ISSUE 02

KOTI Knowledge Sharing Report

Korea's Best Practices in the Transport Sector

Economic Growth and Transport Models in Korea

THE KOREA TRANSPORT INSTITUTE

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Authors
Dongmin LEE_Research Fellow, The Korea Transport Institute
Jinsu MUN_Research Fellow, The Korea Transport Institute
Deok Kwang KIM_Researcher, The Korea Transport Institute
Jinseo PARK_Associate Research Fellow, The Korea Transport Institute
Yeonjoo MIN_Associate Research Fellow, The Korea Transport Institute
Hee-Kyung KIM_Associate Research Fellow, The Korea Transport Institute
Youngkook KIM_Associate Research Fellow, The Korea Transport Institute
Wonjae JANG_Research Fellow, The Korea Transport Institute
Hun KIM_Research Fellow, The Korea Transport Institute
Jae-Joon LEE_Associate Research Fellow, The Korea Transport Institute
Lyoong OH_Associate Research Fellow, The Korea Transport Institute
Ji Youn YEON_Associate Research Fellow, The Korea Transport Institute
Seung Kook WU_Associate Research Fellow, The Korea Transport Institute

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315, Goyangdaero, Ilsanseo-gu, Goyang-si, Gyeonggi-do 411-701, Republic of Korea
Phone +82-31-910-3114
Fax +82-31-910-3222
Hompage: www.koti.re.kr
Contact email: info@koti.re.kr

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• Preface

Economic Growth and Transport Models in Korea

Over the past half century, Korea has achieved phenomenal economic growth at a rapid and unprecedented rate. As a result, the international community has paid attention to Korea over the past half century and Korea has achieved phenomenal economic growth as a middleman between advanced and developing countries. Furthermore, there is a growing demand in the international community for knowledge sharing concerning Korea's experience in the transport sector, which served as a cornerstone of the nation's economic growth.

In response to such demand, the Korea Transport Institute (KOTI) has launched a research and publication project titled "Knowledge Sharing Report: Korea's Best Practices in the Transport Sector." The project is designed to share lessons and implications experienced by Korea in implementing its transport policies with developing countries. This book is the second output of the project and deals with the theme of "Economic Growth and Transport Models in Korea."

According to KOTI's research, national transport policies were able to contribute to economic development with four key success factors. The first factor is the timely investment in transport infrastructure. It is generally agreed that the miracle in the history of Korea's economic development virtually started with the construction of the Seoul-Busan Expressway. The Seoul-Busan Expressway was built 4-lanes wide and 435km long, connecting the south-east region which was heavily industrialized with high-quality seaports to the Seoul Metropolitan Region which was the largest consuming market. At the time of the opening the expressway in 1970, the total number of vehicles using the route was a mere 150,000, which has now grown to over 18 million. From the point of an economic feasibility evaluation, the project could have never been executed. However, the project is now considered the most successful decision-making case among various projects made in the modern history of Korea's economic development. The construction of the Seoul-Busan expressway signifies how important the timely investment in transport infrastructure is not only for the fast movement of goods and passengers but also for a nation's economic development.

The success story of transport infrastructure investment goes further with the Seoul-Busan High-speed Railway, Incheon International Airport, New Busan Seaport and Seoul Urban Railway. These projects are other good examples of timely investment in transport infrastructure in Korea.

A second factor is the legislation of transport infrastructure special accounts. As of 2010, Korea's transport infrastructure had reached the level of 105,000km in roads, 3,500km in railways, 2.2 million flights in airport capacity, and 830 million tons in harbor capacity. The annual performance of transportation activities for the same year is estimated to be about 12.8 billion passengers and 770 million tons of freights.

Korea efficiently managed to supply an extensive amount of transport infrastructure within a short period of time. The central government played an important role in this through securing stable financial resources by legislating a

Transport Infrastructure Special Account in 1994. The special account was based on revenue from ear-marked gasoline tax. In the beginning, a high proportion of the account was allocated to highways just like the National Highway Trust Fund of the US. Gradually, the budget of the account was allocated for all transport modes. The special account contributed to developing the balanced and sustainable shape of the intermodal transport system. As of 2011, the proportion of transport investment by mode was 51.2% for highway, 37.1% for railway and 11.7% for airport and seaport.

