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Korea's Best Practices in the Transport Sector

Best Experiences from Public Transport Reform

Sang Min Lee and Jung Sil Lim

THE KOREA TRANSPORT INSTITUTE

Korea's Best Practices in the Transport Sector

Best Experiences from Public Transport Reform

The Korea Transport Institute (KOTI):

KOTI is an official research agency for the government of the Republic of Korea (South Korea) and a leading think tank for Korea's transport policies. It has been committed to building a safe, convenient, efficient and environmentally sound transport system for the nation since 1987. It is a pioneer in providing new ideas and future perspectives about transport issues in Korea, while positioning itself as one of the world's leading transport research institutions.

KOTI Knowledge Sharing Report
Issue 9: Best Experiences from Public Transport Reform

Sang Min Lee and Jung Sil Lim

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Hompage: www.koti.re.kr
Contact email: info@koti.re.kr

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• Preface

In the midst of pan-global issues such as global warming and oil depletion, each nation puts its efforts to establish eco-friendly transport systems and to accomplish low carbon green growth, sustainable development and sustainable transportation system.

Korea has changed its primary public transport modes from initially tram to bus in the 70s and the 80s, urban railway in the 90s, and inter-regional rail and high-speed rail in the 2000s. Against this backdrop, transport policy has been induced since 90s to focus on bus and urban railway in urban areas and high-speed rail, aviation and inter-city bus between regions under the Public Private Partnership (PPP).

Such a public transport-oriented strategy will offer instructive and practical lessons to developing countries as well as developed countries, and especially, the case of public transport integration conducted in Seoul in 2004 expanded to the nation afterwards has been extraordinary outside of Korea. This was recognized as a meaningful policy implementation as it promoted user convenience, public transport ridership, and efficiency of the national transport system.

I believe that sharing knowledge and experience on transport development will offer us an open platform on which we can establish sustainable transport policies and cope with climate change, resources depletion and many other common global issues. I expect that KOTI's knowledge sharing reports will be a channel for all readers to find useful information and knowledge.

Lastly, I appreciate the Ministry of Strategy and Finance (MOSF) and Korea Development Institute (KDI) to allow us to republish this book.

Gyeng Chul Kim
President
The Korea Transport Institute

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Authors | **Sang Min Lee, Jung Sil Lim**

Sang Min Lee | **The Korea Transport Institute**

Dr. Sang Min Lee graduated from Yonsei University and the same graduate school. He joined The Korea Transport Institute at 1989, and he has been performing the transport economic and transport industry tasks since then. In 1995, he was selected as chevening scholarship of British Embassy, and then he went study abroad at University of Leeds. He got a Ph.D. degree in transport economics at 1998. Since his coming back to the Korea Transport Institute, he has successively fulfilled Head of National Transport Database Center and Director of Dept. of Planning and Administration consequently. In 2009, he has been sent World Bank at Washington D.C. in USA as a senior transport specialist for 1 year to build the network between KOTI and World Bank. Currently, he is director of Dept. of Comprehensive Transport at KOTI, and he is focusing on the development of multi modal integration of regional transport system called “One Nation, One Transport City” as a flagship project of the Korea Transport Institute.

Jung Sil Lim | **The Korea Transport Institute**

Dr. Lim is a associate research fellow in the Department of Comprehensive Transport Research at the Korea Transport Institute. Her research interests lie in national public transport policy, multi-modal integration model, and welfare mobility management.

She received her Ph.D. in the Department of Civil and Transportation Engineering at the Ajou University in 2009. Her doctoral dissertation is Development of a Public Transit Transfer Information Service Model Based on Context-Awareness. Context-Awareness means recognizing the surrounding data and turns it into useful information. Her study shows public transport can be more convenient on a methodology for making intelligent and user oriented service.

Before she joined the Korea Transport Institute, she worked at Seoul Metropolitan Government Transportation Bureau, and Road Traffic Authority (KoROAD). She had research experience in the University of Illinois at Urbana-Champaign in the USA as a postdoctoral researcher. She has comprehensive experience in variety of research, taking part in policy making, and building cases for regulations.

Summary

Korea has introduced an urban rail system to provide high-capacity public transport services for its metropolises that are ever expanding and undergoing densification. The nation has also implemented a structural overhaul of the bus industry, ensuring that city buses are fulfilling their function as a highly efficient and demand-responsive mode of road transport. This reform eventually raised the demand for public transport, which is the most remarkable progress made so far in Korea through its public transport promotion policy. This report deals with the achievements in public transportation, focusing on the process of establishing the current public transportation system based on urban rail and buses. Also examined are strategies to ensure effective operation of the system, as well as relevant examples.

In Korea, buses began to play a central role in urban transport in the 1960s when economic growth led to a rapid rise in urban population. Buses maintained its dominant position through the mid-1980s, when discussion started on the prospects of ensuring other modes of transport that can provide high-capacity, reliable services. This change of situation occurred as a result of urbanization. The concentration of population in cities and an increase in the number of cars caused congestion and other traffic-related problems in the Seoul Metropolitan Area and other large cities. These developments, combined with the need for metro-wide means of travel prompted calls for a new mode of urban transport. Consequently, Seoul Subway Line 1 was

built in the 1970s, more than a decade after the nation s first plan for urban railways was devised. Opening of the first subway line was followed by construction of more urban railways in Seoul. Other metropolises, such as Busan, Daegu, Incheon and Daejeon, followed suit by implementing their respective urban rail projects. Thus began the process of building an urban rail-centered mass transit system in Korea's metropolitan cities.

When the number of the Korea s registered automobiles reached 10 million in the mid-1990s, the congestion problem worsened day by day. In addition, limitations were reached in building urban railways because it required much capital. Buses could not be expected to play an effective role in addressing the traffic problem either. Congestion and other worsening road conditions lowered the reliability of bus operations and the quality of passenger experience. These issues resulted in reduced bus ridership, which led to dwindling roles and functions fulfilled by city buses.

In the early 2000s, the nation began to confront global issues such as climate change and depletion of energy resources. Such realization led to renewed calls for implementing public transport policies that can contribute to build an environmentally friendly transport system. Also critical was the demand to restore the functions of buses so that they could constitute the backbone of public transportation, along with the urban rail system. Consequently, a bus reform was initiated to introduce a quasi-public operation system designed to promote the user-centric bus system. The reform also involved various other measures aimed at improving the public transport environment. This plan included the operation of median bus lanes, the introduction of a new fare system offering transfer discounts, and the integrated operation of buses and urban railways. The reform made it possible to drastically improve passenger services and increase the modal share of public transport. Undoubtedly, the restructuring served as an occasion to restore the functions of buses as a crucial mode of public transport.

Important implications were obtained from the process of building and reorganizing the public transport system. First, it is necessary to conduct in-depth research on funding prospects before promoting in earnest an urban rail project, which requires enormous investment. Also, efforts should be made to ensure that an urban rail project can be developed in a reasonable manner under a mid-to long-term project to

expand urban transport infrastructure.

As for bus transport, it is essential to pursue a user-centric policy to ensure that buses can fulfill their functions as a universal mode of travel that can be supplied in a flexible manner. Public involvement in the operation of buses is unavoidable, given the characteristics of the quasi-public operation system. Thus, the utmost priority should be given to stabilizing the bus industry and securing the means of gaining financial support in a sustainable manner.

2012 Modularization of Korea's Development Experience
Best Experiences from Public Transport Reform

Chapter 1

Background to Public Transport Reform

1. Social and Economic Conditions of Recent Decades
2. Transport Policy Conditions of Recent Decades

Background to Public Transport Reform

Korea achieved rapid economic growth through industrialization over a span of about forty years starting in the 1960s. Transport infrastructure such as roads and rail networks, built under economic and national land development plans during this period served as the groundwork for the nation's economic progress.

Pursuing an externally oriented growth strategy, the Korean economy attained high rates of expansion from the 1960s through the 1970s. Amid rapid migration of people moving into cities during these years, buses quickly became the leading mode of road transport. However, the concentration of population in cities, coupled with the rise in the number of cars, began to cause traffic problems such as road congestion. To solve these problems, the government promoted a subway project while continuing to expand road infrastructure. This subway project led to the construction of Seoul Subway Line 1 and the electrification of railways running from Seoul to Incheon and Suwon. Thus began the history of urban rail-centered mass transit system in the Seoul Metropolitan Area.

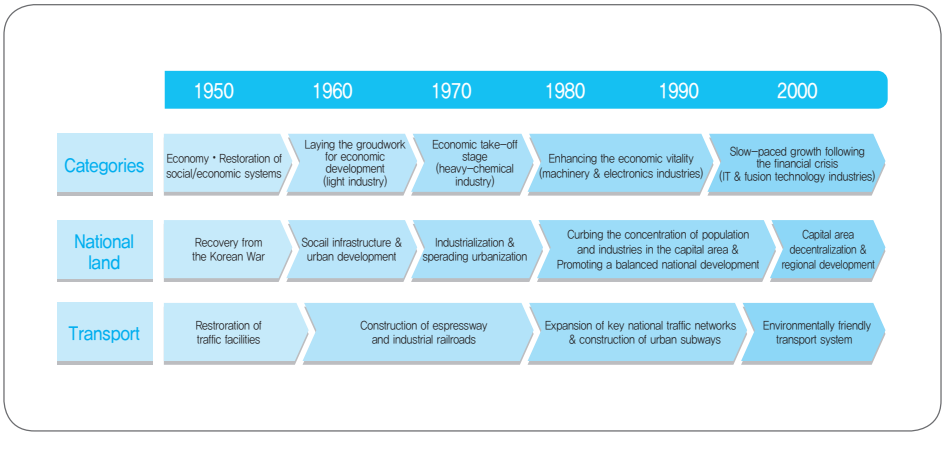
The increase in private car ownership in the 1980s caused a slowdown in demand for public transport, which in turn led to a decrease in the use of road transport modes such as buses and taxis. In particular, the market share of buses fell drastically from 71.3% in 1980 to 56.2% in 1990. The number of registered cars in the nation exceeded 10 million in 1990, further aggravating the congestion problem. Operation conditions for buses also deteriorated, causing a precipitous drop in ridership.

While revenues dwindled, operating costs such as personnel, gasoline and car prices soared, adding to the financial difficulties of bus companies. Increases in personal income and the widespread use of private cars led to calls for improvement in public transport service. However, the bus companies could not afford to take the action required to meet the social demand due to an accumulated operating deficit and the inefficient operating system.

In the 2000s, public transport policies began to assume increasing importance amid challenges from global problems such as climate change and depleting oil reserves. Particularly, there arose social demand for public transport policies to reduce traffic congestion and establish an environmentally friendly transport system. These developments led to the initiation of reform in the mid-2000s. The reform was especially aimed at increasing public benefits by ensuring proper and efficient operation of city buses. Specifically, the bus system went through an overhaul with the introduction of a quasi-public operation system in metropolitan cities. Also, to improve the bus operating environment and encourage demand for bus travel, the median bus lane scheme was introduced along with other measures such as transfer discounts and integrated operation between buses and urban railways.

Korea's current level of public transit infrastructure and operation is comparable to those of high-ranking OECD countries. Such a status was obtained through the introduction of high-capacity urban rail system and the public transport reform

Figure 1-1 Major Social and Economic Changes of Recent Decades in Korea



addressing urban traffic problems caused by the growing number of cars and decreasing demand for public transportation.

This chapter focuses on reviewing the changes in the transport sector starting in the 1960s, when the transport infrastructure began to be established in earnest, up to the 2000s. It also looks at economic and social environments as well as changes in public transport policies in relation to the introduction of urban railway systems and the reform of the public transport system in the mid-2000s.

1. Social and Economic Conditions of Recent Decades

1.1. Changes in Economic and Social Conditions in Korea

1.1.1. Korean War and Post-War Reconstruction (1950s)

Korean War broke out in 1950 even before the nation reached social stability following its 1945 liberation from Japanese colonial rule. Nearly all of the nation's industrial production facilities were destroyed in the war. Consequently, the nation placed its top priority on restoring infrastructure facilities throughout the 1950s after the war ended with a truce. Devastated by the war, Korea was not capable of securing the financial resources needed for implementing post-war recovery projects. Therefore, projects to restore transport facilities were carried out with foreign aid.

1.1.2. Era of Economic Rehabilitation (1960s~1970s)

Korean economy achieved high economic growth from the 1960s to the 1970s under an externally oriented growth strategy. During this period, the process of urban concentration began amid a sharp rise in the national population. In addition, an increase in personal income led to a growing number of cars throughout the nation.

A look at socioeconomic indicators during the 10-year period from 1960 to 1970 reveals that the population expanded by 13.7% from 25,012,000 to 32,240,000. Urban population soared by 37.3%. The nation saw an increase in urbanization rate from 39.1% to 50.1%, and a 27.4% increase in the number of households from 4,377,000 to 5,576,000.

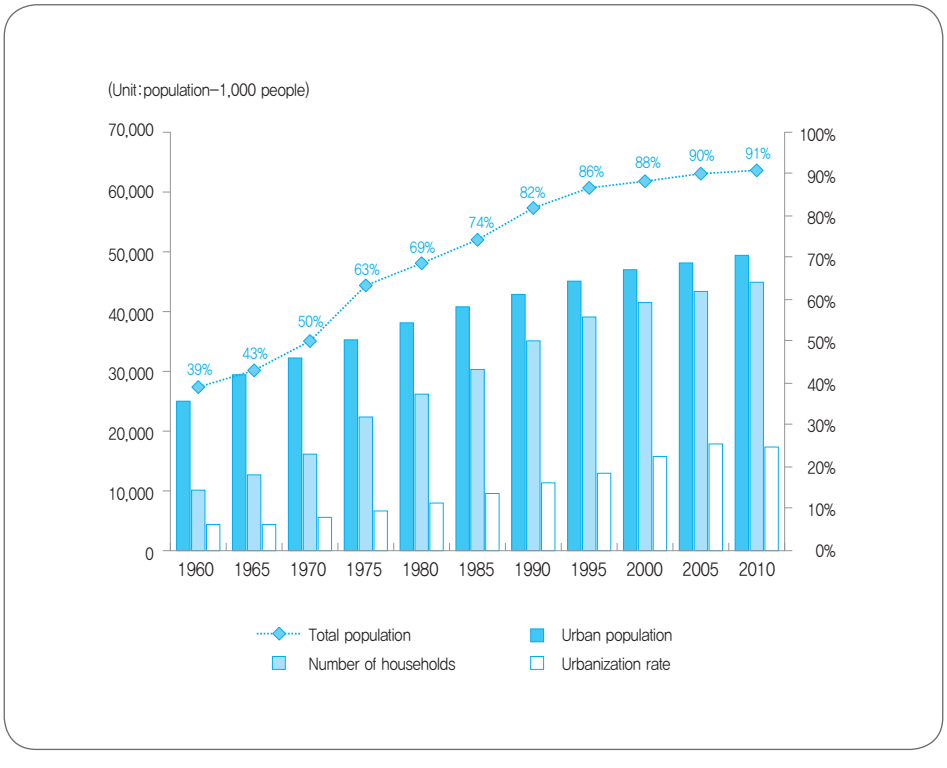
Table 1-1 Changes in Socioeconomic Indicators of Korea

(Unit: population-1,000 people, urbanization rate-%, GDP-$)

Categories	Year										
	1960	1965	1970	1975	1980	1985	1990	1995	2000	2005	2010
Total population	25,012	29,435	32,240	35,280	38,123	40,805	42,869	45,092	47,008	48,138	49,410
Urban population	10,132	12,686	16,152	22,367	26,191	30,318	35,109	39,095	41,508	43,372	44,913
Urbanization rate	39.1	43.1	50.1	63.4	68.7	74.3	81.9	86.7	88.3	90.1	90.9
Number of households	4,377	4,377	5,576	6,647	7,969	9,571	11,354	12,958	15,765	17,857	17,339
Per-capita GDP	79	125	254	602	1,645	2,309	6,147	11,432	10,841	16,413	20,562
National GDP ($100 mil.)	20	30	81	216	643	984	2,703	5,313	5,335	8,447	10,147

• Sources: Korea Transport Institute, "A Comparative Study on Transport Policies of Korea and Japan," 2012.
Bank of Korea, http://ecos.bok.or.kr/

Figure 1-2 Changes in Population Indicators of Korea

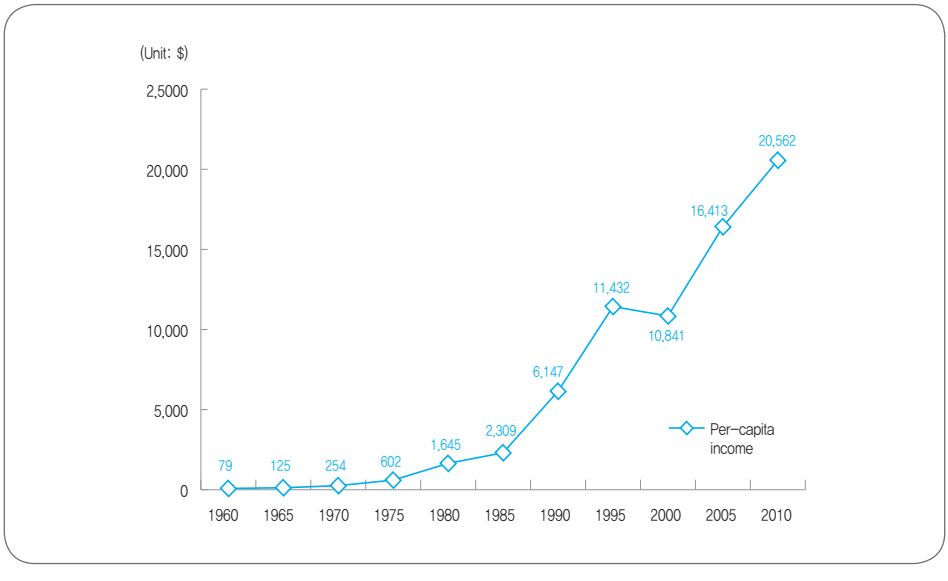


The next 10-year period leading up to 1980 saw the population in cities growing even more steeply compared to the preceding decade. Urban population jumped 38.3% from 16,152,000 in 1970 to 26,191,000 in 1980, while the nation's total population increased 15.4% from 32,240,000 to 38,123,000 during the same period. The concentration of population in cities led to a rise in the urbanization rate from 50.1% to 68.7%. The number of urban households also increased by 42.9%. The per-capita GDP rose from $79 in 1960 to $254 in 1970. By 1980, it reached $1,645 as a result of the nation's high economic growth.

1.1.3. Pursuit of Stable Growth and Improved Quality of Life (1980s~1990s)

With the democracy newly in place, the nation faced the onset of liberalism in all sectors of society and economy. This phenomenon led to efforts to pursue stable growth and improved quality of life as a reaction to the growth-oriented policies the nation had implemented. The nation's population grew 11.1% from 1980 to 1990 and 8.8% from 1990 to 2000. A steep decline in population growth can be observed, compared to the 1960s and 1970s. Urban population growth rate also

Figure 1-3 Per-capita Income by Year



• Source: Bank of Korea, http://ecos.bok.or.kr

reduced, registering 25.4% in the 1980-1990 period and 15.4% in the next decade. Urbanization rates rose from 68.7% in 1980 to 88.3% in 2000. The number of households continued to increase, nearly doubling during this period.

Amid continued economic growth, the per capita GDP jumped from $1,645 in 1980 to over $10,000 in 1995. The rise in income levels, in turn, led to an expansion in the number of private cars, which exceeded 10 million in 2000. The nation was hit severely by the Asian financial crisis in the late 1990s, but it began to recover its economic vitality gradually in the 2000s. However, the nation's economic growth rate was dampened significantly because of unfavorable developments such as the global business slowdown and oil price hikes.

Table 1-2 Number of Cars per Household

Year	Per-capita GDP($)	Total registered vehicles (1,000 cars)	Private and official vehicles (1,000 cars)	Commercial vehicles (1,000 cars)	Number of cars per household
1960	79	31	-	-	0.007
1965	125	48	17	31	0.011
1970	254	126	52	74	0.023
1975	602	193	106	87	0.029
1980	1,645	527	377	150	0.066
1985	2,309	1,113	901	212	0.116
1990	6,147	3,394	3,071	323	0.299
1995	11,432	8,468	8,019	449	0.653
2000	10,841	12,059	11,438	621	0.765
2005	16,413	15,396	14,602	784	0.862
2010	20,562	17,941	16,967	974	1.035

• Note: Statistics for 1980, 1990 and 2000 are based on population and housing census data. Figures for 2001~2005 are estimations based on household projections.
• Source: Ministry of Land Transport and Marline Affairs, "Land Transport and Marine Affairs Statistics," for each year.

1.1.4. Pursuit of an Equitable Welfare Society and Environment-Friendly Sustainable Growth (since 2000)

Korea's economic situation improved in the 2000s. However, the economic development was mostly led by unfair growth that caused a wealth concentration among the upper class and widened the income gap between the rich and the

poor. This development gave reason for emerging social discussion on the topics of equitable society and common growth. The government's economic policy also began to shift emphasis from growth to social welfare. In the 21st century, problems of global warming, environmental contamination and the depletion of fossil fuels began to be perceived as a clear and present threat to mankind. As such, they have come to have an enormous impact on the society and economy.

Continued economic growth ushered in an era of per-capita GDP of $20,000. However, Korea's growth rate has been sharply declining. Coupled with an increase in average life expectancy has led to the problem of an aging population. The nation's population has been increasing thus far, but it is projected to begin decreasing in the

Table 1-3 Energy Consumption and Greenhouse Gas Emissions by Year

(Unit: energy consumption-1,000TOE , greenhouse gas emission - 1 million $tCO_2eq.$)

Categories	Year							
	1991	1995	2000	2005	2006	2007	2008	2009
Energy consumption	83,503	121,469	150,109	170,854	173,584	181,455	182,577	182,065
Greenhouse gas emission	319.6	448.1	513.7	570.3	575.7	588.8	602.3	607.6

• Source: Statistics Korea Information Service, http://kosis.kr

Table 1-4 Population Growth Estimates

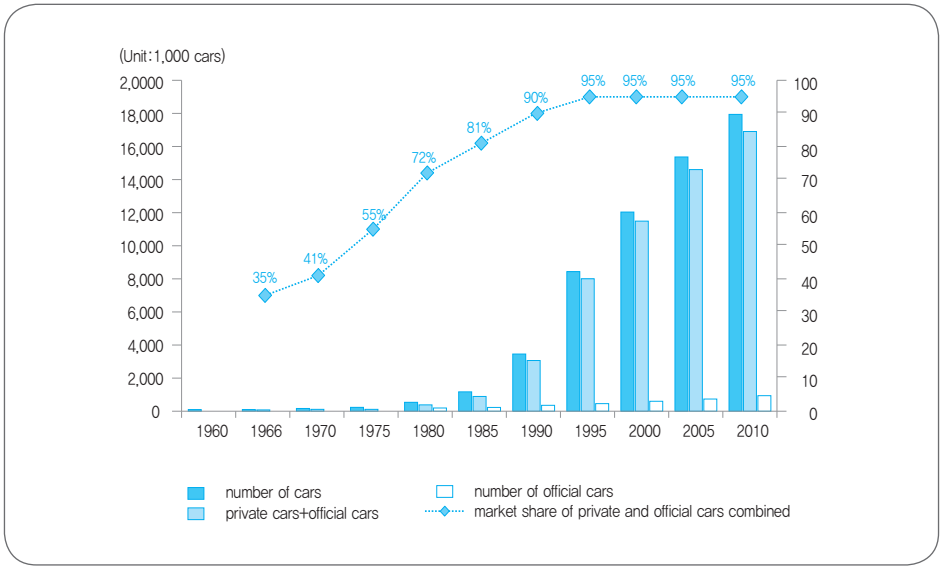
(Unit: people)

Categories		Year							
		1980	1990	2000	2010	2020	2030	2040	2050
Age groups	Infants/ young children	8,215,638	7,142,298	6,574,314	4,613,747	4,542,699	4,355,075	3,622,702	3,114,672
	10~19	8,679,866	8,440,913	6,756,026	6,611,640	4,699,718	4,455,987	4,261,131	3,537,342
	20~29	7,135,810	8,729,809	7,945,164	6,594,369	6,801,842	4,785,845	4,531,109	4,330,485
	30~39	4,742,582	7,408,924	8,280,181	7,794,495	7,035,164	6,781,185	4,767,739	4,514,951
	40~49	3,913,464	4,716,159	6,948,359	8,204,781	8,037,819	6,934,965	6,689,739	4,709,943
	50~59	2,451,278	3,632,871	4,318,722	6,564,826	8,436,823	8,000,739	6,934,754	6,712,931
	60~69	1,442,340	2,057,373	3,164,971	3,994,404	6,455,666	8,240,584	7,901,172	6,904,047
	70+	825,831	1,261,925	1,995,684	3,612,499	5,425,764	8,605,685	12,383,006	14,296,904
Total		37,406,809	43,390,272	45,983,421	47,990,761	51,435,495	52,160,065	51,091,352	48,121,275

• Source: Statistics Korea Information Service, http://kosis.kr

not-so-distant future due to a shrinking birth rate. The concentration of population in cities has almost reached a saturation level, with cities holding 90.9% of the nation's population in 2010. The number of cars has continued to rise even though the economic growth rate has significantly declined. In 2010, the nation's registered cars numbered about 18 million, 95% of which were private and government and company vehicles, making the average number of cars per household exceeding one.

Figure 1-4 Number of Cars / Number of Private Passengers



- Note: Statistics for 1980, 1990 and 2000 are based on population and housing census data. Figures for 2001~2005 are estimations based on household projections.
- Source: Ministry of Land Transport and Marline "Land Transport and Maritime Affairs Statistics," published annually.

2. Transport Policy Conditions of Recent Decades[1)]

2.1. Construction of Basic Infrastructure (1900s~1950s)

The history of rail transport in Korea began as early as 1899 with the introduction of streetcars in Seoul. The nation's first train service began in 1900 between Seoul

1) Korea Transport Institute, "2nd Comparative Study of Transport Policies of Korea and Japan," August 2012. The contents of this study have been reconstructed in a way suitable for this paper.

and Jemulpo, following a trial operation in the previous year. The opening of the first rail system was followed by continued development of rail networks which was an important transport mode under the Japanese colonial rule. These facilities were mostly destroyed during the Korean War that broke out in 1950. After the war ended with a truce in 1953, Korea concentrated on restoring these facilities through the 1960s.

After the Korean War, the supply of buses and taxis was increased in order to cope with travel demand that rose steeply in accordance with the population increase in Seoul. As a result, buses came to take over the role of streetcars in the late 1950s, establishing themselves as the most important mode of urban transport.

Figure 1-5 Change in Transport Modes from 1900s to 1950s

<Early 1900s>

Appearance of street cars

<1920s>

Operation of taxis

<1940s>

Operation of buses

<1950s>

Restoration of the traffic system

2.2. Economic Development and Construction of Transport Infrastructure (1960s~1970s)

2.2.1. Establishment of the Economic Development Plan and the Comprehensive Plan for National Land Construction

Korea's transport policies in the 1960s and 1970s were focused on supplying facility investments to implement national projects under the Economic Development Plan and the Comprehensive Plan of National Land Construction. The Five-Year Economic Development Plan was initiated in the 1960s, laying the groundwork for growth and preparing a shift from light to heavy-chemical industries. Extensive investments in transport infrastructure such as railways and roads began during this period.

In the initial stage, the goal of the transport sector was to maximize the nation's production activities by providing effective connections between raw material production sites, factories and consumers. Investments were made extensively to build rail systems for coal transport, thereby realizing the electrification of industrial railroads. During the First Economic Development Plan period, investments in the rail sector amounted to 21.5 billion won, accounting for 4.6% of the government's financial spending. The amount was over five times as large as the investments made in road construction. However, investments in transport infrastructure began to shift towards the road sector with an increase in the number of cars in the late 1960s.

2.2.2. Decreasing Importance of Rail and Rapid Growth in Demand for Bus Travel

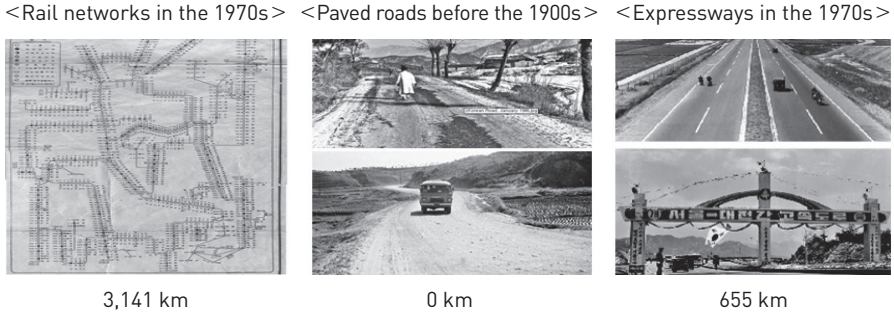
Amid a rapid increase in urban population, the bus system expanded dramatically in the 1960s. In the railway sector, utmost emphasis was placed on expanding rail networks for the transportation of industrial resources such as coal, cement, fertilizer and oil, following the initiation of the first Five-Year Economic Development Plan in 1962. Railroads accounted for the bulk of cargo transport in the nation, gradually increasing their market share in passenger traffic as well.

However, the focus in transport infrastructure policies began to shift towards road construction in the late 1960s due to a steadily rising number of cars. With the

expansion of expressway networks in the 1970s, rail travel began to show a slowing growth rate, and expansion of rail facilities increasingly lost steam. Beginning in the late 1960s, the government actively implemented railroad electrification projects designed to improve the operation efficiency of the existing lines, instead of constructing new ones.

The Comprehensive Plan for National Land Construction began to be implemented in the 1970s. It was an era when the nation's transport policies underwent many changes due to rapid urbanization and soaring numbers of cars. It was also a period when the nation made most significant economic and social progress. Transport policies were seen from the perspectives of developing national land, rather than being treated as part of economic development plans. The national land development plan at that time placed emphasis on promoting export industries and developing growth centers. This strategy led to a transport policy designed to raise investments in expanding the expressways. The road sector accounted for 50% of the total transport investments. In contrast, the railway sector attracted decreasing portions of traffic investment, with its modal split displaying a downward trend.

