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DELIVERING INTEGRATED TRANSPORT MODES AND SERVICES TO CUSTOMERS

Makio SHICHIJO
Director of Economic Research, Traffic Survey and Census Office, Planning Division,
Road Bureau, Ministry of Land, Infrastructure, Transport and Tourism, Japan
shichijou-m2ii@mlit.go.jp

INTEGRATED MODES OF TRANSPORTATION AND PROVISION OF SERVICE TO CUSTOMERS

1. INTRODUCTION

Development of Japan's modern transportation infrastructure began with an all-out effort on railway transportation. The first urban streetcars were established in 1895. They spread from there, becoming a familiar and important mode of transportation in more than 60 Japanese cities by the 1930s. On the other hand, development of roads lagged behind. In 1955, the paved road ratio of ordinary national highways was only 13.6 percent.

As the period of high economic growth began in the 1960s, industrial structure, regional structures, and lifestyles became more advanced, modernized, and urbanized. These developments were accompanied by transport demand. Automobiles came to be preferred because of the time and space options they provide, their mobility, comfort, and personal-ness, the comprehensive door-to-door service they offer. Road development has taken place in response.

As automobile transportation developed, increased attention began to be paid to traffic congestion, accidents, and environmental issues. In terms of road measures, initiatives to utilize users' free preferences by mutually coordinating automobiles and other transportation modes such as public transportation, walking, and bicycles to fully use the characteristics of each mode and optimize the utility of the overall traffic infrastructure are promoted.
This report will describe the current status of Japan's transportation policy.

2. STATUS OF JAPAN'S MODAL SPLIT

Historically, Japan has emphasized railway development over road development. Land development has thus taken place alongside railways. As the population became concentrated in large cities, housing grew alongside railways because of their convenience. In addition, the central urban areas of large cities are densely used, maintaining a high rate of public transportation use. As illustrated below, the rate of public transportation use in Yokohama and Tokyo's 23 wards is much higher than of Paris or Berlin. In Tokyo's 23 wards, the rate of public transportation use is more than 50 percent[1].

[1] Tokyo Metropolitan Person Trip Survey (Yokohama and Tokyo's 23 wards), Mobilität in Deutschland (Berlin), and Certu (Paris)

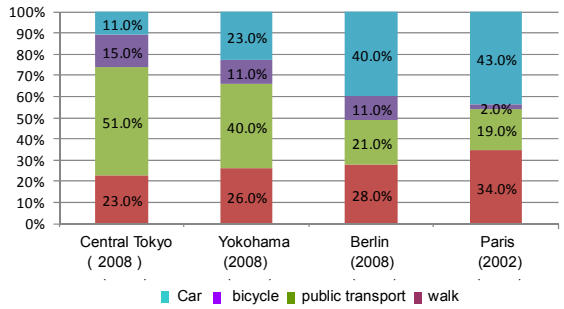


Figure 1 - Modal split in large cities in Japan, Germany, and France

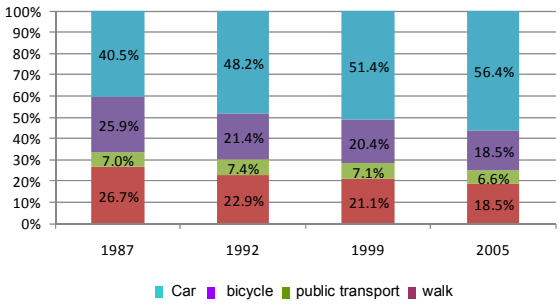


Figure 2- Changes in modal split in regional metropolitan areas in Japan

In regional areas, however, the advance of motorization has reduced the modal split of public transportation. The Nationwide Person Trip Survey found that the modal split of public transportation in regional metropolitan areas was 7.4 percent in 1992, and declined to 6.6 percent in 2005. In contrast, the modal split of automobiles was 40.5 percent in 1987 and increased to 56.4 percent in 2005. This indicates a preference for automobiles.[2]

3. MEASURES FOR THE COMPREHENSIVE DEVELOPMENT OF THE TRANSPORTATION SYSTEM

3.1. Promotion of appropriate modal split

In light of traffic congestion, accidents, and environmental issues, Japan works based on the free preferences of users to promote the use of transportation other than automobiles.

