Urban Transportation in Asian Countries

Misao Sugawara

1. Introduction

Large cities in Asia have unique transport problems. Traffic management alone is limited in solving the problems of urban transportation, and introduction of guided transit systems separate from ground-level transport is essential in solving these problems. This article describes some of the recent measures, including finance resources, taken to solve Asian urban transportation problems.

The advance of motorisation in many large cities in the developing countries of Asia is creating traffic congestion and air pollution that are growing more serious year-by-year. The problems are so bad that they are affecting economic and social functions, and the people face an urgent need to improve their urban transportation systems.

Large cities in East Asia have their own unique transport problems. In many cities, a large number of vehicles of sizes between buses and taxis operate for public use. There are also many motorcycles and bicycles. However, there are not many guided transit systems, and even when they do exist, they are not used to their fullest extent for urban transportation (Figure 1).

Various traffic management means have been introduced in some countries to solve the problem of surface congestion. However, as experienced in Bangkok and other large cities, such means alone have limits (Photo 1).

Consequently, many countries want to introduce guided transport that is separate from surface traffic. However, in reality, such a solution is not easy because of financing. Japan has provided cooperation, including various forms of economic and technical

Figure 1 Traffic Share by Transportation Mode in Large Cities

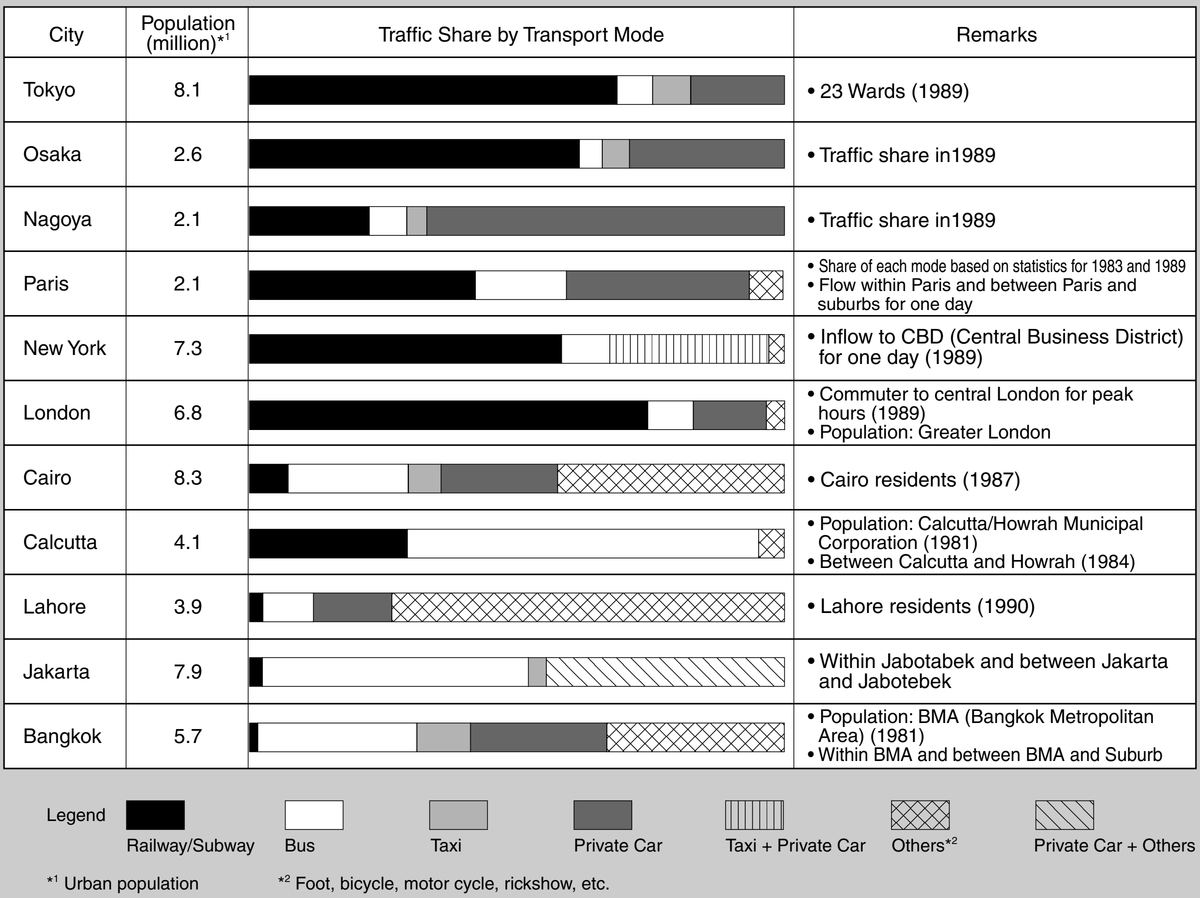


Photo 1 Traffic Jam in Bangkok *(Author)*

cooperation, for urban transportation in Asia. The present situation of urban transportation in Asia and recent efforts to solve the various problems are described below.

2. Improving existing transportation and traffic management

(1) General

The first solution to transportation problems in urban areas is the further

Photo 2 Motor cycles Bangkok *(Author)*

use of existing public transportation systems and adequate traffic management.

In terms of capacity, safety, environmental issues, and energy consumption, it is important to induce passengers to use large- or medium-scale public transportation facilities such as railways, trams, and buses in municipal areas as much as possible. The following need doing to achieve this goal:

1. Elevation of the functions of public transportation facilities such as railways and buses
2. Easier change-over between rail ways and buses
3. Controls on passenger cars
4. New fare systems to encourage use

Table 1 Classification of Cities with Full-scale Rapid Transit Systems

GNP per Capita: US$
Population: Millions

GNP per Capita \ Population	10.0 or more	7.5~10.0	5.0~7.5	3.0~5.0	2.0~3.0	1.5~2.0	1.0~1.5	0.5~1.0
20,000 or more	Tokyo New York	Chicago	Philadelphia San Francisco	Boston Washington Yokohama Berlin	Cleveland Atlanta Baltimore Osaka Nagoya	Sapporo Hamburg	Kobe Kyoto Fukuoka Sendai Munich Stockholm Nurenburg Helsinki	Oslo
15,000~20,000		Paris		Toronto Montreal	Vienna Roma	Milan	Lyons Lille Marseille Rotterdam Brussels Amsterdam Newcastle Naples	
10,000~15,000			London		Hong Kong Singapore		Glasgow	
5,000~10,000				Athens	Madrid	Barcelona		
2,500~5,000	San Paulo	Seoul	Rio de Janeiro	Caracas Pusan		Lisbon		
1,500~2,500	Buenos Aires Mexico City			Santiago				
1,000~1,500								
500~1,000			Cairo					
250~500			Beijing Tientsin Shanghai	Calcutta				
250 or less								

Photo 3 Subway in Singapore - Platform at Orchard Station *(Author)*

Photo 5 Light Rail Transit in Manila *(Author)*

of public transportation

5. Provision of information about using public transportation

On the other hand, there is great demand for door-to-door transport and people want to own automobiles. In countries where private car ownership is difficult, people are relying on motorcycles at an increasing rate (Photo 2).

(2) Use of trains and subways

The basic solution to transport problems in big cities is to persuade commuters to use large- and medium-capacity public transport. But guided transit systems are scarce in the developing countries in Asia. If there are any at all, they are rarely used for urban transport.

Table 1 lists cities with full-scale transit systems and classifies them by population and per capita GNP.

The per capita GNP is low in China, India, and other highly-populated countries. However, the economic activity in large cities is almost as brisk as in advanced countries, and building subways is essential in these cities. The newly-industrialising economies (NIEs) like Singapore, Hong Kong, and Korea already have modern subways and many people use them (Photo 3).

An 88-km long rapid transit system network has been decided in Taiwan, and the first 23-km portion (Tamshui Line) is scheduled for opening verysoon (Figure 2).