Figure 1-6 Expansion of Rail and Road Networks in the 1970s



2.2.3. Opening of Expressways and Urban Railways

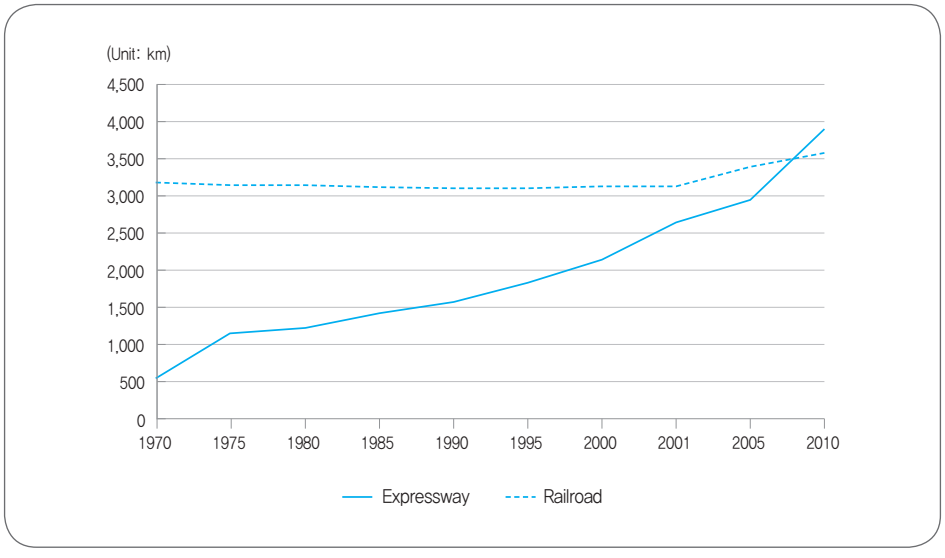
In the 1970s, the expansion of traffic facilities such as roads and railways was followed by improvements in their operating systems. In 1969, express buses began running between Seoul and Incheon, and between Seoul and Suwon, following the opening of the nation's first expressways. A super luxury train was introduced in the same year, ushering in an era of high-speed transport by traveling the distance from Seoul and Busan in four hours and forty-five minutes (a reduction of 55 minutes from the previous record). In a related development, the concentration of population in cities and the increase in the number of cars caused urban traffic problems, which were particularly serious in the Seoul metropolitan area. Traffic problems led to growing calls for improvement in the traffic operating system. In 1968, streetcars were removed from the streets of Seoul due to their inefficiency in relation to road traffic management. Instead, the city made a shift to bus transport system and began to promote investment in subway and electric railway systems. In 1974, a metropolitan mass transport system was introduced with the opening of Seoul Subway Line 1 and the electrification of railways running from Seoul to Incheon and Suwon.

Table 1-5 Lengths of Expressways and Railroads (Unit: km)

Year	Length	
	Expressway	Railroad
1970	551	3,193
1975	1,142	3,144
1980	1,225	3,134
1985	1,415	3,120
1990	1,551	3,091
1995	1,825	3,101
2000	2,131	3,123
2001	2,637	3,125
2005	2,968	3,392
2010	3,860	3,577

• Source: Ministry of Land, Transport and Maritime Affairs, "Land Transport and Marine Affair Statistics," 2011.

Figure 1-7 Lengths of Expressways and Railroads



• Source: Ministry of Land, Transport and Maritime Affairs, "Land Transport and Marline Affairs Statistics," 2011.

2.3. Economic Growth and Expansion of the National Transport Infrastructure Network (1980s~1990s)

2.3.1. The Era of Private Car Ownership

The 1980s, when the second Comprehensive Plan for National Land Construction was implemented, saw a rapid rise in private car ownership as a result of increased personal income. The popularization of passenger cars further aggravated urban traffic problems. Transport policies consequently focused on reducing urban traffic congestion and improving accessibility of traffic services to less developed regions.

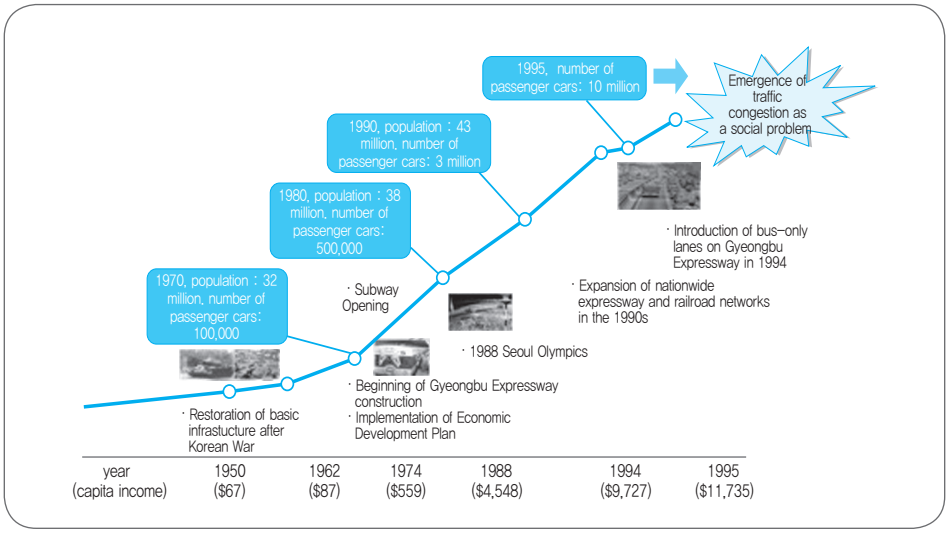
As the nation was being introduced to the era of personal car ownership, the demand for public transport began to slow down, resulting in a decrease in the use of road transport modes such as buses and taxis. On the other hand, the number of the nation's registered motor vehicles surpassed 10 million in 1990, seriously deteriorating urban traffic conditions and further worsening bus operating conditions. A precipitous fall in bus ridership led to a drop in transport revenues. Operating costs, however, continued to rise, causing a growing number of bus companies to

go bankrupt. Their business was also undermined by frequent strikes and operation interruptions. Various efforts were made to address these problems, including a restructuring of the Seoul bus system and the initiation of a public bus service in Goyang and Gwacheon. Bus-exclusive lanes were created to improve speed and punctuality of bus travel. In addition, tax subsidies were provided along with the launching of a mutual aid organization as part of the efforts to relieve some of the financial difficulties of bus companies.

As for the taxi industry, two major international sports events hosted by Korea, the 1986 Asian Games and the 1988 Olympics served as major turning points in improving taxi services. In preparation for the two events, the government introduced a system to designate brand taxi companies while stepping up efforts to upgrade taxi vehicles and the quality of service for passengers. In 1990, a qualification test for taxi drivers began to be conducted. Due to the increase in personal car ownership, demand for taxis leveled off beginning in the late 1980s, finally declining in the 1990s. The drop in taxi ridership caused financial difficulties among taxi companies, which in turn served as a factor that worsened labor employment. To upgrade taxi services, it was necessary to improve the treatment of taxi drivers. To this end, the salary system for taxi drivers was introduced, along with lump-sum management system for transport revenues. To provide management support to taxi companies, half of the value added taxes for corporate taxis were exempted. The taxi companies were told to use the savings from these measures to increase welfare benefits for the drivers. In addition, the government introduced a fare system based on both distance and time.

Railways were not affected by road traffic congestion, so they continued to provide punctual services. This aspect made the rail sector less affected by the popularization of personal car ownership. Demand for rail transport did not decline, but its growth rate slowed down. In the meantime, the subway construction project was steadily pursued to cope with continued increase in the number of people migrating to the cities. Metropolitan subway construction was actively implemented in the 1980s. As a result, Seoul Subway Line 2 opened in May 1984. Its opening was followed by the opening of Subway Lines 3 and 4 in October 1985. In addition, railway electrification projects were promptly carried out in metropolitan areas. These developments led to

Figure 1-8 Changes in Transport Environments from the 1950s to the 1990s



a rapid rise in demand for urban rail transport.

2.4. Pursuit of a Sustainable New Transport System (2000s)

In the 2000s, demand for bus service continued to decline. Thanks to the bus reform initiated in 2004, however, the demand rose slightly after 2005. The bus industry remained stable in terms of the number of operators and buses in use. In the 2000s, the profitability of bus companies worsened to such a degree that the traditional independent revenue settlement system faced a crisis. This situation led to efforts to overhaul the bus operation system. In 2001, private companies for the first time were given financial assistance in operating costs, along with refund of taxes placed on gas. And, the quasi-public operation system, which was first applied to Seoul buses, was expanded to cover buses in other metropolitan cities nationwide. In addition, the transfer fare discount scheme was extensively introduced to promote the use of buses.

In recent years, taxi ridership has continued to fall, prompting quantity restriction to curb the supply of taxis. In addition, the gas tax refund was extended to the taxi industry, which has been suffering from various managerial difficulties.

The rail sector showed a slow but steady rise in demand for railway travel in the

2000s. This rise may be ascribed to the opening of a high-speed rail system and the expansion of metropolitan subways. Following the opening of the Gyeongbu (Seoul-Busan) High Speed Railway in 2004, the construction of Honam High Speed Railway is now being promoted. Arex Airport Express(Incheon Airport Railway) has opened after being constructed with private investment. Costs associated with building an urban rail system are enormous, which makes it difficult to secure necessary financial resources. The high construction cost easily causes an operating deficit. Thus, as an alternative, light rail systems have been proposed in various cities.

2.5. Major Transport Policies of Recent Decades

A look at the criteria and directions of transport policies by era shows that in the 1960s, focus was placed on expanding supply to cope with the rapidly rising transport demand. Efforts were made to expand the supply of transport modes for the public, such as buses and taxis, while building and upgrading the traffic facilities, such as roads and railways. This policy continued through the 1970s. In the early 1970s, various systems were improved under this policy in order to ensure effective supply and operation of transport facilities and modes. The improvements were also aimed at establishing traffic order and promoting the development of traffic systems. In the late 1970s, attention was given to transport demand management amid worsening problem of road congestion caused by a rise in the number of personal cars.

In the 1980s, changes in traffic conditions led to a shift in focus in transport policies. Attention was paid to rail transport from the perspective of expanding the supply of transport capacity. Policymakers also showed interest in expanding and upgrading road facilities and ensuring travel demand management to cope with the congestion problem caused by a rise in the number of private cars. Improving the pertinent regulations and services to ensure effective operation of transport industries also received attention. These trends continued through the 1990s.

Road expansion continued in the 2000s. The government placed particular emphasis on expanding expressway networks. Gyeongbu High Speed Railway opened in 2004, and Honam High Speed Railway project is slated to be completed in 2017. The nation began to face growing concern over global warming and depletion of energy resources caused by excessive oil consumption. Transport companies

were suffering from difficult financial conditions, which led to a fall in the quality of services and a drop in demand for public transport. Amid these circumstances, the government has recently begun to pursue policies focusing on the prospects of building sustainable, environment-friendly urban transport system and operating a transit-centered national transport system.

Figure 1-9 Expansion of National Transport Networks and Modes of Public Transport

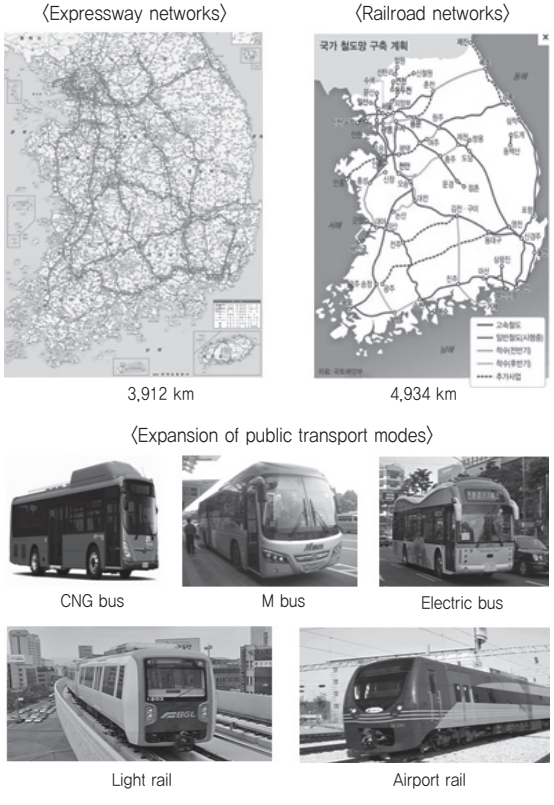


Table 1-6 Transport Policy Criteria and Implementation Directions of Recent Decades

Categories		1960s~1970s	1980s~1990s	2000s
Transport policy	Problems	- Concentration of population in cities - Shortage of rail transport - Difficulty in using public transport	- Rapid rise in personal car ownership - Serious road traffic congestion	- Worsening problems related to energy and the environment
	Policy criteria	- Expanding the passenger accommodation capacity of public transport	- Passenger car demand management	- Building an environment-friendly urban transport system
	Implementation directions	- Bus-centric urban traffic operation	- Expanding facilities, including roads, and improving their operation - Building urban rail system - Preparing public transport promotion measures	- Ensuring effective operation of public transport - Improving public transport services
Transport modes	Bus	- Establishment of order in bus operations - Bus supply expansion • Devising measures to ensure traffic order; Bus companies' business structure realignment	- Improvement of bus competitiveness • Implementation of bus-only lanes • Introduction of bus cards • Making up for losses from non-profitable routes	- Bus reform and introduction of a quasi-public operation system • Financial support for the bus transport industry • IIntroducing a quasi-public operation system for city buses; Route restructuring • Introduction of luxury buses
	Rail	- Realignment of system and organization • Taking steps to improve rail facilities and their operational efficiency	- Improvement of inter-city rail operations • Pursuit of high-speed rail transport • Urban rail network expansion	- Establishment of rail transport system • Separation of facility and operation sectors • Opening of a high-speed railroad • Introduction of a light rail system
	Taxi	- Establishment of a taxi system • Establishment of the taxi business license system and the fare system • Implementation of a personal taxi system	- Improvement of taxi services • Taxi service innovation through Asian Games and Olympics • Taxi service diversification	- Improvement of management conditions of taxi industry • Devising measures to resolve oversupply problem and promote the taxi industry • Introduction of a taxi franchise system

Chapter 2

Building a Public Transport System: Urban Rail

1. Process of Introducing Urban Railways in Seoul
2. Phase 1 and 2 of Seoul Metropolitan Urban Rail
3. Urban Rail Operation System
4. Roles of the Central and Local Governments in Urban Rail Construction
5. Achievements of Seoul Metropolitan Urban Rail Projects and Their Implications

Building a Public Transport System: Urban Rail[2)]

1. Process of Introducing Urban Railways in Seoul

1.1. Seoul's 1st Subway Construction Plans Mapped Out by the Korean National Railroad Administration

Seoul City started its urban rail project in 1971 to ease traffic congestion in the central business districts (CBD) of the city, beginning with Seoul Station~Cheongnyangni section line. It was about a decade after the Korea National Railroad Administration had first mapped out a plan for a subway project in Seoul. The original plan envisioned building the subway over a 9.8 km track with 10 stations, with a total construction cost of 7.54 billion won, excluding expenses for buying rolling stock. Of the construction cost, $13 million would be met by foreign investment. The plan was submitted as an proposal while revising the First Five-Year Economic Development Plan in 1962. The railroad administration had planned to obtain foreign loans for the envisioned idea. However, the administration was engaged in urgent projects to build industrial railways such as Jeongseon Line and Hwangji Line as well as to maintain existing lines.

Years after the original plan was put aside, the government decided to revive the project despite huge financial difficulties lying ahead. The decision was based on the

2) Seoul Metro, "30-Year History of Seoul Subways," 2012. The contents of this book have been reconstructed in a way suitable for this paper.

judgment that the ever worsening urban traffic problem could not be resolved with measures centered on roads and buses. It employed almost the same route plan as the original one: Seoul~Jongno~Cheongnyangni.

1.1.1. A 10-Year City Administration Plan and a Scheme for Urban Rail Transport (1965)

In 1965, Seoul City announced a "10-year Draft Plan for City Administration" on the basis of its research on the prospects of building urban railways. This plan envisioned constructing urban railways with a total length of 51.5 km over the next 10 years. To prepare concrete plans for subway construction with an accurate demand prediction, the city government conducted further research by an outside institute. This research led to "facility plan for high-speed rail transport in Seoul." This plan called for building a network of four urban railway lines, whose lengths would total 65 km that would organically connect the existing city center with six sub-centers envisioned by the 10-year draft plan. This plan was aimed at reducing traffic congestion in the central business district by forming compact traffic networks. It was also designed to ease the phenomenon of population concentrating in central city areas by making proactive investments in association with the plan to develop secondary business districts.

① **Main contents of the 10-year city administration plan**

- Develop city sub centers in six outlying districts; Yeongdeungpo, Gangnam, Cheonho, Mangu, Sungin and Eunpyeong, thereby turning Seoul from a single-nucleus to multi-nuclei city.
- Build a road network organically connecting the sub centers.
- Promote the construction of two subways covering 14.88 km: Seoul Station~Jongno~Cheongnyangni line and the Seosomun~Euljiro~Dongdaemun line – as part of an old district redevelopment project.

② **Overview of subway routes envisioned in the administration plan**

- Line 1: Under the plan, this line would run from Seoul Station to Cheongnyangni Station. It would be linked to the Yeongdeungpo sub center through the Gyeongbu Line and to the Mangu Sub Center by using the Jungang Line. To save construction costs, the existing national railway lines would be used to maximum extent. At the Dongdaemun~Cheongnyangni section, building an overpass line along the Cheonggye Stream would be considered.
- Line 2: This line would link Seosomun and Seongdong Station with Euljiro and Dongdaemun as midway points. It would be linked to Gyeongui Line at Seosomun and to Gyeongchun Line at Seongdong (the start point of Gyeongchun Line at that time), thereby developing traffic networks toward the Sungin Sub Center and Toegyewon.
- Line 3 : This line would stretch about 28 km, starting at Galhyeonni (in the scheduled Eunpyeong Sub Center) and arriving at Cheonho-dong by way of Jungangcheong, Jongno 2-ga, Toegyero, Wangsimni, Ttukseom and Gwangjang-dong. It would include an 18 km overpass section in outlying areas. The use of old streetcar tracks would be considered for its western section.
- Line 4: This line would run 18 km from Ui-dong (in the direction of the Sungin sub center) to Maljukgeori (Yangjae-dong) in the Gangnam Sub Center. There would be in-between points such as Miari, Jongno 4-ga, Jangchungdan and the 3rd Han River Bridge (Hannam Bridge). Except for the Donam-dong~Yaksu section, it would be an overpass line (14 km).

1.1.2. Inauguration of the Seoul Metropolitan Subway Construction Headquarters and the Signing of a Loan Agreement

The Seoul subway project gained steam with the inauguration of the Seoul City Subway Construction Headquarters in June 1970. The headquarters was launched following the central government's decision to build Subway Line 1 and electrify Seoul Metropolitan Subway as a national project and to seek necessary financial and technological assistance from Japan. The government decision had come amid growing calls for action to tackle traffic problems in the city. Having decided to build a subway system without any experience in building urban railways, the government

started to collect pertinent technological data in association with research institutes and universities. It also made endeavors to produce relevant professional workforce through training programs, which provided opportunities for selected engineers and technicians to study abroad.

With progress being made in the project, the headquarters was expanded in its organization to cover various areas such as research, design, engineering, construction, marketing and operation. Thus, the number of its staff amounted to 963 working at 22 sections under seven departments, at the time of the opening of Subway Line 1 in 1974.

At the 4th regular meeting of cabinet-level officials between Korea and Japan, held in July 1970, the two sides discussed matters related to subway construction, including the question of securing financial resources through loans. Korea had already gained loans twice from Japan regarding its railway projects. After the normalization of bilateral diplomatic ties in 1965, Japan provided OECF (Japan's Overseas Economic Cooperation Fund) loans worth 7,325 million yen in total in 1966 and 1967 for improvement of Korea's railway facilities (mainly for imports of rolling stock).

Japan dispatched a survey team to conduct a feasibility study and examine technological aspects with regard to the subway construction and railway electrification project. The team was made up of experts in the fields of urban planning, electricity, design, operation and route planning as well as rail industry professionals from Japan Railway and the Eidan subway. In the "Survey Report on Urban Transport Planning in the Seoul Metropolitan Area," the Japanese team proposed a subway route plan that it judged would be most suitable for Seoul in 10 years, that is, in 1981. The report was based on the existing plan, Seoul's urban planning programs, and scientific research involving zone analysis for estimation of travel demand.

Route designation concept

- The lines should be linear types running from outlying areas to CBD(Central Business District) and to outlying areas. They should be built in a way that they can be extended in preparation for future expansion of the metropolitan area.
- The midway points should be at districts with high population density, and excessively circuitous lines should be avoided in order to ensure speedy travel.
- Efforts should be made to equalize transport load among various lines. Subway Line 1 would pass through the most essential segment in the city, but consideration should be given to the fact that it would be just one of a number of lines when the subway network is completed.
- The subways need to be built in a way that a passenger can reach any destination with just one transfer.
- The influence areas of stations in CBD should not overlap. The desirable distance between stations should be 0.6~1.2 km in CBD, 0.8~1.2 km in residential districts, and 2~3 km in undeveloped areas.
- Neighboring buildings, geographical features and soil quality should be fully investigated to determine whether construction work would be possible with the existing engineering technology. In particular, any decision to insert a curved line to avoid a building should be made after carefully studying various related aspects.
- Urban planning and connection with railways and roads need to be considered.
- Underground sections of roads need to be utilized to maximum extent to help passengers maintain their sense of direction and to reduce construction costs. In addition, using different theme colors by routes and stations would help passengers easily identify them.
- High-speed rail systems, particularly subways, are extremely hard to restructure once they are built, so sufficient research ought to be conducted on travel demand during the designing stage.
- Reduction of construction costs could be sought by building underground malls or passages leading to high-rise buildings.
- In the suburban areas, efforts should be made to expand the station areas through promotion of links with buses (Bus & Ride) and passenger cars (Park & Ride). Squares need to be developed in front of stations for this purpose.

On the basis of the report, five routes were chosen. Each route would connect the central business district with two directions headed for outlying areas. Therefore, the five routes would cover 10 directions bound for populous suburban regions or areas slated to be developed.

* The 10 directions were those bound for Mia-dong, Cheongnyangni, Cheonho-dong, Horse Racing Course (Ttukseom), Bogwang-dong, Yongsan, Seoul Station, Mapo, Sinchon and Naengcheon (Independence Gate).

The subway lines would radially stretch from the central business district within the four gates in 10 directions. They would intertwine within CBD to form a compact network. Generally, various patterns were studied for the placement of lines within CBD. The finally adopted pattern was close to G-shaped pattern (Turner System) that would make it possible for passengers to reach their desired destination with just one transfer. Specifically, the network would be formed through the intertwining of three lines running from east to west and two U-shaped lines.

As for the Jongno district (Jonggak~Dongdaemun), an area that was predicted to have the highest level of travel demand, Subway Lines 1 and 2 would form double-double tracks. Also, based on the prediction that the CBD would extend toward Namdaemun and Seoul Station directions, the network was designed in a way that a number of lines, including Subway Lines 1, 3 and 4 would pass through these areas. Under the plan, the five routes would cover a total of 133 km (209 km when the national railroad sections were included), about 61 km of which would be underground. The project would start with the construction of an 8 km (9 km when extended) section of Sunway Line 1. At the same time, projects to electrify railways from Seoul Station to Incheon and Suwon and from Cheongnyangni to Seongbuk would start as well. This line would pass through the district of Jongno, which was then the leading arterial road in Seoul, and be linked to existing national railroad lines. As such, it was considered to be the most suitable route in terms of investment effects. It was virtually a predetermined decision as the route was the same as the line proposed in subway plans developed in previous years. Another decisive factor was that the Korean government was seeking to obtain a loan from Japan for the project to build Subway Line 1 and electrify railroads in the capital area.

1.2. Construction of Subway Line 1 and the Railway in the Capital Region

The plan for the Seoul Subway Line 1 project gained approval from the Ministry of Construction in March 1971, and construction started the next month. Engineering work was conducted on a phase basis after dividing the projected route into 15 segments. The project also involved electrification work for national railroads in the capital area so that subway trains would run directly from subway tracks to conventional lines. But the subway and railroad lines were to be managed by different operators. Therefore, while construction was under way, relevant authorities had a discussion on such matters as timetable organization, revenue settlement, signal and communication systems, facility investment percentages, and management of joint stations. The nation's first urban rail project, which involved the construction of Seoul Subway Line 1 and railway electrification in the capital area, was completed on Aug. 3, 1974, three years and four months after it started. It took 33 billion won to build the subway and 28.9 billion won for the railway electrification.

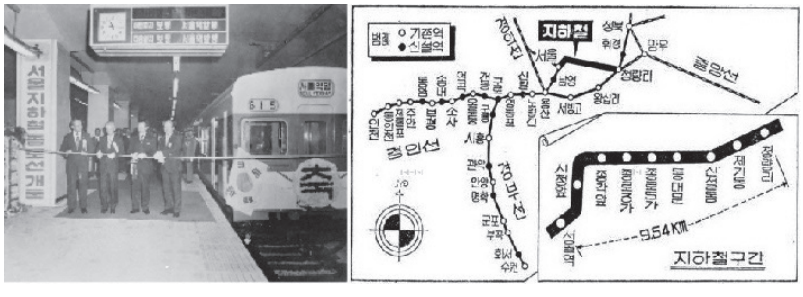
Subway Line 1 was composed of the following sections: 7.8 km from Cheongnyangni to Seoul Station, 41.5 km from Seoul Station to Suwon along the Gyeongbu Line, 27 km from Guro to Incheon along the Gyeongline, and a 18.2 km Yongsan~Cheongnyangni~Seongbuk segment along the Gyeongwon Line. From the beginning, Seoul Subway Line 1 was directly connected to suburban electrified railways. Seoul's subway system began to provide its services on the same day as the electrified suburban railways in the capital region. In this regard, Seoul differs from foreign metropolises such as Tokyo, New York and Paris, whose subways focused on intra-city travel in their initial stages. This aspect may be explained by the fact that Seoul subway system was constructed after the city had expanded and the growth of its satellite cities had progressed to considerable extent. Another reason may be that the subway was built after thoroughly studying urban rail systems abroad.

Table 2-1 Construction Timeline of Seoul Subway Line 1

Year/Month/Day	Content	Remarks
1971.04.12	Construction started for the Seoul Subway Line 1	
1974.08.15	Subway Line 1 opened (Cheongnyangni~Seoul Station 7.8 km, Gyeongbu Line: Seoul Station~Suwon 41.5 km, Gyeongin Line: Guro~Incheon 27.0 km, Gyeongwon Line: Yongsan~Cheongnyangni~Seongbuk 18.2 km)	Opening of the Seoul Metropolitan Subway (92.1 km)
1986.09.02	Six stations opened on Gyeongwon Line between Changdong Station and Uijeongbu Station → Extension of metro-rail section of Gyeongwon Line	
1988.10.25	Geumjeong Station opened on Gyeongbu and Ansan lines → Direct connection to Ansan Line initiated (Last stations: Cheongnyangni Station (maximum) · Ansan Station)	
2000	Various line names in Seoul and other parts of the capital area (Seoul Subway Line 1, Gyeongwon Line, Gyeongin Line and Gyeongbu Line) were unified → Seoul Metropolitan Subway Line 1 (Seoul Subway Line 1)	
2005.12.21	Gyeongin Line's Juan-Dongincheon section opened after its expansion to four tracks; Dongmyo Station opened	
2010.02.26	Seodongtan Station, the 97th station, opened	

• Source: Seoul Metro, "30-Year History of Seoul Subways," 2012.

Figure 2-1 A picture of Subway Line 1 Opening and Its Route Map



• Sources: Kyeong Chan Lee's Cyber History Class, http://leekcp.new21.org,
Blog on Hongik University Station (Subway Line 2) http://blog.naver.com/PostView.nhn?blogId=chaelee222&logNo=60106165046&parentCategoryNo=28&viewDate=&currentPage=1&listtype=0

2. Phases 1 and 2 of Seoul Metropolitan Urban Rail

2.1. Phase 1 of Seoul Metropolitan Urban Rail

2.1.1. Construction of Seoul Subway Line 2

Even after the opening of Subway Line 1, the traffic congestion problem in the central business district was not yet resolved. Besides, the previously devised five-route plan, which was designed to cover 10 radial directions from the central district, was based on the single nucleus concept of Seoul. Therefore, the Seoul Metropolitan Government came up with a master plan to ensure balanced development of the city through a shift from single nucleus concept to multiple nuclei concept. The master plan called for the construction of additional urban railways connecting the central district with Gangbuk (north of the river) and Gangnam (south of the river) areas, thereby facilitating the development of city sub centers in areas south and north of the Han River. The plan envisioned striking a balance in terms of population between Gangnam and Gangbuk, with the Han River in the middle. For these reasons, the original route for Subway Line 2 was revised in a way that it would become

Table 2-2 Construction Timeline of Seoul Subway Line 2

Year/Month/Day	Content	Construction Years
1978.03.09	Subway Line 2 construction launched (in front of Jamsil Sports Complex)	
1980.03.11	Seoul Subway Construction Co. inaugurated	
10.31	1st stage of Subway Line 2 opened (Sinseol-dong~Sports Complex, 14.3 km)	1975~1980
1981.02.09	Subway Operation Business Office inaugurated	
08.31	Seoul Subway Construction Co. dissolved	
09.01	Seoul Metropolitan Subway Corp. inaugurated	
1982.12.23	2nd stage of Subway Line 2 opened (Sports Complex~Seoul National University of Education, 5.5 km)	1977~1981
1983.08.01	Seoul Metropolitan Subway Corp. headquarters completed	
09.16	3rd stage section of Subway Line 2 opened (Seongsu~Euljiro 1-ga, 8 km)	1978~1982
12.17	4th stage section of Subway Line 2 opened (Seoul National University of Education-Seoul National University, 6.7 km)	1979~1984
1984.05.22	Subway Line 2 circular section completed with the opening of the Seoul National University~City Hall section (19.2 km)	

• Source: Seoul Metro, "30-Year History of Seoul Subways", 2012.

a circular line. The five-route original plan was later drastically changed with the course of Line 3 and Line 4. In building new urban railways, Seoul city could use its experience and operational know-how accumulated through the construction of Line 1. Also, efforts to develop domestic technology to produce rolling stock and localize other necessary materials had made considerable progress by then. To finance the Line 2 project, the Seoul City government borrowed $100 million from the central government's foreign exchange reserves, and also issued subway bonds. It also used investments from its budget and received subsidies from the central government. Subway Line 2, which runs along a 48.8 km circular route, was built in four stages. It took 878 billion won and six years and two months to construct the line.

2.1.2. Construction of Subway Lines 3 and 4

To facilitate the construction of subways and diversify funding resources, the Underground Railway Construction Promotion Act was enacted in April 1979 and its enforcement decree was proclaimed six months later. Part of the efforts to construct Subway Lines 3 and 4 with private investments, this legislation led to the inauguration of Seoul Subway Construction Co. on Feb. 5, 1980.

Table 2-3 Construction Timeline of Seoul Subway Lines 3 & 4

Year/Month/Day	Events
1978.01.16	Subway Line 3 & 4 construction plans discussed in detail (private sector participation encouraged)
1979.02.19	Private sector construction plans for Subway Lines 3 & 4 approved
1980.02.29	Subway Lines 3 & 4 construction launched simultaneously (at Gupabal for Line 3; in front of Sinil High School for Line 4)
03.11	Seoul Subway Construction Co. inaugurated
1981.02.09	Subway Operation Business Office inaugurated
08.31	Seoul Subway Construction Co. dissolved
1981.09.01	Seoul Metropolitan Subway Corp. inaugurated
1983.08.01	Seoul Metropolitan Subway Corp. headquarters completed
1985.04.20	1st stage section of Subway Line 4 opened (Sanggye~Hansung University, 11.8 km)
07.12	The northwestern section of Line 3 opened (Gupabal~Dongnimmun, 8 km)
10.18	Lines 3 and 4 completed with the opening of the Dongnimmun~Yangjae section (16.2 km), and the Hansung University~Sadang section (16.4 km), respectively.

• Source: Seoul Metro, "30-Year History of Seoul Subways," 2012.