3.1.1. Raising bus punctuality through measures against traffic congestion

In Japan's regional cities, buses are an important mode of public transportation. However, increased automobile ownership and decreased punctuality due to traffic congestion are leading to less bus ridership every year. Decreased bus usage in turn invites more traffic congestion. In order to break this vicious circle, Japan is pursuing initiatives to improve bus punctuality by easing traffic congestion through road improvements and other measures.

3.1.1.1. Road widening

On Route 10 in Beppu, Oita Prefecture, increased traffic volume led to chronic congestion. The road was therefore widened from four lanes to six. This resulted in shortening

[2] Nationwide Person Trip Survey 2005

congestion at the Ryogunbashi Intersection from about 2,000 meters to 650 meters. Annual time loss due to the congestion was reduced by around 40 percent, from 835,000 person hours per year to 500,000 person hours per year. The widening also contributed to bus punctuality. The number of buses running late by five or more minutes was reduced by about 70 percent.

Figure 3- Situation after widening

3.1.1.2. Elimination of through traffic by development of ring roads

In major metropolitan areas, development of radial roads linking urban centers with suburban and regional cities was given priority, so development of ring roads has lagged behind. However, because through traffic with no business in the city center concentrates there, chronic traffic congestion appeared in urban centers. Furthermore, the rapid spread of urban areas to the suburbs during Japan's period of high economic growth has made the construction of ring roads even more difficult. Even today, ring road development in major metropolitan areas is slow. This is one cause of traffic congestion in city centers.

In the Tokyo Metropolitan Area, a three-ring, nine-radii road network was planned about 40 years ago. Subsequently, radial expressways such as the Tomei, Chuo, Kan-etsu, and Tohoku Expressways have been gradually developed. In contrast, construction of the three ring roads in Tokyo Metropolitan Area is lagging far behind. Even today, after 40 years, the three ring roads are only 47 percent complete.

As a result, automobiles whose drivers intend only to pass through concentrate in the city center, generating chronic traffic congestion. Completion of the three ring roads is expected to divert through automobile traffic around the city center, easing congestion there.

In order to advance the development of the ring roads, in 2007 planning for some sections of Gaikan expressway was shifted from a conventional elevated design to a deep-underground design that does not require the procurement of land.

3.1.1.3. Elimination of Railway Crossings through the Continuous Grade Separation Project

In most Japanese cities, railways were developed before roads were. Road development was carried out later, when rapid spread of urban areas occurred. This means that there are many level intersections between railways and roads. This has led to railway crossings that are "perpetually closed" during the morning and evening rush hours, which generates traffic congestion.

In order to end this traffic congestion caused by "perpetually closed" crossings, eliminate accidents at crossings, and integrate cities divided by railways, the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) is advancing a continuous grade separation project to remove crossings on a prioritized basis. The continuous grade separation project aims to place railways continuously either elevated or underground as a part of road projects. It is intended to eliminate several crossings at one time. Through March 2010, the continuous grade separation project had been implemented at about 140 locations, eliminating around 1,500 crossings.

3.1.2. Development of LRT

In the past, most Japanese cities had streetcar networks. They served as an important mode of transportation for city dwellers. With soaring demand for automobiles, however, it became difficult to secure space for roads inside cities. As the space used for automobiles expanded, most streetcar lines were eliminated. In recent years, however, against a backdrop of improved streetcar performance and growing concern over global warming, streetcars are being rethought. An increasing number of cities are considering introducing streetcars, including LRT.

The MLIT promotes the introduction of LRT by subsidizing some of the costs when local governments adopt LRT.

In Toyama, ridership on the JR Toyamako Line was declining, and there was concern that it would be shut down. Local government took over the operation. Road-use funds provided some of the capital. Toyama Light Rail opened in April 2006 with 1.1 kilometers of new track, five new stops, and seven new cars, all of the low-floor type.

After opening, service was improved. Weekday ridership doubled, while weekend and holiday ridership quintupled. Twelve percent of riders switched from automobiles.