Photo 4 Track Elevation Work in Jakarta *(Author)*

Figure 2 Rapid Transit System Network in Taipei Metropolitan Area

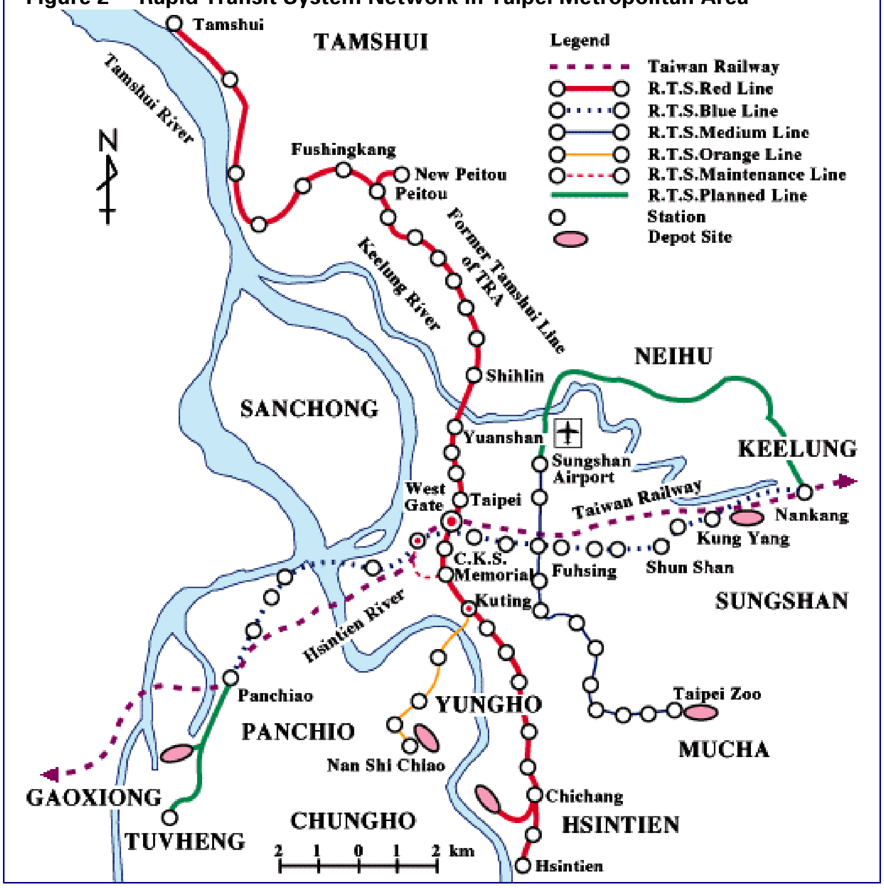
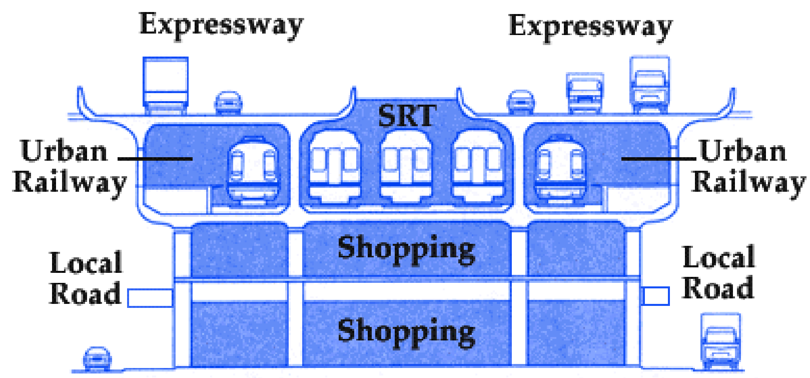


Figure 3 Typical Cross Section of Hopewell Project



In other countries, efforts are being made to use the existing national railways for urban transportation. For example, Indonesia is converting the 160km portion of its national railways in and out of Jakarta into a double-track electrified railway including a 9-km long elevated section as part of a plan to improve urban transportation (Photo 4).

Similar plans are being proposed in Kuala Lumpur. In addition to having a double-track electrified railway, Malaysia plans to build a light rail network in five directions, using in some cases the existing right of way of the Malayan Railway. Construction work is under way on some parts.