Table 2-4 Passenger Capacity of Subway Lines 1 to 4 (Unit: trips/year)

Year	Total	Line 1	Line 2	Line 3	Line 4
1974	31,776,905	31,776,905			
1975	79,991,880	79,991,880			
1976	89,251,981	89,251,981			
1977	124,969,820	124,969,820			
1978	165,927,857	165,927,857			
1979	194,372,797	194,372,797			
1980	197,605,534	194,785,985	2,819,549		
1981	233,547,361	212,103,558	21,443,803		
1982	242,273,667	218,157,687	24,115,980		
1983	283,855,927	237,787,096	46,068,831		
1984	397,469,780	233,508,535	163,961,245		
1985	511,068,702	227,443,144	237,231,995	17,248,233	29,145,330
1986	741,653,450	210,235,030	298,701,663	97,655,584	135,061,173
1987	810,457,532	238,839,704	319,781,098	103,390,256	148,446,474
1988	927,443,677	255,613,492	371,477,903	121,867,056	178,485,226
1989	1,006,939,706	277,828,214	406,352,696	131,013,857	191,744,939
1990	1,168,651,595	305,513,598	488,075,506	161,180,857	213,881,634
1991	1,241,157,067	317,732,691	517,150,320	174,248,221	232,025,835
1992	1,354,150,224	338,521,320	574,529,210	189,269,767	251,829,927
1993	1,388,037,097	346,999,413	592,248,139	193,672,270	255,117,275
1994	1,404,232,972	356,123,906	588,761,851	208,430,560	250,916,655
1995	1,476,788,160	379,763,222	614,087,862	226,564,053	256,373,023
1996	1,422,570,459	190,073,279	684,411,859	252,824,228	295,261,093
1997	1,354,818,219	183,609,058	619,405,286	247,367,918	304,435,957
1998	1,306,277,751	178,680,186	595,319,840	234,009,772	298,267,953
1999	1,301,720,368	175,961,957	601,462,368	227,610,899	296,685,144
2000	1,369,718,707	176,766,072	656,566,816	237,668,711	298,717,108
2001	1,415,737,799	174,659,816	676,270,467	259,142,418	305,665,098
2002	1,439,715,951	171,060,762	692,766,114	265,141,674	310,747,401
2003	1,429,295,846	166,914,137	692,287,339	263,872,678	306,221,692
2004	1,453,858,667	172,081,871	703,795,715	265,398,537	312,582,544
2005	1,436,414,342	171,943,936	698,775,955	259,165,710	306,528,741
2006	1,430,996,090	169,903,083	699,222,041	257,543,491	304,327,475
2007	1,431,757,456	169,635,080	707,328,238	256,172,707	298,621,431
2008	1,446,924,426	168,096,727	727,057,819	256,547,773	295,222,107
2009	1,450,530,740	163,860,092	732,037,588	257,501,239	297,131,821
2010	1,475,348,937	164,409,302	731,847,885	275,466,721	303,625,029
2011	1,509,528,662	170,110,521	747,577,667	282,997,903	308,842,571

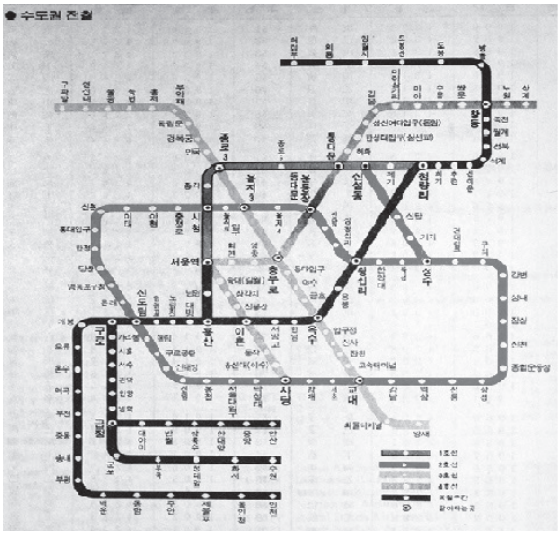
• Source: Seoul Metro, http://www.seoulmetro.co.kr/page.action?mCode=G030030000&cidx=258

The company was launched with joint investment from 23 construction enterprises. Entrusted with the construction and operation of Lines 3 and 4, it began to build the two lines on Feb. 29, 1980. Construction work for Subway Line 2's Euljiro section was under way at that time, so any further construction work nearby would have caused chaotic traffic conditions in the central parts of Seoul. To avoid causing such dire conditions, the company started work at the outlying sections: the Jichuk Train Depot~Dongnimmun for Line 3 and the Sanggye~Samseongyo (currently, Hansung University Station) for Line 4.

The two new lines opened and began to operate in October 1985. Thus, Seoul now had a world-class subway network, despite its relatively short history of 11 years in the field of urban railways. The nation entered a full-fledged era of urban railways in 1985, with a ridership of 500 million in 1985 with the four lines combined.

Seoul Subway Corp., launched to build Subway Lines 3 and 4 with investment from the private sector, had a relatively large staff and organization from the beginning. At the time of its inauguration, it had 307 employees in 14 departments, two offices and 33 sections.

Figure 2-2 A Route Map of Phase 1 Urban Railways



• Source: Jzzzzzzzn, Ppeoljit Blog, http://jzzzzzzzn.egloos.com/1281915

2.2. Phase 2 of Seoul Metropolitan Urban Rail

2.2.1. Necessity for Building New Urban Railways

Completion of the Phase 1 Urban Rail Network Project was a phenomenal achievement in that it provided a systematic, high-speed mass transit mode of transport to Seoul. However, due to continued concentration of population in Seoul, the accommodation capacities of Subway Lines 1~4 soon reached their limits. Seoul City government was suffering from financial difficulties caused by the operation of urban railways as well. Moreover, the lines were very crowded during commute hours but recorded low rates of usage during the rest of the day.

In January 1988, Seoul City announced a plan to build five additional subway lines. According to the plan, construction work to build three new lines and two branch lines would be conducted over two phases beginning in 1990.

The plan envisioned completing two new lines during the first stage: a 13 km section of Seoul Subway Line 5 running from Yeongdeungpo to Hwagok-dong and to Gimpo Airport, and Seoul Subway Line 6 that would stretch 11 km along the Wangsimni~Gunjadong~Cheonhodong route. During the second stage, construction would be conducted to build the Jamsil~Dunchondong~Godeokdong section (9 km) of Urban Railway Line 7, Line 3's extension line stretching along the Yangjae~Suseo~Seongnam City route (16 km), and Line 4's extension line running from Sadang to Gwacheon, and to Geumjeong Station (16 km) by 1999.

In 1989, Seoul City established plans to build Seoul Subway Lines 5 and 7, plus the extension line of Line 3 to cover the Yangjae-Suseo section. In the same year, the central government also developed a plan to build six additional lines with a total length of 86.7 km in the nation's capital area. The six lines were: Line 8 for the Sanggye~Mangu~Gangnam~Noryangjin~Yeouido corridor; Line 9 for the City Hall~Yeouido~Yeonggeungpo~Bucheon City corridor; Line 10 for the Noryangjin~Guro Industrial Complex~Siheung corridor; Line 11 (Jungang Line) for the Cheongnyangni~Guri~Donong corridor; Line 12 (Gyeongchun Line) for the Seongbuk~Toegyewon corridor; and Line 13 (Gyeongui Line) for the Susaek~Neunggok corridor. The government also planned to expand the Seoul~Guro and Guro-Incheon sections (Gyeongin Line) to six- and double tracks, respectively.

Due to financing difficulties, it took a considerable period of time before these projects were implemented.

2.2.2. Phase 2 of Seoul Metropolitan Urban Rail

In May 1995, the Wangsimni~Sangildong section of Line 5 opened. Its Geoyeo Branch Line began passenger services on March 30, 1996. These were the first subway lines built in Gwangjin and Gangdong wards. As such, they were expected to facilitate the development of these regions.

The line could run through its Gangseo section only after two partial openings. First, passenger services began in the Banghwa~Kkachisan segment on March 20, 1996. At the same time, a branch line of Line 2 opened between Kkachisan and Yangcheon District Office. Thus, Gangseo residents could make subway travel to the central districts or Gangnam by using the extension line and Line 2. The remaining segment of the Gangseo section opened on Dec. 30, 1996, thereby completing the entire Subway Line 5 that runs from east to west through the Seoul area.

Subway Line 6, a 32 km route between Yeokchon in Eunpyeong-gu and Sinnae in Jungnang-gu, began its services in 2001. It was the last section to open among Phase-2 urban railway lines.

Seoul Subway Line 7 was designed in a way that its starting sections would pass through the Dobong and Sanggye districts, thereby facilitating the development of nearby areas. It was also designed to accommodate the travel demand of residents in the large residential district in the Sanggye district. In addition, it targeted the commute population of the populous areas of Mokdong, Junghwa and Myeonmok. After passing through these areas, the line crosses the Han River to reach the Express Bus Terminal via northern parts of the Gangnam urban sub center. Then it runs all the way to Gwangmyeong City after going through southern parts of Seoul. The line has nine midway points where passengers can transfer to other urban railway lines. In the 1990s, the Gyeongin Line, the only electrified railway linking Seoul and Incheon, became increasingly congested. It became clear that it would reach saturation point in the not too distant future. To cope with the situation, the railroad administration decided to lay four tracks along the Gyeongin Line, while seeking to connect it with Urban railway Line 7 in a bid to dissipate passengers heading for

Gangnam. In 1991, Seoul City announced a decision to extend the line by 3.7 km from Gwangmyeong to Onsu Station on the Gyeongin Line. The line was also redesigned to take a detour between Dobong Station (Suraksan Station) and Dobong Depot so that it would be connected to Gyeongwon Line at Dobongsan Station. Through these steps, Line 7 came to transport passengers from suburban areas to the downtown district of Gangnam.

Construction of Urban railway Line 8 was carried out in two sections: the 15.5 km Jamsil~Moran section and the 20 km Jamsil~Amsa section. Both sections have now been completed. The total length of Phase 2 Metropolitan Subway in Seoul reaches 160 km, which includes 15 km extensions of Lines 2, 3 and 4 as well as 145 km of new sections in Lines 5 to 8.

Table 2-5 Construction Timeline of Seoul Urban Railway Lines 5 to 8

Year/Month/Day	Events
1989.07.27	Construction and operation plan for Line 5 finalized
1990.06.27	Construction launched for the Gangdong and Gangseo sections of Line 5
12.28	Construction launched for the Gangbuk section of Line 7
12.29	Construction launched for Line 5's Geoyeo section and Line 8's Seongnam section
1994.01.08	Construction launched for Lines 6, 7 & 8 of the Phase 2 urban railways (61.5 km)
03.15	Seoul Metropolitan Rapid Transit Corp. inaugurated
1996.12.30	Line 5 opened
1999.07.02	Line 8 opened
2000.08.01	Line 7 opened
2001.03.09	Line 6 opened

• Source: Seoul Metro, "30-Year History of Seoul Subways," 2012.

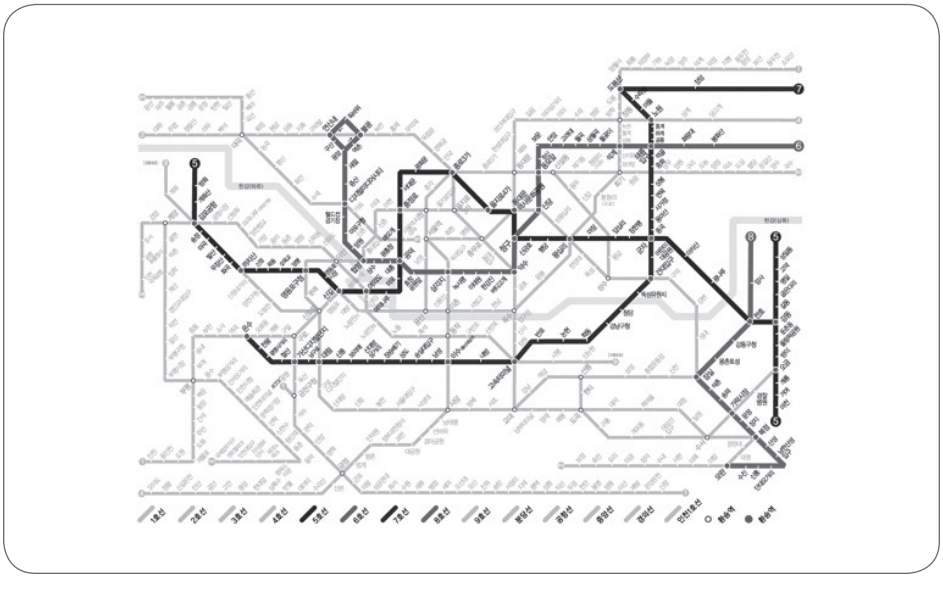
Table 2-6 Passenger Capacity of Seoul Urban Railway Lines 5 to 8

(Unit: trips per year)

Year	Total	Line 5	Line 6	Line 7	Line 8
1995	4,740	4,740	-	-	-
1996	87,254	73,809	-	10,427	3,018
1997	282,041	191,521	-	58,216	32,304
1998	410,351	284,387	-	72,493	53,471
1999	426,925	283,667	-	84,002	59,256
2000	518,729	291,094	7,165	150,000	70,470
2001	741,919	301,992	102,273	256,696	80,958
2002	791,068	301,195	129,570	277,056	83,247
2003	819,930	306,868	141,379	287,938	83,745
2004	846,879	312,313	153,433	296,624	84,509
2005	840,884	305,608	153,781	297,654	83,841
2006	838,414	300,028	158,188	297,896	82,302
2007	835,919	297,274	158,442	298,282	81,921
2008	846,925	298,451	162,045	302,946	83,483
2009	842,511	292,496	164,820	302,715	82,480
2010	874,025	296,458	177,622	315,541	84,404

• Source: Seoul Metropolitan Rapid Transit Corp., "Seoul Urban Rail Transport Plan 2011," 2011.

Figure 2-3 A Route Map for Seoul Urban Railway Lines 5 to 8



• Sourc: Nas Media, http://blog.naver.com/choko5458/140118444852

2.3. Urban Railway Line 9: First Public-Private Partnership Project in Seoul Urban Rail

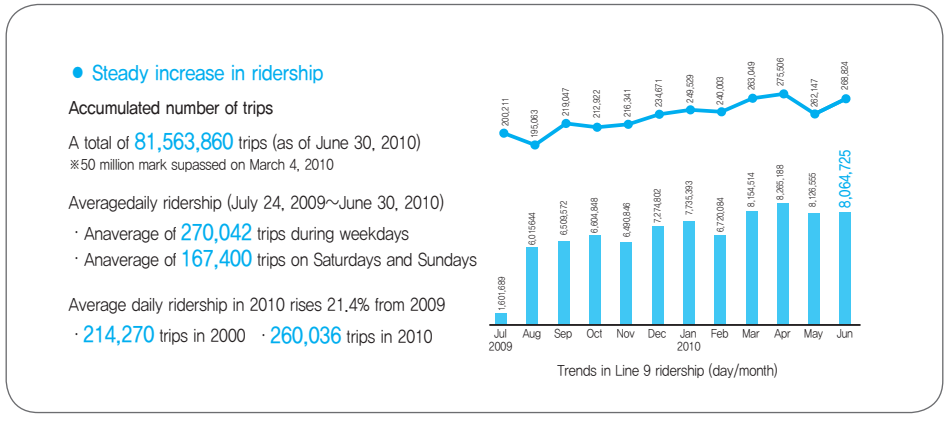
Seoul Urban railway Line 9 was built with a vision to introduce future-oriented 21st-century urban rail system, based on careful analysis of problems found with previously built subways in Seoul. Its construction was conducted with the following objectives: expanding facilities for passenger convenience, minimizing public inconvenience caused by construction work, ensuring systematic project management, and diversifying funding sources. A look at these guidelines show that compared to Phase 2 Seoul Metropolitan Subways, more emphasis was placed on consideration of public convenience and funding methods. This observation indicates that urban railway construction projects were beginning to reflect the trends of civic participation as well as various developments related to the information age. Of the Seoul Subway line, Line 9 was the only one that was constructed under a BTO (build-transfer-operate) scheme. The line, which runs 27 km between Gaehwa and Sinnonhyeon, opened on July 24, 2009. The line was built under the control of the Seoul Metropolitan Infrastructure Headquarters, but it is being operated by Seoul Metro Line 9 Corporation, which has the right to run the line for 30 years, even though the ownership belongs to the Seoul Metropolitan Government. Seoul Metro Line 9 Corp. has entrusted the business of managing station affairs to Seoul Metro Line 9 Operation Co. Before its official opening, the urban railway line underwent trial runs from May 7 through May 22, 2009. The line's 4.5 km 2nd stage section from Sinnonhyeon to Sports Complex, whose construction began in January 2009, is scheduled to open in December 2014. Construction for the 5.94 km 3rd stage section linking Sports Complex and Olympic Park started in December 2009. In the second half of 2010, ground was broken for the construction of the remaining 3.2 km section between Olympic Park and VHS Medical Center. Urban railway Line 9 is expected to be completed in 2016.

Table 2-7 Construction Timeline of Seoul Urban Railway Line 9

Year/Month/Date	Events
1994.12	Line 9 basic design
1997.12	Line 9 final design
2000.09	Master plan for urban rail finalized
2001.12	Line 9 construction launched
2003.05	A revised plan announced for building Line 9 as a public-private partnership project
2009.01.01	Construction launched for the 4.5 km section between Sinnonhyeon and Sports Complex
2010.04	Master plan revised to extend the line by 1.5 km by relocating the final destination from Bangi (Oryundong) to Dunchondong (VHS Medical Center)
2010.08	Construction launched for the 3.2 km section between Olympic Park and Dunchondong (VHS Medical Center)
2013.12	Sinnonhyeon – Sports Complex scheduled to open
2016.02	Olympic Park-VHS Medical Center section scheduled to open

• Source: Seoul Metro, "30-Year History of Seoul Subways," 2012.

Figure 2-4 Transport Record of Seoul Urban Railway Line 9



• Source: Seoul Metro 9, http://www.metro9.co.kr

3. Urban Rail Operation System

Urban railways have been built in Seoul to reduce serious traffic congestion in the central business district. Currently, nine urban railway lines from Line 1 to Line 9 are operating. Various organizations have implemented the construction and operation of these lines through diverse processes. The organizations and processes are summed up by year in Table 2-8.

Table 2-8 Timeline of Urban Rail Operating Organizations

Year/Month/Day	Events
1970.06.09	Subway Construction Headquarters inaugurated
1971.04.12	Line 1 construction launched
1974.08.15	Line 1 opens (7.8 km)
1978.03.09	Line 2 construction launched
1980.02.29	Lines 3 & 4 construction launched
1981.09.01	Seoul Metropolitan Subway Corp. inaugurated (take over Lines 3 & 4 construction projects)
1984.05.22	Subway Line 2 completed (57.2 km)
1984.09.15	Subway Construction Headquarters dissolved (Line 2 construction project completed)
1985.10.18	Subway Lines 3 & 4 completed (Line 3 27.7 km, Line 4 28.3 km)
1989.11.03	Subway Construction Headquarters launched for Phase 2 subway construction
1989.11.12	Construction launched for Line 3 and 4 extensions
1990.06.27	Line 5 construction launched
1990.12.28	Line 7 construction launched
1990.12.29	Line 8 construction launched
1994.01.08	Line 6 construction launched
1994.03.15	Seoul Metropolitan Rapid Transit Corp. inaugurated (in charge of the operation of Lines 5 to 8)
1994.04.01	Line 3 and 4 extensions completed (12 km)
1996.12.30	Urban railway Line 5 completed (52 km)
1999.07.02	Urban railway Line 8 completed (17.6 km)
2000.08.01	Urban railway Line 7 completed (42 km)
2001.03.09	Urban railway Line 6 completed (31 km)
2001.12	Line 9 construction launched
2004.12	Seoul Metro Line 9 Corp. founded
2009.07.24	Line 9 opened

• Source: Seoul Metro, "30-Year History of Seoul Subways," 2012.

In 1970, a pressing need for subway construction led to the launch of the Seoul Subway Construction Headquarters which built Subway Line 1. The Seoul City government took charge of its operations.

Even after operation of Subway Line 1 began, population kept rising in the central parts of Seoul, and the increase in the number of people using the subway led to the need to build a second subway line. Thus, the subway construction headquarters built Subway Line 2. However, because of the difficulties in securing financing resources, it became necessary to establish a private company that could be in charge of both construction and operation of subways. While promoting plans for Lines 3 and 4, Seoul Subway Co. was inaugurated on Aug. 31, 1981. On Sept. 1, 1981, the company handed over the project to build Lines 3 and 4 to Seoul Metropolitan Subway Corp. Construction of these two lines had been under way as a private investment project since it started on Feb. 29, 1980. While Line 2 construction was under the control of the Seoul Subway Construction Headquarters, construction of Lines 3 & 4 proceeded under the responsibility of the subway corporation. After opening these lines, the corporation took full charge of their operations (the corporation changed its name to Seoul Metro in 2005).

Construction of Phase 2 subways was designed to curb the use of private cars, the number of which was rapidly increasing, and to expand the network of Phase 1 subways. Implementation of the plan required a dedicated organization. Thus, the Subway Construction Headquarters was reestablished on Nov. 3, 1989 for the construction of Phase 2 subways. The previous headquarters was dissolved on Sept. 15, 1984, not long after Subway Line 2 opened on May 22, 1984.

The headquarters extended Lines 3 & 4 and built new lines, Lines 5 to 8. As the opening of the Phase 2 urban railways drew near, attention was focused on who would be in charge of their operations. It was determined that a separate organization should operate the new urban railways. Therefore, Seoul Metropolitan Rapid Transit Corp. was launched on March 15, 1994.

Line 9 was built with a vision of introducing a future-oriented urban rail system, free from the problems commonly found with previously built urban railways in Seoul. Under a concession agreement with the Seoul Metropolitan Government, the project adopted a BTO (Build Transfer Operate) scheme. Under the contract,

the right to possess the urban railway facilities is handed over to Seoul City after completion of the construction. However, Seoul Metro Line 9 has the exclusive right to manage and operate the subway for 30 years.

Table 2-9 Current Status of the Urban Rail Operating Organizations

(Monetary Amount Unit: 100 million won, as of August 2011)

Categories		Seoul Metro	Seoul Metropolitan Rapid Transit Corp.	Seoul Metro Line 9 Corp.
Inaugurated		Sept. 1, 1981	March 15, 1994	Dec. 20, 2004
Organization		6 headquarters 6 divisions 21 departments 37 teams 1 office 1 development center 2 control centers 16 business offices 9 centers	6 headquarters 5 departments 1 center 34 teams 4 management centers 19 divisions 33 management offices	4 headquarters 1 center 1 division 16 teams
Number of current employees		9,535	6,386	591
Regular workforce		9,150	6,230	592
Number of lines		4	4	1
Length (km)		137.9	152.0	27.0
Number of stations		120	148	25
Number of train cars		1,954	1,561	96
Number of trains		200 (4~10)	200 (6~8)	24 (4)
Headways (minutes)	R/H	2.5~3.0	2.5~4.5	local: 4.5~8.0 express: 20.0
	N/H	4.0~6.5	6.0~8.0	local: 10.0 express: 20.0
2011 budget		16,875	7,950	-
Liabilities (as of the end of 2010, principal)		22,201	6,793	-
Issuance of public bonds in 2011		-	1,325	-
Traffic performance in 2010 (trips/day)		4,042	2,395	266
		Basic fare: 900 won (up to 10 km) Additional fare: 100 won (10~40 km, every 5 km) (over 40 km, every 10 km)		Same
Transport revenue		7,901	4,630	-

• Source: Ministry of Land, Transport and Maritime Affairs, "Rail Statistics," 2011.

4. Roles of the Central and Local Governments in Urban Rail Construction

4.1. Project Implementation System

Normally, urban rail systems are introduced as a mode to carry out metro-wide transport functions. Therefore, their construction projects are usually implemented by autonomous governments of metropolitan cities. Local governments may provide funding for the projects through general-account budget spending as well as by issuing bonds and taking out loans from financial institutions. Construction management is carried out by local governments themselves or entrusted to professional organizations.

The operation of urban railways built with metropolitan financial investment is carried out by public corporations affiliated with local governments concerned. Usually, each metropolitan city launches one public corporation for the operation of urban railways. Seoul, however, has two operators: Seoul Metro for Phase 1 lines (Subway Lines 1~4), and Seoul Metropolitan Rapid Transit Corp. for Phase 2 lines (Lines 5~8). Seoul is using the dual operation system because of differences in operational efficiency. Phase 2 subways are equipped with automated station operation systems and automatic train control (ATO) system, so their operation requires a smaller workforce relative to the size of facilities. In addition, Phase 1 operators incurred a large amount of debt while building Lines 3 and 4, so a different operator was selected for Phase 2 urban railways as not to burden it with the debt of additional construction and operation.

It is practically impossible for a local government to secure all the financial resources needed to build an urban railway. Therefore, central government provides financial assistance. Between the 1970s and the 1990s, state assistance for urban railway construction was carried out without specific criteria. During that period, central government provided support in the form of subsidies and loans, and the scope was determined depending on the state's financial conditions. However, the government in 1991 set guidelines for providing state support for urban rail projects to ensure effective implementation. The guidelines make it obligatory for the central government to conduct a preliminary feasibility study for an urban railway project

promoted by a local government in case it needs state support worth 30 billion won or more. To ensure objective feasibility evaluation and effective implementation of state support programs, the central government (Ministry of Strategy and Finance) has been conducting preliminary feasibility studies for urban rail projects. Previously, local governments themselves assessed the feasibility of particular projects. After undergoing the feasibility evaluation procedure, local governments should draw up master plans regarding the route, receive approval from the Minister of Land, Transport and Maritime Affairs, and obtain a project license.

Table 2-10 Financing Details of Phase 2 of Seoul Metropolitan Urban Railway

Stakeholders		Roles and contents
Central government	Ministry of Strategy and Finance	Preliminary feasibility study Financial assistance
	Ministry of Land, Transport and Maritime Affairs	Approval of basic and project plans Issuance of project license
Local governments		Establishment of basic and project plans Construction management Financing
Urban rail operating organizations (corporations)		Urban rail operation

4.2. Financing

Financial resources for the implementation of urban rail projects were secured in a variety of ways. As for Subway Line 1, the project cost far exceeded the financial capacity of the Seoul City government. Therefore, the central government helped fund the project by signing a loan agreement with a foreign government. The city government issued a subway bond after enacting a relevant ordinance.

For the construction of Seoul subways during the Phase 1 period in the 1980s, the central government provided financial assistance when deemed necessary through grants and loans. However, the percentage was minimal. More than 70% of the necessary funds were prepared through loans externally. These debts have posed a considerable financial burden for Seoul Metro, the operator of Phase 1 subways.

As for the Phase 2 urban railway projects in the 1990s, Seoul City's financial contribution accounted for 53% of the total funding. The city was able to increase its level of contribution thanks to increases in subway budget and increased tax revenues from various land construction and development projects. In addition,

Table 2-11 Financing Details of Seoul Metropolitan Urban Rail Phase-1 (Unit: hundred milion)

Categories		Total	Line 1	Line 2	Lines 3 & 4
Self-financing	Subtotal	23,926	330	8,771	14,825
	City budget	Subtotal	6,324	149	3,282
	State budget	5,364	149	2,523	2,692
	Others	649		599	50
Debt-financing	Subtotal	311		160	151
	Government funds	Subtotal	17,602	181	5,489
	Banking funds	3,140	23	150	2,976
	Loans	3,686		1,836	1,850
	Foreign bonds	3,863	158	556	3,149
	Pubic bonds (Corporate bonds)	158		158	
	Public bonds (Corporate bonds)	6,755		2,789	3,966

• Source: Ministry of Land, Transport and Maritime Affairs, "Urban Railway Development Policy in Korea,"

financial support from the state, including loans, accounted for 25% of the funding. As a result, the percentage of investment based on debt financing was reduced to approximately 22%.

With the enactment of the Urban Railway Act in the 1990s, legal grounds were secured for providing state support to urban rail projects. In 1993, the government enacted "Traffic Facility Special Account Act" and the "Transport Tax Act" to secure support from the state budget for urban rail construction in a stable manner. Of the revenues in the special account, those transferred from the general account included all the transport tax revenues and revenues from special consumption tax imposed on passenger cars. The transport tax was a purpose tax designed to secure financial resources needed for expanding social overhead capital such as roads and urban railways. The tax was imposed on gasoline, diesel and other alternative oil based products.

During the 1980s and 1990s before the enactment of relevant laws, several railways were built to connect new cities outside of Seoul, such as Ansan, Gwacheon, Ilsan and Bundang. These projects were implemented by employing a method used for recovering profits from development projects. Therefore, the railway project costs were entirely or partially covered by major stakeholders in

the new town development projects. However, projects to improve railways in the capital area were mostly financed by the state, because those projects did not result in development profits. As for the Seoul Metropolitan Subway, central and local governments shared responsibility for providing financial support, with the central government providing 75% of the financial assistance and the local governments coming up with the remaining 25%.

The government has actively promoted the introduction of private-sector capital into urban rail projects. In 1994, the government enacted "Private Capital Inducement for Social Infrastructure Projects Act," stepping up its efforts to facilitate private-sector investment in public projects. In 1999, it introduced the Minimum Revenue Guarantee system which stated that local governments should make up for the shortfall if operating profits from a project implemented with private capital fell short of the 90% level of stipulations in the concession agreement. Against this background, light rail projects were launched in Gimhae, Yongin and Uijeongbu areas. However, local governments in these areas are facing financial difficulties as the revenue level has been or is expected to be lower than originally predicted.

5. Achievements of Seoul Metropolitan Urban Rail Projects and Their Implications

5.1. Achievements of Seoul Metropolitan Urban Rail Projects

With a population explosion in the national capital and the resultant increase in travel demand in the 1970s, roads became increasingly crowded. It would not be an effective option to build a bus-centered urban traffic system, given the expanding spatial scope of the metropolitan area, the rapidly growing traffic population, and the surge in the number of automobiles. With buses losing their competitiveness due to the steep rise in personal car ownership and worsening road conditions, more and more voices called for the construction of an urban rail system.

The nation's first urban rail project was completed in 1974 with the opening of Seoul Subway Line 1 in the capital area. The event was followed by more projects to build urban rail systems in Seoul, which continued through the 1990s. The Seoul

Table 2-12 Operation Status of Urban Railways in Korea

Local governments	Operating organizations	Routes in operation	Opening (year/month/day)	Length (km)
Seoul	Seoul Metro	Line 1	1974.08.15	7.8
		Line 2	1984.05.22	60.2
		Line 3	1985.10.18	38.2
		Line 4	1985.10.18	31.7
	Seoul Metropolitan Rapid Transit Corp.	Line 5	1996.12.30	52.3
		Line 6	2001.03.09	35.1
		Line 7	2000.08.01	57.1
		Line 8	1999.07.02	17.7
Seoul	Seoul Metro Line 9 Corporation	Line 9	2009.07.24	27.0
Busan	Busan Transportation Corporation	Line 1	1985.07.19	32.5
		Line 2	1999.06.30	45.2
		Line 3	2005.11.28	18.1
		Line 4	2011.03.30	12.0
Daegu	Daegu Metropolitan Transit Corporation	Line 1	1997.11.26	25.9
		Line 2	2005.10.18	31.4
Incheon	Incheon Transit Corporation	Line 1	1999.10.06	29.4
Gwangju	Gwangju Metropolitan Rapid Transit Corp.	Line 1	2004.04.28	20.5
Daejeon	Daejeon Metropolitan Express Transit Corp.	Line 1	2006.03.16	20.5

• Sources: Homepages of Seoul Metro, Seoul Metropolitan Rapid Transit Corp., Seoul Metro Line 9 Corporation, Busan Transportation Corporation, Daegu Metropolitan Transit Corporation, Incheon Transit Corporation, Gwangju Metropolitan Rapid Transit Corp., and Daejeon Metropolitan Express Transit Corp

Metropolitan Area now has a network of urban railways that is unprecedentedly long even by global standards. The combined length of Seoul's urban railway exceeds 300 km. While the urban railways were being built, railway electrification projects were also implemented in the national capital region. These projects contributed significantly to increasing the demand for urban rail traffic. In the 1980s, other metropolitan cities also began to build urban railways. The Busan Subway Line 1 project was initiated in 1981. Other metropolitan cities of Daegu, Incheon, Daejeon and Gwangju followed suit. As of 2011, 18 urban railway lines were in operation in Korea. Their combined length reaches 562.6 km. The capital city of Seoul has nine lines, with combined length of 316.9 km. They are linked to 12 railways connecting Seoul to various regions in the capital area. Seoul's world-class urban railway

network carries 2.4 billion passengers a year (2010 statistic). Its modal share is 35%, higher than buses with 28% and passenger cars with 26%.