A third factor was highways and public transport operation. In 1994, the Korean government designated HOV lanes on the Seoul-Busan expressway and allowed only buses and 9 or more passenger vans to use the lanes for intercity passenger travel. Another good example is the design of BRT (Bus Rapid Transit) lanes in urban areas. To solve commuting difficulties for commuters from new cities on the outskirts of Seoul and serious road traffic congestion, the local governments of the Seoul Metropolitan Area collectively agreed to introduce BRT lanes to the metropolitan highway network. As of 2011, a total extension of the BRT lanes, 157km on 13 corridors, is under operation in the Seoul Metropolitan Area.

The operation of HOV lanes and BRT lanes signifies that highways can be used efficiently for the use of public transport without high-cost railway network investment. Korea's transport model shows that it is possible to maintain a low-carbon, energy efficient transport system without having a costly railway network like Japan or European countries. This was possible by giving high priority to bus and high-occupancy vehicles. Korea's transport model is characterized as a case of keeping transport systems sustainable despite the highway-oriented transport network.

The last factor is utilization of ICT for public transport. In 2004, Seoul City government executed a public transport reform. The reform consisted of four key tasks for restructuring the bus network into a hub-spoke system, introducing BRT lanes, recovering operation deficits and lastly, adopting a smart card payment system which would allow free transfers. Later, the reform was adopted by the entire Seoul Metropolitan Area. The success factor of the reform is said to be the advanced information and communication technologies (ICT). This is because the convergence of ICT with transport greatly helped to increase the operational capacity of existing transport infrastructures, efficient management of bus fleets and provide customized transport services based on users' needs.

In this book, you will see how the four key success factors work in twelve different transport sectors. Twelve of KOTI's researchers have devoted themselves to writing about the relationship between Korea's economic growth and transport models. We hope that this publication will help facilitate the process of establishing transport policies in developing countries.

Gyeng Chul KIM
President
The Korea Transport Institute

• Contents

Part III Transport Technologies and Policies

CHAPTER 1

HIGHWAY

Dongmin LEE
Research Fellow, The Korea Transport Institute

01
History of Korean Roads

Korean Roads during the Modernization Era

Korean roads in the 1900s during the early modernization era were unpaved and the main transportation mode until 1950 in the nation was railway. Road construction during Korea's modernization era in practical terms is considered to have started from the post-Korean War restoration projects. After the Korean War, four arterial roads extending 1,309km, which could function as principal supply routes of the nation, were expanded and constructed. The length of paved roads prior to the Korean War was 1,066km (1944), yet this was reduced to 580km after the war (1951). Post-war restoration projects were implemented with foreign aid such as foreign manpower, technology, materials and funds, which resulted in road construction and development of road construction technology.

Korean Roads in the Contemporary Era

Road construction in Korea's contemporary era commenced in full swing through the Five-year Economic and Social Development Plan that started from 1962. Road construction in a modern fashion started as full-fledged road development commenced and thanks to the convenience of roads, the main transport mode was transformed from rail-based transport to motor-based transport. In particular, the Gyeongbu Expressway, which had opened on July 7, 1970 after the groundbreaking ceremony for the first section (Seoul-Suwon) in 1968, has acted as a key axis of grand road networks of the national industry and has played a central role in national economic and social development.