In Bangkok where traffic congestion is rapidly increasy. A new project was approved in November 1990 to use land owned by the State Railway of Thailand (SRT) to build elevated railways thereby building new urban railways and expressways as a unit. The SRT has railways in four directions leaving Central Station, and they are building four-level elevated structures. The third level will be used by new urban railways next to the state railways while the fourth level will be used by expressways. The first and second levels will house stores and other commercial outlets. This large government project was awarded to a private enterprise called Hopewell (Figure 3).

Thailand is also undertaking the Tanayon Project and Sky Train Project involving new elevated railways. A new subway system has been announced but is still in the planning stage.

(3) Traffic management and regulation of automobiles

The most common methods of traffic management are exclusive lanes and preferential lanes for buses. One-way traffic and reversible lanes are also effectively used in some places.

Singapore has a unique toll on passenger cars entering the downtown area. The number of passenger cars increased drastically during Singapore's economic development, creating terrible traffic jams. To solve the problem, the government introduced tolls to control passenger cars entering the city as early as the 1970s.

When the toll was first introduced, passenger cars with four or more people were allowed to enter the city freely, but those with three or fewer people were forced to pay a toll . The control was made even stricter in 1988. Today, all cars, whether passenger cars or taxis, must pay $3 (US$ 2.40) per car and attach the receipt (permit) to the windscreen before entering the business center in the city. This method of traffic control is called area licensing.

Malaysia has a more total urban policy. Passenger cars entering the business center in Kuala Lumpur must pay a special fee according to a payment schedule that varies by area and time.

In Indonesia, the Thamrin and Sudirman streets running approximately north-south in the centre of Jakarta are crowded throughout the day. In April 1992, the city introduced a law prohibiting automobiles from those roads from 06:30 to 10:00, unless containing three or more persons. As a result, the congestion on the Thamrin and Sudirman streets was alleviated to some extent, but neighbouring roads became more crowded.

(4) Changeover between trains and buses

The line density of railways is small because of their large capacity. Therefore, it is important to integrate feeder services to use the railways more efficiently.

The urban planning in Singapore took the form of first building densely-inhabited new towns along the major roads and then allocating a bus terminal at an effective point in each of them. Feeder buses were introduced within the new towns to carry people to the bus terminal, and regular buses were used to carry them on from the bus terminal to the business center of the city. The regular buses in the integrated transportation system were later replaced by the subway completed in 1987. The subway stations are conveniently connected to the bus terminals. The new system in Singapore is considered an excellent model of a transportation system integrating subway and bus services.

Integration between trains and buses is also a main theme in the proposed railroad improvement project in Indonesia for the metropolitan Jakarta area.

3. New transit systems in Asia

Introduction of new transit systems is needed in Asia to improve urban transportation. The new transit systems found in Japanese cities are not popular in other Asian countries because of financing difficulties. Instead, they are relying more on light rail systems.

(1) Light rail transit systems

In most cases, "light rail transit" is a general term used to describe im-

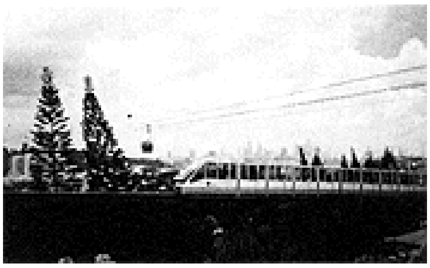


Photo 6 Monorail on Sentosa Island in Singapore *(Author)*

proved trams featuring greater ease of riding, better comfort, lighter weight, energy saving, higher power, and lower noise, etc. They may be single cars, articulated cars, or trains consisting of two or more cars and they run on rails on ordinary roads or on separate roads.

The light rail transit system built in Manila in 1984 is an elevated railway completely separate from surface traffic. It is called Light Rail Transit (LRT) because it is smaller, lighter, and higher performance than conventional trains (Photo 5).

