keiyo line with corridor development and Minato Mirai 21 with Minato-mirai line development are typical cases.

Note that in the case of dense urban areas, development profit decrease (negative development profit) may occur. For example, the land readjustment project at the east exit of Sendai Station resulted in a depreciated compensation district with a decrease in development profit. The city of Sendai secured land in the suburban area and relocated many temples and cemeteries that existed in the East Exit project area to that area, and then secured land for the project.

Jakarta's Harmoni district is another dense urban area where land prices remain high, but it is also a transit point for the TransJakarta (BRT) and a key transportation hub where a new MRT station is under construction. The Ministry of Spatial Planning and the National Land Agency are considering a land readjustment project (Konsolidasi tanah) in this area, and are considering a three-dimensional use of space to cope with the low development costs.

- Floor-Area Ratio (FAR)

This approach can be divided into two main types.

- (i) Trades: In Japan, in addition to the particular case of Tokyo Station and its surrounding area, FAR bonus linked to changes in the city plan proposed by the private sector (land owners, tenants and other related parties) and designated districts with relaxed FAR have become legally generalized (i.e., not attached to special circumstances). FAR relaxation also exists in Jakarta based on contribution to road construction costs. However, generalization in a system

based on laws and ordinances is desired.

- (ii) Artificial floor: This is a method to generate FAR by installing an artificial deck above the rail track, attaching it to the nearest road, and legally recognizing it as the floor of a building. The case of Shinjuku Station in Japan is an example of this. To widen a congested highway, a bus and taxi terminal was constructed on top of the JR East rail track by installing an artificial deck, with the lower level serving as a rail facility. Since there was now excess FAR, with the approval of the Tokyo Metropolitan Government, the FAR was reallocated to the station building that was to be constructed on the adjacent JR East site, allowing for a higher-rise building than initially planned.

- Cost Sharing by Merging Construction with Public Works

When a government agency plans to widen a road or expand a station plaza, including the adjacent land of private ownership, it will consult with the owner of the land. However, if the private owner also plans to carry out another development in conjunction with the public project, it may be possible to reduce some of the planned costs through a merged implementation with the public project. Examples include the widening of National Route 20 (Koshu Kaido) (managed by Road Bureau of the MLIT) and the development of the new south exit of JR Shinjuku Station, and the expansion of the station plaza at the Marunouchi Exit of Tokyo Station (managed by Tokyo Metropolitan Government) and the redevelopment of JR East's station plaza. This approach can usually be treated as a form of PPP.

- Vertical Separation

In the vertical separation (separating infrastructure and operation) method, the fixed assets (lower portion) are developed by the government or public entity for the main body of the railroad, thereby reducing the initial investment and supporting the management of the railroad or BRT operator that conducts the operation and management (upper portion). An example is the Keiyo Line in which Chiba Prefecture and others bear the cost of the lower portion while JR East bears the cost of the upper portion.

This method is also used for other urban railways and Seibi-Shinkansen lines, or lines that are expected to be less profitable than existing Shinkansen lines. In 1964, the government established the Japan Railway Construction Public Corporation (now the Japan Railway Construction, Transport and Technology Agency) under the jurisdiction of the former Ministry of Transport (now the Ministry of Land, Infrastructure, Transport and Tourism) to carry out railroad construction projects for national and other railroads. The main lines that have been constructed so far are as follows.



- (i) Urban Railway: Tsukuba Express, Minatomirai Line, Rinkai Line, Saitama Railway
- (ii) Seibi-Shinkansen: Tohoku Shinkansen (Morioka to Shin-Aomori Station), Hokkaido Shinkansen (Shin-Aomori to Sapporo Station), Hokuriku Shinkansen, Kyushu Shinkansen (Kagoshima Route, West Kyushu Route (Nagasaki Route))

In developing countries, the separation of the upper and lower portions of the system and the establishment of a public agency to provide loans to operators of railroads and BRTs to develop the lower portion and operate and manage the upper portion would contribute to the promotion of TOD. If conditions are met, it is also worth considering ways for public institutions to secure immediate funding through yen loans or capital participation.

In addition, leasing of vehicles to rail track and BRT operators deserves consideration. In this case, public institutions or private leasing companies could be considered as lenders. It is also desirable to continue with the used vehicles that Japan has provided in the past.

- Loans from Public Institutions

Developing countries should consider borrowing from public infrastructure investment institutions in their own countries as well as from Japanese and developed countries' aid agencies for both planning and implementation of TOD projects. At the same time, the national and local governments should enhance their loan menus, including public investment institutions and sector loans, to solve various problems in urban areas through TOD.

### (3) Key to TOD Success 3: Organizational Capability

In both the public and private sectors, improving organizational capacity and human resource development are important in terms of connecting the urban development sector with the urban transportation sector, as well as industry-academia-government. In developing countries, it is essential to improve the urban management capacity of administrative agencies such as national and local governments.

Cooperation among diverse stakeholders, including administrative agencies involved in urban planning, etc., private developers, and railway and feeder transit operators, is indispensable for the implementation of TOD. If there is a lack of know-how or human resources for implementation, requesting support from other organizations should be considered. Specifically, the following policies are important:

- Cooperation Between Urban Transportation and Urban Development Division (Creation of organization in charge of TOD): In the private sector, it is revealed during

the study that the public transportation division and the urban development division have different approaches to investment recovery, and some Japanese trading companies have recently started establishing TOD promotion departments as examples. In addition, in public institutions, for example, Himeji City has established the Himeji Station Area Development Office and the Railway Station Area Development Office in the Urban Hub Development Division, which are in charge of both public transportation and urban development divisions for each district. In developing countries, it is desirable to establish similar organizations for smooth implementation of TOD.

- Request for Support from Organizations with Know-how and Expertise: If the local government in charge of TOD lacks the know-how and human resources to implement TOD, it is wise to request assistance from an organization that has such know-how and human resources. In Japan, the UR is a common example, with a track record of having undertaken numerous TOD projects, including the Osaka Station Umekita District and the Minato Mirai 21 District. TOD and urban development support in developing countries is also possible. If a developer in a developing country lacks TOD know-how or human resources, it may be a good idea to consider collaborating with a Japanese development assistance organization (e.g., Japan Overseas Infrastructure Investment Corporation for Transport & Urban Development; JOIN) or private developers.
- Accelerated Licensing Process: This is an extremely important issue for the private sector in deciding whether to participate in TOD. For example, it would be effective to establish a one-stop service system for TOD (i.e., administrative licensing and approval for TOD in one place and within a set period of time), and enhancement of the legal system for this purpose should be considered as necessary.
- Industry, Academia, Government Collaboration and TOD Promotion Activities: The tacit knowledge on TOD should be converted into formal knowledge through the exchange of information through periodic meetings among relevant parties, such as joint organizations among central government and local governments, as well as industry-academia-government, and among the private sector, academic societies, etc.; and through the award system for papers and actual TOD projects. In this context, it is necessary to improve the technical capability of TOD in the entire country and internationally. In doing so, it is essential to utilize remote technologies, which have been widely utilized due to the spread of the COVID-19 coronavirus.

The four items above are important for improving the urban management capacity of government agencies in developing countries. As mentioned in 2.4.1, national and local governments need to reach a level where they can serve as integrators or initiators of TOD, but they could also benefit by learning from Japan's experience as described below.

- Methods to Convert Tacit Knowledge to Formal Knowledge: The Japanese experience will be discussed with regard to specific measures for the establishment and sustained operation of various organizations to promote TOD as mentioned above.

Taking the Jakarta metropolitan area in Indonesia as an example, the DKI Jakarta Provincial Government is promoting TOD in cooperation with related master developers, but the experience gained there has not been communicated to the national government, surrounding local governments, other master developers, and others. The results of surveys conducted by BAPPENAS and other national government organizations, as well as experiences in regions outside the Jakarta metropolitan area and overseas, have not been communicated to stakeholders in the Jakarta metropolitan area and remain tacit knowledge. The following four methods can be identified for sharing the experiences of various TOD stakeholders (currently tacit knowledge) and converting them into formal knowledge.