Beginning in the 1990s, the central government devised measures to provide systematic support to local governments implementing urban railway projects as well as to promote public-private partnership projects tapping into private capital. These measures were designed to ensure that local governments' financial borrowing

Table 2-13 Operation and Planning Status of Light Rail Systems in Korea

Categories	Local governments	Operators	Routes in operation	Opened	Line length (km)
Under operation	Geon-gyo ·Busan·Gimhae	Busan-Gimhae Light Rail Transit Co.	Busan-Gimhae : Sasang~Samgye	Sept. 17, 2011	23.2
	Uijeongbu	Uijeongbu Light Rail Transit Co.	Uijeongbu : Singokdong~Gosandong	July 1, 2012	11.1
Under construction	Yongin	Yongin Ever Line	Yongin : Giheung section~Everland	Being renegotiated	18.1
	Seoul	Uitrans	Uidong~Sinseoldong	Financial agreement signed in November 2011	11.4
Under planning	Seoul	-	Sillim Line: Yeouido~Seoul Nat'l University	Under negotiation	7.8
	Seoul	-	Nangok Line : Boramae Park~Nanhyangdong	Master plan being changed	4.3
	Seoul	-	Dongbuk Line : Wangsimni~Eunhaeng Intersection	Under negotiation	12.3
	Seoul	-	Myeonmok Line : Cheongnyangni~ Sinnaedong	Priority negotiator selection underway	9.0
	Seoul	-	Seobu Line : Jangseungbaegi~Saejeol	Third party proposal notice under preparation	12.0
	Seoul	-	DMC district circulation	Slated to be associated with plans to develop areas surrounding DMC	6.5
	Gwangmyeong	-	Gwangmyeong~Anyang	Priority negotiator workout application	10.3
	Cheonan	-	Cheonan Asan Station~Cheonan Bus Terminal	Ministry of Strategy and Finance preparing private investment deliberation	12.3
	Seongnam	-	Pangyo~Jeongja Station	Master plan being established	13.7

• Source: Ministry of Land, Transport and Maritime Affairs, Rail Statistics, Internal Data, 2012.

for investment in urban rail projects would not cause financial difficulties to urban railway operators. These government efforts led to the enactment of relevant laws, which helped lay the groundwork for actively promoting Public Private Partnership (PPP) and light rail projects in the 2000s.

Seoul Urban Railway Line 9, which opened in 2009, is the nation's only urban rail line built through a public-private partnership project under a BTO contract. Such a private participation project has particular strengths in terms of expanding convenience facilities for urban railway users, minimizing public inconvenience during construction, ensuring systematic and effective project management, and diversifying funding resources. It can also minimize the government's financial burden. Light rail systems are being considered by small and medium-sized cities like Gimhae and Uijeongbu, as they cost less and require shorter construction period compared to full-scale urban rail systems. They are mostly pursued as PPP projects. Currently, several cities, including Yongin, Gwangmyeong, Cheonan and Seongnam, are promoting light railway projects. The Seoul City government is also studying the prospects of introducing light rail systems for areas with serious traffic problems that cannot be solved by expansion of urban railway and bus services.

5.2. Implications

Projects to build urban railways, which are mostly intended for transportation within cities, are normally promoted by local governments. However, few local governments are affluent enough to fund such projects, which require huge spending. Therefore, local governments may make necessary investments with various types of loans. This, however, will likely pose a significant financial burden on railway operators later. Thus, it is necessary for the central government to study ways of relieving local governments of such financial burdens. For example, the central government could provide assistance in arranging foreign loans or help local governments in paying off public debts. It also needs to help facilitate private investments in such projects by improving relevant laws and systems, particularly in relation to feasibility studies, capital raising and profit guarantees.

Projects to build urban railway Line 9 in Seoul and light railways in Gimhae, Uijeongbu and Yongin are public-private partnership programs. They, in particular,

have adopted a minimum revenue guarantee scheme, under which local governments make up for the shortfalls in case the actual operating income falls short of the estimations suggested in concession agreements. The scheme may cause significant financial burden to local governments should the levels of profit and usage demand be lower than predicted. Therefore, when promoting such projects involving private investment, it is essential to set attainable goals and evaluate feasibility based on accurate estimation of usage demand and profits. Additionally, careful consideration ought to be given to setting optimal fares.

Urban railways are capable of high-speed, high-capacity transportation. However, it takes huge financial investments and long periods of time to build and expand them. Because of these constraints, it is difficult to expeditiously cope with increasing travel demand solely with the urban rail system. Therefore, it is unavoidable that urban railways and other travel modes, such as buses, should divide roles and functions among themselves. When promoting an urban rail project, ways of creating demand for the railway as well as ensuring its profitability should be discussed from the planning stage. By doing so, the likelihood of making up for operating losses caused by low demand can be minimized. In this regard, endeavors should be made to maximize the effects of urban railway construction on the basis of research on transport policies on intermodal connections and travel demand management.

Amid global concerns about aggravating environmental and energy problems, railways, including urban rail systems, have recently been attracting renewed interest as an increasingly important mode of transport. To solve the current traffic problems and translate their growth potential into reality, developing countries need to consider building transport infrastructures like urban railways. Korea is a rare case of a developing country developing itself into an advanced nation in a short period of time, not only in terms of the economy but also in the field of rail transport. With its experience in developing its urban rail systems, Korea can serve as a good example for other developing countries.

Chapter 3

Building a Public Transport System: Buses

Building a Public Transport System: Buses

1. Background to Bus Reform

With more people moving into cities, bus traffic had expanded rapidly until the 1990s, when the number of registered cars reached 10 million. The increase in the number of cars caused serious traffic congestion within cities and led to a drastic decrease in the number of people using buses. The drop in the number of passengers led to a fall in revenues, exacerbating the financial difficulties faced by bus companies. The situation was so serious to the extent that the entire bus industry was in structural recession in the early 2000s. The operational conditions for buses worsened due to the growing demand for private car traffic, which made the roads increasingly crowded. Other factors that contributed to the unfavorable situation for the bus industry included opening of Phase 2 of the Seoul Metropolitan Subway, the expansion of community bus services, and the lack of bus priority policies.

Bus fares were subject to government regulations that were in place to stabilize commodity prices. Therefore, it was not possible for bus companies to raise passenger fares to improve their financial conditions. Bus companies monopolized the bus routes, handling them as if they were their private properties; as a result, the routes were organized in a way that could not flexibly cope with the changes in traffic demand patterns. On top of worsening financial conditions, it was becoming increasingly difficult for the bus companies to secure sufficient number of workers. This difficulty, plus their limited capital resources, led to a fall in the quality of

services, a decrease in their modal split, and a deficit in transport revenue. Some attempts were made to reform the bus system and partially restructure the routes, only to eventually fail. Government policies regarding buses turned out to be ineffective and impracticable. Regulatory measures against the bus transport industry were reinforced, even though steps to encourage autonomous, self-reliant managerial efforts were absent. A bidding system for bus routes was introduced as a way of tackling the problem of unprofitable routes to negligible effect.

In 2002, Seoul City declared its intention to reform the bus system. The move was based on internal and external consensus that the operation of buses in the city could no longer be left entirely in the hands of private companies seeking profits through competition. Under this consensus, it was determined to introduce a system featuring characteristics of public operation.

1.1. Previous Attempts to Reform the Bus Operation System[3]

1.1.1. Joint Dispatch System, Joint Management of Revenues

Even before 2004, Seoul City made various attempts to modify the bus operation system. In 1994, for example, the Seoul Development Institute conducted City Hall-commissioned research on "Implementing a Joint Dispatch System Based on the Operation of Public Garages." The research was particularly aimed at determining the desirable role of city buses and establishing necessary facilities. Conclusions of the research included suggestions for building public garages and implementing a joint dispatch system. The institute proposed carrying out a zone-based joint dispatch scheme after dividing the city into 10 zones. After starting with a joint route management system, the scheme should develop into a rigorous joint revenue management system, the institute asserted. The joint revenue management system, which was introduced as one of the core public transport reform measures initiated in 2004, had its origin in the institute research conducted 10 years earlier.

3) Seoul Metropolitan Government, "Convenient Public Transport, Happy Seoul Citizens," 2006. The contents of this book have been reconstructed in a way suitable for this paper.

1.1.2. Comprehensive Measures for City Bus Reform

Seoul City had persi stently carried out studies reorganizing the city bus system before it initiated public transport reform in 2004. For example, it carried out research on "Ways to Rationally Restructure City Bus Routes" in 1995, and a study on "Measures to Improve and Support City Bus Systems" was done in 1996. In 2000, it conducted studies on "Industrial Policies on Transit Buses and Directions for Reorganizing the Bus Industry" and "Optimum Operation Sizes of City Bus Companies and Development of a Rational Management System." Noteworthy is the fact that these advanced studies included suggestions for partially introducing a public operation system and a route tendering system, measures which were officially introduced in the 2004 reform. The 1996 study on improving and supporting the city bus system can be cited as a good example. It included a proposal that bus routes should be determined based on convenience of the bus users, rather than on the prospects of maximizing profits by route. The proposal also called for ensuring transparency in managing fare revenues. Specifically, it suggested inaugurating a public bus operation organization, which would implement a bidding system under which successful bidders would be allowed to run their particular routes for a period of six months or a year. This proposal led to the development of "Comprehensive Bus Reform Measures" in 1997. However, these measures were not implemented because of the absence of a specific organization that would be committed to carrying out relevant activities, as well as fierce conflicts of interest among bus companies, unions and civic organizations.

1.2. Transport Conditions in Seoul[4]

During the pre-reform period, companies operating city buses in Seoul suffered from worsening financial difficulties. Their revenues were dwindling amid a downward slide in their market share, while operating costs such as personnel and fuel expenses kept rising. In 1996, the modal share of buses was 30.1%, higher than 29.4% of urban railways and 24.6% of passenger cars. In 2002, the percentages changed to 34.7% for urban railways, 26.9% for passenger cars and 25.9% for buses.

4) Korea Bus Transport Business Cooperatives Union, "The History of Bus Transportation in Korea," 2009. The contents of this book have been reconstructed in a way suitable for this paper.

Table 3-1 Mode Share Changes in Seoul

(Unit : 1,000 passenger trips/day, %)

Year	Classification	Buses	Urban railways	Passenger cars	Taxis	Other modes	Total
1996	Ridership	8,358	8,183	6,829	2,901	1,529	27,800
	Modal splits	30.1%	29.4%	24.6%	10.4%	5.5%	100.0%
2002	Ridership	7,705	10,285	7,983	2,195	1,513	29,681
	Modal splits	25.9%	34.7%	26.9%	7.4%	5.1%	100.0%
Growth	Growth	-653	2,102	1,154	-706	-16	1,881
	Modal splits	-7.8%	25.7%	16.9%	-24.3%	-1.0%	6.8%

• Source: Seoul Development Institute, "A Survey of Household Travel Patterns in Seoul," 2012.

In just six years, the buses had fallen from first to third in terms of the modal split.

Chronic congestion in major road sections was the most important factor causing deterioration in bus operating conditions. In 2002, average travel speed of buses was 18.9 km/h, lower than the 22.5 km/h of passenger cars. Buses could not ensure reliable services due to irregular operation intervals and delays in schedule. Furthermore, bus companies' excessive pursuit of profits led to bus routes overlapping on arterial roads, thereby aggravating the congestion problem.

The bus-only lane system, introduced in 1992, expanded steadily, helped improved the bus travel speed a bit. However, it reached its limit in its operational functions, due to worsening traffic conditions caused by road congestion and overlapping routes. The lack of an effective bus system to manage the bus operations led to failures in efforts to improve bus travel speed.

The decline in the competitiveness of buses and their services caused a vicious

Table 3-2 Road Travel Speed in Seoul

Categories			1995	1996	2000	2002
Average daily travel speed (km/h)	Passenger car	Entire area	21.69	20.9	22.92	22.5
		Central business district	18.25	16.44	18.84	16.3
		Outskirts	21.92	21.23	23.21	23.0
	Bus		18.79	18.35	18.99	18.91
Number of registered cars (1,000 units)			2,043	2,168	2,441	2,691
Travel speed in CBD (km/h)			18.25	16.44	18.54	16.3

• Note: Seoul Statistical System, http://stat.seoul.go.kr/jsp2/Octagon/jsp/WWS7/WWSDS7100.jsp?stc_cd=141&lang=kor
• Source: Seoul Metropolitan Government Statisic System

circle. It caused bus users to make shifts to personal cars, and the increased private car usage further aggravated bus problems. Such a development served as a critical factor negatively affecting overall traffic conditions. Building urban railways required enormously high investment costs, thus imposing financial burdens on the central and local governments. Plus, it took too much time to build a new urban railway. Thus, urban rail could not be considered an effective option for addressing the pressing traffic problems. For these reasons, it became necessary to implement a public transport reform aimed at resolving urban traffic problems through the restoration of the proper functions of city buses.

2. Overview of the Bus Operation System[5)]

2.1. Introduction of the Quasi-Public Operation System

2.1.1. Quasi-Public Operation System

While pursuing reform of the Public Transport System, Seoul City made clear its intention to replace the traditional private operation system of city buses with a quasi-public operation system. The move was designed to strengthen the public-serving functions of the city buses.

Depending on its operating method, the quasi-public operation system can be divided into four categories: a route management type, a revenue management type, a commissioned management type and a partial public operation scheme. Under the route management scheme, the central and local government possesses the route license and operating right. Bus operators are consigned the operating right from the government through an open bidding process, and operate the route for a specific period of time. Under the revenue management scheme, the government manages the revenues, and ensures that deficits from low-profit routes are made up for on the basis of operational performance and estimation of costs. Under the commissioned management system, the government entrusts bus business cooperatives, legal entities or private operators with the operation of particular routes with financial

5) Seoul Metropolitan Government, "Convenient Public Transport, Happy Seoul Citizens," 2006. The contents of this book have been reconstructed in a way suitable for this paper.

aid to cover vehicle purchasing expenses and deficits. The partial public operation system refers to a scheme under which the public operation scheme applies only to some of the routes.

Seoul City sought to improve the quality of the bus operating environment through provision of proper infrastructure and flexible route adjustments based on demand through a route bidding system. To provide better bus operating services to the citizens, the city government also considered implementing a joint management scheme for routes, revenues and vehicles.

While developing measures to overhaul the public transport system, Seoul City tried to devise a scheme to ensure the bus system's public-serving functions within the framework of the conventional system based on the operation of private companies. In other words, the city government was concerned about how to form the framework of the quasi-public operation system. City Hall's draft plan called for the operation of buses on arterial routes based on a public management scheme, while envisioning the establishment of a revenue settlement organization and the improvement of bus services. The city government was pursuing these measures as core contents of the projected reform. However, efforts to reorganize the bus system on the basis of the quasi-public operation system did not go smoothly. A project to implement

Figure 3-1 Types of Bus Operation System

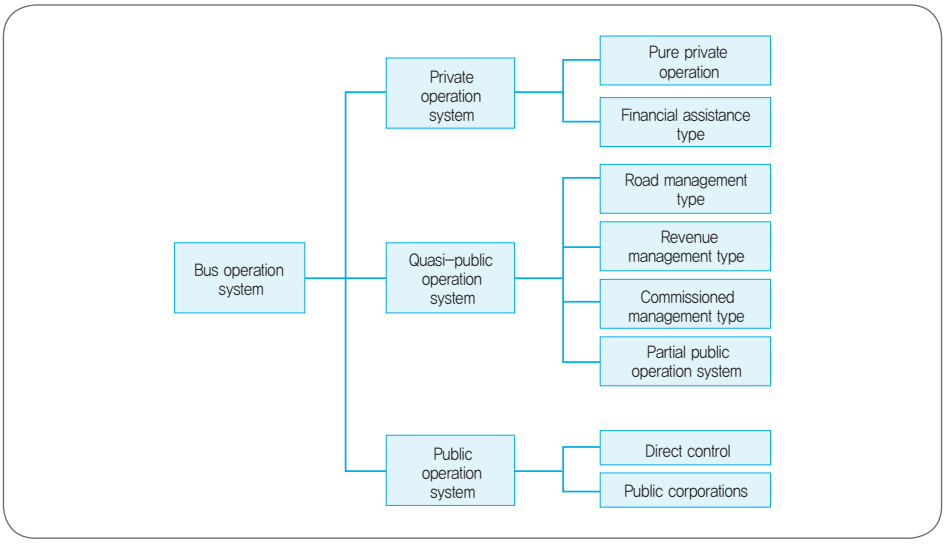


Table 3-3 Factors behind the Implementation of the Quasi-public Bus Operation System in Seoul

External factors	- Increase in the number of people using passenger cars (road congestion) - Need to supplement the functions of Phase 2 Seoul Urban Railways - Expansion of community bus routes
Internal factors	- Monopolized routes unable to cope flexibly with changes in demand - Financial difficulties due to rising operating costs and dwindling ridership - Dissatisfaction among bus users - Lack of incentives for efforts to create profits - Difficulty in securing workers
Economic factors	- Failure in route adjustment - Reinforced restrictions - Lack of support for autonomous management and restrictions on civic participation - Lack of mid-/long-term bus policies

the new system on a trial basis in northeastern parts of Seoul was aborted in July 2003. Afterwards, City Hall formed a "Bus Reform Civic Committee" and tried to find out ways of fundamentally reorganizing the bus system through discussions involving civic organizations, transport-related academic community and bus companies. Through these discussions, the city government could devise measures to determine the bus routes based on the consideration of citizens' convenience as well as profitability of bus companies.

Through fierce negotiations with management and bus cooperatives on reforming the bus operations system, City Hall hammered out an agreement and signed it with bus companies on Feb. 4, 2002. The accord included provisions for operating buses on 10 major corridors through a bidding system as well as for establishing a commission of bus companies for jointly managing fare revenues on the basis of the distance travelled by buses. Thus began the quasi-public operation system that is the framework of the public transport system today.

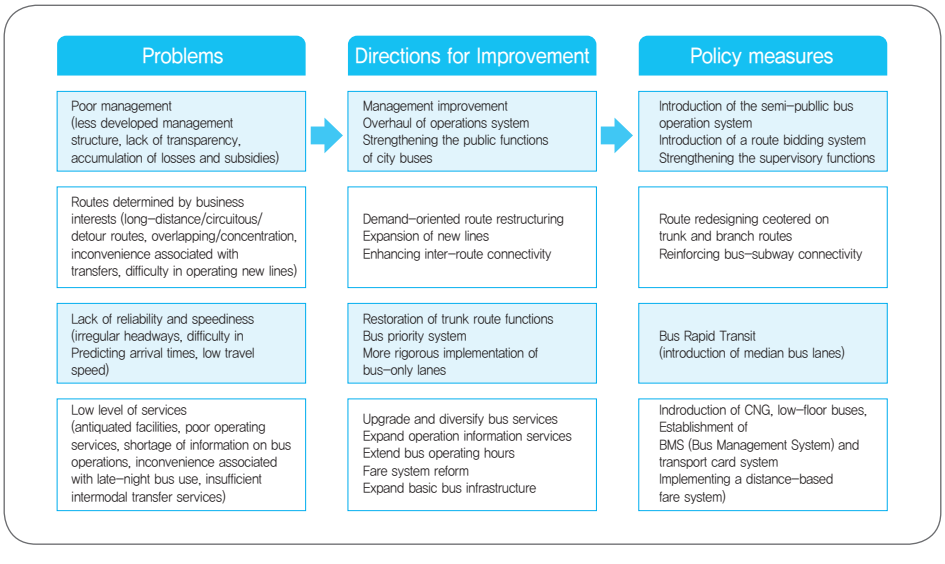
The quasi-public operation system is based on the principle that public benefits should be the leading criteria for determining bus routes and operating systems. It requires Seoul City government to build and manage bus infrastructure such as median bus lanes and public garages as a way of ensuring the principle. It also provides for a bidding system designed to select operators to run buses on major arterial routes. The operators are encouraged to cut costs through efficient management of the bus fleet and workers. However, fare income is managed by a separate settlement organization under a scheme to separate operations and revenue management. The system is also

intended to introduce a competitive system featuring the route bidding system and provision of subsidies, thereby laying down the groundwork for improving the welfare of bus drivers and ultimately bringing innovation to bus services.

The quasi-public operation system was based on three fundamental principles: public management, private operation and operational infrastructure. Public management refers to a scheme that allows the Seoul City government to determine and adjust the routes according to travel demand and establish a system to evaluate orderly operations, service quality and contract implementation. Operational infrastructure consists of two categories: one regards facilities such as public garages, median bus lanes, bus control headquarters, and bus priority system, and the other is about financial support to help cover the operating costs and guarantee optimum profits. Private operation refers to the formation of a consortium of the existing or new bus companies to implement managerial affairs such as cost settlement and management of vehicles, facilities and workers.

Seoul City decided to divide the Seoul area into five districts, excluding the central business district, and form a consortium comprised of companies that operate buses on contested routes for each zone. It also suggested selecting the consortia through a bidding system in a bid to ensure public transit functions of the routes and promote

Figure 3-2 Directions for Bus Service Innovation



healthy management of bus companies through the introduction of competition into the bus industry. In addition, the city government proposed inaugurating a revenue settlement center that would manage fare revenues and pay subsidies. The center would also manage bus operation records, as well as facilities and information. It also put forth basic directions for increasing the welfare level of trunk route bus employees, and decided to devise programs to provide incentives to model companies and impose sanctions on companies offering poor services. To provide legal support to reform efforts, the city government decided to promote the revision of the Passenger Vehicle Transport Business Act and relevant city ordinances

2.1.2. Process of Reaching an Agreement on Restructuring Bus Operation System

Discussion for bus reform gained steam in June 2003 with the inauguration of the "Bus Reform Civic Committee" comprised of civic organizations, professors, experts, relevant industries, the city council and other related organizations. With the launching of the committee, full-fledged discussion began over the issue of introducing a scheme to jointly manage fare revenues, which would be the backbone of quasi-public operation system. The joint revenue management system would also be accompanied by the reorganization of routes through autonomous adjustments. The Seoul Bus Transport Business Cooperative accommodated some of the opinions of its members by holding a special plenary meeting and signed the agreement with City Hall on Feb. 4, 2004.

Contents of agreement

- Implementation of route bidding system for 10 major corridors
- Ensuring a system to guarantee optimum profits
- Making compensation in case of vehicle redundancy
- Measures to dispose of the liabilities
- Safeguarding the business licenses of the 57 operators, while allowing content modifications
- Matters needed for executing the agreement should be determined through consultations between City Hall and the cooperative. When an agreement is difficult to reach, the civic committee plays the role as a moderator.

2.2. Action Plans of Quasi-Public Operation System

2.2.1. Joint Management of Fare Revenues

Under the joint income management system, all the fare revenues from city buses running in Seoul are pooled and allocated to the operators depending on operational performance. When the revenues fall short of the costs, the Seoul City government makes up for the shortfall through subsidies. This is to stabilize the management of bus companies by guaranteeing their income through financial support. This scheme was an essential factor that made the management of the bus companies agree on the city's public transport reform plan. The management came to share the view that they would not suffer losses under the joint revenue management system.

City Hall is in charge of route planning, service evaluation and cost evaluation, while the transit card company-affiliated clearing house settles the fare revenues on the basis of operational performance identified by the transit card system. Then, the joint bus operating committee (Bus Transport Business Cooperative) distributes the total revenue to bus companies. The committee settles total expenses for each route; the estimated deficit is made up for with subsidies from Seoul City.

2.2.2. Clearing Operating Costs According to Joint Operation Agreement of Bus Companies

City Hall and the bus companies reached an agreement on reforming the bus operation system in February 2004, accelerating the process of specific action programs for the reform. In particular, there was a need to ensure reasonable estimation and settlement of operating costs in order for the joint revenue settlement system to be successful. To encourage participation of bus companies in the voluntary route adjustment process, the city government needed to come up with a scheme to cover the operating costs. First, Seoul carried out a bidding process, targeting 19 routes on 10 corridors. As for the self-adjustment routes, the city government decided to pay for the operating costs in advance by considering the difficult financial conditions facing bus companies. To ensure objectivity, operating costs were estimated by two accounting firms, one selected by City Hall and the other chosen by the cooperative.

2.2.3. Major Stakeholders' Roles in Joint Revenue Management

a. City Hall

City Hall is in charge of route planning, service evaluation and self-adjustment of routes. By analyzing the bus operations information provided by the transit card company and Bus Management System (BMS) it provides route plans, funding schemes, financial support, operational information, and conducts an evaluation of operation services. When the operating income falls short of operating costs, City Hall provides financial support at the request of the Joint Bus Operation Committee. Additionally, it conducts an appraisal of bus companies and offers incentives/penalties based on the information on bus operations and monitoring results provided through BMS as well as operations information provided by Korea Smart Card.

b. Transit Card Company-Affiliated Clearing House

The clearing house provides bus operation information to City Hall, and offers comprehensive data on fare clearing information on individual routes, companies and various types of buses as well as operational performance, travel speed and passenger embarkation and disembarkation to the joint bus operation committee and bus companies.

c. Bus Transport Business Cooperative

The cooperative manages fare revenues jointly with Joint Bus Cooperation Committee. For joint management of bus fare revenues, the committee handles the business of joint revenue management in two accounts: bidding routes and self-adjustment routes. The income from bidding routes account is provided to bidding route operators, each of whom is given the amount that corresponds to their successful bidding price. The revenues from self-adjustment routes' account are settled according to operational performance based on the number of vehicles in operation and the per-km transport cost as stipulated in the joint transport agreement. When a shortfall occurs in fare revenues, adjustments are made through countervailing measures between the accounts. If the shortfall still cannot be covered, the committee asks the Seoul City government for financial support. In addition, the cooperative reports the settlement conditions to City Hall.

2.2.4. Ensuring Job Stability and Increasing Welfare of Employees

Seoul City believes that the quality of bus services could not be enhanced without dealing with the workers' concern about employment stability. Therefore, it suggested ensuring job safety of employees by making it a principle to use the existing buses when implementing bus reform measures, thus minimizing the number of buses that are made superfluous. In addition, it also proposed that priority should be given to qualified drivers in the existing companies when recruiting drivers for the routes determined through bidding. Moreover, city government prepared measures to relieve bus companies of financial difficulties that may be caused by simultaneous requests for severance pay by employees that transfer to new companies following the bus reform. Specifically, it revised city ordinances so that loans can be provided to such bus companies out of the fund designed to promote the development of small- and medium-sized businesses. In addition, city government took measures to prevent workers from suffering from any financial disadvantages due to their transfer to other companies.

The city government decided to improve the level of wages of bus company workers gradually over several years, while maintaining the principle that the wages and remuneration should be determined on the basis of a labor-management agreement. In addition, it suggested that bus companies devise guidelines for providing bonuses to individual workers depending on the number of accidents, job performance and passenger satisfaction level. It encouraged the companies to save money in preparation for the payment of retirement allowances. It also increased work efficiency through the application of a flexible work scheme (shift). For example, the conventional two-shift eight-hour work scheme was turned to a new method based on staggered work hours. A decision was also made to dispatch vehicles flexibly depending on hours, days of the week, and seasons.

2.2.5. Service Evaluation

With the implementation of the quasi-public operation system, a new bus service evaluation method was introduced. The new method was designed to induce voluntary efforts to improve management and services, instead of relying on the conventional regulations and penalties. The establishment of the BMS made it possible to monitor

bus operations in real time, while the transport card system allowed transparent management of revenues. These changes helped implement the new evaluation system effectively.

Article 76 of the Passenger Vehicle Transport Business Act stipulates poor management and substandard services as preconditions for revoking bus companies' business licenses. However, under the joint revenue management system, which guarantees bus companies' income through the scheme of making up for shortfalls on the basis of distances travelled by buses, such preconditions can hardly be met, unless companies display extremely uncertain business prospects or have a noticeably low level of assets. Therefore, as a means of checking the performance of bus companies, the Seoul City government decided to provide subsidies depending on the results of service evaluation. The evaluation outcome also serves as the basis for renewing contracts and awarding bidding qualifications to bus companies. Under these guidelines, the city government decided to conduct the evaluation twice a year to produce grounds for compensation or punitive measures. The city also decided to adopt a relative evaluation method and to apply it separately to self-adjustment routes and bidding routes.

The service evaluation is based on passenger satisfaction levels and operational achievements. Passenger satisfaction level is determined through questionnaire-style surveys, while operational achievements are measured through BMS and transit card data. The results of the assessment are used for providing incentives or implementing administrative sanctions.

A decision was reached to deposit a certain percentage of the operating profits to secure financial resources for incentives. City Hall also determined that the incentives could include administrative measures such as giving preferential right to participate in route bidding, simplifying the procedures for applying for permits to use public garages and facilities, and abating punitive measures against law violations. The city government made it clear that companies offering poor services would be subject to punitive steps such as route closure and bus fleet reduction. City Hall also stated that such companies would suffer disadvantages when readjusting bus routes and be banned from using public garages.

2.2.6. Bidding for Major Trunk Routes

Through bidding, Seoul City selected buses to run on 10 leading corridors, which all have symbolic significance. The bidding, designed to provide better transport services, was conducted between March and April 2004. Through the tender procedure, four companies were chosen to operate a total of 726 buses on 19 routes.

The bidding scheme was introduced as a way to increase the public functions of city buses as well as to ensure efficient bus operations and upgrade bus services. In addition to determining bus routes and operating schemes based on the prospects of increasing public convenience, the city government also stepped up efforts to establish infrastructure such as median bus lanes and public garages. The selected bus companies were encouraged to upgrade their bus fleet by securing jointed, handicap-accessible low-floor CNG buses as well as to secure a qualified workforce, such as drivers.

2.3. Bus Management System

Seoul City's bus operation and management organization plays a key role in adjusting the overall bus operations to provide convenient and efficient bus services to citizens, strengthen connections with other modes of transport, and develop effective bus policies. The organization supervises the joint operation committee comprised of private operators, and tries to maximize the utility of the entire bus industry through information sharing. Such affairs as policy decision, financial support, route planning and operation management are carried out by the Bus Management Department under the Metropolitan Transport Headquarters, while the collection and management of basic BMS data necessary for bus operations control is executed by the Bus Information Team under TOPIS, the Traffic Information Center.