The (LRT) running north to south through Manila City is an elevated 15-km railway. It was opened in 1984 and carries about 300,000 passengers daily. A new plan is now under way to build a second line crossing the existing LRT and a third loop line connected to the existing LRT at both ends (Figure 4).

A similar LRT was built in 1988 in the Tunmen area (population 600,000) 25 km northwest of the centre of Hong Kong. It has six lines with a total service distance of 23.3 km on flat surfaces. There are 41 stations, 200 to 300 m apart in the central part of the city. The system has a minimum curve radius of 20 m and can run along existing roads. In this regard, the LRT system in Hong Kong may be considered a high-performance tram system.

China already has large-scale subways in large cities like Beijing, Tientsin, and Shanghai. LRTs are planned in many other largeChinese cities.

Chongqing and Harbin plan to introduce LRTs using the existing underground paths running in a grid-like pattern.

Conventional trams, buses, and trolley buses are popular in Dalien. In addition, this city is considering introducing a variety of medium-capacity guided transit systems and LRTs to increase the track transport capacity in the urban area and connect it with other areas designated for new economic and technological development.

Thailand has a number of urban railway construction projects to reduce the road congestion in city centers. Elevated LRTs are included in two projects over the most crowded roads in city centers.

(2) Monorails

Monorails are often considered a modern means of transport. However, their history dates back to 1824 when the first monorail was built in London for carrying cargo on a pier.

The railroad museum in Delhi has a display of a monorail pulled by a steam locomotive. It was built in 1908 in Patiala State for transporting agricultural products (tea).

There are two types of monorail: the straddled, and the suspended types. Monorails have long been used in amusement parks and the like, but use as a means of urban transport is quite rare. The few examples include the suspended monorails in Wuppertal and Dortmund Germany, and the straddled monorails in Seattle in the USA.

In Japan, straddled monorails are in operation in Haneda, Kitakyushu, Osaka, etc., and suspended monorails are in use in Shonan and Chiba. A new straddled monorail system is now under construction in Tama near To-