(i) Establishment and Operation of Public Interest Corporations

Although there do not seem to be many examples in Indonesia and other countries, public interest corporations established through cooperation among industry, academia, and the public sector are engaged in activities such as 1) information exchange among members, 2) policy proposals to the national, local, and other government agencies, 3) technical cooperation in creating new policies of government agencies and, 4) support and certification for the development of new planning methods and construction techniques.

In Japan, there are a number of public interest corporations in the field of cities and transportation, for example: 1) The City Planning Association of Japan (research and study on urban planning, national and regional planning, etc., holding conventions and seminars on urban planning, publishing journals and publications, supporting implementation of urban development months, etc., supporting activities of international organizations such as IFHP (International Federation for Housing and Planning) and EAROPH (Eastern Regional Organisation for Planning and Housing), and awarding prizes for urban planning and urban development); 2) Planning Consultants Association of Japan (surveys, research and proposals on urban planning, support for urban planning consultant services and engineers, lectures, training sessions, etc.); 3) Japan Transportation Planning Association (continuous multi-level crossing, station plazas, AGT, monorail, LRT, BRT, commissioned research, publication of journal, etc.); 4) Urban Regeneration and Land Readjustment Association (conducts domestic and international research and study presentations on land readjustment, conducts urban development forums, publishes an official

magazine, etc.); 5) The Land Readjustment Center (free dispatch of experts to support commercialization, support for comprehensive outsourcing to private companies in public projects, introduction of private business agents in cooperative projects, introduction of residential land users, etc.); and 6) Urban Renewal Association of Japan (support for the establishment of redevelopment associations, debt guarantees, contracted surveys, support for the selection of specific business agents, holding training sessions, etc., and publishing an official magazine).

- (ii) Establishment of Professional Qualifications: In order to plan TOD and facilitate projects, it is essential to develop and certify engineers with national qualifications. Examples of qualifications in the urban and transportation field include professional engineer, architect, land readjustment engineer, redevelopment planner, RCCM, civil engineering construction management engineer, and others. There are two types of certification examinations: one is directly administered by the government and the other is outsourced to a related public interest corporation.
- (iii) Establishment of Awards: Awards for outstanding TOD plans and project implementation organizations and important figures/engineers in promoting and educating the public about TOD. In Japan, there are commendation programs by the national government, local governments, and public interest corporations. For example, there is the Minister of Land, Infrastructure, Transport and Tourism Award. In addition to the "Urban Development Month," which is held annually to honor individuals and organizations that have made significant contributions to city planning, there are also, 1) My Town Photo Contest (Secretariat: Japan Transportation Planning Association), 2) Urban Development Slogan Contest (Secretariat: City Planning Association of Japan), 3) Urban Development Design Competition (Secretariat: Machinami Foundation) and, 4) Urban Revitalization and Urban Design Competition (Secretariat: Urban Design Center).
- (iv) Objective Evaluation of Technical Consultants, Developers, Engineers, and Others: In addition to developing excellent TOD plans and project implementation organizations and engineers, it is important to develop objective evaluation information necessary for government agencies and others in the procurement of TOD consultancy and project implementation services.

In Japan, the Central Construction Industry Council of the Ministry of Construction (now the MLIT) issued a proposal in 1993 to reform the

tendering and contracting system for public works projects, and at the request of the Ministry of Construction, the Japan Construction Information Center developed the "Construction Records Information System" (CORINS). In 1994, the registration of construction projects of the Ministry of Construction in the CORINS became mandatory, and the scope of registration was expanded to include prefectures and government-designated cities. In 1995, the "Technical Consulting Records Information System" (TECRIS) was put into operation. The following two tables show the scope and features of CORINS / TECRIS and the registration status as of March 2022.

Table 3-2 Scope and Features of CORINS / TECRIS

	Procuring Entity	Contractor
Scope	<ul style="list-style-type: none"> <li>- Central government entity</li> <li>- Local government</li> <li>- Public government</li> <li>- Private corporation providing public service</li> </ul>	<ul style="list-style-type: none"> <li>- Prime contractor that receives order for construction and operation from the central and local government</li> <li>- Prime contractor that receives order for construction and operation from public government, private corporation providing public service (highway operator, rail operator, etc.) and others</li> </ul>
CORINS / TECRIS Features	<ul style="list-style-type: none"> <li>- Search contractor's track records</li> <li>- View information about the contractor</li> <li>- View information about the engineer</li> </ul>	<ul style="list-style-type: none"> <li>- Register information on previous project</li> <li>- Register information about the engineer</li> <li>- Utilization of company's performance data</li> </ul>

Source: <https://cthp.jacic.or.jp/overview/ct/> (in Japanese)

Table 3-3 Registration Status of CORINS / TECRIS

		CORINS	TECRIS
1. Number of Registration in CORINS / TECRIS			
	Number of registered corporations	159,000	17,000
	Number of registered items	6,223,000	2,367,000
	Number of registered engineers	1,947,000	
2. Number of Procuring Entity in CORINS / TECRIS			
	Central government entity	24	20
	Incorporated administrative agency	62	11
	Prefectural entity	52	65
	Designated city	15	24
	Municipality	878	713
	Others	32	32
	Total	1,063	865

Source: <https://cthp.jacic.or.jp/overview/data/> (in Japanese)

The above four items are based on Japan's experience, however, in order to convert tacit knowledge into formal knowledge and smoothly implement TOD from upstream to downstream in developing countries, industry-academia-government collaboration is indispensable.

(4) Key to TOD Success 4: Smooth Transfer with Urban Transit Modes

Transportation hubs such as train stations depend on how smoothly users can get to and from the stations to increase their ridership. To achieve this, it is necessary to understand that last-mile measures, such as station plazas, connecting passageways, public spaces, and connections with other modes of transportation, are essential.

Smooth transfer between rail and BRT to city bus, taxi, paratransit, and other feeder modes are important to increase passengers' convenience and overall usage. Specifically, the following two points should be implemented to realize smooth connections between rail/BRT and feeder modes. Please note that, barrier-free accessibility should be considered in areas with elevation differences (e.g., Shibuya Station).

- Smooth, safe, and fast transfer between rail/BRT and other transportation modes (between station and station area).
- Adequate-sized station plaza, access road, and last-mile pedestrian flow (between station area and surrounding area).

In the examples of Japan's three major terminal stations (see table below), the percentage of "other transportation modes" accounts for over 20% in each case. If smooth transfers to other modes can be achieved, users will become customers of both rail (farebox) and non-rail businesses.

Table 3-4 Breakdown of Passengers at Three Major Terminal Stations in Japan

Station	Station Area	Number of Passengers / day		
		Rail / Subway (no. of lines)	Other transportation modes and the share	Total
Tokyo Station	117 ha	2,218,171 (24)	1,021,000 31.5%	3,239,171
Shibuya Station	139 ha	3,320,383 (8)	1,730,000 34.3%	5,050,383
Shinjuku Station	----	3,594,710 (11)	970,000 21.2%	4,564,710

*\*Long-distance bus, city bus, taxi, automobile, motorcycle, bicycle, etc. (forecasted value)*

*Source: JICA Study Team*



Photo 3-1 Tokyo Marunouchi Station Plaza;

*Photo: Japan International Consultants for Transportation, Co., Ltd.*

Transportation hubs such as train stations rely on how smoothly users can get to and from the station to increase their use. To achieve this, it is necessary to understand that last-mile measures, such as station plazas, passageways, public spaces, and connections with urban transportation modes, are essential.

(5) Key to TOD Success 5: Importance of Non-Rail Business

In a station with large number of passengers, shopping, office, leisure, and other non-transportation business should be considered to improve economic viability. When non-transportation business are running, impact on increased ridership and transportation (farebox) revenue can be seen. The following table shows the percentage of non-transportation business revenue for Japan's major railroad operators (for the year ended March 31, 2019).