Full-fledged road construction projects commenced during the first Five-year Economic and Social Development Plan period (1962-1966) and nationwide road networks were improved, triggering a shift from rail-oriented transport to road-oriented transport system during the 2nd Five-year Economic and Social Development Plan period (1967-1971). The Road Readjustment Promotion Act and the Act on the Special Accounts for Road Readjustment Projects were enacted in 1968 which allowed gasoline tax and automobile tolls to be invested for road projects. During the 3rd Five-year Economic and Social Development Plan period (1972-1976), construction of highways were expanded with a goal of establishing a one-day life zone across the nation and pavement rate of national roads sharply rose from 23.7% to 45.5%. During the 4th Five-year Plan period (1977-1981), arterial road networks were constructed linking the existing highways with major industrial locations and the central government started to provide assistance for pavement of major local roads. During the 5th (1982-1986) and 6th (1987-1991) Five-year Plan periods, inter-connectivity between roads was secured and the length of highways constructed reached as much as 1,597km. In addition, the Act on the Special Accounts for Road Projects was enacted in 1988, allowing financial resources generated from 90% of special excise tax on gasoline and alternative fuels to be invested in road projects. During the most recent 7th Five-year Plan period (1992-1996), plan to build 9×7 grid-type arterial road networks was formulated through which road networks were expanded and projects aimed to improve road functions

Figure 1.1. Change in the length of road distance following the five-year economic and social development plan

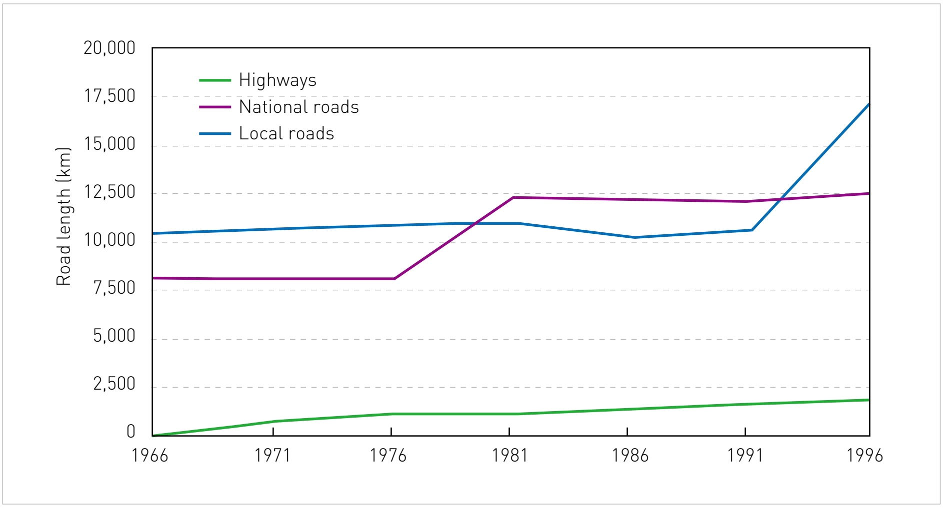


Table 1.1. **Road project status during the five-year economic and social development plan periods**

Five-year economic & social development plans	Road project description
1st (1962-1966)	•Road budget: 14 billion KRW •Road projects: road pavement for 488km sections, construction of 431 bridges, road width expansion and road alignment improvement for 120km section ※ With assistance from the Ministry of National Defense and 8th United States Army, construction was implemented jointly with the military.
2nd (1967-1971)	•Basic direction for road projects - A shift from railway transport to road transport era, improvement of nationwide road networks •Road budget: Initially 30 billion KRW •Road Readjustment Promotion Act and Act on the Special Accounts for Road Readjustment Projects were enacted in 1968. - Gasoline tax and automobile tolls were invested to road projects. •Highway construction - Construction of highway between Seoul and Incheon commenced: 1967 - 10-year Highway Construction Plan was formulated (1967)
3rd (1972-1976)	•Direction for road development - To establish a one-day life zone across the nation with the construction of highways-expansion of road pavement - With the completion of Gyeongbu Expressway in 1970, public road transportation rate rose significantly. - Construction of the Honam, Yeongdong and Namhaean expressways was implemented. - National road paving rate significantly rose. (23.7% → 70.2%) •Road construction with development loans and road surveys - IBRD loans were introduced for pavement of infrastructure road networks •Establishment of highway networks: construction of Honam, Namhae and Yeongdong expressways
4th (1977-1981)	•Direction for road development - To build arterial road networks linking the existing highways with major industrial complexes - To pave national roads and major local roads (national road pavement rate in 1981: 55.4%) •Major project plans: - Highways: Construction of Daegu-Masan section, expansion of the Busan-Masan section to four lanes. - Paving of local roads: State-funded pavement of major local roads - Expansion of general national roads: Major arterial roads were expanded to 4 lanes
5th (1982-1986)	•Direction for road policy - To secure inter-connectivity among roads and establish integrated public road transport system - Raising road pavement rates, strengthening repair and maintenance, and improving malfunctioning road facilities •Pavement of general national roads in 1986: 77.1% •Road maintenance commenced in full swing.
6th (1987-1991)	•Construction and expansion of highways (Total length of highways: 1,415km→1,597km) •Pavement and improvement of general national roads (national road pavement rate in 1991: 92%) •Local road and county road projects: to improve living environment of rural areas •Road maintenance and management: expressways and national roads * Act on the Special Accounts for Road Projects was enacted in 1988. - 90% of special consumption tax such as gasoline and alternative fuel would be invested for road projects.
7th (1992-1996)	•Direction for road policy - To boost competitiveness of industries, enhance social equity and promote balanced development. - Promotion of globalization and self-sufficiency and laying the groundwork for reunification •9×7 grid-type arterial road network construction plan was formulated. •Road network expansion and improvement of road functions.