Figure 4 Rapid Transit System Network in Manila

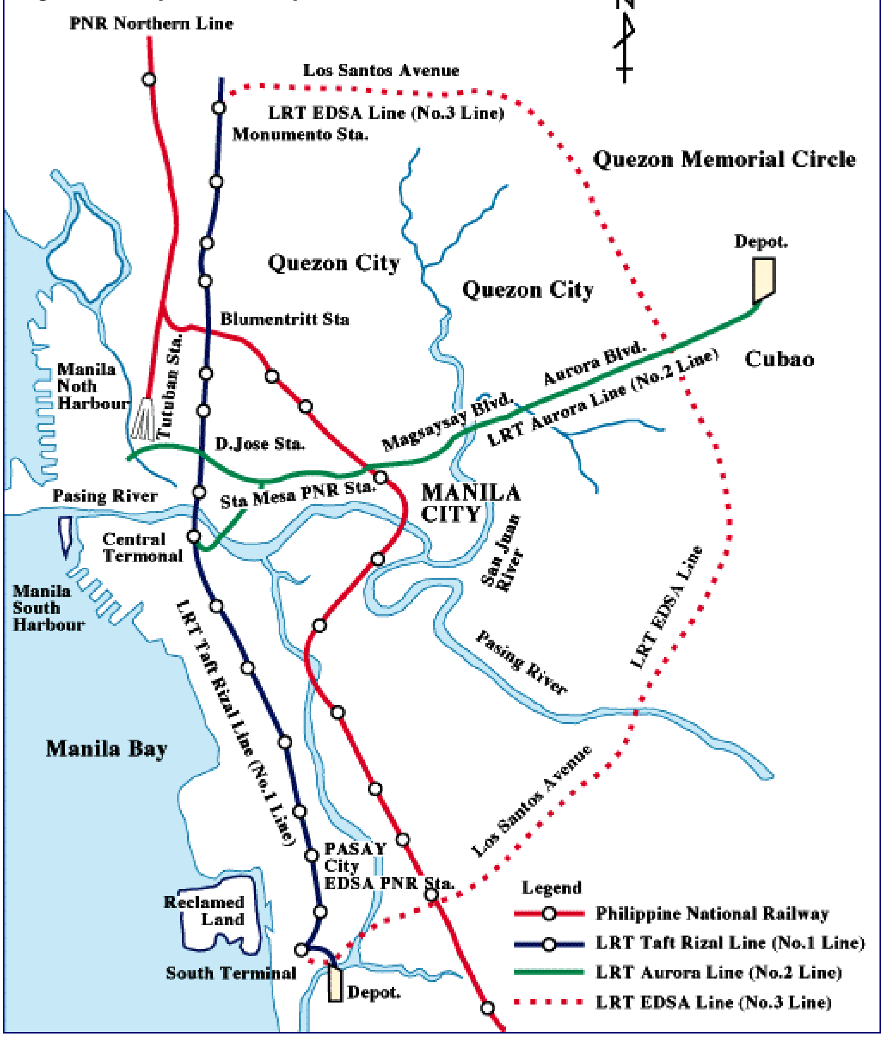


Photo 7 Elevated Structure for Medium-scale Guided Transit in Taipei City - Mucha Line -

(Author)

kyo.

But monorails are very rare in other Asian countries, with a few exceptions including one for tourists on Sentosa Island in Singapore (Photo 6).

A 3.6-km monorail was completed in 1988 in Sydney to connect the city center and redevelopment projects in the harbor area in a loop.

This monorail is a straddled single line system . It is a one-way (counter clockwise), automatic, seven-car train that can carry around 5,000 persons per hour at 2-minute intervals during peak hours.

China must be the most eager country to introduce monorails. More than a dozen cities in China have expressed a desire to build monorails as the means of urban transportation. Chongqing became the first among them to have a concrete plan for building a monorail system.

Chongqing has a population of 1.6 million living in the city itself and a total of 14.7 million including the people around it. It has undulating topography making a monorail more appropriate than other means of transportation. A feasibility study was conducted by the Japan International Cooperation Agency (JICA).

(3) Medium-capacity guided transit system

A medium-capacity guided transit system generally refers to means of transportation capable of carrying 8,000 to 20,000 passengers per hour (one way) during rush hours. In the broader sense of the word, it also refers to light rail transit systems mentioned earlier and small subways.

However, the medium-capacity transportation system discussed here is a system running on rubber tyres to minimise noise and vibration problems for the people along the line even when it is installed in central areas of cities.

This type of system is in operation in Japan at eight locations. They are equipped with ATC, ATO and other operation systems designed to enhance safety while reducing labour.

Since such systems are designed for completely automatic operation, they are unjustifiable in countries where the labor cost is low.

Among the proposed rapid transit systems in Taipei, Taiwan, the French VAL type has been chosen for the Mucha line (between Sungshan Airport and Taipei Zoo) where the

Figure 5 Flow Chart of Finance Resources for Railway Project Integrated with Urban Development

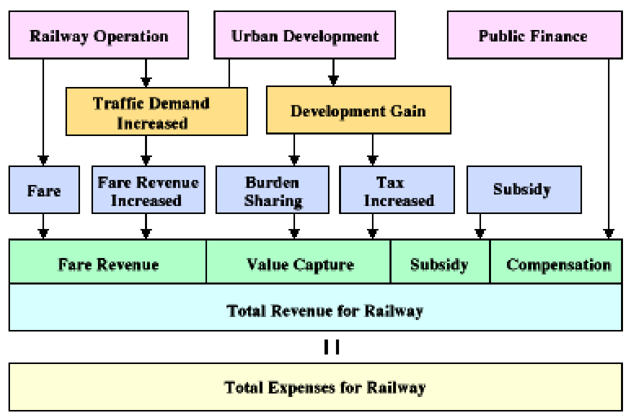


Table 2 Example of Results of Economic and Financial Evaluation on Rapid Transit System Projects in Developing Countries

City*1	System	Length (km)	Forecasted Traffic Demand (1000 Persons/day)	EIRR*2 (%)	FIRR*3 (%)
A	Subway	13.5	1,000	8.7	1.1
B	MRT (Elevated)	14.2	200	9.2	4.3
C	Railway (Surface)	30.0	90	16.4	5.7
D	Monorail	17.4	640	12.2	3.8

*1: A,B,C and D have been used for actual city names to maintain confidentiality.
*2: Economic Internal Rate of Return.
*3: Financial Internal Rate of Return.