Table 3-5 Share of Non-Rail Businesses of Major Japanese Railway Companies  
(trillion JPY)

Corporation	Segment	Rail	Non-rail	Total
JR East Group	Operating Revenues	2.038	0.964	3.002
	Percentage	68%	32%	100%
JR West Group	Operating Revenues	0.954	0.575	1.529
	Percentage	62%	38%	100%
Tokyo Metro	Operating Revenues	0.384	0.051	0.435
	Percentage	88%	12%	100%
Tokyu Group	Operating Revenues	0.212	0.946	1.157
	Percentage	18%	82%	100%
Hankyu-Hanshin HD	Operating Revenues	0.234	0.558	0.791
	Percentage	30%	70%	100%

*Source: Each company's financial statement (Fiscal year 2019)*

JR East and JR West were born from the privatization (1987) of Japan National Railways, whose non-transportation revenue initially accounted for about 5%; both now exceed 30% and even higher during the pandemic. Tokyu Group and Hankyu Hanshin HD, which have been major private rail operators for a long time, are unique in that the non-transportation revenue accounts for more than 70% of the total revenue. Note that Tokyo Metro is a subway operator with limited land holdings, so the percentage of non-transportation revenue is low.

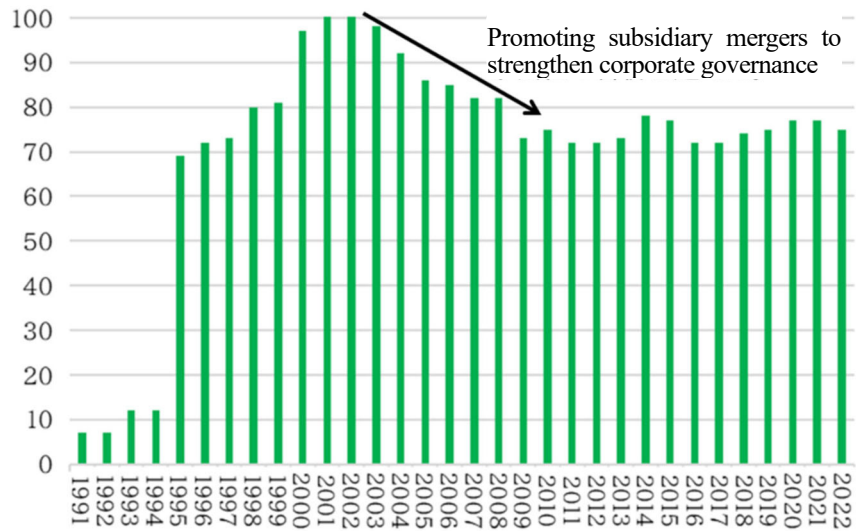
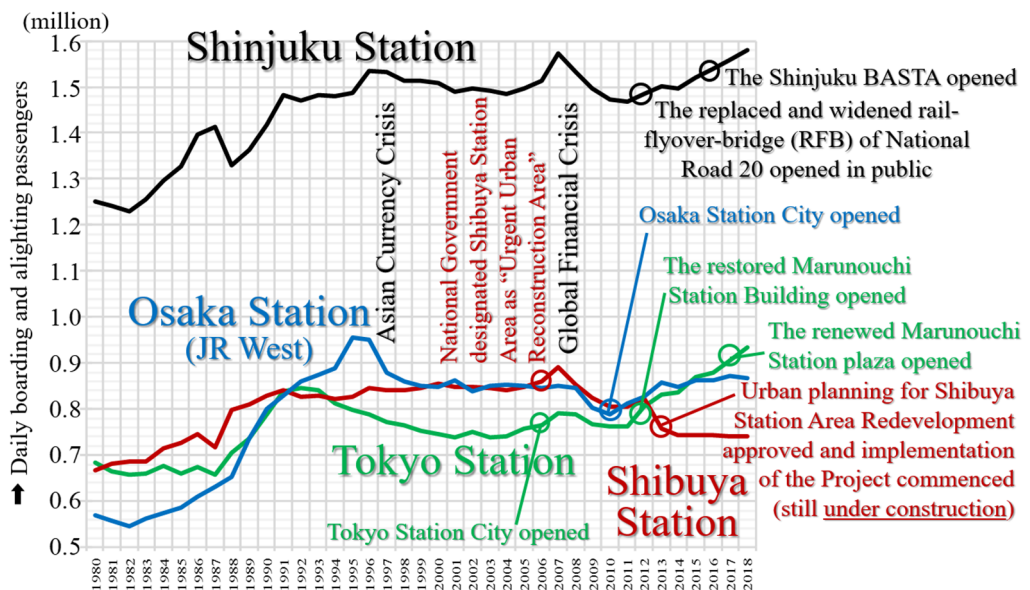


Table 3-2 Trend of Number of Subsidiaries of JR East

Source: JICA Study Team based on JR East document

One effect of the development of non-rail businesses is the increase in the number of subsidiaries. The figure below shows the number of subsidiaries of JR East. After the company's establishment in 1987, the number of subsidiaries increased to 69 in FY1995 and reached 101 in 2001. By 2001, the number had reached 101. Since then, the number of subsidiaries has been merged to strengthen corporate governance, and in recent years the number of subsidiaries has been maintained at over 70 (see figure below).

By systematically engaging in non-transportation businesses, synergistic effects with transportation business can be realized. The next figure shows the number of passengers at four major stations in Japan. With the exception of Shibuya Station, which is in the middle of a large scale development project, the number of passengers at three stations temporarily declined due to major economic incidents or major disasters, while the number of passengers increased as a result of the development of non-transportation projects.





### Figure 3-3 Synergies of Rail and Non-rail Businesses

*Source: S. Akimura, JREA vol. 2, 2022*

#### (6) Key to TOD Success 6: Understanding of Station Area and Site Level

It is important to understand the condition of land use, urban development, and mobility at the station area and site level to formulate TOD that matches local characteristics.

- Importance of station building façade as a city's gate that symbolizes its history, culture and future
- Number of passengers and rail/BRT modal share in each station can be factors to help understand potential for success.
- An integrated regression model which correlates number of passenger with population and density can be used as a Key Performance Indicator (KPI) of TOD from planning to implementation (Please refer to 2.6.2).

The following are Japan's experience in regard to the second item above.

#### • Commercial Business-type TOD

With reference to JR East's Station Renaissance (a measure that has continued since the group's medium-term management concept "New Frontier 21" announced in November 2000), the following two groups are proposed.

**Group A** Introduce large-scale commercial/business functions: major terminal stations and their vicinity, such as those with 200,000 or more passengers/day and those located in prefectural capitals

**Group B** Introduce small-scale commercial/business functions: station and surrounding area with 30,000 to 200,000 passengers/day

JR East has set the development method for Group A as "complete review of station business facilities and existing stores" and "creation of space through construction of artificial deck, etc." while Group B is "partial review of station business facilities" and "speedy development with little investment."

#### • Residential, Industrial/Logistics and Recreational-type TOD

In the case of residential, industrial/logistics, and recreational facilities, the success or failure of TOD may depend on the percentage and number of commuters, employees, and visitors who use rail and BRT, respectively, to get to the nearest station (see figure below). Another important factor is "Key to Success of TOD 4: Smooth Transfer with Urban Transit Modes" (see above), or the state of the "last mile".