Figure 4 - Train and bus transit point

Figure 5 - Grass-covered track

	JR Toyamako Line		After LRT
Interval	30-60 min.	→	15 min. (10 min. during rush hours)
First/last trains	Between 5 & 6 am/ 9 & 10 pm	→	Between 5 & 6 am/ 11pm & 12 am
Number of stations	9 stations (exclude Toyama Station)	→	13 stops
Cars	Train car	→	Low-floor cars only
Fare			flat-rate, 200 yen

Table 1 - Improved service

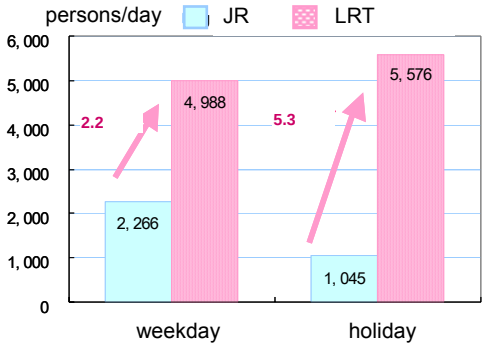


Figure 6 - Comparison of Toyama LRT daily ridership

3.1.3. Creation of environments for safe and comfortable bicycle riding

In order to work towards achieving clean, energy efficient, and sustainable urban transportation systems, Japan promotes conversion from passenger cars to bicycles. This is done by implementing measures for the creation of safe and comfortable environments for cycling through appropriate separation of pedestrians, bicycles, and automobiles according to their traffic volumes and measures against the increasing number of accidents between pedestrians and bicycles.

Japan's bicycle routes include bicycle roads that are separated from roadways and sidewalks by fences and so on, bicycle lanes that are designated zones for bikes on roadways, and bicycle/pedestrian paths where bicycles share sidewalks. The total length of these bicycle routes that separate bicycles and automobiles is about 81,600 kilometers (as of April 1, 2009).

Of that length, however, bicycle routes that separate bikes from pedestrians account for only 2,900 kilometers. This is not even 1 percent of Japan's total road length of 1.2 million kilometers.

Therefore, in order to expand environments for bicycle use that enable the safe passage of both cyclists and pedestrians, in 2008 the MLIT joined with the police to create bicycle riding environments in 98 model zones across Japan that will serve as examples for the development of cycling environments in the future.

Before After

Figure 7 - Example of cycling road development (Mitaka, Tokyo)

3.1.4. Promotion of universal design for walking spaces

Japan's population is rapidly aging. Developing walking spaces with universal design in order to enable the safe, secure, and comfortable movement of the elderly and persons with disabilities as well as all other pedestrians is an urgent task for the nation.

Japan therefore set the Basic Policy on the Promotion of Smooth Travel, based on the Law on Promotion of Smooth Travel by the Elderly, Disabled, etc. (the New Barrier Free Law), to comprehensively promote shifting to barrier-free. By eliminating level differences on sidewalks, constructing wide sidewalks, installing detectable warning surfaces for people with visual disabilities, and putting roofs on bus terminals, universal design is promoted on a priority basis for the major routes of people's lives. These include train stations, shopping areas, hospitals, welfare facilities, government offices, and educational facilities.

Figure 8 - Elimination of level differences on sidewalk,

textured paving block for the visually impaired, bus stop roof

3.2. Seamless Connections between Automobiles and Public Transportation

In addition to appropriate modal split for each type of transportation, the convenience of transportation nodes is being upgraded to enable seamless use of different modes of transportation in cities.

3.2.1. Development of Station Squares

Because railways have historically been a major mode of transportation in Japan, cities developed around railways, and public transportation networks including buses developed around train stations. Station squares are therefore being developed to ensure that their spaces and functions meet the needs of transportation nodes. At the same time, it is kept in mind that these squares serve as the symbolic "faces" and as open space.

At the intersection in front of JR Yokogawa Station, streetcar stops were dangerously located on the national highway. They were also far from the train station, requiring much time to transfer to trains. In addition, cars turning right on Ordinary National Highway 54 and a city road crossed there, causing frequent traffic congestion as well as safety concerns.

These problems were addressed through lane widening and moving the streetcar stop, placing a roof over it, and making it barrier free. Because streetcars now enter the station, transfer distance was shortened from 140 meters to 25 meters, and transfer time from three minutes to less than one minute. As a result, the number of morning (7:00–9:00) riders of public transportation from Yokogawa Station to the city center increased by about 17 percent, from 1,070 to 1,250.