were implemented to build arterial road networks across the nation.

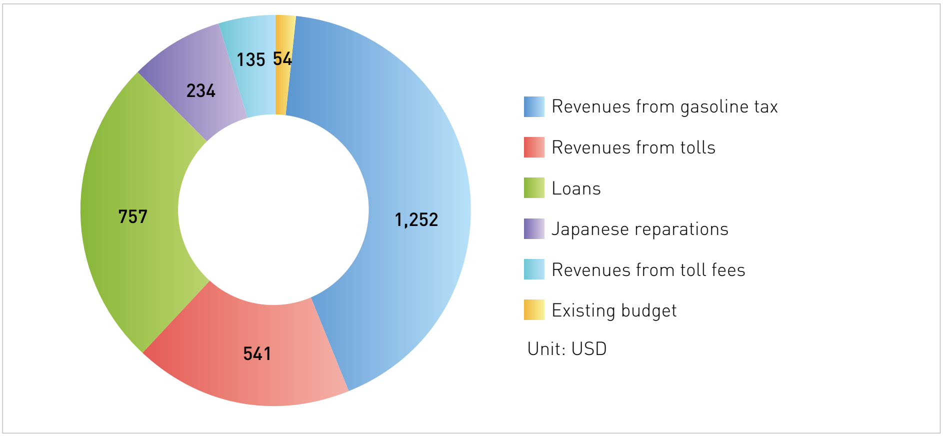
Since 1999, the Road Readjustment Master Plan (1st: 1999-2011, 2nd: 2011-2020) was established with the goals of building road networks to promote balanced development of national land; addressing traffic congestion areas and strengthening access among regions; improving road facility levels in major national roads; incorporating national road networks (7×9) and road networks in the Seoul Metropolitan Area (7×4+3R); and advancing road management by adjusting road grades and restructuring the road management system.

Korea's Experience in Road Construction

Experience of Securing Financial Resources for Road Construction

Financial resources required to implement road projects until the early 1960s were funded by foreign aid for post-war reconstruction projects and road construction was facilitated with the support for the Korean army and the 8th United States Army. However, additional funding for road investment was secured during the 2nd Five-year Economic and Social Development Plan period. The enactment of the Act on the Special Accounts for Road Readjustment Projects in 1968 allowed gasoline tax and automobile tolls to be invested for road projects. As indicated by

Figure 1.2. Funding plan for construction of Gyeongbu Expressway by financial resources



the funding plan for construction of Gyeongbu Expressway (refer to Figure 1.2), this accounted for approximately 65% of total funding or 21.4 billion KRW of the total 33 billion KRW.

In the meantime, for road projects in the 1970s road construction budget was secured from IBRD loans, in addition to gasoline tax and automobile tolls. Since the late 1980s, the Act on the Special Accounts for Road Projects was enacted in 1988, which stipulates levy of special excise tax on gasoline and diesel oil as well as passenger cars. Most of these revenues were used for road construction investment to build road networks across the nation. Since the mid-1990s, traffic tax was newly established and under the system gasoline tax and diesel oil tax were defined as earmarked taxes. In addition, road investment accounts were expanded to special accounts for transport facilities.