TOD Classification Flow from Japan's Experience

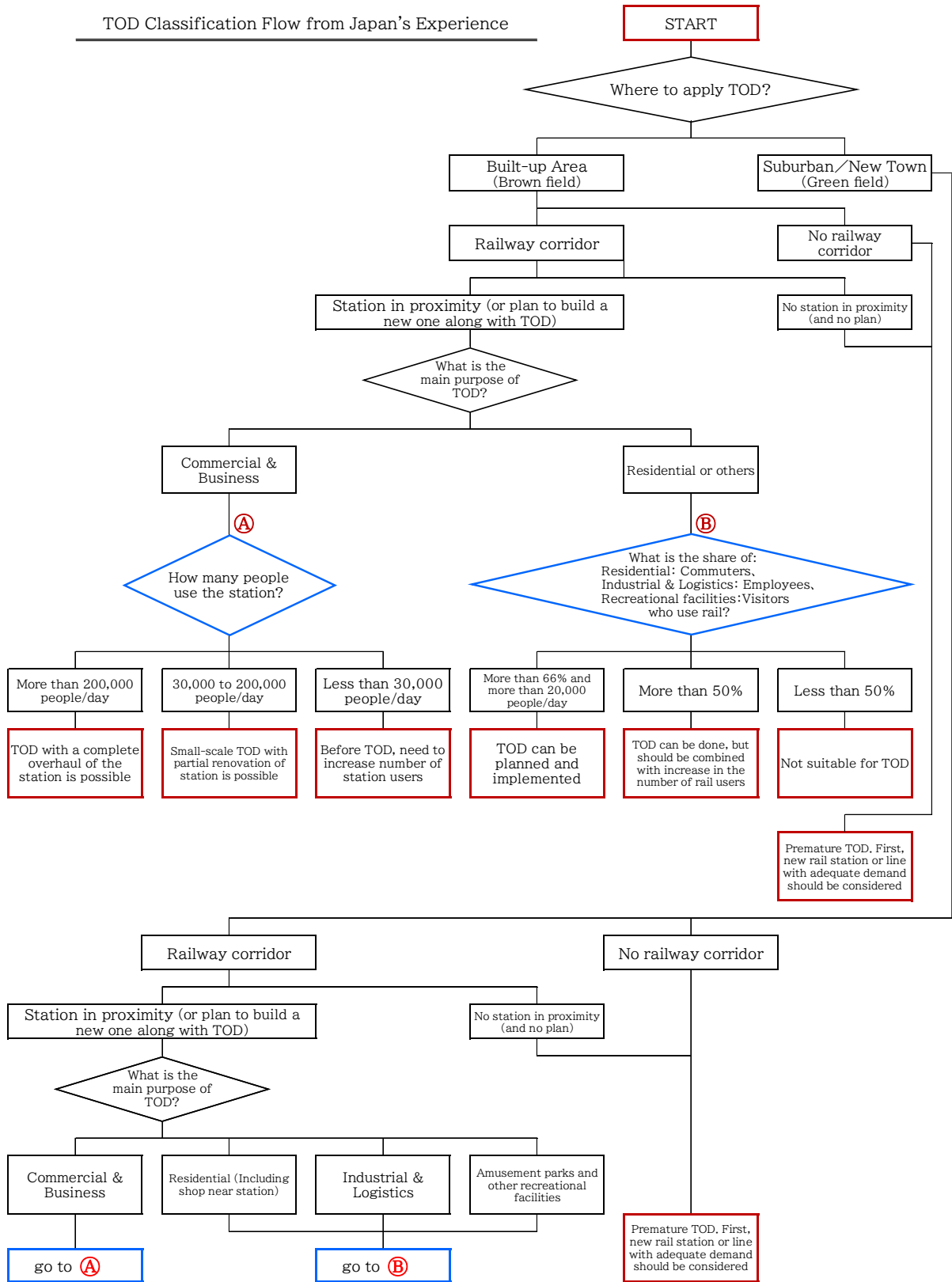


Figure 3-4 TOD Classification Flow at Station Area and Site Level (Based on Japan's Experience)

Source: JICA Study Team

## 3.2 JICA and Japan Strength and Issues in TOD Cooperation

### 3.2.1 JICA's Strength in TOD Cooperation

JICA can directly support developing countries through various surveys and technical cooperation projects (upstream support). JICA also provides indirect (downstream) support by making proposals to developing countries' governments and others through yen loans and technical cooperation projects (see table below).

Realization of proposals may take time and is not always guaranteed. As a countermeasure, it is desirable to regularly share information with relevant organizations such as UR, JOIN, and JBIC from the upstream stage, and to coordinate with them on how to provide downstream support.

Table 3-6 Necessary Measures to Realize TOD and JICA Cooperation Menu

Necessary Measures to Realize TOD	JICA Cooperation
① Establish the Metropolitan Vision and Identify Urban Issues	Urban Development Masterplan
② Public Transportation Corridor as a Solution to Urban Issues	Urban Transportation Masterplan
③ Planning and Implementation of Public Transportation Corridor	Preparatory Survey, ODA Loan
④ Comprehensive Development Plan for Public Transportation Corridor	Technical Cooperation Project
⑤ Entities to Implement Development along the Public Transportation Corridor	Technical Cooperation Project (Proposed)
⑥ Financial Resources for Development along the Public Transportation Corridor	Technical Cooperation Project (Proposed)
⑦ Necessary Legal System for the Development along the Public Transportation Corridor	Technical Cooperation Project (Proposed)
⑧ Implementation of Each Development Project	Technical Cooperation Project (Proposed)
⑨ Implement and Continue Area Management along the Corridor	Technical Cooperation Project (Proposed)

Source: JICA Study Team

### 3.2.2 JICA and Japanese Issues in TOD Cooperation

In recent years, incidents and large-scale accidents such as large-scale disasters, crimes including terrorism, and public health crises such as the COVID-19 global pandemic have been occurring continuously in many countries, and it goes without saying that it is necessary for TOD implementation areas to respond appropriately to such incidents. In the following, we will discuss some of the areas in which Japan excels and contributes to TOD in developing countries and, conversely, some areas in which Japan could improve.

#### 3.2.2.1 Aspects in Which Japan Excels

In Japan, large-scale disasters such as earthquakes, typhoons, and torrential rains occur regularly, and disaster prevention measures are constantly being strengthened. For example, Shinjuku Station was not able to adequately cope with the people who had difficulty returning

home immediately after the Great East Japan Earthquake, and the station has just begun to prepare to receive people who have difficulty returning home from work place. At the same time, the Shinjuku Station Area Disaster Prevention Council was established, and the areas surrounding the station are working together to formulate a new safety assurance plan, as well as conducting regular drills.

Similar actions are being taken at many other stations and their surrounding areas, and this should also be applied to large cities in developing countries that are not immune to large-scale disasters. Railway stations, large terminals, and public facilities, which are the hubs of large cities, should actively act as evacuation and rescue centers in the event of a disaster, and it is necessary to formulate a Business Continuity Plan (BCP) during and after the construction of TOD and to conduct educational activities and periodic disaster drills.

The same should also be considered for measures to be taken in the event of terrorism, criminal incidents, or large-scale accidents.

### 3.2.2.2 Aspects in Which Japan Needs Improvement: 1) Crime Prevention and Pandemic Responses at Train Stations

Unlike Japan, which is a relatively safe country, security checks are mandatory when entering and exiting public transportation systems and buildings in foreign countries, including developing countries.

Specifically, security gates and metal detectors have been installed on high-speed railroads and urban railroads in other countries as countermeasures against acts such as terrorism. However, sufficient consideration must be given at the time of planning to the division of security areas, the separation of security flow lines, and alighting flow lines when transferring from one transportation system to another. The following photos show examples from overseas.

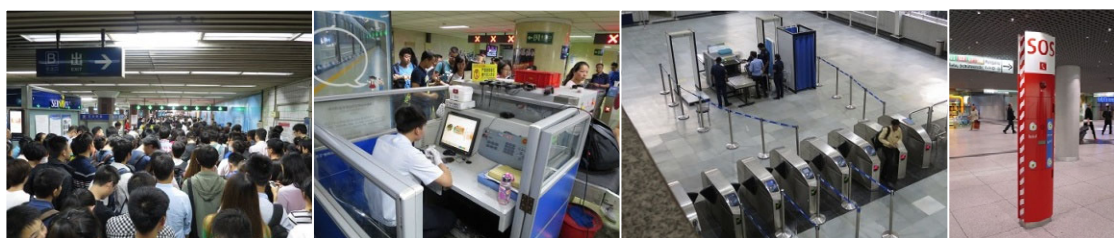


Photo 3-2,3,4,5 Security measures in a station (China) and equipment for emergency calls (right; Germany)

*Photo: Japan International Consultants for Transportation, Co., Ltd.*

In Indonesia, during the early phase of the Coronavirus pandemic, the response was to conduct antigen testing at rail stations and allow passengers to board only if they tested negative (see photo below).



Photo 3-6, 7 Antigen testing at a train station (Jakarta, Indonesia)  
*Photo: Japan International Consultants for Transportation, Co., Ltd.*

### 3.3 JICA's Approaches to TOD Cooperation

The following is a description of JICA's TOD cooperation strategy for the future, including approaches that should be focused on to realize TOD in concrete terms, the stages of application, preconditions, external conditions, and points to be noted.

#### 3.3.1 Measures Needed to Implement TOD

The measures needed to implement TOD are as follows.