The Seoul Bus Business Cooperative manages fare revenues jointly with Joint Bus Cooperation Committee, and allocates revenues to its member companies according to operational performance based on the number of vehicles in operation and the per-km transport cost as stipulated in the joint transport agreement. When a shortfall occurs in the fare revenues, the committee asks Seoul City government for financial support. The cooperative also reports the settlement conditions to the city

Table 3-4 Bus Management System of Seoul

	Supervisory organizations		Roles
Seoul Metropolitan Government	Bus Management Department	Bus policy team	- Policy development for effective bus operation - Supervise the implementation of the quasi-public bus operation system and provide guidance to bus cooperatives - Improve bus structure, deal with labor-management relations, operate bus drivers' qualification system - Evaluate bus services and conduct survey of public satisfaction level
		Management improvement team	- Estimate standard bus operating costs and conduct managerial and accounting analysis - Establish operating cost estimation guidelines - Evaluate managerial soundness and promote measures to improve management conditions - Conduct balance of payment analysis and devise financial support plans
		Financial support team	- Provide financial support and gasoline subsidies to city buses - Supervise the management of cash revenues and check the operating frequencies
		Route team	- Readjust bus routes and take steps to improve route efficiency - Manage the routes and bus dispatches by district - Manage bus statistics and analyze the data on bus operations
		Operations management team	- Manage city bus operations - Improve bus stops and install relevant facilities
		Community bus team	- Manage community bus operations, evaluate services, and readjust fares
	Traffic Information Center (TOPIS)	Bus information team	- Build and operate BMS for city and community buses - Manage bus route and bus stop databases - Collect and analyze bus stop arrival and departure information - Bus information service operation and management - BMS safe operations training and evaluation
Bus transport cooperative	Seoul Bus Transport Business Cooperative (consultative body for joint revenue management)		- Joint management of city bus fare revenues - Conclude collective labor and wage agreements and mediate negotiations - Conduct training of city bus drivers
Private company	Korea Smart Card		- Issue and manage Seoul City T-Money cards - Ensure maintenance of transit card operating system, including terminals and collection system - Integrated settlement of metropolitan public transport revenues

• Sources: Homepage from Seoul Metropolitan Government (http://traffic.seoul.go.kr), Seoul Bus Transport Cooperatives Union (www.sbus.or.kr) , Korea Smart Card (www.koreasmartcard.co.kr)

government.

Korea Smart Card Corporation is in charge of the operation and maintenance of Seoul City's mass transit card system as well as issuance of transit cards. Through the transit card system, the company collects information and data on revenue settlement by routes, companies and bus types, as well as operational performance, travel speed and embarking and disembarking. The combined data provided to the city government, the joint bus operation committee and the bus companies so that they can be used to ensure effective implementation of the quasi-public bus operation system. In addition, the company conducts the business of clearing public transport fare revenues by using transit card usage data from the Seoul, Gyeonggi Province and Incheon areas under an integrated revenue settlement scheme.

The quasi-public operation system has been introduced for the operational management of city buses in Seoul. Under the new system, the roles required to manage the operation of bus companies were divided among the Seoul Metropolitan Government, bus companies and relevant private-sector corporations. This scheme helped secure a stable operation environment. This resulted in a 14% improvement in the route operation rate and a 25.2% reduction in the number of accidents involving buses. As shown in these statistics, the change in the bus operation system has contributed significantly to ensuring public functions and the safety of bus services.

Table 3-5 Indicators for Bus Operation Achievements

Goal	Achievement indicators	Goal achievement rate
Ensuring a reliable public service	Operating rate	82.5% (2003. 12) → 96.4% (2004. 12) → 96.4% (2005. 6)
	Number of accidents (excluding property damage)	659 (2003. 7~8) → 493 (2004. 7~8)

• Source: Seoul Metropolitan Government, "Convenient Public Transport, Happy Seoul Citizens," 2006.

3. Contents of Bus Reform

3.1. Restructuring of Bus Routes into Trunk and Feeder Routes[6]

3.1.1. Problems with the Bus Route System in Seoul

a. Excessively Long and Circuitous Routes

The demand-centered operation of bus routes in Seoul in the early 2000s resulted in the operation of a number of inefficient routes, such as excessively long and circuitous lines. This scheme offered benefits of using the bus routes to just a

Table 3-6 Causes and Problems of Inefficient Routes

Categories		Long distance	Circuitous	Competition/ Overlapping	Shortage	Oversupply
Causes		Routes excessively lengthened due to garage locations and regional demand	Occurrence of winding routes due to demand within a region	Competition over routes between urban railways and buses	Occurrence of short-demand areas due to excessive pursuit of profits or structural reasons	Increase in headway because of shortages of routes or buses
Problems	User aspects	Increase in waiting period due to loss of reliability	Improved accessibility yet also an increase in travel time	-	Increase in wait time due to reduction in operating buses	Deterioration in the quality of service due to worsening overcrowding
	Operator aspects	Increase in accident risk due to driver fatigue and reckless driving to meet operating schedule	Increased risk of accidents due to operation along narrow roads in residential districts	Deterioration in financial conditions caused by excessive competition	A deficit factor in terms of management	-
	Social aspects	Deterioration in traffic congestion in the central business district and along major trunk roads	Deterioration in traffic congestion due to circuitous bus travel	Increase in inefficiency in the overall transport system	Difficulty in providing stable services due to reluctance to operate buses on low-demand routes	Reduction in the quality of services due to overcrowded routes

• Source: Seoul Development Institute, "Rational City Bus Reform Measures," 1995.

6) Seoul Development Institute "Seoul Traffic System Reform Action Plans," "Bus Route Restructuring, Bus Operation System Reform, Transfer System," 2004. The contents of this book have been reconstructed in a way suitable for this paper.

portion of bus passengers, eventually undermining the quality of public transport services throughout the city. In particular, compared to 1997, the number of routes that covered long distances of 50 km or more remained almost the same. However, there was a significant increase in the number of routes 70 km long or longer, when airport limousine buses were included in the count. The diameter of Seoul City's administrative area was about 30 km, but the average running distance was 34.1 km for regular buses and 57.7 km for express city buses. Long routes with running length of 50 km or more constituted 29.9% of regular bus lines and 71.2% of express city bus routes. The high-curvature routes were causing long travel times and traffic congestion. Passengers came to have a negative perception that buses naturally make detours, eventually avoiding bus usage.

b. Concentration of Routes in Specific Areas (Overlapping Routes)

Naturally, overlapping bus routes increase convenience for users. However, excessive concentration of routes within a limited number of sections causes some areas to be left with few public transport services. Excessive competition among bus operators are likely to result in worsening of management conditions and lowered efficiency in bus operations. They even caused difficulty in drawing bus route maps. Seoul showed quite a high overlapping ratio of 10.8: 10.7 for regular buses and 11.4 for express city buses. The buses' average competition ratio against urban railways stood at 36.09%. Sixty bus routes (56 for regular buses, and four for express city buses) showed the competition ratio of over 60% relative to urban railways. This finding was an indication that many of the bus routes were overlapping those of urban railways. To a considerable extent, the two modes were engaged in unnecessarily keen competition, instead of creating mutually complementary relations. This contributed to decreasing operational effectiveness of buses.

c. Discrepancy between Bus Users' Demand Patterns and Bus Operation

To secure their competitiveness against other modes of transport such as passenger cars, buses had to improve their speed and travel time reliability. However, the bus industry was unprepared to make improvements in such areas. Rise in income led to growing demand for high-quality or luxury services, yet the bus industry had no means to meet the demand, which led to losses in the marketplace. Inflexible routes

and services were making it difficult for bus companies to create new markets. In particular, there was no institutional mechanism encouraging bus companies to save some of their operating profits to spend on improving their services.

d. Lack of Bus Routes (Weak Connections)

The number of bus passengers continued to fall due to circuitous long-distance routes, excessive competition with urban railways, and the lack of efforts to improve services. The bus routes were determined amid excessive competition over profitable lines and estimations about travel demand. This approach led to a waste of time for passengers and operating losses for bus companies. It caused oversupply of bus services in some areas, and shortages of bus services in others. It also resulted in a shortage of effective intermodal connections. These conditions prompted calls for redesigning of bus routes to meet demand patterns and to increase accessibility to diverse areas by building connection systems (networks of bus routes and transfer facilities).

3.1.2 City Hall's Scheme to Redesign Bus Routes

a. Establishment of the Bus Hierarchy by Function

The fundamental framework of the public transport reform in Seoul was the reorganization of the bus route system. On the basis of functional classification, the bus routes were restructured into trunk lines, branch lines and metropolitan lines.

Trunk lines are long-distance routes. Buses on these routes run along arterial roads to ensure speedy mobility between regions. Branch lines are short-distance lines. Buses covering these routes usually run on local distribution roads to ensure convenient access to local destinations.

The Greater Seoul Area was divided into eight districts. To enhance the efficiency of bus operations, buses were categorized into general trunk line buses, metropolitan

Table 3-7 A Conceptual Drawing of the Bus Hierarchy by Functions

trunk line buses, general branch line buses and circular branch line buses. General trunk line buses handle demand for travel between regions within Seoul, while metro trunk line buses connect major outlying areas with Seoul's central/secondary business districts. General branch line buses handle demand for travel within regions. By connecting to trunk roads and urban railway stations, they play a role in handling demand for travel between regions. The circular line buses make it convenient to access business/commercial districts, and help to cope with internal travel demand within regions.

Table 3-8 Categories Classification of Bus Routes and Operational Features

Trunk lines	Blue Bus (Trunk route bus)	• Interregional connections among the central and secondary business districts and outlying areas • Ensuring mobility and reliability
	Red Bus (Metropolitan trunk route bus)	• Connections between satellite cities in the Seoul metropolitan area and central or secondary business districts • Meet the demand for personal car travel crossing city limits
Branch lines	Green Bus (Branch route bus)	• Connect between trunk routes and urban railways • Meet demand for travel within districts, and secure accessibility
	Yellow Bus (Circular branch route bus)	• Circular branch routes within the city center or secondary business districts • Meet demand for travel within central or secondary business districts

b. Criteria for Reorganizing the Route System

The criteria for restructuring the trunk and feeder routes were set by considering a number of factors such as their functions and roles, characteristics related to bus operation, usage, and connections with urban railways.

The lengths of bus routes were determined by considering urban space structure, travel patterns and operation hours. Also considered were service features and users' travel patterns. Trunk routes are long-distance lines directly connecting city limits or major city regions with the central or secondary business districts. Given road conditions and the fact that Seoul has a radius of about 15 km, the trunk routes were designed in a way that their two-way operating distance would not exceed 50 km. Exceptions were made for the lines that start from city boundaries, as well as for

long trunk routes that pass through the central business district. Optimal lengths for branch lines were determined by considering the fact that they were designed to ensure connections to trunk lines and urban railways as well as to facilitate connections within regions. The diameters of districts, except for those overlapping with the central business districts, were usually set at a level similar to the radius of the Seoul region. Therefore, the two-way distance for branch line buses was set at 30 km or less. However, exceptions were allowed for routes that extend to neighboring

Table 3-9 Criteria for Reorganizing the Bus Routes by Functions

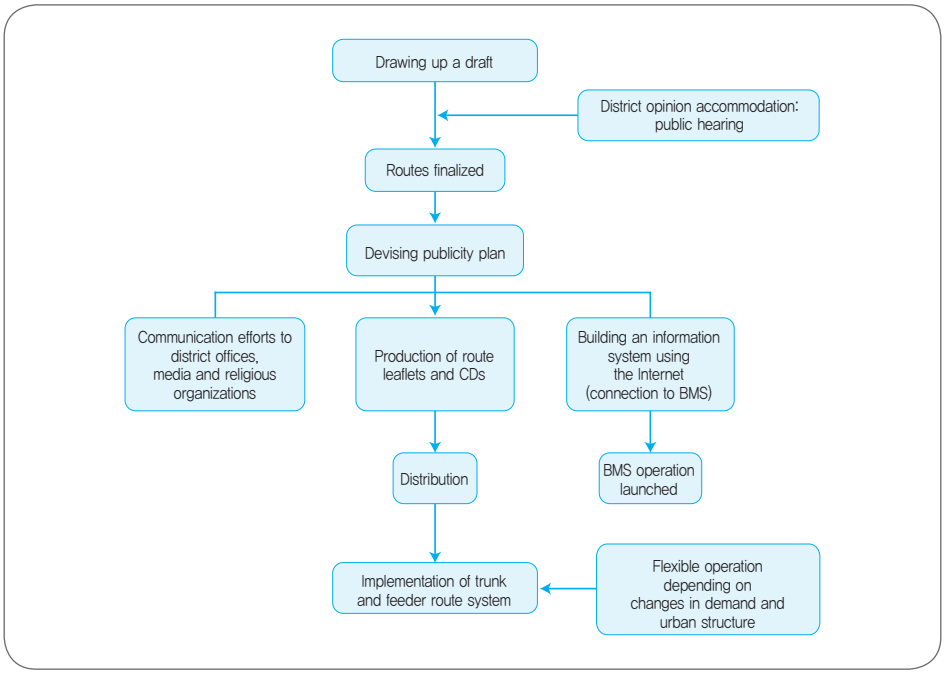
Categories	Trunk route functions	Branch route functions
Roles of routes	• Handle demand for intercity long-distance travel • Support urban railways on high-demand routes • Provide bus services to areas without urban railway services	• Connect trunk buses and urban railways • Operate around regional travel modes
User accessibility	• Provide walking access of bus services to 50% or more of bus riders	• Provide walking access of bus services to 90% or more of bus riders
User convenience	• Operate mainly on bus-only lanes to ensure speedy travel for long-haul passengers	• Mostly short-haul operations to reduce headway and ensure reliability
Operating road conditions	• Operations mainly on trunk roads	• Operations mainly on local distribution roads
Route curvature	• Maintain a direct course between departure and arrival points to the maximum extent	• Allow curved routes for some local distribution roads and roads in residential districts
Service diversification	• Provide long direct route services to remove transfer inconvenience in downtown areas • Provide metropolitan trunk services by considering demand for travel crossing the city limits	• Provide circular branch route services for specific areas by considering demand for shopping and business travel in commercial and business districts
Inter-route relations	• Allow duplicate operations of branch buses on major corridors to meet high travel demand. These and trunk route buses play mutually complementary roles	• Ensure that branch routes are not overlapped
Route supply	• Provide optimum number of routes and buses by considering the prospects of personal car users making modal shifts	• Provide an appropriate number of routes and buses by considering the function of ensuring connections to trunk route modes of travel
Operating conditions	• Designed to operate buses mainly on bus-only lanes to secure the reliability of trunk route buses	• Designed to operate mainly on local distribution roads. However, branch buses are allowed to use bus-only lanes to the extent that they do not negatively affect the operation of trunk route buses

• Source: Seoul Metropolitan Government, Internal Data.

districts.

The length of time needed for covering a route differs depending on the route length as well as road and traffic conditions. In addition to these factors, how long a driver can work aboard a bus during one ride was also considered. It was determined that normally, running one whole course on a trunk line would take 100 minutes to two hours. The estimation was based on the prediction that the average bus speed along the trunk routes would be 25~30 km/h with the introduction of bus priority measures, including the expansion of exclusive bus lines. As for the branch lines, it was decided that the driving time for one ride would not exceed 100 minutes.

Figure 3-3 Process of Bus Route Reorganization



3.1.3. Bus Route Restructuring

a. Route Restructuring

The final plan for bus route reform was determined through public hearings and procedures arranged by district offices to accommodate different opinions. The

Table 3-10 Number of Routes and Buses in Operation Before and After Reform

Before reform	After reform	Remarks
- Total of 367 routes, 8,139 buses • Regular bus: 255 routes, 6,638 buses • *Jwaseok* bus: 46 routes, 943 buses • Circulation bus: 66 routes, 558 buses	- Total of 410 routes, 7,856 buses • 80 trunk routes, 2,592 buses • 292 branch routes, 4,451 buses • 43 metro routes, 769 buses • 5 circulation routes, 44 buses	- Trunk route bus reform plan finalized (March 24, 2004) - Branch route bus reform plan finalized (April 23, 2004)

• Source: Seoul Metropolitan Government, Internal Data.

number of lines were set at 80 (2,592 buses) for trunk routes, 292 lines (4,451 buses) for branch routes, 43 lines (769 buses) for metropolitan routes, and five lines (44 buses) for circular routes.

Nineteen routes along ten major corridors were determined through a tendering system. Bidding was conducted for four districts (Dobong, Gangdong, Songpa, Eunpyeong). Bus operations on the routes began on July 1, 2004. The 10 leading corridors were determined based on the following criteria:

- The most important road corridors for travel between districts, serving as the basis for the city's network of buses
- High-demand routes with eight or more lanes, connecting the outskirts with the central business district
- Major trunk routes where median bus lanes were established, or were slated to be installed
- Routes whose connectivity with future public garages were secured

Four consortia, comprised of five companies or less, were selected as organizations that would run buses along the major trunk routes that would be supported by bus priority measures. These consortia, launched as corporations, would be given licenses effective for six years. They were chosen based on their bidding prices on the total costs for bus operations on the routes. Their revenues would be managed by a joint revenue management organization established under the joint transport agreement. Should the income from the operation of the routes fall short of the operating costs, the shortfall would be made up for with subsidies from the Seoul City government. Should the income exceed costs, it would be deposited into the joint revenue management body. City Hall launched a publicity campaign to minimize confusion over changed routes and the new numbering system.

b. Classification of Districts and Coded Routes

The buses were categorized by type, and were given coded numbers based on the division of Seoul area into eight districts (from 0 to 7). The system was designed to enable bus users to infer a bus's departure point, destination point and the route it would take just by looking at its number.

- Trunk route bus (Blue Bus): Runs along major trunk roads; operates between city outskirts and CBD, between CBD and secondary business districts, and between secondary business districts
- Branch route bus (Green Bus): Facilitates transfers to or connections with trunk route buses or urban railways; operates for short-haul trips within districts
- Circulation bus (Yellow Bus): Circles CBD or secondary business districts
- Metropolitan bus (Red Bus): Runs between outlying areas beyond the city border and CBD/secondary business districts in Seoul

Figure 3-4 Classification of Zones, Route Numbers

Type of Bus	Numbering System
Blue Bus 	**3-digit number : Departure + Destination + Bus ID (0~9)** Example: 048 0: This bus starts from District Area 0 (Jongno, Junggu, Yongsan) 4: This bus heads for District Area 4 (Seocho, Gangnam) 8: Bus ID number
Green Bus 	**4-digit number: Departure + Destination + Bus ID (11~99)** Example: 1 12 1: This bus starts from District Area 1 (Dobong, Gangbuk, Seongbuk, Nowon) 0: This bus heads for District Area 0 (Jongno, Junggu, Yongsan) 12: Bus ID number
Red Bus 	**4-digit number: 9 (Suburban Area) + Departure + Bus ID (00~99)** Example: 9112 9: The first number 9 means this bus serves suburban areas 1: This bus starts from Suburban Area 1 (Uijeongbu, Yangju, Pocheon) 12: Bus ID number
Yellow Bus 	**2-digit number: District + Bus ID (1~9) (1~9)** Example: 01 0: This bus circles District Area 0 (Jongno, Junggu, Yongsan) 1: Bus ID number

• Source: Personal blog, http://furia.tistory.com/78

c. Effects of Bus Route Restructuring

The route restructuring led to a 5.2% increase in bus travel speed. The curvature of the routes declined by 7.7% from 1.30 to 1.209. The length of a route decreased by

2.7 km, compared to the average length of a route (18.6 km) and the curvature (1.3) before the reform. Since average bus speed reached 18.1 km/h (after reform), it can be said that the length of time needed for covering a route went down by about nine minutes. This means that the total travel time of citizens was reduced by 92.5 million hours a year and that 8,749,000 liters of oil were saved in a year.

Table 3-11 Bus Routes Before and After Reform

Categories	Before reform (base)	After reform	Difference
Curvature	1.3	1.2	0.1
Shortest distance	29.7	29.7	-
Average route length (km)	38.6	35.9	2.7
Travel time (minutes)	128.0	119.0	9.0

- Notes: 1. Figures after the reform are not based on real measurements but estimations based on pre-reform curvature (1.2)
  2. The average route length after reform represents a value gained gram the multiplication of the pre-reform shortest distance (29.7 km) and after-reform curvature (1.2)
  3. Travel time figure is obtained by applying travel speed of 18.1 km/h
- Source: Seoul Metropolitan Government, "Convenient Public Transport, Happy Seoul Citizens," 2006.

Table 3-12 Effects of Bus Route Restructuring

Goal	Achievement indicators	Goal achievement rate
Mobility	Bus travel speed (km/h)	17.2 (2003. 11) → 18.1 (2004. 11)
Accessibility	Number of connected stations per route	9.66 (2002. 10) → 10.3 (2005. 6)

- Notes: 1. (Table 3-11)
  2. The smaller the bus service area, the better the condition
  3. A smaller variance in the population-to-bus route length ratios between districts indicates better conditions
- Source: Seoul Metropolitan Government, "Convenient Public Transport, Happy Seoul Citizens," 2006.

3.2. Bus Rapid Transit (BRT) and Median Bus Lanes[7]

3.2.1. Background to Bus-Oriented Road Operation

a. Growth in the Number of Cars and Traffic Population

Improvements in the general living standards of Koreans led to a rapid rise in private car ownership and the number of people traveling by personal vehicles. However, not enough efforts were made to improve public transport conditions, despite widespread demand in society for convenient and comfortable transport

7) Seoul Metropolitan Government, "Convenient Public Transport, Happy Seoul Citizens," 2006. The contents of this book have been reconstructed in a way suitable for this paper.

services. This caused an increasing number of people to depend on the use of their private cars.

The problem was particularly serious in the Seoul Metropolitan Area. There were not enough bus routes that could accommodate people commuting to Seoul from outlying regions without urban railway access. Moreover, the supply of buses could not meet demand during commuting hours. These conditions contributed to a rise in personal car traffic in the capital area.

The growing dependence on private vehicles resulted in increased energy consumption as well as traffic congestion, eventually causing social costs to rise. This situation prompted discussion on ways to ensure convenient and speedy public transport services. As an option, the idea of promoting a bus-centric traffic system began to be studied in earnest. This idea was favored over rail services because building new railways would be costly in both time and expense. The decision was also based in consideration of the prospects of offering flexible service and serving mobility-impaired citizens.

b. Need to Address Passenger Inconvenience

Urban railways and buses are the leading modes of public transport in Seoul. As for the urban railway system, it costs too much and takes too long to build a new urban railway. Taxis cannot properly function as a public transport mode, given its high fare level and relatively low passenger capacity. In comparison, buses can transport large numbers of people at relatively low cost, and serve wider areas than urban railways. Additionally, bus systems can be organized in relatively short periods of time. Therefore, there was a growing need to facilitate the use of buses with such strengths.

However, there were a number of problems with bus services. “Lack of reliability” was most frequently cited by citizens as one of the major problems of bus service, followed by “reckless driving” and “passing bus stops without stopping.” These problems occur due to congested road conditions, which make it difficult for buses to arrive at stations on time like urban railways. Thus, it became urgently necessary to introduce bus priority systems, which would help buses arrive at stations on time without speeding or reckless driving, and prevent bus drivers from passing by bus

stops due to tight schedules.

The bus reform initiated by Seoul City comprised of three categories: improvement of infrastructure facilities and systems, route restructuring, and improvement of operation system. The first category included a number of measures such as the introduction of median bus lanes, establishment of BMS, introduction of public transportation card system, expansion of transfer convenience facilities, and implementation of a discount fare scheme. In particular, provision of facilities for bus rapid systems, such as median bus lanes, played an important role in improving bus speed, reducing travel time, and ensuring punctuality.

3.2.2. Consideration of Median Bus Lane System

Due to a rapid rise in the number of cars and a limited supply of roads, the traffic situation in Seoul had seriously deteriorated by 2001, when City Hall began research on restructuring the city's public transport system. As for the operation of buses, there were chronic problems such as reduction in bus speeds and resultant poor reliability. Even before 2002, the city government had tried to address these problems by steadily expanding the scope of bus-only lanes.

However, the operation of the dedicated lanes, mostly curbside, had not led to drastic improvements in service because of the limitations of curbside lanes. Consequently, the city government made a bold decision to introduce the median bus lane system, a scheme known for its effects on improving bus travel speeds and securing reliability of bus operations.

The decision, aimed at overcoming the problems of the existing curbside bus lanes, helped prepare a blueprint for building a speedy, reliable and convenient bus system. It raised expectations that the bus service for passengers would be drastically improved. Seoul City also studied the prospects of applying other bus priority measures, such as bus-only roads, bus priority signals and bus gates, but decided they would be difficult to implement due to relevant restrictions. However, City Hall determined that it would be possible to introduce bus-exclusive signals consecutively in accordance with bus route plans. The outcome of research on bus priority measures can be summed up as follows:

a. Bus-only Road

The bus-only road scheme had a problem that building such a road would cost too much and take excessively long construction periods. This scheme is not very widely used worldwide. However, its feasibility could improve in the future because such roads could overcome the inflexibility of urban railways at relatively low costs.

b. Bus Priority Signal

If applied to only specific areas, bus priority signal system could cause problems such as a reduction in interconnection effects and an increase in congestion of other vehicles on access roads. Therefore, it is difficult to implement this system in areas where the general flow of traffic will be significantly affected by high volumes of bus travel. Most major trunk roads in Seoul are interconnected and have high volumes of traffic. Therefore, application of this scheme on such roads would only cause trouble. Further research is underway globally to address such issues. Seoul City also needs to continue R&D activities concerning this system.

c. Bus Gate

It would be possible to install bus gates at intersections with high volumes of left- and right-turn traffic, on roads with exclusive bus lanes. However, a pilot operation of these facilities was discontinued on the Dongsomun intersection because of the bus gate waiting space's low usage rate and high rates of signal violations. Another pilot operation carried out at the entrance of the Mia Overpass did not produce positive effects as desired.

d. Bus Exclusive Signals

Turns are prohibited in many areas of the central business districts or at major intersections of trunk roads. When opening new bus routes or redesigning existing ones, it was necessary to allow turns only for buses, to prevent unnecessarily long travel length and time. After the bus reform, Seoul City introduced this system for some places where turns were originally prohibited.

3.2.3. Installation of Median Bus Lanes

a. Routes Installed with Median Bus Lanes

The routes where median bus lanes would be installed were selected through screening by sections in the first stage, and then by routes in the second stage. Then, additional routes were chosen on the basis of the prospects of increasing connections between selected routes and efficiency as well as ensuring the supply of services for business or commercial districts.

In addition, the prospects of installing exclusive bus lanes for urban expressways were also studied as a way of allowing the metro-wide express buses to enter Seoul easily from the outlying areas.

A total of 92 road sections were chosen as candidates for the introduction of exclusive median bus lanes. Sixty of them were roads where bus-only lanes had previously been installed. Thirty-two others were selected in consideration of connections among arterial roads.

○ Phase 1 Selection of the Candidate Sections

A total of 92 sections were selected with the following criteria:

- Three or more lanes: Minimize the effect on other cars
- 50% or less in bus/urban railway overlapping rate: Relieve public inconvenience through provision of services to less connected areas in terms of urban railway/rail services, and encourage less passenger car use
- Passing through central/secondary business districts: Induce a reduction in passenger car use and encourage modal shift to buses in high travel demand areas through supply and improvement of bus service
- Traffic flows to major cities in the capital area: Induce a reduction in passenger car use and encourage a modal shift to buses in areas leading to satellite cities
- Bus traffic volume exceeding 150 vehicles per hour: Ensure efficiency relative to other automobiles, and meet installation standards for median bus lanes

Nine sections, including Gangnamdae-ro, Susaeng-no and Siheungdae-ro, satisfied all of the five criteria. Twenty-four sections satisfied four or five criteria, and 53 sections satisfied three or more. The last 53 sections were examined again for

Phase 2 selection process.

○ Phase 2 Selection of the Candidate Sections

The 53 routes were reclassified into 25 routes, and scrutinized under the following criteria:

- Connectivity with suburban cities and central/secondary business districts: Induce a reduction in demand for passenger car travel to central business districts and encourage modal shift to buses through ensuring connectivity with suburban cities and central/secondary business districts
- Sections with bus traffic volume exceeding 150 vehicles per hour make up 30% of the road or more: Enhance efficiency related to the continuity of routes, and ensure efficiency in relation to other vehicles

Eleven routes, including the Dobong~Mia-ro route, were found to be satisfying these two criteria. As such, they were chosen for installation of median bus lanes.

○ Other Routes Considered for Median Bus Lanes: Teheran-no~Olymping-no

Gangnam area has a concentration of business and commercial facilities from east to west and attracts large volumes of traffic caused by commute travel and business trips.

In addition, a considerable portion of trips from outlying cities (Hanam, Seongnam, Bundang, Yongin, Gwacheon, Euiwang) are also concentrated in this area. The 11 routes selected for median bus lanes are mostly radial type lines. Thus, an alternative route was needed for connections in the east-west direction.

The Seocho-ro~Teheran-no~Olymping-no~Pungnam-no route that stretches from east to west could enhance the effects of the median bus lanes through links to the Dongjakdae-ro, Gangnamdae-ro, Songpadae-no and Cheonhodae-ro, which were chosen through the above-mentioned screening process.

However, further research was required because this route had various geometric and structural problems such as an Olympic monument in the middle of Olymping-no, the urban railway ventilating opening on Teheran-no, narrow width of Seocho-ro, and a tunnel construction under way between Seocho Station and Bangbae-ro.

○ Exclusive Bus Lanes Considered for Urban Expressways

There was a growing need for reforming the metro-wide traffic system to ease the congestion problem caused by growth in travel demand following the rapid development of the capital region.

While developing the reorganization of metropolitan buses, Seoul City began to study the prospects of securing speedy travel by public transport from the outskirts to the central parts of the city through the use of the existing urban expressways. The city decided to select urban expressway routes where exclusive bus lanes could be installed. Seoul City was envisioning launching metro express bus lines along the six corridors, including Ilsan and Guri-Hanam corridors, based on the quantity of traffic that flows into Seoul and demand for travel between Seoul and its satellite cities.

b. Phased Implementation of Median Bus Lanes

Seoul City decided to install median bus lanes along 170 km of roads on 13 routes as part of the project to introduce bus priority system. The city plan called for installing bus lanes on six of the 13 routes in 2004 as Phase 1 project. Phase 2 project for the remaining seven routes was slated to start in 2005. The plan for the introduction of bus priority system is shown in Table 3-13.

Originally, Seoul City planned to start the operation of median bus lanes on six routes on July 1, 2004 in the initial stage. Ahead of this, the city had sought to implement a pilot operation of a median bus lane on the Dobong~Mia-ro section in 2003. The section was selected for pilot operation because it was predicted that the removal of the Cheonggye Overpass, on July 1, 2003, would cause congestion on roads leading from Dobong~Mia areas to Jongno. For the pilot operation, City Hall also worked out a plan to demolish the Mia Overpass. However, the envisioned "Pilot Reform in the Northeastern Parts of Seoul" did not come to fruition, and on July 1, 2004, median bus lanes opened only on three routes – Dobong~Mia-ro, Gangnam Dae-ro, and Susaek~Seongsan-ro-instead of the originally planned six. The original plan ended up in half success because of various factors; particularly opposition from bus companies, conflicts with local residents and the difficulty in conducting negotiations with local administrative bodies. Originally, median bus lanes were slated to open to traffic on six routes in July 2007, but due to delays in

negotiations with other local governments, the exclusive mid-road bus lanes only opened on three routes (Dobong~Mia-ro, Susaek~Seongsan, Gangnam Daero) on the scheduled date.