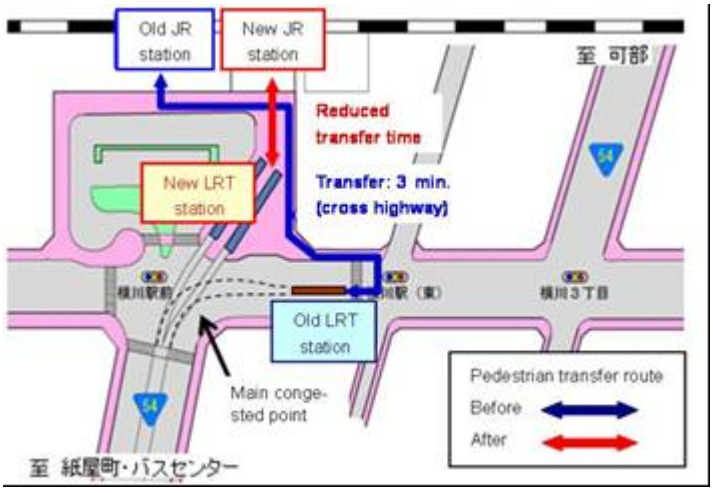


Figure 9 - Improvements to Yokogawa Station intersection

3.2.2. Park and Ride

In Japan, the land around railway stations is densely used and expensive, so it is difficult to obtain land for park and ride facilities. Park and ride is therefore less developed than in the US and Europe. Under these conditions, MLIT is working to promote and spread park and ride through pilot programs.

Aiming to encourage streetcar use, ease congestion by controlling traffic in the city center, implement safety measures, and realize environmental effects by reducing exhaust and CO_2 emissions, three park and ride pilot programs were begun in Kochi in November 1998. Another pilot program was subsequently implemented, so that full-fledge park and ride began in 2000 in two locations inside the city and two outside. As of July 2010, there are five park and ride locations, with space for 381 vehicles. Ninety percent of users are regular users.

Figure 10 - Park and ride facilities (*left:* Ikku area; *right:* Takasu area)

3.2.3. Station Rent-a-Cycle

Construction of bicycle parking facilities around train stations is progressing in order to raise the convenience of access to and egress from railway stations and to eliminate uncontrolled bicycle parking. Additionally, bicycle sharing is being disseminated in order to use space more efficiently and stimulate tourism originating at train stations.

In 2000, a pilot program rent-a-cycle system was implemented in Takamatsu with the support of MLIT. The full-fledged project began the following year at two sites, JR Takamatsu Station and Kotoden Kataharamachi Station, with 150 bicycles. Currently rent-a-cycle ports operate at seven locations, with about 1,050 bicycles for rent. The project has a network of facilities at sites where a large number of users can be expected, such as City Hall and railway stations in the city's urban center. With cycles rented for 24 hours for one coin (100 yen), its simplicity of use has been well-received. Many tourists use it as well. It is used annually by about 271,000 people (in FY 2008). Since 2008, fees at five rent-a-cycle ports can be paid using the IC cards issued by a private railway

company, further enhancing the project's convenience. Currently the rotation rate is 0.85 per bicycle per day. The possible adoption of a fee system that would encourage early returns and an unattended rental system are being studied.

Figure 11 - rent-a-cycle port at Kotoden Kataharamachi Ekimae and underground rent-a-cycle port at the JR Takamatsu Station square

4. PROMOTING PUBLIC TRANSPORTATION UTILIZATION USING ITS

In Japan, not only is traffic infrastructure being developed, provision of services that enable selection of appropriate transportation through the use of ITS is also being promoted.