- ① Establish the Metropolitan Vision and Identify Urban Issues (Reduce urban concentration, reduce congestion, reduce private car usage, reduce greenhouse gas emissions, promote compact city principles)
- ② Public Transportation Corridor as a Solution to Urban Issues (Corridor identification)
- ③ Planning and Implementation of Public Transportation Corridor (Alignment and station location identification)
- ④ Comprehensive Development Plan for Public Transportation Corridor (Station area, corridor land use, and development project identification)
- ⑤ Entities to Implement Development along the Public Transportation Corridor (Role identification)
- ⑥ Financial Resources for Development along the Public Transportation Corridor
- ⑦ Necessary Legal System for Development along the Public Transportation Corridor
- ⑧ Implementation of Each Development Project
- ⑨ Implement and Continue Area Management along the Corridor

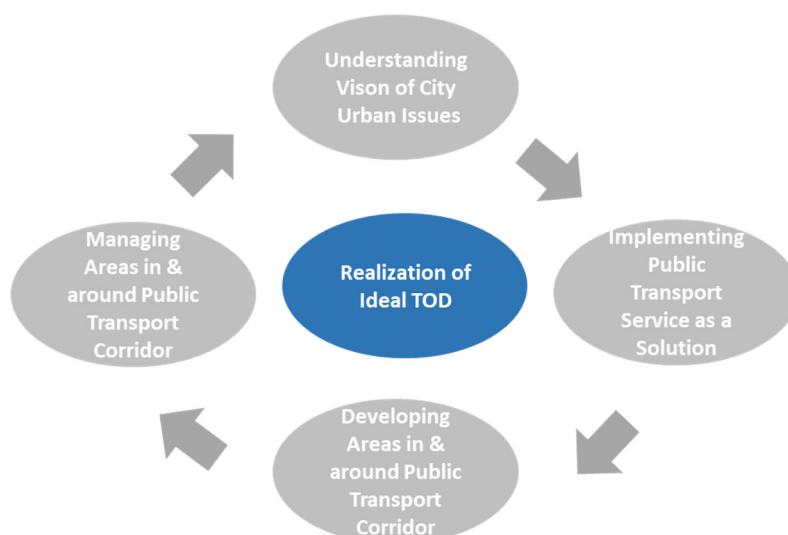


Figure 3-5 Desired Policy Cycle to Realize TOD

Source: JICA Study Team

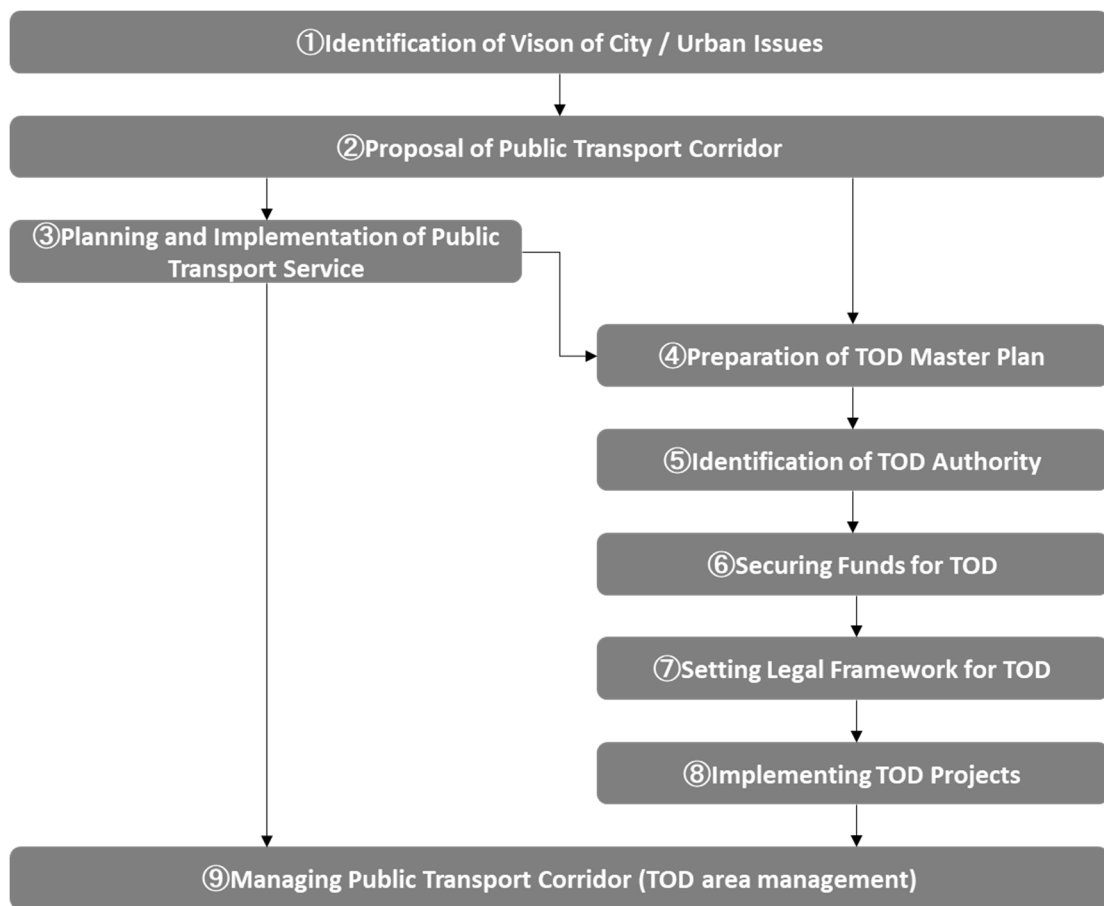


Figure 3-6 Flow of Measures to Implement TOD

Source: JICA Study Team

### 3.3.2 Proposal for JICA's TOD Cooperation Approach

#### 3.3.2.1 Overview of the TOD Cooperation Approach

To realize JICA's metropolitan vision and its values, the public transportation corridor development project and the urban development must work together to ensure that the various TOD projects at the area level are implemented at the same time, and that the respective efforts in each sector, stage, and entity are aligned. Proposed approaches to TOD cooperation include the formulation of a Comprehensive Development Masterplan along the corridor, formation and capacity building of implementing agencies with coordination and implementation capabilities, necessary legal and institutional arrangements, financing of TOD projects using the spillover effect, area management, technology transfer from Japan, etc. JICA's previous cooperation projects are considered to have taken a more upstream/downstream approach. The priority areas of the proposed project are considered to be located outside of the areas where JICA's conventional cooperation projects are mostly focused, and therefore, it is necessary to strengthen the project in the future.

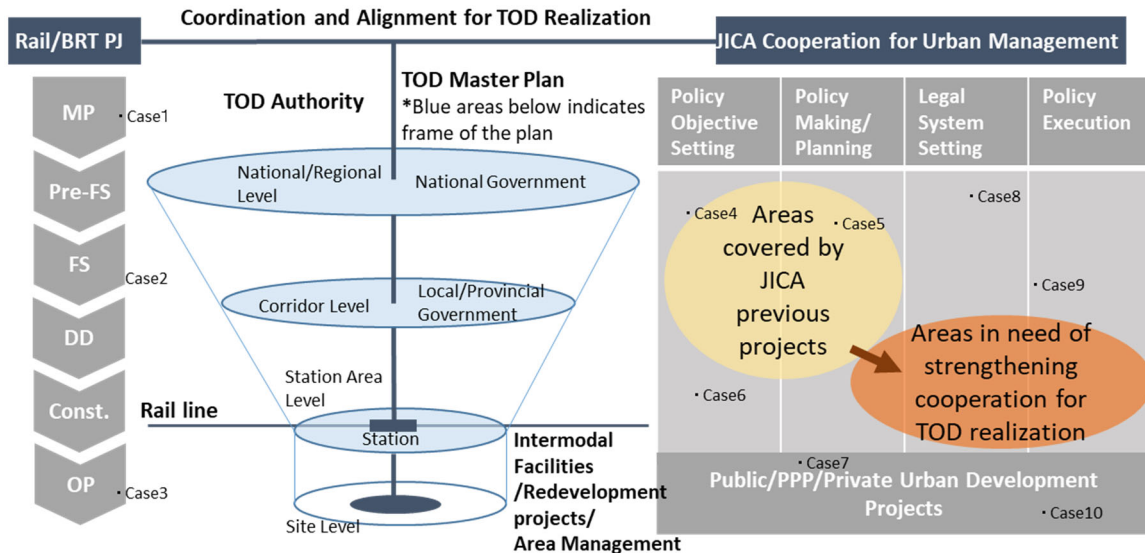


Figure 3-7 JICA’s Proposed TOD Cooperation Approach (1)