Table 3-13 Routes Installed with Bus Priority System and Phased Implementation Plan

	Routes	Routes	Lane type	Implementation stage	Length (km)	Number of lanes	Major intermediate places
Arterial roads	1	Dobong-no·Mia-ro	Median	Phase 1	14.0	7~9	Mia
	2	Mangu-ro·Wangsan-no	Median	Phase 1	10.4	6~7	Cheongnyangni, Mangu
	3	Cheonho-ro·Hajeong-no (section with median bus lanes)	Median	Under implementation	7.6	5~10	Cheongnyangni, Wangsimni
	3-1	Cheonho-ro·Hajeong-no (section without median bus lanes)	Median	Phase 2	8.3	6~11	Cheonho, Gildong
	4	Songpa-ro·Jayang-no	Median	Phase 2	9.6	5~11	Jamsil
	5	Gangnamdae-ro	Median	Phase 1	9.3	8~10	Yeongdong
	5-1	Gangnamdae-ro (Hannam-no section)	Median	Phase 1	6.5	6~10	-
	6	Dongjak-no·Sinbanpo-ro	Median	Phase 2	8.4	6~9	Sadang, Namhyeon
	7	Siheung-no·Hangang-no	Median	Phase 1	14.9	6~11	Daerim, Yongsan
	7	Siheung-no·Hangang-no (Noryangjin-no section)	Median	Phase 2	3.8	6	-
	8	Gyeongin-ro·Mapo-ro	Median	Phase 1	16.2	6~10	Yeongdeungpo, Gongdeok
	9	Gonghang-no	Median	Phase 2	10.3	6~8	-
	10	Susaeng-no· Seongsan-no	Median	Phase 1	8.7	6~8	Susaek, Sinchon
	11	Tongil-ro·Uiju-ro	Median	Phase 2	10.6	6~7	Yeonsinnae
	12	Teheran-no·Olymping-ro	Median	Phase 2 Long-term consideration	14.7	6~7	Sadang, Yeongdong, Jamsil, Cheonho
Urban express ways	13	Gangbyeonbung-no (Seoul/Goyang border~Mapo Bridge)	Median+ Curbside	Phase 2	8.6	8~10	-
	13-1	Gangbyeonbung-no (Seoul/Guri border ~~Jamsil Bridge)	Median	Phase 2	4.2	6~8	-

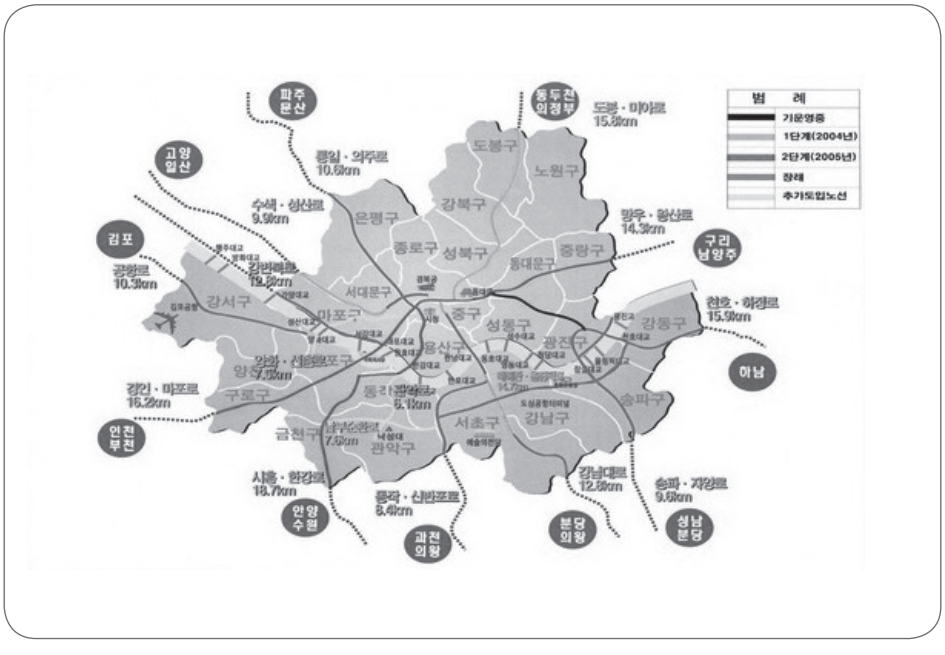
• Source: Seoul Metropolitan Government, "Convenient Public Transport, Happy Seoul Citizens," 2006.

Table 3-14 Phase 1 Routes to be Installed with Median Bus Lanes

Target routes	Length (km)	Number of lanes (two-way)	Project cost (100 million won)	Sections	Remarks
Dobong-no~ Mia-ro	15.8	7~9	131.5	Seoul/Uijeongbu border~ Mia Intersection~Jongno 4-ga Intersection	Opened in July 2004
Susaeng-no~ Seongsan-no	9.9	6~8	80	Seoul/Goyang border~Jeungsan Underpass~Bongeun Overpass	
Gangnam Daero	10.4	8~10	84	Sinsa Station~Yangjae Station~ Yeongdong 1 Bridge, Samil-no	
Siheung-no~ Hangang-no	14.9	6~11	139	Seoul/Siheung border~Daebang Underpass, Hangang Bridge~Seodaemun Intersection	Opened in November 2004
Gyeongin-no~ Mapo-ro	16.2	6~10	151	Seoul/Bucheon border~Yeongdeungpo Intersection~Mapo Bridge~Seodaemun Intersection	
Mangu-ro~ Wangsan-no	10.4	6~7	97	Seoul/Guri border~Sangbong Terminal~ Cheongnyangni Station~Dongdaemun	

• Source: Seoul Metropolitan Government, Internal Data.

Figure 3-5 A Median Bus Lane Route Map



• Source: Seoul City Blog, http://inews.seoul.go.kr/hsn/program/article/articleDetail.jsp?menuID=001001002&boardID=162373&category1=NC1&category2=NC1_2

3.2.4. Operation and the Effects of Median Bus Lanes

a. Operation of Median Bus Lanes

Before the installation of the median bus lanes on these three routes on July 1, 2004, the new system was tested through its pilot operation on Samil-no in March. Through this trial operation, City Hall confirmed that the median lanes were effective in improving bus speed remarkably. It also mapped out a systematic and comprehensive plan to conduct traffic management and monitoring so that the mid-road bus lane system could be firmly established. In addition, the city government intensified the publicity campaign to induce citizens' participation. From February through May, it distributed videos and leaflets containing the information on the median lanes for buses. City Hall publicized the new system through various news media throughout the month of June. Announcements on the exclusive bus lanes were aired every hour through the Traffic Broadcasting System. Banners and LED signs along roads were also used for the publicity campaign. In addition, advance inspection teams checked the lanes to diagnose possible problems.

The median bus lanes opened on July 1, 2004. However, public response from citizens was unfavorable. It had been raining slightly since the previous night, and the number of passenger cars on the road had soared due to the opening of summer sale period of department stores in downtown Seoul. On the first two days of operation, not only trunk route buses but also long-haul metropolitan buses and branch route buses used the median bus lanes, causing a long line of buses to fill the median bus lanes on Gangnam Daero; they were derisively called "bus trains." However, in about a month's time, public attitude began to change. On Gangnam Daero, the long-distance metro buses and branch route buses were diverted to use curbside stops, which helped to resolve the "bus train" problem. Citizens began to adapt themselves to the new routes and bus stops, and the speed of the buses running along the dedicated bus lanes improved noticeably. Amid these positive developments, citizens began to understand the bus reform policy and actively accommodate various related measures. Finally, bus reform began to produce the desired results, and one of the most important success factors was the implementation of the median bus lanes.

The most noticeable change brought about by the median bus lane system was that the timeliness of buses improved greatly. It became possible to predict when the bus will arrive and how long it would take to get to the destination. A growing number of people began to say that they could ride the bus to go to their appointments. Statistically, buses were found to be arriving at desired destinations one or two minutes off schedule, while passenger cars were usually four to five minutes off schedule. Bus speed increased by 33~100% depending on route, and transport efficiency rose to 1.75~2.8 in terms of the ratio of passengers transported. In addition, passenger comfort improved significantly as buses could run straight ahead along the red-colored median lanes without changing lanes frequently.

Phase 1 plan ended up installing median bus lanes on only three routes out of the originally scheduled six. Subsequently, City Hall mapped out Phase 2 plan for the remaining three routes. The focus of Phase 2 project was placed on securing timeliness of bus services, improving speed, and securing safety. The city government also devised a plan to expand median bus lanes to other major trunk routes. Through a survey of roads conducted on at least six lanes, three lines were selected additionally. They were Yanghwa~Sinchon-no (Gyeongin Expressway entrance~Ahyeon three-way intersection, 7.5 km), Gwanang-no (southern tip of Hangang Bridge~Seoul National University entrance, 6.1 km), and Nambu Beltway (Siheung IC~Sadang Station, 7.6 km). With these three routes, the total number of routes chosen for median bus lane projects rose to 16. Total length of median bus lanes on the 16 routes would be 191.2 km. In 2005, additional median bus lanes were built along a total of

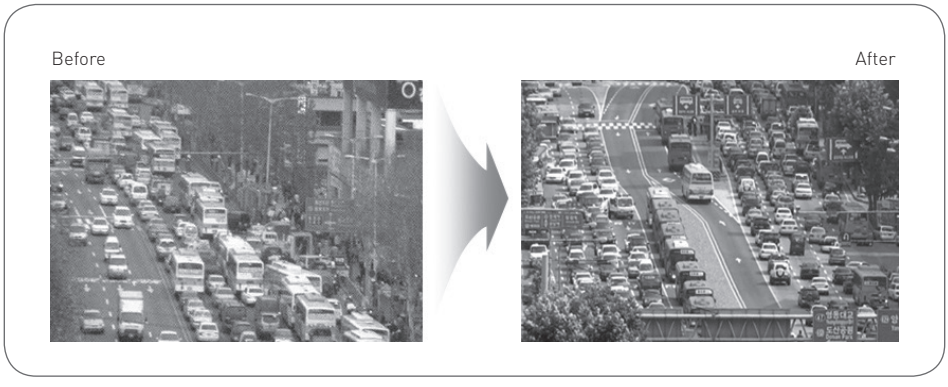
Table 3-15 Phase 2 Median Bus Lane Construction Sections and Periods

Routes	First half of 2005	Second half of 2005	Remarks
Mangu-ro-Wangsan-no	Mangu Station~Cheongnyangni (4.8 km)	Cheongnyangni~Dongdaemun (3.4 km)	Cheongnyangni~Dongdaemun section; completion of Cheonggyecheon Restoration work; urban railway construction work at Dongmyo Station (completed in December 2005)
Gyeongin-no-Mapo-ro	Oryu IC~Yeongdeungpo	Yeongdeungpo~Seodaemun (7.3 km)	Yeongdeungpo~Seodaemun rotary section; linked to Mapo Bridge expansion work (completed in December 2005)
Siheung-no-Hangang-no	-	Seoul/Anyang border Seodaemun (14.9 km)	Implemented at the same time as road pavement at Noryangjin-ro after Urban railway Line 9 construction (2nd half of 2007)

• Source: Seoul Metropolitan Government, http://traffic.seoul.go.kr

37.1 km sections on three of the 16 routes.

Figure 3-6 Road Traffic Conditions Before and After Median Bus Lane Operation



b. Effects of Median Bus Lane Operation

With the median bus lanes firmly established as key facilities in the bus-centric public transport system, Seoul City has been stepping up its efforts to turn them into more comfortable and safer lanes.

Since the implementation of the median bus lane system, the speed and reliability of buses have improved remarkably. Buses running on the median bus lanes were not off schedule by more than two minutes, comparable to one minute of urban railways. The progress was so impressive that buses now could be called "urban railways on roads." In addition, a decrease in buses changing lanes led to a reduction in safety accidents involving passengers. The congestion problem in Gangnam Daero, which was once so crowded with buses to the extent that a term "bus train" was coined, has been resolved. Therefore, more than 10% of those using passenger cars driving through that section of road were found to have shifted to public transport.

Seoul City has been exerting efforts to gradually improve problems with the median bus lanes established so far. At the same time, it has also devised a plan to push ahead with the project to install median bus lanes on the remaining routes out of the originally selected 16. The city is also making steady efforts to extend the existing median bus lanes, as in the Mangu~Wangsan-no and Gyeongin~Mapo-ro sections. Like urban railway lines, the median bus lanes are playing a key role in

connecting Seoul and the surrounding areas in the national capital region. Studies found that the establishment of median bus lanes led to improvement in the bus travel speed on the median bus lane sections by 31.74%. Timeliness was also found to have improved considerably, with the deviation between average and actual headways decreasing by 27.74%. Surveys showed that the number of passengers rose by 26.8%, indicating that the median bus lanes have contributed significantly to enhancing transport efficiency.

Table 3-16 Improvements Achieved through Median Bus Lane Operation

Goals	Achievement indicators	Goal achievement rates
Speed	Travel speed (km/h)	16.7 (2003. 12) → 22.0 (2004. 12)
Punctuality	Distribution of operation intervals	0.69 (2004. 7 curbside) → 0.56 (2004. 7 median) → 0.50 (200.6 2 median)
Transport efficiency	Number of passengers	Up 26.8% (2004. 12 → 2005. 12)
Cost reduction	Travel cost reduction benefits	Savings of about 225.1 billion won

• Notes: 1. The speed refers to the average travel speed on general roads before reform, and the average travel speed on median bus lanes after reform.
2. Punctuality refers to the gap between the average and actual headways. The closer to 0, the better.
3. The number of passengers was based on figures collected from the median bus lanes that opened in 2005 along the Mangu-Wangsan-no, Gyeongin-Mapo-ro and Siheung-Hangang-no.
• Source: Seoul Metropolitan Government, "Convenient Public Transport, Happy Seoul Citizens," 2006.

3.3. Improvement and Expansion of Bus Transfer Facilities[8]

3.3.1. Public Transport Transfer Center

a. Background

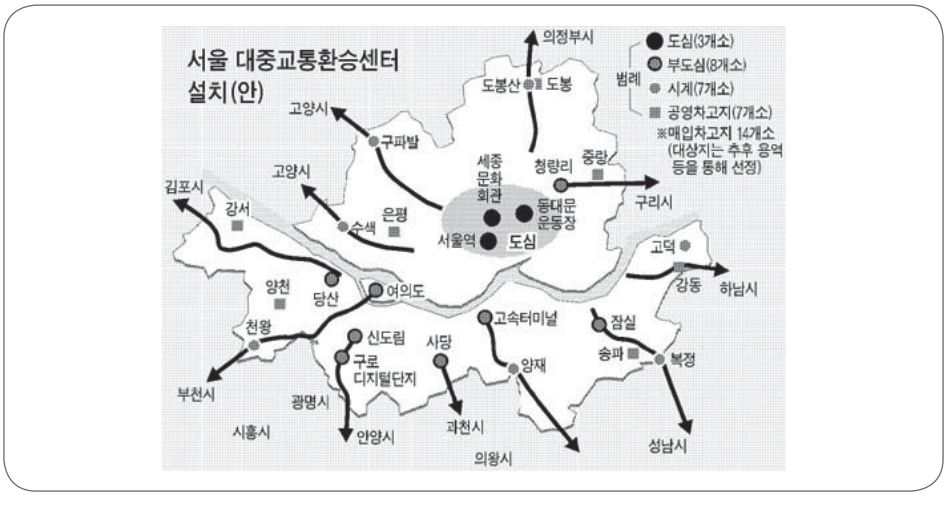
In the early 2000s, traffic conditions were deteriorating by the day due to the excessive number of city buses and passenger cars that moving into central districts from the city outskirts. Some suggestions were made that road conditions would improve significantly if the private car or bus users moved into the central districts by transferring to buses or urban railways at transit centers. Research showed that the number of public transport users would rise if improvements were made to address the inconvenience of walking long distances to transfer from one travel mode to another.

8) Seoul Metropolitan Government "Convenient Public Transport, Happy Seoul Citizens," 2006. The contents of this book have been reconstructed in a way suitable for this paper.

a) Directions for promoting transit centers

- Establish transit centers at traffic nodes linking urban railways and buses along major corridors
- Focus on increasing user convenience by minimizing time and distance for transferring to public transport
- Form transfer networks by zones in the city center, sub centers and the outskirts
- Pursue connections with related projects, such as "New Town" development, median bus lanes, BRT and public-private partnership projects

Figure 3-7 Establishment of Public Transport Transfer Centers in Seoul (draft plan)



• Source: Joongang Ilbo, "Seoul to build transfer centers in 25 locations," http://article.joinsmsn.com/news/article/article.asp?total_id=448318

b. Selection of Project Implementers

Through analysis of traffic conditions and other regional conditions, City Hall designated 22 candidate locations for transit centers: three in the central business districts, eight in secondary business districts, seven at city boundaries, and four at the outskirts.

- Central business districts (three locations): Seoul Station (construction completed), Dongdaemun Stadium, in front of Sejong Center for the Performing Arts

- Sub centers (eight locations): Cheongnyangni, Yeouido, Dangsan Station, Jamsil Station, Guro Digital Complex Station, Express Bus Terminal, Sindorim, Sadang
- City limits (seven locations): Dobongsan, Gupabal, Yangjae, Godeok, Susaek, Cheonwang, Bokjeong Station (construction completed)
- City outskirts (four locations): Gwanmun Intersection, Gyomun Intersection, Siheung Intersection, Seoksu IC

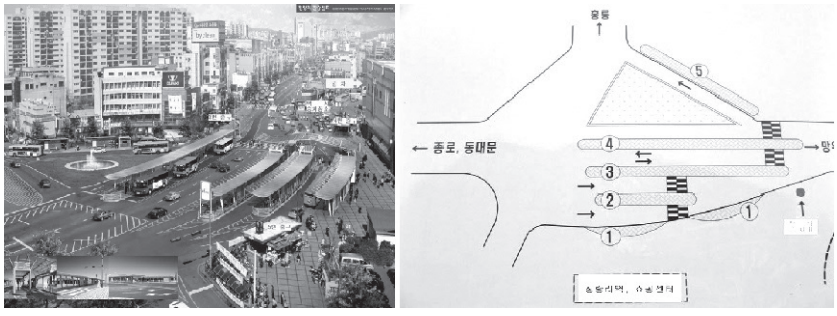
Transfer centers have already been built at Seoul Station and Bokjeong Station. The center at Seoul Station has been upgraded in connection with traffic system changes expected around the station. Cheongnyangni transfer center opened on July 3, 2005, along with the median bus lanes along the Mangu-ro. On July 10, Yeouido transfer center opened with the median bus lanes on Gyeongin-no. On Dec. 10, the Guro Digital Complex transfer center opened along with the median bus lanes on the Siheung~Daebang-no section. Plans have been developed to build transfer centers at Express Bus Terminal and Jamsil Station as well. Gupabal transit center is being planned in connection with the Eunpyeong New Town project. A transit center project is being promoted for Sadang Station as a public-private partnership project.

c. Effects of Transfer Centers

a) Cheongnyangni Transfer Center

The Cheongnyangni area is a major public transport node that attracts large volumes of traffic. It is a place where passengers can transfer to various travel modes such as subways, buses and railroad. However, passengers were experiencing inconvenience as they had to walk 100~200 m for a transfer from one mode to another. The center is now equipped with facilities that can accommodate all types of buses –metropolitan, trunk and feeder route buses. The distance passengers have to walk for a transfer has been reduced to 50 m or less, and shelter facilities have been upgraded. Through the integration of numerous bus stops, which had previously been scattered in nearby areas, the center has contributed to facilitating the use of public transport. As of 2005, the center was accommodating 56 bus routes. The number of buses passing through the center reach 450 an hour. The number of passengers using the center amount to about 60,000.

Figure 3-8 Cheongnyangni Transfer Center

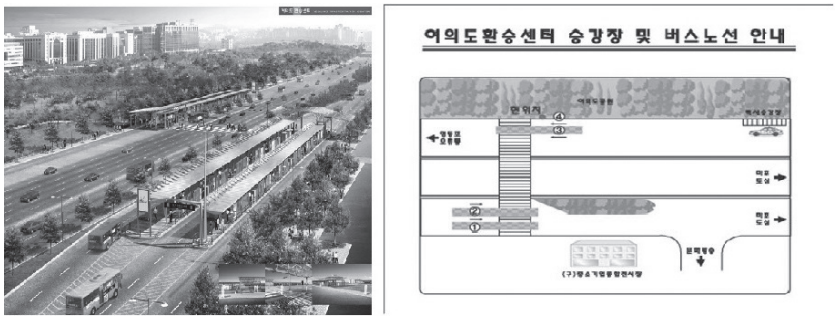


• Source: Metropolitan Transport Association, http://www.mta.go.kr/app/trans/center/center_detail_list.jsp?inst_no=13

b) Yeouido Transfer Center

As the transfer center nearest to the central business district, the Yeouido transit center was designed to serve as transfer hub for passengers heading for Anyang, Eunpyeong, Songpa and other areas of Seoul. The opening of the center also helped reduce traffic congestion around Yeongdeungpo Station significantly by providing forwarding points for metro-wide buses. When the center opened, there were only three bus routes available. The number of bus routes using the center has since increased to 35. Demand for the center is expected to rise drastically when AIG Finance Center and other large facilities are completed in Yeouido.

Figure 3-9 Transfer Center at Yeouido



• Source: Metropolitan Transport Association, http://www.mta.go.kr/app/trans/center/center_detail_list.jsp?inst_no=6

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c) Guro Digital Complex Transfer Center

This center is mainly used by local residents who transfer to a Seoul Urban railway Line 2 train after arriving here by on community buses. By ensuring connections to median bus lanes on Siheung Daero, this center contributes to promoting the convenience of citizens using branch route buses. Bus operation frequencies have been increased by an average of two times a day per bus, thus making it possible for the local residents to use the buses without having to wait for long periods.

The opening of the center has helped relieve traffic congestion on nearby roads which had previously been crowded with buses. The transfer passage from urban railway to bus, or vice versa, has been reduced in length to less than 50 m, thereby improving user convenience.

Figure 3-10 Guro Digital Complex Station Transfer Center

• Source: Metropolitan Transport Association, http://www.mta.go.kr/app/trans/center/center_detail_list.jsp?inst_no=5

3.3.2. Bus Stop Red Zones

a. Background

The red zone can be defined in terms of outside appearance and function. As for appearance, the pavement of the zone is made of red-colored material different from asphalt in a bid to increase visibility and differentiate it from other lanes. Functionally, it is designed to enhance awareness of citizens about unlawful driving or dropping off passengers in bus zones. It is colored red to indicate that buses have

priority to use the zone and that other vehicles are prohibited from using it.

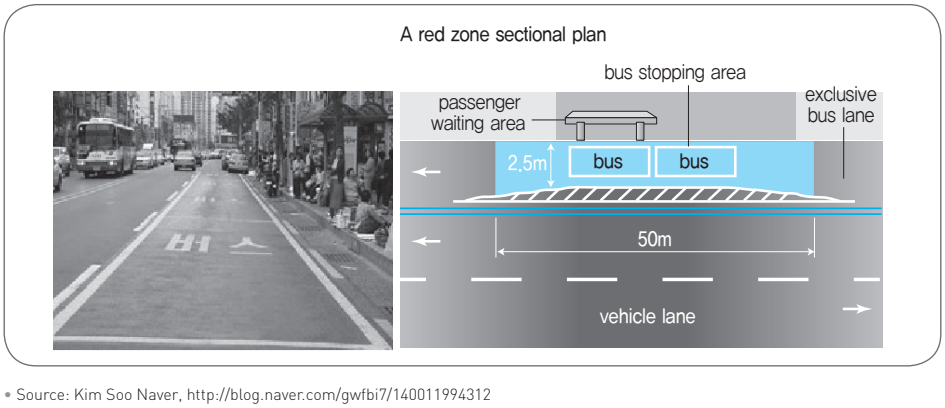
The purpose of the red zone is to prevent other vehicles such as private passenger cars or taxis from stopping or parking near bus stops, thus ensuring smooth entry of buses into the stops. It is also designed to help protect the safety of citizens getting on and off the buses. Equipped with anti-slip functions, the red zone pavement helps to promote the safety of buses in rain or snow.

b. Installation Status

Red zones were first installed at bus stops near Hongik University Subway Station in April 2004 on a trial basis. Conducted at the same time as the introduction of median bus lanes, the red zone project was designed to improve the functions of the existing curbside bus-only lanes. The red zone proved to be effective in monitoring by City Hall and the Seoul Metropolitan Police Agency. It also drew favorable responses from operators of buses running along the route. Encouraged by the favorable results, the Seoul City government implemented the red zone project in full-fledged manner beginning in 2005. Implemented first at the Jongno section in April, the project expanded to cover 428 bus stops along 39 routes throughout the city.

In addition to using the pavement made of red-colored material, the Seoul City government improved the road signs, repainted the lines to help buses stop at correct places, and installed walls near the sidewalk to ensure passengers' safe embarking and disembarking. To ensure effective spending of the relevant budget and prevent redundant work, the red zones were installed at the same time as other road pavement works.

Figure 3-11 A Bus Stop Red Zone



• Source: Kim Soo Naver, http://blog.naver.com/gwfbi7/140011994312

c. Effects of Red Zone Installation

The establishment of red zones has helped prevent illegal parking or stopping of taxis or personal cars at bus stops within exclusive bus lane sections, thus helping to increase bus speed and allow buses to have the right of passage. In addition, it has contributed to improving the qualitative level of transport culture in Seoul.

The desired effects of red zones were not attained immediately after their installation. Efforts should be made to effectively maintain them. Installation should be accompanied by training and enforcement as a way to help the public become aware of the purpose of the red zones. Only then will the bus stops with red zones be able to establish themselves as spaces reserved for buses.

3.4. Fare System Reform[9]

3.4.1. Problems with the Conventional Public Transport Fare System

The metro rail system in the capital area applied different criteria in determining the fares: a zone-based scheme for travel within the city limits, and a distance-based system for travel outside. This difference caused unfairness in terms of fare burden. For example, fares for the same distance of travel might differ depending on whether the travel was made in or outside city boundaries.

(Ex.) • Out of city limits (Geumjeong Station~Ansan Station, 19.5 km): 850 KRW
• Within city limits (Nakseongdae~Gubeundari Station, 19.4 km): 700 KRW

In addition, some regions were under the administrative jurisdiction of Seoul City but categorized as distance-based fare districts. Residents in such regions had to pay additional fares.

(Ex.) • Dobongsan, Dobong and Banghak Stations outside the limits of Changdong and Suraksan Stations
• Guro~Siheung and Guro~Onsu sections outside the limits of Namgu-ro and Sindorim Stations

Even within city limits, there were some cases where travel distance within one

9) Seoul Metropolitan Government, "Convenient Public Transport, Happy Seoul Citizens," 2006.

zone was longer than that over two zones. In such cases, those travelling in two zones had to pay higher fares.

(Ex.) • Long distance within a zone (Yeongdeungpo~Jamsil, 24.2 km): 600 KRW for one zone
• Short distance over two zones (Apgujeong~Sinimun, 10.8 km): 700 KRW for two zones

Under the system that determined fares regardless of the distance traveled, metro users could not easily understand the criteria for calculating fares. Many also had complaints about the irrational system under which passengers had to pay high fares for short travel distances.

The biggest problem with buses was that, unlike urban subways, they provided no transfer discounts. Thus, those who could reach their destinations with just one ride paid half the price paid by travelers who had to transfer from one bus to another, regardless of the distance travelled.

The conventional system did not allow transfer discounts between different modes of travel, either. Because of the disconnected fare scheme, fare burden doubled when doing transfers, regardless of whether the transfer was from subway to bus, from bus to subway, or from a common city bus to local area bus. This was a disadvantageous system for those who lived far away from urban railway stations or who had to ride local area buses to reach subway stations.

3.4.2. Contents of Fare Reform

The conventional public transport fare system in Seoul had chronic operating deficits, which resulted in low quality of services and user inconvenience. Seoul's public transport network had an inefficient operating system compared to metropolitan cities in other advanced countries, as shown in the case of having to move along long passages for transfers.

a. Directions for Public Transport Fare Reform

a) Ensuring Fairness for Transport Users

As for subways, there was a need to address the problem of short-distance travelers

paying higher fares than long-distance travelers due to the irrationalities in the zone system. More and more people called for measures to correct the irrational fare application criteria regarding travel across city boundaries. To tackle these problems, it was necessary to consider introducing a distance-based fare system that imposes incremental fares according to distance travelled beyond the basic-fare.

b) Reflecting on Operators' Income Conditions

The average transport cost per passenger is much higher than the average revenue per passenger, causing a drop in the quality of public transport services. The decreased quality of service, in turn, further aggravates the situation as it leads to a fall in the number of passengers. It was therefore desirable to create a new effective fare system through provision of new types of services, rather than habitually relying on fare hikes as a way of recovering the costs.

c) Diversifying the Fare System for User Convenience

Efforts should be made to lessen the fare burden of public transport users through active introduction of various discounts such as different fares depending on hours of the day, passes or free day tickets, and integrated fare tickets.

d) Relieving the Fare Burden Related to Intermodal Transfers

Given the fact that passengers in Seoul use transfers more frequently than their counterparts in foreign metropolises, the current existing discount rate of around 7% is insufficient. Through further transfer discounts, transfer users should be relieved of their fare burden. Discounts should be available not only for transfers between bus and metro, but also between buses.

b. Guidelines for Determining Fare Levels

Regarding its projected fare reform, Seoul City set the following three principles for determining fare levels.

First, public transport fares should be determined at a level where the cost of providing service can be covered by passenger fares. In case the revenue falls short of the cost, operators will become less enthusiastic about the business. At present, due to chronic deficits, organizations or companies operating public transport cannot

afford to invest in projects to improve services. Second, the value of service and the fare level ought to be decided according to users' perceived quality of service. The higher the quality of service, the higher the consumer demand; therefore, the costs for raising the level of service will be reflected in the process of determining fares. Third, fare burden must be decided on the basis of the users' ability to bear them. Here, the fares include discounted fares for children and the elderly.

The consideration of the three principles – cost compensation, service value and the ability to bear the fare burden – led to an increase in the basic fare at the beginning, drawing complaints from citizens. However, the reform eventually helped promote fairness in terms of public transport fares. Residents of unfairly disadvantaged areas, due to transfers, had to pay twice as much as the normal fare even when traveling short distances. Now they no longer had the burden of paying the additional fare for transfers. And, those in the neighborhood of subway stations, who paid the basic fare even for long-haul trips, came to pay additional fares depending on the distance travelled. The burden of long-distance commuters was relieved with the introduction of a regular pass system for subway trips. As explained so far, Seoul City determined the fare levels on the principle of its reform philosophy emphasizing fairness.

c. "Integrated Distance-Based Fare System" for Both Buses and Subway

The integrated fare system based on distance travelled allows users to transfer from one mode of transport to another without paying an additional basic fare. Under this scheme, people using local area buses to subway stations pay the fares in accordance with the distance they travelled, without having to pay the transfer charge. Therefore, this scheme makes it possible to relieve low-income individuals of the mass transit fare burden. This scheme gives the biggest benefits to short-haul travelers who use frequent transfers from subway to bus, and vice versa. However, this system has a drawback: it takes too long to embark or disembark buses because of the need to place the card on the sensor. Besides, as passengers can learn of the final fare only when getting off buses, they cannot predict the fare they need to pay. Such a scheme also makes it complicated to settle the fares. The most crucial weakness of this system is that long-haul travelers have to bear the most fare burden.