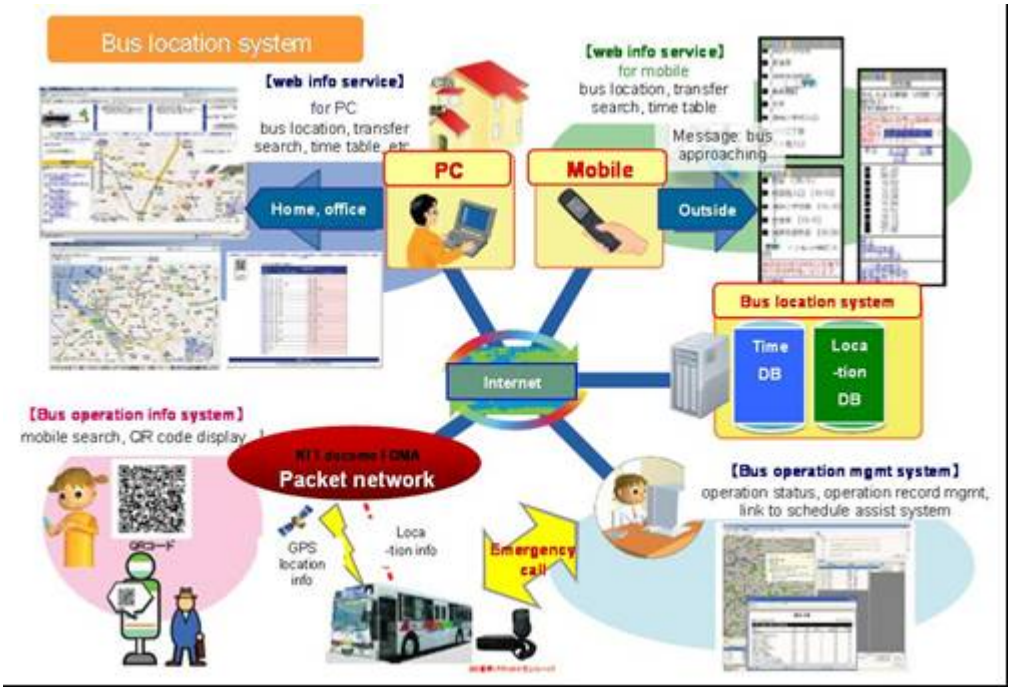
4.1. Provision of Information on Approaching Buses Using a Bus Location System

Bus operations are generally strongly affected by road and weather conditions. This can make it difficult to ensure punctuality. The inability to accurately predict when a bus will arrive is frustrating for bus riders. Providing information on the current location of buses using a bus location system can eliminate this frustration. It can also help riders to use their time more efficiently.

The spread of the internet and mobile phones in recent years have enabled these media to be used to provide services that inform riders in real time of the operating status of buses.

Okinawa began a pilot program in 2004 to test the effectiveness of bus location systems. Naha Bus Co., Ltd., began operating a system in 2007. It is being used more than 30,000 times each day. Numerous requests for expanded service were received via surveys on the website and through the Bus and Taxi Monitor Council. In light of this, in May 2010, Naha Bus, which operates mainly inside the city of Naha, and Ryukyu Bus Kotsu, which operates mainly outside the city, collaborated to link their systems. A bus location system

that enables riders to search the website for transfer information and to confirm the current location of buses was achieved.



Sources: Materials from Daiichi Kotsu Sangyo Co., Ltd., Ryukyu Bus Kotsu Corp., and Mobile Create Co., Ltd.

Figure 12 - Mechanism of Ryukyu Bus's bus location system

4.2. Provision of Information Predicting Traffic Congestion on Expressways

As a user service and a measure against traffic congestion, expressway companies are providing traffic congestion forecasts (length and time required) based on real-time and past traffic conditions. This promotes drivers changing their departure times and routes or switching to a different mode of transportation.

Haneda Airport is Japan's most-used airport. There are road traffic information displays in each terminal. They show in real time the time required to each destination on the Metropolitan Expressway and the degree of traffic congestion on the way. Use of this service enables people arriving at Haneda Airport to select the best modes of transportation and routes to their destinations.