Photo 8 Expressway in and around Bangkok *(Author)*

traffic demand is relatively low. This line has almost been completed and is scheduled for commercial operation in the near future (Photo 7).

(4) Dual mode buses

One of the important requirements for transportation is continuity of service. A dual-mode bus is in use in Adelaide City in Australia. It runs at fast speeds between two cities. But once in the cities at both ends of the line, it slows down and runs as an ordinary bus collecting and distributing passengers. It runs just like an ordinary bus in the city centre, but after leaving the busy area, it runs at a speed of 100 km/h on slightly elevated tracks to a suburban new town. Small horizontal wheels acting as sensors are fitted at the bottom at both sides of the car and they automatically steer the car's axle. While running along the high speed section, all the bus operator does is use the accelerator and brakes.

This type of bus is outstanding be cause it carries passengers from one city to another at fast speeds, without the need for passengers to change the transportation means at bus terminals.

In Japan, installation of a similar rail-bus system is scheduled for suburban commuting areas in Nagoya.

Such a system was once planned for Thamrin Street in Jakarta but the plan was later cancelled, most probably due to the conclusion that a full-scale railroad or subway was needed on such a trunk road.

4. Methods of introducing railroads and rail transit systems in large cities in Asia

(1) General

Many countries have plans to introduce guided transit systems to solve their urban transportation problems. However, despite the very strong desire for such installation projects, they are often left unmaintained or are postponed, particularly in developing countries. The main reason is low profitability.

Profitability of urban transportation is often low mainly because of the large fluctuation in demand and because the fares must be kept low too (Table 2).

Since urban transportation is essential to the daily life and the economic activities of a city, the different means are normally operated by public subsidies.

However, in developing countries, it is often hard to source subsidies for construction of urban transit systems, and the necessary funds must be found somewhere else.

(2) BOT System

In some countries, the national infrastructure is being built and operated by businesses from more advanced countries and the resulting service is used to enhance the economic level of the people. Since the facility is built (B) and operated (O) by a foreign business and is then transferred (T) to the beneficiary country after a certain period of time (30 years, for example), this increasingly popular method is called the BOT system.

Such a method allows a developing country to achieve urban development with out spending its own money.

This method has been used in some motorway construction projects (Photo 8). If it were applied to railway construction, it would be most important to make certain that the enterprise has the right to make decisions about fares. At the same time, options for future development of areas along the railway, investment and subsidies from the government, and all other items that need to be guaranteed by the government, must be clarified.

(3) Integration between railway construction and urban development

If a guided transit system is to be used, a number of items must be implemented. First, the project must be closely integrated with urban plans. Then, sufficient demand must be secured by ensuring continuity through some sort of connection with other means of transportation in terms of facilities and fare systems. It is also important to keep the construction costs as low as possible.

If the development of the areas along the guided transit is done successfully as an integrated project, profits from the development may be used to cover the cost of constructing and maintaining the new guided transit. It is extremely important to establish such a system (Figure 5).

I have participated in economic and financial feasibility studies for integrated projects involving urban development and construction of transit facilities in the metropolitan areas in Jakarta in Indonesia and Bangkok in Thailand. If these projects prove successful, they will certainly present one effective method for solving urban transportation problems in developing countries. ■

Misao Sugawara

Dr Sugawara was born in 1927 and joined the Japanese National Railways after graduating in civil engineering from the University of Tokyo in 1949. As a renowned scholar and author of many books dealing with transportation issues, he plays an important role on various government advisory councils and local public bodies. He has been a professor of transport planning at the Tokyo Institute of Technology and the Science University of Tokyo, as well as a board member of JNR. As president of the Japan Railway Technical Service (JARTS) from 1988 to 1993, he led technical cooperation activities with South East Asian countries.