Seoul City decided to simultaneously implement two fare schemes: the Integrated Distance-based Fare System that is applied for both subways and buses, and the "flat fare system" applied to buses travelling across city limits. The Integrated Distance-based Fare System based on the two schemes became the framework for restructuring the city's public transport fare structure.

In the process of completing the integrated fare scheme, there arose a need to address the irrationalities in the metro zone system and consequently devise a more trustworthy method of imposing fares. The Integrated Distance-based Fare System was considered a good option in terms of the need to reduce the city's debt through cost recovery on metro lines. It was also regarded as a favorable scheme from the perspective of ensuring fairness among individual riders. Introduction of the integrated fare system makes it possible to operate and manage the two differently operated public travel modes in a user-oriented integrative manner. The scheme will improve public convenience and raise competitiveness of public transport modes at the same time. In addition, it can transform the fare system under the benefit principle, and minimize the unreasonable burden of paying transfer charges.

a) The Concept of the Integrated Public Transport Fare System

The Integrated Distance-based Fare System is applied to all modes of public transport operating in Seoul.

* Fair calculation formula: Basic fare + additional unit fare (distance travelled-basic fare distance)/additional unit distance

In order to prevent excessive increases in long-distance travelers' fare burden, it was decided that a flat rate would be applied to travel distance of 40 km or more. By considering the value of services, City Hall also decided to apply different basic fares to different modes. Within the boundaries of Seoul, the distance-based system, as shown in the formula above, applies to both urban railways and buses. However, as for buses travelling across city limits, the city government decided to apply a flat fare system.

As for urban railways, the city government decided to expand the distance-based system to cover trips made within the city limits. Consensus was reached that passengers should pay the basic fare for distance of up to 10 km, and additional fares

for every 5 km outside the basic fare range. The city government decided to also apply the same scheme to buses. However, considering the fact that about half of bus passengers travel 6 km or less in a trip, the city determined to apply the conventional flat rate for bus-only trips.

d. Implementation of the Integrated Public Transport System and Its Effects

Before the implementation of the new fare plan, Seoul City faced a big hurdle: opposition from urban railway operators and the bus industry of Gyeonggi Province. The Seoul City government could reach agreement with urban railway operators without much difficulty because both Seoul Metro and Seoul Metropolitan Rapid Transit Corp. were affiliated with Seoul City Hall. However, the city government had to go through difficulty clearing differences with Incheon Rapid Transit Corp. and Korail. The projected shift to an integrated distance-based system would inevitably lead to a rise in the basic fare. Seoul Metropolitan Subway passengers had previously paid 650 KRW in discounted fare when paying with a mass transit card. Under the new scheme, they would have to pay 800 KRW for a ride over basic-fare distance. In return for raising the basic fare, Seoul City was to offer transfer discounts. However, the railroad administration had not prepared for such measures, as they believed they could not avoid complaints from riders. However, they finally agreed to Seoul City's plan, placing general public interest before their organizational interests. But the city had to overcome yet another obstacle: complaints that the level of fare hikes seemed too much for long-distance travelers. Facing the complaints, City Hall decided to raise government subsidies for long-distance passengers, and finalized the fare reform plan. The finalized plan set the basic distance at 12 km and the additional unit distance at 6 km. The agreement came through just 10 days before the reform was formally announced on July 1, 2004.

Implementation of the integrated fare system prompted the need to deal with passengers traveling across city boundaries. For example, some Gyeonggi residents may enter Seoul aboard a Gyeonggi bus, and transfer to a Seoul bus and sometimes, a local area bus as well. Because of the free transfer scheme, a bus company's profit shortfall should be made up for with subsidies from local governments. Therefore, there arose controversy over who should pay the subsidies in the case

of passengers using both Seoul and Gyeonggi buses. Various proposals were made aimed at tackling the problem. One of them was to conduct surveys at the Seoul-Gyeonggi boundaries to determine the ratio of Seoul and Gyeonggi passengers. The percentages of subsidy burden should be decided according to these ratios, advocates of this proposal suggested. Another proposal called for using the departure locations of passengers as the criteria for determining whether the local government should pay the subsidy. Amid such controversy, the Seoul City and Gyeonggi Province governments had several rounds of negotiations. In January 2005, the Gyeonggi Province government agreed to accept Seoul City's integrated fare system and revenue settlement principles.

Seoul City's public transport fare reform aimed to facilitate the use of public transport and ensure transparency of revenue settlement. Post-reform research shows that users' average fare per trip went down by 4.5% to 592 KRW from 620 KRW before the reform.

As for the buses, the average fare per trip was found to have fallen from 620 KRW to 574 KRW. In terms of trips for specific purposes, the average fare dropped from 821 KRW to 802 KRW, according to the research. Because of the free transfer benefits, mass transit card usage rate reached 88.9% in December 2004, up by 11.5% from a year earlier. This increased rate of transit card usage was improved revenue transparency considerably.

Table 3-17 Change in Per-trip Fare Before and After Fare Reform

Goals	Achievement indicators	Goal achievement rates
Inexpensive fare	Fare per trip (KRW)	620 (2003, second half) → 592 (2004, second half)
Revenue transparency	Card usage rate (%)	77.4% (2003. 1) → 88.9% (2004. 12)

• Source: Seoul Metropolitan Government, "Convenient Public Transport, Happy Seoul Citizens," 2006.

4. Bus Transport Operational Management System[10]

4.1. Bus Management System (BMS)

4.1.1. Background to Implementation

Public transportation in Seoul has a daily ridership as many as 18 million. In pre-reform years, transit users had a desire for diverse bus services. However, Seoul City government failed to satisfy public aspirations, displaying a serious problem with its public transport system. The problem was related with a number of factors, including a rise in personal car ownership, the deteriorating profitability of bus companies and the resultant fall in the quality of service, and buses' market share stagnation compared to subways. Faced with these problems, the city government needed an innovative mass transport policy to address the congestion problem of the city's saturated road network without building new metro lines that would require an astronomically high amount of costs. Against this backdrop, Seoul City reached a conclusion that it should establish a cutting-edge traffic information system to provide high-quality services to public transport users.

Seoul City had developed a number of fragmentary traffic policies during the previous 20 years, and some of them brought about temporary positive effects. However, to address its fundamental transport problems, it needed to develop an inexpensive and integrated system that can organically connect stakeholders from various interests (City Hall, transport companies, drivers, and riders). The city government needed a comprehensive bus management system beyond policies aimed at promoting practical measures, such as expansion of the bus operation infrastructure (bus-only lanes) and provision of fuel subsidies.

Seoul City government needed to build the best possible system that could ensure field applications of various traffic policies and increase the convenience for riders through provision of real-time traffic information.

10) Seoul Metropolitan Government, "Convenient Public Transport, Happy Seoul Citizens," 2006. The contents of this book have been reconstructed in a way suitable for this paper.

a. Problems Viewed from Different Perspectives

a) Bus Users' Perspectives

Seoul City Hall conducted a questionnaire survey of bus users to find out problems with bus operations. The survey, administered over phone, was carried out from April 8 through April 11, 2003, targeting 1,000 Seoul residents. The residents were randomly selected by gender and age groups in accordance with the number of participants allocated each ward to prevent regional bias. In the survey, the respondents pointed out the lack of reliability related to "irregular headway" as the biggest problem. It was followed by bus bunching, which refers to two or more buses simultaneously running along the same route, and psychological anxiety caused by the lack of bus schedule information service. Those questioned in the survey also referred to the following problems: buses not stopping near the bus stops, skipping bus stops, unkind drivers, reckless driving, deterioration in bus services such as inadequate next stop announcements, and insufficient service for persons with mobility handicaps (elderly citizens, children).

b) Bus Drivers' Perspectives

Bus drivers pointed out the difficulties adjusting operation intervals caused by the lack of headway control on the same routes. They also said they were having trouble adjusting travel speed because of the lack of information on road conditions (smooth or congested).

c) Bus Companies' Perspectives

Bus companies pointed out the following problems: a reduction in profitability due to irregular headway and the lack of punctuality, and an increase in accident rates caused by speeding or reckless driving and the resultant rise in costs.

d) City Hall's Perspectives

City Hall pointed out the problem of decreasing efficiency in supervision which it attributed to its reliance on field surveys. It also noted that it was experiencing difficulties in systematically managing and designing the routes due to the lack of bus operation control functions.

b. BMS Introduction and Related Directions for Improvement

While preparing for the July 2004 reform of the public transport system, the Seoul Metropolitan Government reached the conclusion that BMS was absolutely necessary. The system was designed to increase citizens' satisfaction level by securing the reliability of buses, and to generate basic data needed for establishing public transport policies for the future.

BMS is a scheme that can generate positive effects for all the parties involved – citizens, drivers, bus companies and the Seoul City government. It was expected to help increase the level of passenger satisfaction through provision of information on bus operations. Specifically, it was predicted to help relieve passenger inconveniences caused by irregular headways, bus service omission and the practice of buses passing by bus stops without stopping, as well as anxiety caused by speeding or reckless driving. Estimated time of arrival service was expected to reduce the inconvenience of riders waiting for buses at bus stops.

Drivers agreed that BMS's operational information service would help them keep to the operation schedule. Specifically, bus drivers would be able to adjust travel speed as they would know the distance between their vehicle and other buses running ahead and behind. Under the system, the bus operation conditions would be fully disclosed in real time, thereby helping to establish orderly operation of buses.

Bus companies hoped that BMS would help upgrade bus services and increase the number of passengers, thereby improving their financial conditions. They expected that the maintenance of regular headways and running buses on schedule would lead to a rise in ridership, and that an effective control over speeding and reckless driving would reduce accident rates and insurance premiums. In addition, BMS was expected to foster a sound managerial environment as it would make it possible to keep optimum operation intervals, maintain proper distance between vehicles, and cut costs through workforce reduction. In particular, BMS would enable bus companies to improve their services by taking corrective action on drivers for skipping bus stops or committing other unlawful driving practices.

Finally, there were positive expectations that BMS would help the Seoul City government in encouraging residents to shift from private cars to public transport.

Also, it was generally agreed that the system would produce the following effects: gaining trust of residents through convenient and easy-to-use bus operations, securing economical, reliable and fair services through scientific management of bus operations, improving punctuality through the operation of exclusive median bus lanes, ensuring the practice of drivers abiding by traffic rules and regulations through rigorous and prompt enforcement of administrative sanctions against unlawful driving practices.

4.1.2. BMS Establishment

a. Background to Project Implementation

BMS project was implemented by using a fast track construction method. During the basic design stage, the working design for priority facilities was developed in addition to the basic design. At the working design stage, the construction of priority facilities and a working design process were carried out at the same time. Construction of priority facilities began in April 2003 with the establishment of the BMS Project Center System. Terminals were installed on 1,429 buses running on 49 routes out of about 7,700 buses operating in the city. Information gathering and provision services had begun.

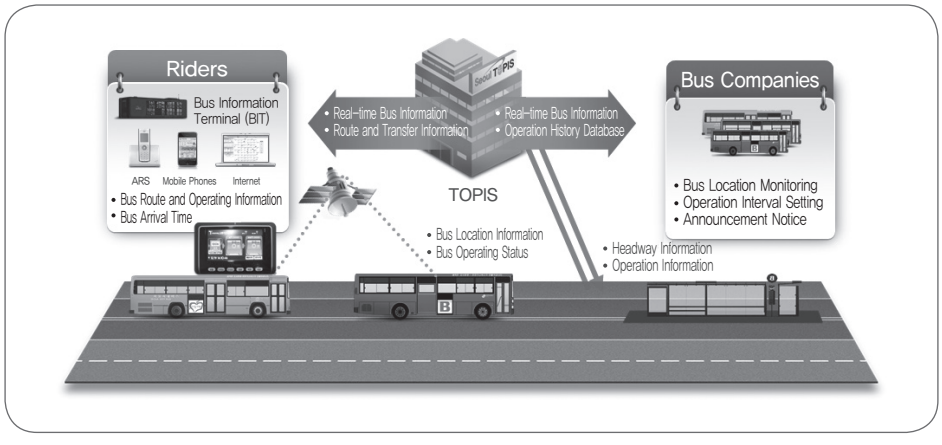
In January 2004, full-fledged work to establish the main facilities began. In November 2004, the first stage of information collection and provision process was initiated, targeting 5,031 buses running on trunk routes and leading branch lines. The former Disaster Prevention Center building underwent facelifts and maintenance work to be used as the BMS project center. With the establishment of the integrated bus control center, the BMS project was completed on May 28, 2005. The second-stage information collection process for the remaining branch line and metropolitan buses was completed in August. The service now covers all the officially approved city buses in Seoul.

b. System Composition

BMS is largely comprised of these systems – information collection, information processing and information provision. The information collection system processes GPS location information through the terminal aboard the bus, sending 20-second

cycle data as well as event data at bus stops to the center through a wireless data communication network. Then, the information processing system turns the collected information into databases through a communications server and a local processing server. The information provision system provides such information to drivers, transport companies, residents and pertinent Seoul City officials via various types of servers. Figure 3-12 illustrates BMS's information collection and provision system.

Figure 3-12 BMS Information Collection and Provision System



• Source: Seoul Metropolitan Government Traffic Information Center (TOPIS), Internal Data.

c. System Utilization

The data collected by BMS is processed and provided to drivers, bus companies, residents and pertinent Seoul City officials.

a) Drivers

Through a terminal installed on the bus, drivers are provided with information on the distances between buses running on the same route and the time gap with the bus ahead. By using this information, drivers can maintain steady headways, thereby ensuring reliability. In addition, drivers are given information on emergencies or pubic notices by their company's operation terminal or TOPIS. Such information helps the drivers prevent accidents and avoid operational conflicts.

b) Bus Companies

Bus companies can monitor the operation conditions of buses in real time through the operational terminal program provided by TOPIS. They can confirm the operational status of their buses by routes on the map, give instructions to particular buses about their distance from buses running ahead or behind, and communicate various public notices necessary for bus operation. In addition, bus companies can visualize the history of a bus's operation on a route in a diagram by using the program's vehicle dispatch management system. Through this program, they can effectively manage their drivers. Also, in association with the transport card system, which produces passenger embarkation and disembarkation data, the BMS program can be used to generate vehicle-km data needed for revenue settlement under the quasi-public bus operation system.

c) Citizens

By using website, PDA, ARS or smartphone, riders can obtain information on buses' arrival and departure times at bus stops, as well as their estimated time of arrival. TOPIS encourage riders to register their respective bus routes of interest (My Bus) with the TOPIS system so that they can access the information easily. This method also helps to reduce communication fees. In October 2005, TOPIS gave all the bus stops five-digit standardized numbers and accommodated them in its system. This initiative helped riders receive information on the estimated time of arrival of buses through the Internet and ARS. Currently, the system is accessed approximatively 30,000 times daily for bus information.

d) Seoul City

Operators at TOPIS can monitor all bus operations in real time. They can check historical statistics on bus operations or bus stops, as well as emergencies and violations. Through this data, they can compare the operational conditions among the bus companies. The data are also used for evaluating bus companies. In association with transit card data, they can also compare the historical data of buses with passenger embarkation and disembarkation data. By combining these data, they can conduct embarkation and disembarkation analysis, in-vehicle passenger analysis,

and route overlap analysis. The results of these analyses can be used in making decisions on opening/changing/abolishing routes, estimating the optimal number of buses for each route, and analyzing the effects of exclusive bus lanes. Such analysis methods and the relevant data make it possible to develop policies related to buses in a scientific way, rather than relying on intuitive judgment.

4.2. Smart Transport Card System

4.2.1. Problems with Conventional Traffic Cards

Restructuring of the bus operation system was the focal point of Seoul's public transport reform when it was first proposed in 2002. For reorganization of the bus system, improvement in the operational aspect was considered crucial. In other words, significant consideration was given to ensuring transparency of revenues as a way to improve the quality of bus services. It was in this context the question of upgrading the transport card system was raised. The outdated transport card system, which had been used for a considerable period of time, had reached its limit in data processing capacity. It was also considered to be lacking in technical qualifications to meet international standards.

a. Operational Aspects

At that time, fare discounts offered to transit card users led to a decrease in fare revenues, which in turn caused increased government subsidies. This resulted in restrictions on the expansion of fare discount rates. Due to the involvement of different card operators, it was difficult to establish a cooperation system to ensure the compatibility of different cards. The transport card system was operated differently from urban railways, city buses and community buses. There were different operators depending on regions. These conditions made it impossible to map out a nationally compatible card system. There was also a problem with Seoul City government's policy related to the system ownership. Technological monopoly by a specific company would lead to a rise in expenses and ineffective system operation. Also, system providers sought to monopolize the maintenance business by refusing to disclose technologies (particularly those for codification and Key (SAM) storage methods) needed for stable operation of the system. Clashes over these

matters between the Seoul City government and the profit-seeking operators made it further difficult to speedily implement policies designed to provide more convenient transport services to the citizens. There was also a problem of card commission fees, which amounted to as much as 23.3 billion won a year.

b. System Aspects

With the transport card system in use at that time, it was difficult to cope with various types of demand. The transport cards were issued by the Seoul Bus Transport Service Cooperative and credit card companies. The prepaid cards were issued by the cooperative, which was also in charge of the revenue settlement. As for deferred payment, credit card companies issued credit cards that could be concurrently used as transport cards. Revenue settlement for the deferred payment cards was handled by Kookmin Bank, while the operation was under the control of four organizations – Seoul Metro, Seoul Metropolitan Rapid Transit Corp., Korail, and Incheon Metro. It was virtually impossible to implement a unified policy under such a complicated system. In addition, the use of diverse types of cards made it difficult to properly operate the fare system, casting doubts over whether the revenue settlement was being handled in a transparent and fair manner. The lack of transparency in bus company revenues led to unnecessary payment of subsidies from the city government. The cooperative's inadequate handling of the settlement business contributed to fueling suspicion about the management of the transport card system. The operators and revenue settlement organizations were also found to be lacking in their capabilities to carry out the transport card system in a stable manner. These factors led to an urgent call for measures to secure transparency related to bus company revenues.

c. Functional Aspects

The need to replace the conventional prepaid transport card was raised when preparing for the comprehensive bus reform. The existing card had proved to be susceptible to financial accidents, such as copying, because it was based on the Type A specification of the Philips MIFARE scheme, not on ISO technical standards. It also caused the users inconvenience as it had to be regularly recharged. Furthermore, there was no proper way of handling the remaining cash value on the card when it was less than the fare for a ride. As for the credit cards concurrently used as

deferred payment transit cards, there was a need to replace them with those based on the international standard of EMV (Europay, MasterCard, Visa) specifications. Another factor that necessitated replacement was the growing call for prevention of financial accidents through the issuance of cards satisfying international standards. The terminal and central server facilities built in 1966 were so outdated, causing overloads and delays in data processing. Clearly, they were not suitable for executing a diversity of functions under the new public transport system. They were lacking in the capacity to accommodate various payment means and fare policies (distance and time-based schemes, etc.). They also turned out to be poor in terms of system scalability. The existing system was equipped with just one SAM (Security Authentication Module), so if the system were to be expanded, problems could be expected to occur. It was definitely necessary to replace it with a new system that could accommodate multiple SAMs. The unstable revenue settlement system also needed to be improved. In particular, the fragmented settlement system needed to be reorganized under a unified scheme.

There was also a need to address the lack of connectivity between systems, a problem caused by the system providers' refusal to disclose relevant technologies. Under a system lacking an integrative mechanism, proper efforts could not be made to ensure the compatibility of systems among the provinces and metropolises. Nor was it possible to seek exchange of technologies or transfer of operational know-how. These problems prompted a call for the creation of a new, trustworthy transit card system as part of public transport reform.

4.2.2. Building a New Transit Card System

a. Implementer Selection Process

In the course of the discussion on initiating public transport reform in Seoul, awareness level on the need to establish a new transit card system continued to increase, prompting Seoul City government to hold a working-level meeting on Sept. 26, 2002 to discuss the proposal for a new transit card scheme. The meeting discussed measures to cope with the existing system provider's high-handed behavior regarding its intellectual property right, ways of promoting cooperation among relevant organizations for building a new transport card system, directions

for SAM development, and system operating schemes.

First of all, Seoul City officials in charge of transit card affairs began to collect relevant data from various organizations, including transit operators and system providers. Using this data, they analyzed the problems of the existing card system as well and put forth suggestions for improvement. On the basis of the analysis, City Hall sent an information proposal request to relevant companies in December 2002; Hyundai Information Technology and 15 other companies received the request. In the information proposal explanatory meeting, City Hall received information proposals from about 20 companies, including SI companies, transit card system companies, credit card companies and electronic money companies, and briefed them on the city's plan to introduce a new transportation card system. In particular, Seoul City proposed introducing a new transit card system under the objectives of ensuring transparency of revenues, accelerating rational management, and achieving a 100% transit card usage rate.

To minimize user inconvenience and prevent overlapping investment, City Hall accommodated the Ministry of Information and Communications' standard SAM, and received technological consulting services on standardization to secure compatibility with public parking lot payments, congestion pricing and other card systems. This is because the city government realized from the beginning that developing a new transit card system would be possible only with the involvement of private companies. In March 2003, City Hall began to implement the new transport card project in earnest after establishing an advisory committee composed of relevant experts. It decided to entrust the project to a private company, and announced guidelines on information proposal. A number of SI companies became interested in the project and submitted their respective information proposals and held briefing sessions. Based on these activities, guidelines on project proposal were announced. A number of domestic companies specializing in transport cards formed a consortium and participated in the bidding. In the end, LG CNS was selected as the priority negotiation partner.

b. Project Directions

a) Project Implementation Method: Private Project + Reinforcement of Public Functions

City Hall intended to build the framework facilities with investments from the private sector, while trying to ensure stability and public functions of transit card services. In particular, its view held that it was very important for the city government to secure the intellectual property rights regarding the card system. It also determined that it was essential to have the right to make decisions on such matters as card key values, settlement fee rates and alliance fees.

b) System Construction Scope (Usage Scope of the New Transit Card)

City Hall wanted to make the transit cards usable in all urban railway sections in the nation's capital region (Seoul, Korail, Incheon). It also decided to allow Korail and Incheon Metro to voluntarily participate in the project and took steps for a new corporation to install the system in the metro rail in the capital area and the Incheon subway. It was determined that the new card system should apply to city and community buses in Seoul as well as transit buses operating in the Gyeonggi Province area. City Hall decided to induce the application of the new transit card system to taxis and to build a taxi fare card settlement system gradually over several years.

c) Business Scope of the New Corporation

The burden of making initial investments was to be borne by a private-sector company. With transport fare clearing functions, it would have settlement fees (VAN fee) as its main source of income. City Hall decided to allow the company to create profits by expanding the transit card project to cover such areas as taxi fares, parking lot fees and civil document fees, and through various alliance projects.

The project implementer would be asked to build the system through cooperation with its predecessor and find ways to ensure efficiency. City Hall decided to allow the use of the old cards for a certain period after the opening of the new transit card system. It was decided that when the new card's market share rose to around 90%, the new corporation would take up handling all the settlement data. As for deferred

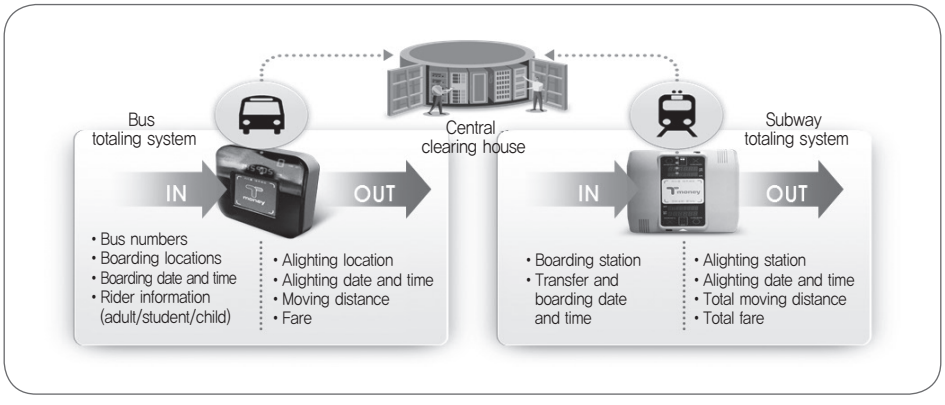
payment cards, the city government decided to allow their use for three years until 2006 when credit card standards were slated to be changed, introducing replacements through normal procedures afterwards.

c. Korea Smart Card

Korea Smart Card Corporation (KSCC) was inaugurated on Oct. 6, 2003 as a legal entity to build and operate Seoul City's new transit card system. The company was created under the initiative of LG CNS, which had been chosen as the priority negotiation partner for the transit card project. KSCC is in charge of system operation, card issuance, and transport fare settlement. It was established with investments from the Seoul Metropolitan Government, LG Group, mobile carriers, credit card companies and the Korea Teachers Cooperative Union. Of these investors, Seoul City has the largest stake in the company. On Nov. 3, 2003, KSCC and City Hall signed an agreement on the new transport project, starting work to build the system. Instead of using the conventional memory card, the company issued the T-money card, a contactless smart card. Embedded with a CPU chip, the card can fulfill various cutting-edge functions. T-money card is used about 22 million times on buses and subways in a day and the related data is collected and handled by KSCC. The company has know-how on the operation of the general public transport system. The number of card terminals distributed throughout Seoul reaches approximately 30,000. When a terminal malfunctions at a station, the company's clearing house becomes aware of the breakdown even before it gets noticed by the station staff. The center expeditiously acts, identifying the cause of the malfunction and sending a staff engineer to the station to check the terminal.

KSCC's development of the new transportation card system helped create momentum for bus reform by facilitating the use of smart cards in Korea. Many foreign countries are regarding the achievement as a case of successful traffic system reform, and are particularly impressed by the fact that such an advanced smart card system is in universal operation in Seoul, a super-mega city with a population of over 10 million. Since October 2004, delegations from 23 countries have visited KSCC to gain knowledge of the system and know-how. Some foreign countries are seeking to import the T-money system.

Figure 3-13 Automated Fare Collection System Using Smart Transport Cards



• Source: Seoul Metropolitan Government Traffic Information Center (TOPIS), Internal Data.

4.2.3. T-money Card

a. T-money Features

T-money card is a contactless smart card. Unlike the previous traffic cards with built-in memory cards, the new card has a built-in CPU (Central Processing Unit) chip that allows it to execute arithmetic functions. Based on international standards (ISO14443 Type A, B), the card was designed in a way that allows for flexible application of transport policies. Embedded with a 8K memory mode, it has a communication speed of 0.25 seconds. One of the most prominent features of the T-money card is that it cannot be copied or altered because of its security algorithm. In addition, the new card terminal can accommodate various fare policies. The system is capable of implementing different fare schemes by hours of the day for individual users, due to its drastically expanded data processing capacity. Also, through accommodation of various SAMs, T-money has secured nationwide compatibility. Its online data collection system has made it possible to launch a demand-responsive flexible management system. With its ability to adopt SAMs, the T-money system can also accommodate use of transit cards issued by other companies. This feature made it possible to pursue a nationwide compatibility policy.

b. T-Money Functions

T-money plays an essential role in public transport reform. It helps to ensure user

convenience, effective establishment of a transit database, and promotion of relevant industries. First of all, T-money provides invaluable convenience to the riders. The card can be easily purchased at a number of businesses and organizations that have gained T-money settlement membership (convenience stores, museums, movie theaters, public parking lots, automatic dispensers, etc.), which have increased significantly. Also, the T-money card is rechargeable or refundable in the amounts of up to multiple thousands of won at 24-hour convenience stores. It also offers fare discounts through its traffic mileage service.

The card system enables City Hall to achieve efficiency in operation. It allows the city government to establish effective traffic policies based on the data collected from 22 million daily trips made in Seoul. Thus, it has helped lay down the groundwork for implementing such measures as route redesigning, quasi-public bus operation, distance-based fare system, and transparent management of fare revenues, eventually contributing to building a state-of-the-art transport infrastructure such as ITS. It also contributes to the national economy, promoting the smart card industry, securing relevant industrial technology standards, and saving national budget as the a card replaces cash as a means of small-amount payment.

Let's take a look at the T-money system's settlement mechanism, by using buses as an example. As soon as the consumer places the T-money card on the bus terminal, communication is activated between the terminal and the clearing house via a satellite. After exchanging such information as "boarding location" and "transfer usage," the clearing procedure is completed. When the bus comes within a specified distance from the garage, the transaction details are transmitted by radio to the information collection system through a wireless AP (access point) and an information collection TV. Based on the passenger embarkation and disembarkation information sent from city buses, community buses and metro station terminals to KSCC, the fare settlement process for individual transport companies begins around 2 a.m., and is completed about five hours later. The T-money payment service for taxis also began during the first half of 2006. Recently, mobile T-money has been released through smart phones embedded with smart chips. KSCC is sure to provide further sophisticated T-money services in the future.

c. Effects of Smart Card (New Traffic Card) Introduction

Seoul City decided to introduce a new transit card system to ensure that the project can be implemented in a way that suits its public character. The new system made it possible to reduce operating costs by ensuring the transparency of revenue settlement and preventing payment of unnecessary fees. Improvement of the outdated system also made it possible to secure sufficient accommodation capacity and a higher level of security. For the operation of the new system, a corporation named "Korea Smart Card Corporation" was inaugurated. Seoul City played a leading role in establishing the corporation. In this way, it could secure intelligence property rights concerning the technologies needed for card issuance and key value management. This move is significant in that by doing so, the city government has secured an institutional mechanism enabling it to exercise control over the implementation of relevant traffic policies. KSCC has built a reliable system for managing card issuance, recharging, and settlement, and made it possible to reduce operating costs by eliminating the need to pay unnecessary commission fees.

In addition, the integrated settlement system enabled the company to collect and manage data effectively. It could also secure operating costs through alliance with electronic money companies, credit card companies and mobile carriers. The company also plays a supporting role in ensuring transparency in the handling of fare revenues, improving management conditions of bus companies, and carrying out related policies. It has contributed to the technological progress in relation to the issuance and charging of transit cards, and helped to create an environment for implementing policies for reforming the fare system and enhancing card usage rate.

• Technological aspects

- Issuance of transit cards and management of recharging services
- Fare settlement and system operation functions
  · Previous fragmented systems integrated into a single structure
  · Cost-saving effects
- Research on IC card and terminal technology
  · Research on transit card and terminal standardization
  · Building a traffic database for research (technological studies) on ways to

improve traffic card system

· Building a database by using origins and destinations recorded on transit cards

• Policy aspects

- Performing the function of allocating revenues through experts capable of adjusting fare systems and developing profit models
  · Performing the function of allocating profits to bus and card companies
  · Developing profit-related models (capability of readjusting fare systems)
- Managing a scheme to raise the transit card usage rate (target set at 100%)
  · Marketing control: Developing business models
  · Managing alliance partners: Handling alliance projects involving electronic money companies and mobile carriers
  · Ensuring effective management of business with the help of marketing and finance experts
- Support functions for public transport fare policies
  · Performing the function of assisting Seoul City's public transport fare policies

5. Achievement and Implications of Bus Reform

5.1. Achievements of Bus Reform

The bus reform initiated on July 1, 2004 led to improvements in structural problems related to the operation of buses. The bus routes, which had been operating arbitrarily, were reorganized into four major categories: metro-wide, trunk, branch and circulation routes. Travel speed improved thanks to the median bus lanes installed on major thoroughfares to ensure speedy bus travel from the city outskirts to central business districts. In addition, reliability and responsiveness of buses were ensured through the installation of a satellite-using location system on buses and the inauguration of TOPIS. The operation of median bus lanes and real-time management of bus operations led to improved bus speed and eventually, bus mobility.