Source: JICA Study Team

Support for the development of public transportation corridor proceeds at the request of recipient countries, and the appropriateness of such development projects in terms of urban administrative management is explained through technical assistance for the masterplan formulation. In the case of stand-alone projects for public transportation corridor development, aside from the prerequisite of masterplan, the biggest concern is the project cost, which tends to limit the scope of the project in order to control the cost. It is difficult to take into account the perspective of the local government. In recent years, TOD has been increasingly considered in FSs and other projects on the public transportation corridor improvement project. However, especially in the implementing agencies of recipient countries, TOD is basically recognized as an option for non-operational revenues of operators and other project implementers from the viewpoint of project profitability. As a result, local government (city planning) often fall behind or fail to coordinate well with the projects they receive assistance for.

To compare this to the construction of a building, JICA is supporting the construction of elevators, which require technical expertise based on the overall design, but the common areas, including the hall in front of the elevators, and the floors on each floor have not yet developed, which is a worrisome situation for the building as a whole. The development should have been more convenient for all users of the building, and the floors should have been more crowded, which would have increased the property value of the building.

To realize TOD, JICA will not only support the development of the public transportation corridor, but will also support the local government to realize the vision and value of the city. In other words, JICA will not only support the construction of elevators, but will also support the construction of each floor, which will greatly enhance the value of the entire



building. This is JICA's approach to TOD cooperation.

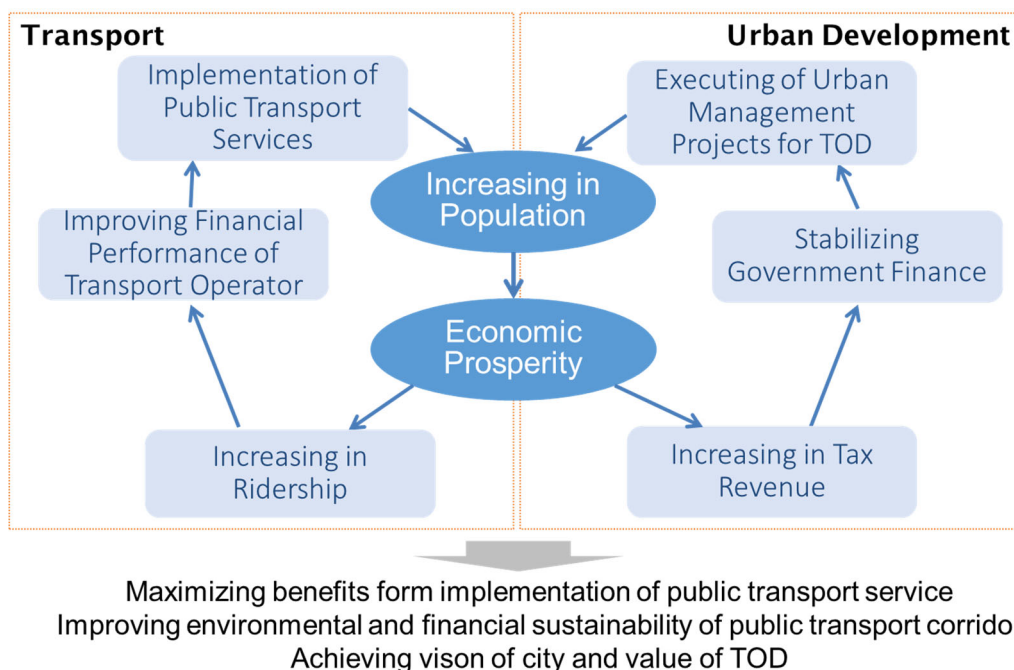


Figure 3-8 JICA's Proposed TOD Cooperation Approach (2)

*Source: JICA Study Team*

The cooperative approach is described in detail beginning in the next subsection.

### 3.3.2.2 Support the Urban Management of the Government, from Upstream to Downstream Development along the Public Transportation Corridor Development.

Focusing on a particular line, JICA's conventional urban management assistance has mainly focused on upstream assistance in the flow of TOD implementation. To achieve desirable TOD, it is necessary to accompany the planned development along the line after the public transportation corridor is built. On the other hand, in developing countries, there are cases where the government lacks the capacity to lead this planned development, and the private sector is left to develop without appropriate development planning and guidance, thus undermining the purpose of development. As is evident in the case of TOD in Japan, it is essential for the government to play a central role and actively engage in the development of the corridor to achieve the desired TOD outcome.

After providing upstream urban management support such as urban transportation master plans, JICA will continue to provide urban management support in parallel with the development of the identified public transportation corridors until the desirable development along the specified lines achieved.

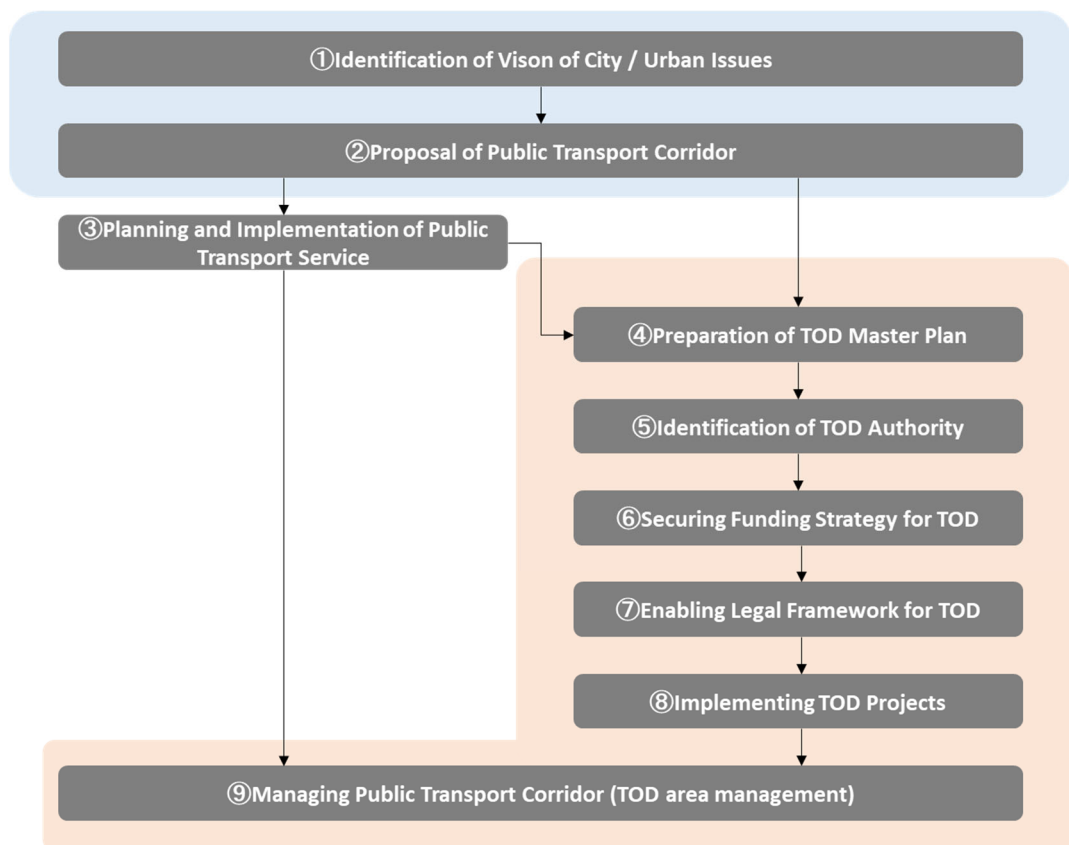


Figure 3-9 JICA's TOD Assistance Flow

Source: JICA Study Team

Specific support will be explained in the following subsections. If the area around the station is greenfield or publicly owned, but if the land is privately owned, it is necessary to ensure that good development along the station is achievable by the country's urban planning laws. For example, it is necessary to reflect the existing planning framework of the country by, for example, supporting changes in the land use plan of the area around the station in accordance with the country's urban planning law

In addition, the development of the project implementation entity, securing of financial resources for development along the corridor, and necessary legislation such as project methodology will take a long time to realize. To ensure that such necessary downstream measures of TOD are done in a timely manner, they need to be already considered in the upstream master plan of TOD. Thus, it is also necessary to strengthen JICA support upstream of TOD in preparation for downstream TOD issues.