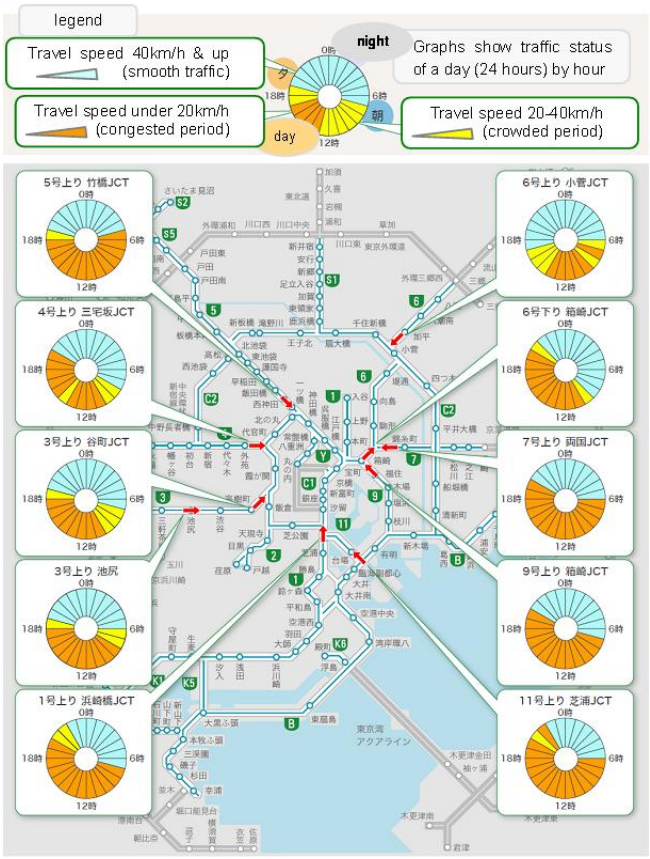


Figure 13 - Example of forecasting traffic congestion

Figure 14 - Road traffic information (Haneda Airport)

4.3. Private-sector Services Providing Traffic Information

In recent years, by private-sector services providing traffic information using traffic congestion data from road administrators have become substantial.

NAVITIME is a service provided by the private-sector company NAVITIME Japan. It is a comprehensive navigation service that enables searching with cell phone for optimal routes for modes of transportation such as walking, trains, cars, buses, and airplanes. It provides rich real-time data, from the operating status of trains and buses, to national traffic congestion data, pinpoint weather information, and even the availability of spaces in parking lots. Driving routes that take traffic congestion into consideration can be searched for. The traffic information is based on Vehicle Information and Communication System (VICS) collected from the Japan Road Traffic Information Center, police, and road administrators.

4.4. Express Buses and Rail Ride

Traffic congestion in city centers became a problem as motorization advanced. This made it difficult to ensure the punctuality of intercity express buses on their routes through cities. Express bus and rail ride services that use suburban expressway parking areas and transfer passengers from buses to trains have therefore developed.

Express bus and rail ride sets special stops in expressway parking areas. When an expressway is congested, bus riders get off at the parking area and transfer to the nearest railway to travel to the city center. Currently, service is in operation for express buses from the direction of Tochigi. Passengers can transfer to the Tsukuba Express for Akihabara at the Metropolitan Expressway's Yashio Parking Area.

There has been a special stop in the Metropolitan Expressway's Yōga Parking Area since May 2010. A pilot program is underway that allows buses on 18 routes to the center of Tokyo from the direction of Shizuoka to transfer passengers to the Tokyu Den-en-toshi Line Yōga Station, which is about a five-minute walk away, when traffic is congested. Bus passengers can choose to transfer when traffic on the Metropolitan Expressway is congested, or they can remain on the bus. The bus driver provides passengers with information about congestion on the Metropolitan Expressway. For passengers who decide to transfer, the normal train fare of 190 yen to Shibuya is discounted to 100 yen. The pilot program has been underway for six months. It will be evaluated to determine whether it should go into full operation.

It normally takes about 15 minutes from the Yōga Parking Area to the city center, but when there is traffic congestion it may take more than an hour. It takes about 15 minutes from Yōga Station to Shibuya Station by train, enabling punctuality regardless of traffic congestion.