Securing Road Zones for Future Road Expansion

Securing road zones in the history of Korea's road construction started at the planning phase of the construction of the Gyeongbu Expressway. Initially, the government intended to build 16 lanes or at least eight lanes in both directions for Gyeongbu Expressway. However, the government constructed four lanes in both directions for political reasons. The former President Park Chung-hee left 50m vacant on both sides of the Gyeongbu Expressway and prohibited construction of buildings in the areas to resolve road shortages in the future, although only a 4-lane expressway was constructed initially. This spare area in the road zone facilitated expansion of highways in the future.

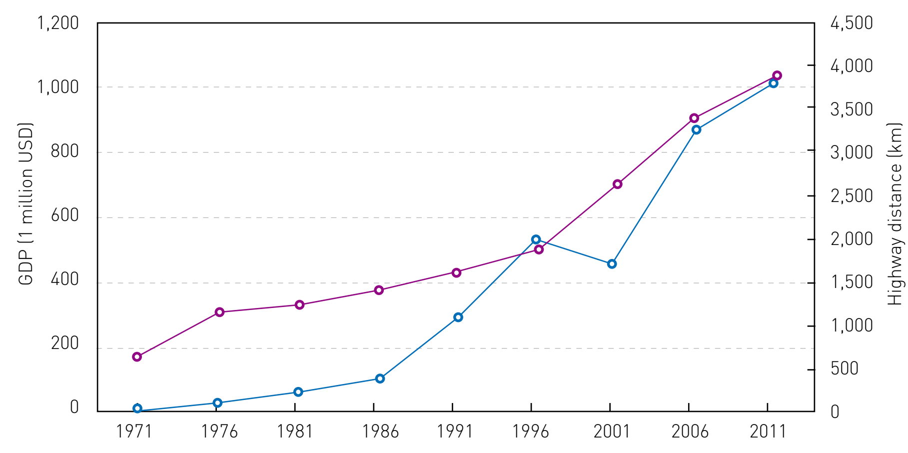
Such concept of securing road zones became to a legally binding force through provisions of designating road adjoining zones in related laws. More specifically, road adjoining zones can be designated within the scope of not exceeding 50m for highways (Motorway Act) and 20m for general roads (Road Act). This is a spare width of road which can also reduce damage caused by traffic accidents departing from road lanes.

Economic Growth Resulting from Road Construction

According to an analysis, direct and indirect benefits motorists have enjoyed from all the highways that had opened by 2005 include reduction of various costs, including travel time costs, vehicle operation costs, traffic accident costs and environmental pollution costs worth 12.6 million USD a year, which accounts for 17.2% of GPD of 2005[1]. It is also known that road construction has indirect effects such as job creation, regional economy multiplier effect, and balanced regional development.

Korea's economic development resulting from expansion of national arterial roads can be explained through the following statistics: Korea's GDP in 1971 right after the Gyeongbu Expressway was opened stood at a mere 9.5 billion USD, yet the nation's GDP in 2010 when the distance of highways increased six-fold it rose 118-fold to reach a worth of 1.1164 trillion USD.

Figure 1.3. Trends of GDP after the opening Gyeongbu Expressway (by year)



National Arterial Road Networks Constructed in the Shortest Time

Korea is the only country in the world that constructed national arterial road networks in the mid-1900s and achieved phenomenal economic growth. It was

1) Korea Research Institute for Human Settlements (2006), A Study on the Impacts of Highway Projects

made possible by implementing road construction products based on long-term plans (seven rounds of Five-year Economic and Social Development Plans and a subsequent Road Readjustment Master Plan). Korea's road construction proceeded in the order of construction of highways, which are the framework of national land, construction of national roads that comprise the nation's arterial road networks, and construction of local roads, which are main roads linking local locations. Such construction of road networks contributed to efficient transport of passengers and cargo, maximizing such effects.