### 3.3.2.3 Support the Formulation of a Comprehensive Corridor Development Masterplan

Once a station is built, development and redevelopment will proceed in the surrounding area. The development along the public transportation corridor should be aligned with the corridor's development to achieve the desired TOD. To ensure and maximize the achievement of the corridor's goals, the land use along the corridor should encourage people

to use it and reflect a business model that makes the service sustainable financially, and the development around each station should reflect the characteristics of the area. The existence of stations should be managed and guided appropriately by the private sector to resolve issues and redevelop the area. In addition, it is necessary to develop the necessary infrastructure to support development along the rail line. To ensure that these activities proceed in a planned manner, the government will take the lead in formulating a comprehensive plan for the corridor's development, and JICA will support the formulation of this plan.

This comprehensive development plan for the corridor also includes consideration of the roles of each stakeholder, prioritization of basic infrastructure development, implementation plans, implementation structure, and required financial resources.

#### 3.3.2.4 Support the Development and Capacity Building of the Implementing Entity for Efficient Planned Corridor Development

As shown in the cases of Japan, especially in postwar Japan, TOD has been implemented through the initiatives of the government, including the national government and powerful local governments. In developing countries, even if a public transportation corridor is developed through development assistance, there is a lack of administrative initiative or capacity to make the subsequent development along the corridor more planned and desirable. As a result, the development along the public transportation corridors tends to be left to private developers, which in some respects undermines the effectiveness of the development. In general, local governments, which have the legal basis for planning land use in areas surrounding rail stations, are expected to play this role, but in developing countries, it is extremely rare for local governments to be able to fulfill this role. Furthermore, good corridor development cannot be achieved through the administrative efforts of a single local government, but rather requires the cooperation of several local governments and related agencies of the central government. Moreover, it requires the involvement of not only the central entity responsible for the development of the public transportation corridor, but also other related ministries and agencies, such as those that must deal with individual project laws when developing the infrastructure and implementing the project. In order to make them coherent and unified, close cooperation between these administrative entities, especially between the central government and local governments, and between cities and transportation authorities, is indispensable.

JICA needs to provide support for these administrative management issues. The approach will be to develop an implementing entity to formulate and implement development plans for the entire country and to strengthen its capacity to do so. This implementing entity will be developed jointly by the above-mentioned administrative entities in cooperation with the relevant agencies, while identifying a lead agency according to the country's current situation.

Members will be dispatched from the agencies concerned, and external personnel will be utilized as needed. If a legal basis is required for the establishment of such an implementing entity, which is tentatively called a TOD Implementing Agency, JICA has to provide the necessary support. By organizing and supporting implementing agencies in this way, developing countries can expect to efficiently improve their administrative management capacity, and JICA can also improve the efficiency of its assistance by narrowing down the scope of its support.

The composition and roles of such TOD implementing agencies need to be considered respectively, reflecting the current situation in the countries to be supported. The general roles of the TOD implementing agencies would be to coordinate with the above-mentioned related organizations, develop and manage the designated areas along the rail line so as to overlay the existing framework, formulate a comprehensive development plan for the rail line, and implement a part of the project by themselves. In the case of implementation of the project, it is assumed that financing will be provided, in which case JICA will also provide support for financing. Over time, the administrative management know-how gained through the development and management of the rail line will spread to other areas along the rail line and contribute to raising the level of administrative management in the country as a whole.

### 3.3.2.5 Consider the Spillover Effect of the Public Transport Corridor Development as part of the Project Financing

Most of Japan's TOD has been financed through public finance, such as fiscal investment and loans and municipal bonds issued by local governments. In developing countries, it is desirable to secure such financial resources for the TOD implementation by establishing a roadmap prior to the development of public transportation corridors. There have been cases where good development along rail lines has not progressed because the financial resources have not been secured, and the development of infrastructure around stations has not progressed, which has compromised the convenience and development effectiveness of the rail lines.

As one of the methods of financing TOD projects, JICA focuses on the spillover effect associated with the construction of public transportation corridors, which typically involves an increase in land prices when a rail station is constructed. The value of this increase is the spillover effect. (For the detail please refer to the following report by JICA)

([https://www.jica.go.jp/activities/issues/transport/related/ku57pq00002o2oy8-att/spillover\\_effect\\_study.pdf](https://www.jica.go.jp/activities/issues/transport/related/ku57pq00002o2oy8-att/spillover_effect_study.pdf))

A portion of this increase in value will be used as a financial resource for necessary TOD projects. TOD is not a specific project but a program of a series of projects aimed at creating a desirable urban image, and the increased value generated by the public transportation

corridor improvement project is used to fund TOD projects such as infrastructure improvements in the surrounding area. The tools to return the spillover effect to TOD projects can be broadly classified into tax-based and development-based tools, and this return mechanism will be made to function through support to the implementing entities and project implementation.

JICA will ensure the effect at the urban transportation masterplanning stage to effectively utilize the spillover effect. The methodology is shown in the JICA study results above.

By utilizing the spillover effect and implementing a project that will trigger development along the rail line along with the opening of the station, or by implementing a project that improves accessibility to the station, the added value of the area can be further increased, and a portion of that added value can be reinvested to create such a cycle of phased development. When development along the rail line progresses systematically in this manner, the number of users of transportation services along the public transportation corridor can be expected to increase, thereby improving the project's sustainability. There is also the possibility of returning some of this added value to the public transportation services along the corridor, if necessary. This will promote the realization of TOD for the entire rail line, for example, by accumulating a fund and using it to help transport service providers continue their business in the event of a business crisis.

#### 3.3.2.6 Leverage Japanese Government Loans to Facilitate Local Government Decision-Making on Urban Management Issues

Politics and decision-making delays in the target countries may prevent the timely implementation of necessary TOD measures. For example, the development of an interagency TOD implementation entity may not proceed as planned, or the legal system necessary to implement TOD might not be developed. There is also the possibility of returning some of this added value to the public transportation services along the corridor, if necessary. This will promote the realization of TOD for the entire rail line, for example, by accumulating a fund and using it to help transport service providers continue their business in the event of a business crisis.

When working on such downstream TOD measures, the need for and frequency of interest adjustment increases, and the degree of difficulty in decision-making and consensus-building in local governments tends to be higher. The implementation of measures necessary for the development of the rail line should be promised in advance as a condition for the provision of loans for the development of the public transportation corridor. This packaging will remove as many obstacles as possible and enhance the feasibility of TOD.

#### 3.3.2.7 Establishment of a Competitive Environment, such as by a PPP Framework,

during the Upstream Stage of Corridor Development Masterplan Formulation, that can Appropriately Consider Japanese Infrastructure Technologies

In terms of regional development, local developers have experience, and it is difficult to see the need for participation by Japanese companies. To promote participation in TOD projects by Japanese companies that possess the knowledge and technology for station area development that Japan has accumulated over many years, the Japanese government should present the level of knowledge and technology that can be realized from the masterplan stage, and, with the understanding of the country concerned, the requirements for TOD realization should be organized at the private sector project implementation stage. As a result, the need for Japanese companies with knowledge and technology will be recognized by local developers, and JV partnerships will be formed to create business opportunities for Japanese companies.