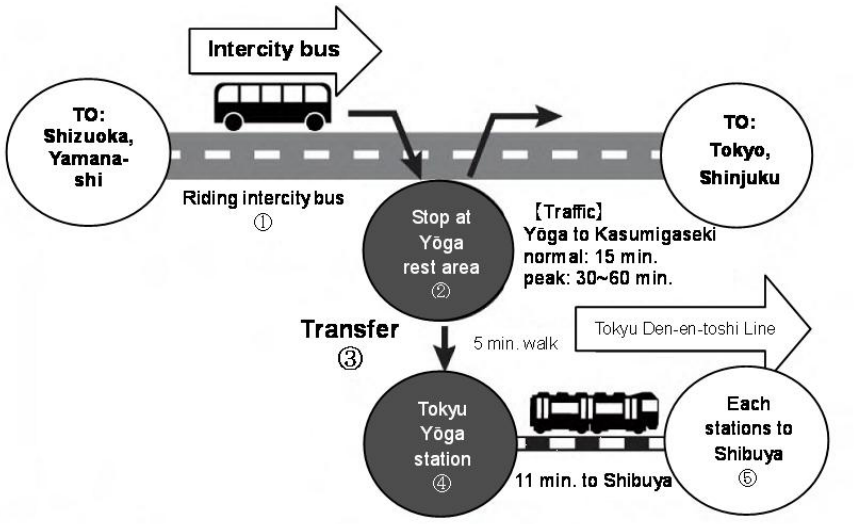


Figure 15 - Image of transfers at the Metropolitan Expressway Yōga Parking Area

5. Comprehensive Approaches to Traffic Planning

5.1. Overview

Increased automobile ownership and traffic volume due to rapid economic growth caused traffic congestion in city centers to become a serious social issue. Bypasses have been constructed and grades have been separated at intersections in order to ease congestion. In city centers, however, land acquisition and costs act as constraints, limiting the ability to expand traffic capacity. Comprehensive measures, such as transportation demand management (TDM), that suppress automobile traffic volume are therefore necessary.

"Metropolitan area comprehensive plans for smooth traffic flow" generally target cities with populations of at least 100,000. Along with attempting to smooth traffic flow in a metropolitan area, they aim to solve environmental issues and other problems that arise from traffic. They promote a comprehensive approach that adds traffic demand management (TDM) and multimodal measures to steps to expand traffic capacity. Plans have been implemented in 23 metropolitan areas to date.

5.2. The Case of the Sendai Metropolitan Area

The City of Sendai has set the Sendai Metropolitan Area Comprehensive Plan for Smooth Traffic Flow. According to this plan, dependence on automobiles is higher in the Sendai metropolitan area than in other major cities. This causes congestion on arterial roads during the morning and evening commutes. In addition, Sendai's commuters come from a wide area. At least 20 percent of commuters to work and school travel 30 kilometers or more. The following measures are therefore planned.

First, to increase traffic capacity, development of bypasses and ring roads (the Kitayobancho-Okai route, etc.), road widening (Tomiya-Taiwa on Route 4, etc.), intersection improvement (continuous grade separation in the Tagajo area along the JR Senseki Line), and installation of advanced traffic signals and other traffic safety measures were listed. The following are planned as TDM and multimodal measures: staggered work hours and voluntary restraints on driving personal cars, provision of traffic information, improvement of bus service (development of routes and adoption of community buses), enhancement of measures against on-street parking, improvement of bus traveling performance (establishment and enhancement of dedicated and priority bus lanes), development of railway transportation (the Tozai subway line), development of station squares (Shiogama Station on the JR Senseki Line, etc.), and development of access roads to transportation nodes (Kawauchi-Hatadate route).

Figure 16 - Major measures in the Sendai Metropolitan Area Comprehensive Plan for Smooth Traffic Flow

6. CONCLUSION

Transportation policy in Japan historically focused primarily on improving public transportation service. Road development consequently lagged behind. Road development advanced along with the high economic growth that began in the 1960s, following in the wake of rapid motorization.

The development of automobile transportation, however, has led to growing concern about road traffic congestion, accidents, and environmental issues. Road transportation policy is developing a series of measures such as TDM and enhancing the convenience of transportation nodes. It is working to build a transportation system in which multiple modes of transportation such as automobiles, public transportation, walking, and bicycles are effectively linked and functional.

Today, Japan is facing a decreasing birthrate and aging population. It is at a socioeconomic turning point. Existing transportation infrastructure should be redeveloped from the perspective of an integrated transportation system. Provision of advanced, efficient transportation services using ITS is an important issue for Japanese transportation policy.