The integrated distance-based fare system allowed public transport users to pay fares in proportion to the distance travelled, and to transfer from bus to bus, bus to metro, metro to metro without paying transfer charges. These benefits led to

Table 3-18 Achievements of the Public Transport Reform in Seoul

Categories	Achievement indicators	Goal achievement rates
Speed	Operation speed (km/h)	16.7 → 22.0
Service supply	Operation rate (%)	82.5 → 96.4
Operation safety	Accidents (number)	659 → 493
Punctuality	Distribution of operation intervals	0.69 → 0.56
Affordable fares	Fare per trip (KRW)	620 → 592
Revenue transparency	Card usage rate (%)	77.4 → 88.9
Public transport promotion	Modal split (%)	61.2 → 62.3
Improvement in air purity	Particulate matter ((PM10) Carbon oxide (CO)	69 → 61 0.7 → 0.6
Cost reduction	Travel cost-reduction benefit	Saving of about 225.1 billion won

• Source: Seoul Metropolitan Government, "Convenient Public Transport, Happy Seoul Citizens," 2006.

increased number of bus riders. Expansion of bus routes connected to urban railways helped to create an integrated public transport network, and the rise in transit card usage helped ensure transparency in managing bus fare revenues. Positive effects of the bus reform were shown not only in various traffic indicators but in environmental criteria as well, such as the level of particulate matter or carbon oxide in the air.

Compared to 2003, the annual number of accidents involving bus passengers went down by 25.2% to 166, indicating that the safety level for residents has greatly improved. Implementation of the integrated distance-based fare system led to a drop in the average passenger fare by 29 KRW. Bus operation ratio improved by 13.9% as a result of the reform that emphasized public-serving functions of bus services. The operation of median bus lanes led to a rise in the bus speed (22 km/h), which had been lower than that of passengers' cars. It also led to the stabilization of headways and an improvement in punctuality. The daily bus ridership soared by 1,388,000 passenger trips a day. This consequently led to a jump in the modal share of public transport to 62.3% and an increase in operating revenues. Compared to 2003, the level of particulate matters in the air as well as carbon oxide emissions have been reduced. The introduction of the semi-bus operation system led to the establishment of a proper evaluation system, which eventually helped improve the welfare of bus workers. The reform also made it possible to increase management efficiency and operating conditions through route restructuring.

Table 3-19 Population and Traffic Modal Shares in Seoul

Categories	Units	Year 1996	Year 2002	Year 2003	Year 2004	Year 2005
Seoul population (population in Greater Seoul Area)	1,000 people	10,470 (21,065)	10,281 (22,877)	10,277 (23,240)	10,288 (23,527)	10,297 (23,782)
Ridership	1,000 trips/day	27,800	29,680	29,375	30,344	31,004
Modal splits	%					
- Public transport		59.5	60.6	61.2	62.0	62.3
(Buses)		(30.1)	(26.0)	(25.6)	(26.2)	(27.5)
(Urban railways)		(29.4)	(34.6)	(35.6)	(35.8)	(34.8)
- Taxis		10.4	7.4	7.1	6.6	6.5
- Passenger cars		24.6	26.9	26.4	26.4	26.3
- Other modes		5.5	5.1	5.3	5.0	4.9

• Source: Seoul City Transport Bureau, http://traffic.seoul.go.kr/archives/285

5.2. Implications

The bus reform brought about systemic, user-oriented changes in bus services as shown in route reorganization, installation of median bus lanes, implementation of an integrated distance-based fare system, and establishment of a transit card system and BMS. These changes could be realized mainly because of the adoption of a quasi-public operation system, which made it possible for Seoul City and private operators to formulate an organically cooperative system on the basis of joint revenue management.

By shifting to the semi-operation system, Seoul City could resolve long-standing problems caused by supplier-centric, profit-oriented bus operations, such as overlapping and shortage of routes, lack of intermodal linkage with urban railways, and excessive burden of travel expense caused by the imposition of fares by routes.

The bus reform brought about user-centric changes toward ensuring reliability of bus operations, enhancing comfort and convenience of passengers, relieving the fare burden, and facilitating connectivity with urban railways. In this regard, the reform can be considered a success, even though Seoul City government has the continuing burden making large investments to reinforce the role and functions of buses to increase public benefits. The reform has particular significance in that it has initiated a user-centric paradigm change in transportation policy.

To effectively implement the quasi-public bus operation system, which involves

the risk of causing considerable financial burden on local governments, it is essential to create conditions for ensuring healthy management of bus companies as well as stable supply of services. Buses are an elementary mode of transport. Therefore, facilitating their use contributes to guaranteeing the public's transportation rights. It can also bring various other benefits such as reductions in socioeconomic costs caused by traffic congestion, preventing unnecessary spending on road facilities, and saving energy. In this regard, it is necessary to secure a firm basis for implementing effective bus policies through realignment in laws and systems related to the quasi-public bus operation system such as financial support and tax incentives. Currently, local governments are acting independently to evaluate bus services and management status, estimate transport costs, and secure necessary financial resources. As for Seoul City, in particular, financial requirements for the system have not been reflected in the city budget. Therefore, subsidies provided to bus companies to make up for their deficits have been carried over from one year to the next, adding to the financial burden of the city government. To address these problems, it is essential to devise a method of estimating the relevant financial requirements and having them reflected in the budget.

In addition, attention needs to be paid to the fact that the quasi-public operation scheme puts considerable restrictions on bus companies' management rights. This restriction makes it difficult for the companies to take proper steps, such as the introduction of new services, to create demand for bus use. Therefore, companies usually focus on management control designed to cut costs. Therefore, it is necessary to study ways of giving more managerial leeway to the private operators in order to actively improve bus services and promote management efficiency.

In addition, continuous efforts should be made to increase demand for bus travel by improving bus operating conditions, upgrading the fleet, diversifying passenger information services and fares, and introducing various new services such as a regular pass system.

Chapter 4

Achievements of Public Transport Reform and Policy Suggestions

1. Achievements of Public Transport Reform
2. Policy Suggestions for Improving Public Transport System

Achievements of Public Transport Reform and Policy Suggestions

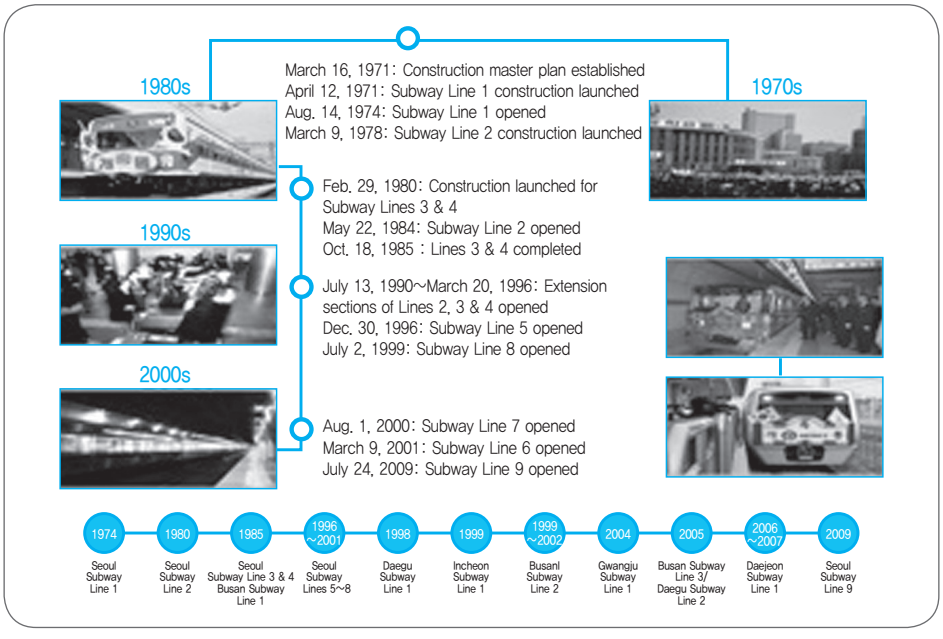
1. Achievements of Public Transport Reform

1.1. Securing the Basis for User-Centric Public Transport Operation

1.1.1. Establishment of an Urban Rail-Centered Metropolitan Transport System

The Seoul Metropolitan Government implemented its Phase 1 urban rail projects through the 1980s to cope with the rapidly growing demand for urban traffic and ease the traffic congestion in the central business district. In 1971, it kicked off the first project to build Seoul Subway Line 1 connecting Seoul Station and Cheongnyangni. In 1975, the city government started construction of subway Line 2, a circular line, designed to support plans to develop Gangnam and other areas of the city. In the 1980s, the radial lines of subway Lines 3 and 4 were built to maximize the role of the Subway Line 2 amid the city's radial expansion, as well as to ensure balanced development of the city and increase the modal split of subways. Construction of these lines led to a sharp increase in the number of urban rail passengers, which in turn caused extreme congestion within urban railway cars. However, road traffic congestion continued to become worse as increases in personal income led to the popularization of private car ownership. These factors combined to create political and social pressure for construction of more urban railways, eventually leading to

Figure 4-1 Timeline of Urban Rail Construction



the initiation of Seoul's Phase 2 urban rail projects (metro lines 5~9) in 1990.

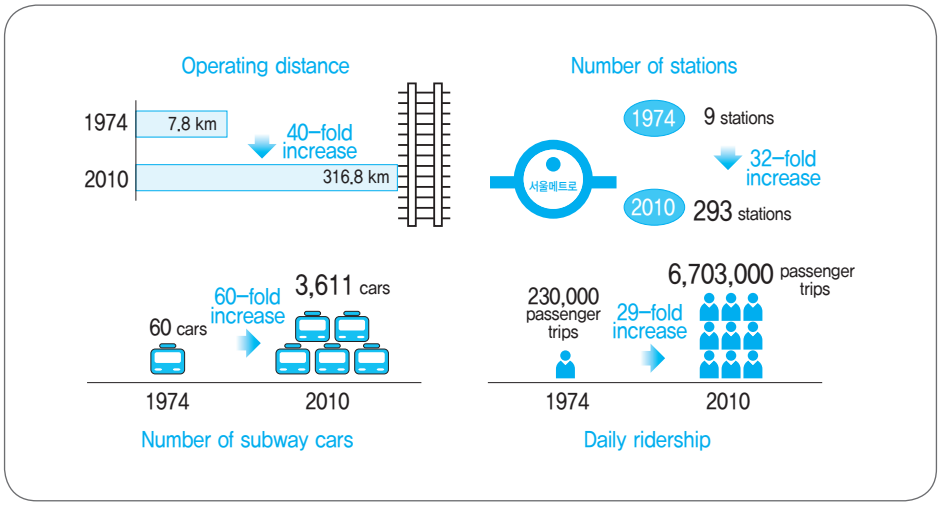
Other metropolitan cities of the nation followed suit and began introducing metro systems. Busan was the first to do so, starting to build its first subway line in 1981. Other metropolitan cities such as Daegu, Incheon, Daejeon and Gwangju launched their urban rail projects in full scale in the 1990s, encouraged by the government's traffic improvement policies for metropolitan areas.

Since the 1970s, Korea has steadily expanded its urban rail networks as a mode of mass transit, particularly for metropolitan areas, in an effort to resolve urban traffic problems caused in the process of industrialization and urbanization. Korea accumulated experience in constructing urban railways, steadily implementing R&D to develop domestic urban rail technologies. As a result, the nation has come to possess world-class rail technology.

Within a short time span, Seoul has built an unprecedentedly extensive network of urban railways (316.9 km) with 293 stations. Thus, it has established an urban railway-centered public transport system that can accommodate changes such as the development of a multi-nuclei urban system and the expansion of Seoul metropolitan area. Urban

railways in Seoul have fully established themselves as the backbone of urban transport. The urban railway system operates 296 stations, transports 6.7 million passengers a day, and has a modal share of 35%.

Figure 4-2 Growth in Seoul Urban Rail



• Source: Seoul Metro Internal Data

1.1.2. Securing User-Centric Basis for Bus Operation

With the number of the nation's registered cars surpassing 10 million, the problem of road traffic congestion got worse by the day in the 1990s. To address this problem, network of urban railways was expanded. These developments led to a precipitous fall in the demand for urban bus travel and the dwindling demand led to reduction in fare revenues, which, combined with rising operating costs, caused business slowdown in the bus industry. The situation was so dismal to the extent that the bus companies could not afford to pay attention to growing calls for bus service improvement. To resolve the structural problem in the operation of buses, Seoul City initiated a public transport reform in July 2004. By implementing a quasi-public bus operation system, the city government reinforced the role and functions of city buses in serving public interests. The reform readjusted excessively long bus lines and circuitous

or overlapping routes. All bus routes were reorganized into trunk and feeder lines, which were interconnected by routes and functions. These measures helped improve user experience and bus operating efficiency. With joint revenue management and the operation of a management evaluation system for bus companies, the city government could improve bus services and ensure their stability.

The public transport fare system was changed to a distance-based scheme, which made it possible for passengers to transfer from one mode of transport to another, free of additional charges. This new system helped ensure social fairness regarding public transport fares, as it resolved the problem of imposing additional burden of paying transfer charges on residents living in less well-connected areas. The new fare system has led to a user-centric, more reasonable fare structure that determines the fare based on the distance travelled. In addition, a new bus management system based on scientific data was established to replace the previous antiquated, arbitrary management scheme. Bus priority infrastructure has also been expanded extensively, helping to upgrade the level of transport services. These new measures provided momentum for encouraging modal shifts from private cars to public transport, thereby ensuring efficient operation of roads and establishing a transit-oriented urban mass transit system.

Figure 4-3 Comparison of Various Traffic Indicators Before and After Reform

Categories	Before reform	After reform	Improvements
Number of accidents	659 cases	493 cases (–25.2%)	Improvement in bus operation stabillty
Fare	620 won	592 won (–4.5%)	Introduction of a user–centric integrated fare system for public transport
Card usage rate	77.4%	88.9% (+11.5)	Enhancing transparency of bus fare revenue management
Travel speed on bus–only lanes	16.7 km/h	22.0 km/h (+31.7%)	Inprovement in punctuality of bus services and user convenience
Bus operating rate	82.5%	96.4% (13.9%)	Securing the stabillity and public function of bus service supply

• Sources: Seoul Metropolitan Government, Internal Data.
Seoul Metropolitan Government, "Convenient Public Transport, Happy Seoul Citizens," 2006.

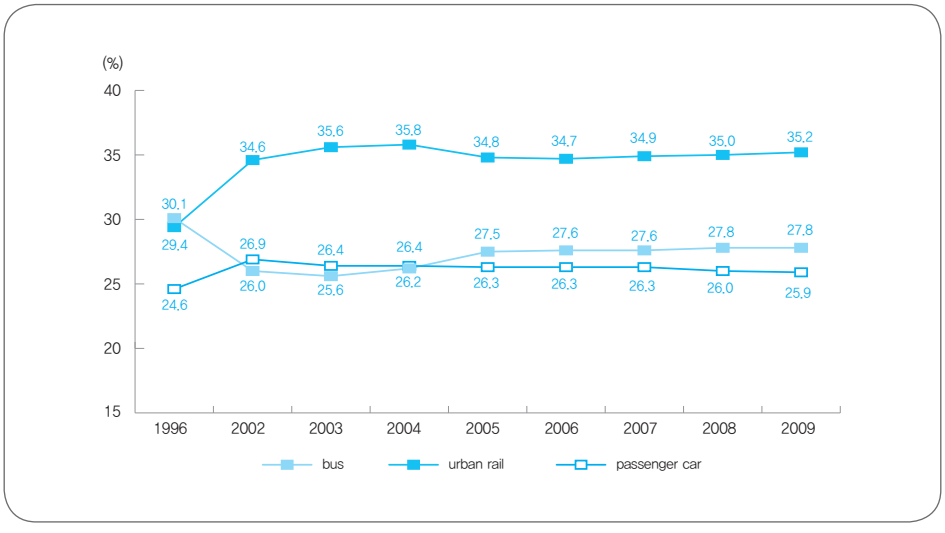
The public transport reform initiated by Seoul City is particularly meaningful in that it has brought about a shift from supplier-centric transport policies to user-oriented ones. It also represents a shift from a passenger car-centric traffic infrastructure expansion policy to a transit-oriented one that can be implemented along with a travel demand management policy.

1.2. Public Transport Promotion

The subway system has been firmly established as a mode of metropolitan transportation, and the bus operation system has gone through an overhaul in a user-centric manner. These achievements have led to improved intermodal connectivity between bus and subway and the formation of an integrated network of routes, thereby enhancing accessibility and mobility of public transport. With the introduction of the integrated distance-based public transport fare system, transfer charges were removed, alleviating passengers' fare burdens. The system led to a rise in the number of passengers using transfers and helped firmly establish the trunk and feeder bus route system, eventually contributing to an increase in the number of subway and bus users.

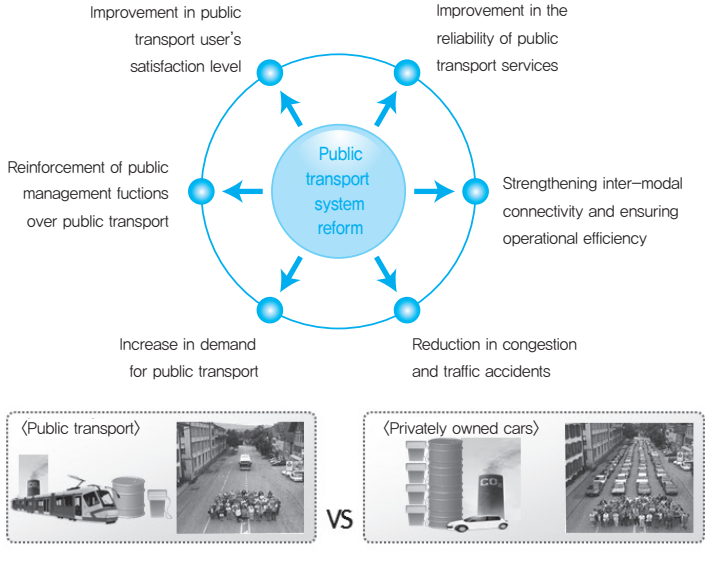
The continued expansion of the urban rail network since the 1970s led to a steady increase in demand, raising its modal split to 35.2%. Demand for bus travel, which had been declining since the 1990s, began to turn around following the introduction of bus reform in 2004. At the same time demand for taxis, which had kept rising, began to go down. Thus, the modal split of public transportation reached as high as 63% in 2009. This is an indication that the public transport reform provided momentum for reversing the downward trend of demand for transit use, which had shrunk by a third over the previous 20 years. Clearly, public transportation was on the rise in Seoul.

Figure 4-4 Change in Traffic Mode Shares in Seoul



• Source: Seoul Metropolitan Government Traffic Information, http://traffic.seoul.go.kr/archives/285

Figure 4-5 Expected Effects of Public Transport Reform



CHAPTER 04

1.3. Establishment of a Sustainable Transport System

The growing popularity of public transport, as shown in the rise in demand for bus travel and the modal split of urban railways, signals the start of changes toward a mass transit system that is environment friendly. Sustainability analysis shows that the reform has brought about various positive effects such as improved punctuality and the resultant cut in fuel expenses, reduction in time loss costs through a drop in access time, a decrease in traffic accidents and relevant costs, and a reduction in congestion costs. In addition, establishment of a public transport-oriented traffic system represents a departure from the conventional travel structure dependent on passenger cars. As such, it suits the global agenda of green growth and sustainable growth. It has also helped to ensure optimization of a social transport system in terms of minimizing social costs and promoting traffic welfare. Besides, the introduction of a quasi-public bus operation system has made it possible to supply transport services to areas which had previously been neglected due to supplier and profit-oriented bus operations. In this regard, the reform is generating a positive impact in terms of transport fairness. It has also made it possible to readjust bus routes regularly, supervise bus operations constantly, and prevent excessive competition between public transport modes over profitable routes. These aspects can lead to traffic efficiency of public transport and improvement of revenue conditions. The reinforced intermodal connectivity can replace demand for investment in high-cost traffic facilities such as metro and road construction projects, thereby minimizing external diseconomies. In this regard, the reform suits sustainable growth based on the concept of co-existence of the economy, society and environment.

2. Policy Suggestions for Improving Public Transport System

2.1. Introduction and Operation of Urban Railways

Research of relevant domestic and foreign cases shows that metro projects are normally undertaken by local governments as they are meant for transport within cities. However, it takes astronomical costs to build a metro system. For this reason,

local governments in developing countries need state support in funding such projects. Such measure is necessary to prevent local governments from being trapped in a vicious circle of debt: excessive borrowing for construction of an urban railway leads to continued growth in the size of the principal and interest, which in turn leads to additional borrowing for debt servicing. Under this condition, the size of debt would keep growing, imposing increasing burden on railway operations. On the other hand, it is essential to carry out a project feasibility evaluation to secure proper estimation of travel demand, thereby preventing miscalculation when predicting profitability and setting fares. Also, the project plan should be devised in a way that can ensure competitiveness of a railway by accommodating user requests.

When seeking to build an urban railway as a public-private partnership project, the question of developing a practically attainable plan assumes utmost importance, as local governments might experience financial trouble under the Minimum Revenue Guarantee scheme, under which they are required to make up for the revenue shortfall in case operating revenues fall short of the original estimation.

As the number of passenger cars keeps growing, railways cannot but be engaged in competition with the road sector. Such competition requires the subway sector to make efforts to create demand for metro travel. Demand for travel on a newly opened subway line may not reach the originally estimated level, causing operating deficits. To prevent such a problem, it is necessary to devise ways to operate the railway facilities in association with land use near the stations. Government should also ensure convenience of intermodal connections by considering urban travel patterns.

Metro construction is implemented under the initiative of the central or local government; therefore, the subway lines are run by public corporations or other public organizations. As such, public organizations may tend to put managerial emphasis on implementation of government policies rather than on improving user convenience through creative operation of business or active development of new services. To make up for such possibility, it is essential to pay close attention to performance evaluation and other measures to ensure managerial efficiency.

Subways are not built through a single process; their construction requires application of various industrial technologies, including those related to the

construction field. Therefore, countries with intention to keep promoting subway projects need to make efforts to secure technological self-reliance in order to cut construction and operating costs. Countries lacking in relevant technological prowess would need to receive technology transfer or training from foreign countries in the process of pursing metro projects.

Investment in urban railways should be made with realization that they are social overhead capital; relevant project plans need to be devised from the perspective of guaranteeing minimum public services to low-income people. By considering the population, geography and travel patterns, the government should also consider introducing light railways or BRT system for areas where it is difficult to build urban railways. Such measures ought to be promoted as part of efforts to minimize the number and scope of less connected areas whose residents suffer from difficulties in gaining access to public transport.

2.2. Establishment of Bus Transport System and Its Operation

With the acceleration of population migration into cities in the 1960s, demand for bus travel rapidly increased in the 1970s, particularly in the nation's capital region. However, the number of bus passengers began to fall noticeably in the 1990s due to modal shifts from buses to urban railways and passenger cars, after Seoul introduced urban railways to address the traffic congestion problems aggravated by rapidly increasing number of private automobiles. A steady reduction in bus ridership led to a drop in fare revenues, while operating costs such as personnel, fuel costs and vehicle purchase prices kept rising. As a result, a growing number of bus companies went bankrupt and/or faced union strikes and interruption of services. It was difficult to raise bus fares as they were subject to restrictions under the government's policy to stabilize commodity prices. In addition, bus companies virtually monopolized the bus routes as their personal properties, making it difficult to implement a successful policy to improve services.

To address these structural problems in bus operation, in July 2004, Seoul City initiated a public transport reform aimed at restructuring bus operation and route system, ensuring a bus-centric road operation, expanding transfer facilities, and overhauling the fare system. The reform was prompted by internal and external consensus that bus

operations should no longer be left to the mercy of market principles. The consensus made it possible for the city government to set the basic directions for introducing a quasi-public operation system to replace the traditional scheme of allowing private companies full authority over bus operations.

The key to ensuring successful implementation of bus reform lies in securing conditions during the preparatory stage to minimize conflicts among users, bus companies, company employees and local residents, and to prevent other possible problems.

Seoul City formed a "Bus Reform Civic Committee" to discuss ways of addressing the traffic problems of the city with civic organizations, the academic community and the bus companies. Through the committee meetings, the city government tried to foster a social consensus that the bus operation system should be fundamentally restructured in order to serve the interests of riders and to improve the bus companies' financial conditions. City Hall and bus companies held negotiations on adjusting routes, particularly in regard to the practice of bus companies favoring profitable lines while neglecting unprofitable routes. The negotiations led to the bus companies' autonomous adjustment, under which the routes were reorganized broadly into trunk and feeder lines. To resolve conflicts over route adjustments, the city government accommodated public opinion through district offices and public hearings. In addition, the city government was determined to operate trunk and metropolitan bus routes in median bus lanes, with a goal to improve mobility and reliability of buses. It also decided to streamline the major routes' connections with branch and circular bus lines in order to minimize possible confusion from the operation of median bus lanes.

The quasi-public bus operation system initiated by City Hall emphasizes the principle of giving priority consideration to public benefit when deciding on bus routes and operational methods. Under this principle, Seoul City implemented bus infrastructures such as median bus lanes and public garages. City Hall would lay the groundwork for operation and management of trunk route buses, while the individual bus companies are required to make efforts to cut costs through effective management of vehicles and workers. The new system requires establishment of a separate revenue settlement organization. In return for separating bus operations

from revenue settlement, the city government decided to guarantee payment of subsidies to make up for the buses' operating losses, as well as provide incentives for efforts made in improving management and services. To remove the anxiety over job safety, the city government devised an employment guarantee system for bus company employees (excluding executives). In addition, to increase the welfare levels of workers, guidelines were prepared for the payment of performance-based bonuses based on such factors as number of accidents, job performance, and passenger satisfaction.

A bus reform should be accompanied by policies to expand the infrastructure for reducing user inconvenience and ensuring effective bus management. Public bus garages need to be expanded so that the companies have access to vehicle maintenance facilities. To facilitate transfers between trunk and feeder routes, it is essential to build transfer centers equipped with relevant facilities. A cutting-edge traffic information system also needs to be introduced to provide various information services to public transport users. BMS makes it possible to organically connect bus companies, drivers and passengers and to monitor public transport infrastructures such as travel modes, roads and transfer facilities in real time. Passengers can also receive bus operation information in real time, and bus companies can ensure effective route operation and dispatch management. The transit card system makes it possible to integrate fare systems among different modes and to impose charges according to distance travelled as well as offer discounts for transfers from one mode of travel to another. It also allows promotion of various types of fare systems.

The quasi-public bus operation system has provided momentum for ensuring transparent management through joint revenue settlement. It also led to the introduction of a route bidding system, which made it possible to readjust the routes, which had previously been operated solely based on profitability, in a manner that gives priority consideration to the public benefit. The quasi-public bus operation system has prompted other metropolises such as Daejeon, Daegu, Gwangju, Busan and Incheon to introduce bus reform by following the example of Seoul. However, the system also carries the risk of causing serious financial burden. Therefore, in order for the system to continue to operate, it is necessary to stabilize the bus transport industry and secure financial support in a stable manner.

State-level guidelines need to be devised regarding management evaluation, estimation of transport costs, and securing of financial support. It is necessary to develop an institutional mechanism to prevent local governments from failing to secure a proper level of budget needed for the system. Such a mechanism would also be necessary to prevent the possibility of local governments suffering from financial burden caused by subsidies carried over from one year to another.

There are limits in operating the quasi-public operation system only with financial support from local governments. Therefore, it is essential to consider expanding the managerial leeway of private operators so that they can introduce new services and take their own measures to create demand for bus travel. In addition, steady efforts need to be made to improve operating conditions, upgrade bus fleets, diversify information services for passengers, and modify the fare system by introducing a regular pass system.

References

Blog on Hongik University Station (Subway Line 2), http://blog.naver.com/PostView.nhn?blogId=chaelee222&logNo=60106165046&parentCategoryNo=28&viewDate=&currentPage=1&listtype=0

Chung Il Bong, Seoul National University of Science & Technology Graduate School of Railroad, "A Study on Improving Work Schedule of Subway Drivers (Focused on Optimization Level Improvement)," 2010.

Joongang Ilbo, "Seoul to build transfer centers in 25 locations," http://article.joinsmsn.com/news/article/article.asp?total_id=448318, Joongang Ilbo news article _"Public transport transfer centers at 25 places in Seoul"

Korea Bus Transport Business Cooperatives Union, "The History Bus Transportation of Korea," 2009.

Korea Transport Institute, "Comparative Study of Transport Policies of Korea and Japan," December 2012.

Kyeong Chan Lee's Cyber History Class, Development of Modern Society- Opening of Seoul Subway Line 1, http://leekcp.new21.org

Metropolitan Transport Association, , http://www.mta.go.kr

Ministry of Land, Transport and Maritime Affairs, Korea Transport Institute, "2011 Economic Development Experience Moduling Project", "Institutional Measures for Building Transport Infrastructure and Funding Examples," 2011.

Ministry of Land, Transport and Maritime Affairs, "Land, Transport and Maritime Affairs Statistics," 1960~2010.

Ministry of Land, Transport and Maritime Affairs, "Rail Statistics," 2011.

Ministry of Land, Transport and Maritime Affairs, "Urban Railway Development Policy in Korea." 2012.

Seo Young Wook, Kim Yeon Kyu, Kim Chan Seong, Korea Transport Institute, "Seoul Public Transport Reform's Impact on Subway Travel Patterns in the Seoul Metropolitan Area," 2006.

Seoul Development Institute, "A Survey of Household Travel Patterns in Seoul," 2002.

Seoul Development Institute, "Rational City Bus Reform Measures," 1995.

Seoul Development Institute, "Seoul Traffic System Reform Action Plans", "Bus Route Restructuring, Bus Operation System Reform, Transfer System," 2003.

Seoul Metro Line 9, http://www.metro9.co.kr

Seoul Metro Line 9, "Newsletter Commemorating 1st Anniversary of Seoul Metro Line 9," 2010.

Seoul Metro, http://www.seoulmetro.co.kr

Seoul Metro, "30-year History of Seoul Subways," 2012.

Seoul Metropolitan Government, http://www.seoul.go.kr/main/index.html

Seoul Metropolitan Government, "Convenient Public Transport, Happy Seoul Citizens," 2006.

Seoul Metropolitan Rapid Transit Corp., "Seoul Urban Rail Transport Plan 2011" 2011.

Statistics Korea Information Service, http://kosis.kr

Statistics Korea, http://kostat.go.kr

http://www.ktdb.go.kr, homepage of Korea Transport Database

http://www.mltm.go.kr, homepage of the Ministry of Land, Transport and Maritime Affairs

http://blog.naver.com/gwfbi7/140011994312

http://jzzzzzzzn.egloos.com/1281915

http://blog.naver.com/choko5458/140118444852

http://furia.tistory.com/78

http://ecos.bok.or.kr, Bank of Korea statistics

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