#### 3.3.2.8 TOD Enforcement

In JICA's TOD cooperation approach, it is necessary to give effort on how to do enforcement, i.e., leading to the implementation of TOD after the plans, systems, and organizational structures are in place. Although support for TOD planning and institutional development has been provided in the past, some of it has been limited to the promotion of understanding of TOD among local government officials, without reaching the stage of enforcement and implementation. There are different possible causes for these results from country to country and project to project, and there is no uniform approach to dealing with them. For example, the transportation masterplan is not legally binding, so the policy can change drastically from time to time under different administrations (Philippines), the criteria for development approval lacks transparency and is a black box (Vietnam), and the decentralization of government in recent years has given local governments a great deal of authority, which has resulted in a lack of understanding of the issues and making coordination of interests among governments a challenge (Indonesia). Further action is often required to address individual issues for implementation and enforcement. It takes about 10 years at the earliest from the formulation of the comprehensive development masterplan under which the public transportation corridor is proposed to be developed to the actual opening of the transportation system, and the opening schedule often does not go according to plan. In countries where TOD associated with the development of public transportation corridors has not yet been realized, specific, timely, appropriate, and continuous action is needed to specifically address the individual issues that hinder the implementation and execution of TOD as described above in the face of this long period in order to ensure its implementation and execution.

Regarding this, the following suggestions are contained in the Final Report of the The Research on Integrated Urban Rain and Urban/Regional Development (JICA, 2017).

- In the F/S of urban rail projects, the role of urban-side stakeholders is absent or limited. A greater voice of the urban-side will promote discussion on the need for rail infrastructure continuity and transportation hubs, and even the sharing of project costs, and will allow for greater consideration of TOD factors in the selection of station locations, etc.
- Urban rails are often built in existing urban areas, resulting in a large amount of resettlement. It is possible to combine TOD development with urban rail projects, using appropriate public lands along the line in conjunction with housing supply measures.
- Since urban rail projects themselves have become policy objectives and rail projects are implemented mainly by transportation-related agencies, the focus of F/S is on route selection, mode selection, project costs, and resettlement, and only the initial construction costs are considered an issue. It is necessary to fully consider the original purpose of promoting the use of railroads and development in front of and along railway stations, as well as the costs associated with such development.

Although this is a proposal to the F/S for an urban rail project, the content of this proposal can be read as the specifics of a downstream technical cooperation project (proposal) in the "Necessary Measures to Realize TOD and JICA Cooperation Menu" proposed by the study team. In many cases, it is more appropriate to separate them from F/S and regard them as separate projects. In addition to the F/S, the city side must continue to be present during the subsequent detailed design and construction phases and for the long period of time required for the development of the public transportation corridor, and it is necessary to secure a larger voice than before and to accumulate responses to individual specific issues with full consideration of TOD.

As the development of good quality urban railroads like in Bangkok progresses and the general public witnesses and experiences the development of station area, it is expected that TOD will become a reality even without assistance. Especially for the first pilot TOD, it is essential for the government to take the initiative and do enforcement with strong, timely, appropriate, and continuous support from JICA.

### 3.4 Public Private Partnerships Improvement Measures

As we have discussed above, a major issue in the formation of TOD projects is the establishment of a cooperative framework between the development entities on the rail and urban sides.

In emerging economies, when the main rail development entities are government agencies or public organizations, it is difficult to promote TOD development in a planned and rational manner because of the differences in the nature of the entities and the differences in their business objectives and profit structures, which prevent coordination with real estate development projects led by private companies.

TOD from the viewpoint of railroad operators, is expected to bring various benefits, such as increased ridership due to improved transportation convenience around stations and increased revenue through so-called non-rail business, while from the viewpoint of the non-rail private company, it is an initiative that has great significance for both parties, as it will secure business opportunities with high potential. If a third party in a fair and impartial position can act as an integrator, standing between the rail operator and the non-rail private company, and coordinate the masterplanning and commercialization of the entire TOD development to maximize the impacts of the railway project, the TOD development may be promoted in a systematic and rational manner.

In view of the above, one of JICA's strategies for future TOD cooperation is to implement initiatives such as "PPP Project Formation Coordination" as explained in the followings.

In the "PPP Project Formation Coordination," a team of JICA experts will stand between the railway operator and the non-rail private company and play the role of an integrator, appropriately taking in the intentions and thoughts of both parties and promoting TOD project that will generate mutual benefits.

In this initiative, a team of experts will educate railway operator that are not interested in urban or real estate development and do not have knowledge or know-how about the effects, significance, and merits of promoting TOD development in conjunction with private investment, and induce them to make decisions and build a system as an organization to implement TOD development on their own. At the same time, activities to identify private companies that wish to invest in TOD projects will be conducted in an integrated manner.

The timing of the private sector's participation in TOD development, which is expected to be highly profitable and effective in terms of implementation, will be from the initial planning stage as a project collaborator, with the aim of formulating a plan that incorporates the private sector's intentions and other factors.

On the other hand, since the selection and selection of private companies to collaborate with



the public railway development project requires a transparent and fair procedure, with the understanding and cooperation of the railway operators, an organization such as the "Public-Private Partnership Council for the Railway Corridor Development Project (tentative name)" with a team of experts serving as the secretariat will be established and companies that meet certain criteria will be selected as members of the council.

In addition, in order to develop specific TOD development projects, based on discussions and coordination with the railway operators and the private companies' intentions at the above-mentioned council, conditions such as possible candidate sites for TOD development, development content, functions to be introduced, timing, etc., will be set, and a schedule for station development and development on the railway-side related to the target sites and other conditions related to development will be organized. At the same time, the project team will organize the requirements and conditions for the participation of private companies, and promote TOD development projects in the designated areas.

### 3.5 For the Promotion of TOD

In this section, we will discuss the important issues in promoting TOD.

#### 3.5.1 Smart City and TOD

In the future, TOD should be considered along with the smart city concept. An example is the Bang Sue district in Bangkok, Thailand (see above).

In smart cities, BIM/CIM, digital twin, and MaaS are being used as tools to promote Digital Transformation (DX).

#### 3.5.2 Future Direction of TOD

TOD is expected to move in the following direction while integrating with the concept of smart city.

- Various concepts and tools, including digital twin, MaaS, and BIM as tools for promoting DX (Digital Transformation), will be applied from upstream to downstream, including supply chain and engineering chain.
- Integration and collaboration between different organizations and regions (and internationally, depending on the sector) will also increase.
- Digitalization will progress even in areas where digitalization has lagged behind.
- On the other hand, as digitalization progresses, digital crimes such as hacking are expected to increase, so it is also important to implement crime prevention and post-incident measures through international cooperation.

The effects of the DX on the station and station area are as follows.

- Guidance and information provision to users will become more sophisticated and personalized. For example, it will be possible to display the current location on a smartphone and provide directions to the desired location (bus stop, building, etc.).
- Payment will be possible without carrying cash, and the same payment methods will be available within the TOD, including stations.
- Automation and unmanned operation of railways and buses that travel within the TOD.
- In terms of security, advances in personal authentication and sensing technology allow smarter checking of larger numbers of people.

When promoting TOD in developing countries in the future, it is expected to also include the above items.

## **4 Promotional Materials and Suggestions for Their Use**

In this study, promotional materials (brochures) for TOD cooperation were prepared. This item is intended to be used by JICA project managers to grasp an overview of JICA's assistance and its effects when planning surveys and technical cooperation projects for the integrated development of urban and transportation systems, while presenting it to their counterparts in developing countries. It is recommended to confirm the details of the items to be covered and case studies in the report, and to use the report to formulate and supervise projects based on the case studies and lessons learned.

Promotional materials were prepared in Japanese, English, and Indonesian. In addition to countries where English is spoken, the materials are expected to be used in Indonesia, where TOD is being actively considered for introduction, and in rural areas where English is not easily understood.

The publicity materials consisted of the following content, on eight pages, and were prepared so that the details could be easily reviewed in the report (see the Material 4 in the "Materials of the Study Results").

Title: Transit Oriented Development (TOD) for Sustainable Urban Development  
~Planning and Implementation Approach~

### Definition of TOD

1. Overview and History of TOD
2. Initiator to Lead Comprehensive Development Masterplan (CDM) as a Basis of TOD
3. Three Metropolitan Visions and Six Keys to TOD Success
4. Case Study of TOD in Japan
5. Case Study of TOD Implementation in Six Metropolitan Areas
6. Steps to Achieve TOD