In particular, construction of the 428km-long Gyeongbu Expressway in a mere 2 years and 5 months was the result of mobilizing all national resources and capabilities. There are five reasons why it was possible to construct the Gyeongbu Expressway in such a short time:

- Optimal reshuffling of government organization to promote highway construction
- Speedy construction with mobilization of the army construction engineer corps (3 battalions, a total of 173,588 personnel) for difficult construction sections
- Strong commitment and passion of the President, head of the nation
- Maximum cooperation and support for technical staffs such as technical public servants, military officers and the construction industry
- Despite failure to introduce loads, institutional changes were made to use gasoline tax and automobile tolls for road construction in accordance with the Act on the Special Accounts for Road Readjustment Projects (1968).

02
Road Status

Road Status

As of 2010, total road length was 105,565km and the ratio of paved roads out of total roads stood at 79.8%. Even though the total length of roads is steadily on the rise, road length per vehicle is steadily on the decline (1990: 16.7m/vehicle → 2009 5.9m/vehicle) given the rapid increase in the numbers of vehicles (1990:3.6 million→2010: 17.94 million). At present, approximately 50% of arterial roads (highways and national roads) are two-lane roads (highways: 4.0%, national roads: 48.7%) and projects to expand them to four-lane roads are under way.

Table 1.2. Road facility status (2010) (Unit: km, %)

Road grade	Length (km)	Paving ratio (%)	Management authority
Total	105.565	79.8	
Highways	3,860	100.0	Ministry for Land, Transport and Maritime Affairs (Korea Road Corporation)
National roads (cities)	13,812 (2,250)	97.6 (98.2)	Ministry for Land, Transport and Maritime Affairs (City sections: Mayors)
Metropolitan city roads	18,879	99.4	Mayors of Metropolitan cities
Local roads (state-funded local roads)	18,180 (3,858)	82.4 (83.5)	Governors (City sections: Mayors)
Municipal roads	27,005	68.5	Mayors
County roads	23,829	61.4	County mayors

Table 1.3. Trends of road facility expansion (2010)

Category	1970	1980	1990	2010	Annual average growth rate (%)
Total road length (km) Road pavement ratio (%) Road length per area (km/km^2)	40,244 9.6 0.4	46,951 33.2 0.5	56,715 71.5 0.6	105,565 79.8 1.1	2.4 5.4 2.6
Numbers of vehicles owned (1,000 vehicles)	127	528	3,644	17,941	13.2
Road length per person (m/person) Road length per vehicle (m/vehicle)	1.2 316.9	1.2 89.0	1.3 15.6	2.1 5.9	1.4 ▽9.5

• Source: Ministry of Land, Transport and Maritime Affairs, Road Manual, 2011

Road Investment Performance

Over the past decade, road budget stood at around 8 trillion KRW. However, with the change in government policy direction, budgets for the road sector have been showing downward trends since 2002. In particular, budgets for highways and national roads showed a drastic drop.

Table 1.4. Trends of budgets for the road sector (Unit: 100 million KRW)

Category	2002	2004	2006	2008	2010
Special accounts (Increase rate)	80,976 (-)	80,647 (-0.41%)	73,363 (-9.03%)	79,259 (8.04%)	77,817 (-1.82%)

• Source: Ministry of Land, Transport and Maritime Affairs, Road Manual, 2010

Table 1.5. Trends of investment performance by road (Unit: 100 million KRW)

Category	2002	2004	2006	2008	2010
Highways	14,450	14,544	10,310	9,293	11,405
National roads	44,409	42,700	33,604	36,642	42,712
State-funded local roads	4,900	5,630	5,773	7,236	6,285
Others[1]	17,217	17,773	23,676	26,088	17,415
Total	80,976	80,647	73,363	79,259	77,817

• Note: 1) Others are sum of road management out of budgets for the road sector, mega-regional road and industrial complex access road construction out of construction subsidies by local governments, construction and management of roads constructed by private capital, educational financial subsidy, road loan repayment and logistics.
• Source: Ministry of Land, Transport and Maritime Affairs, Road Manual, 2010

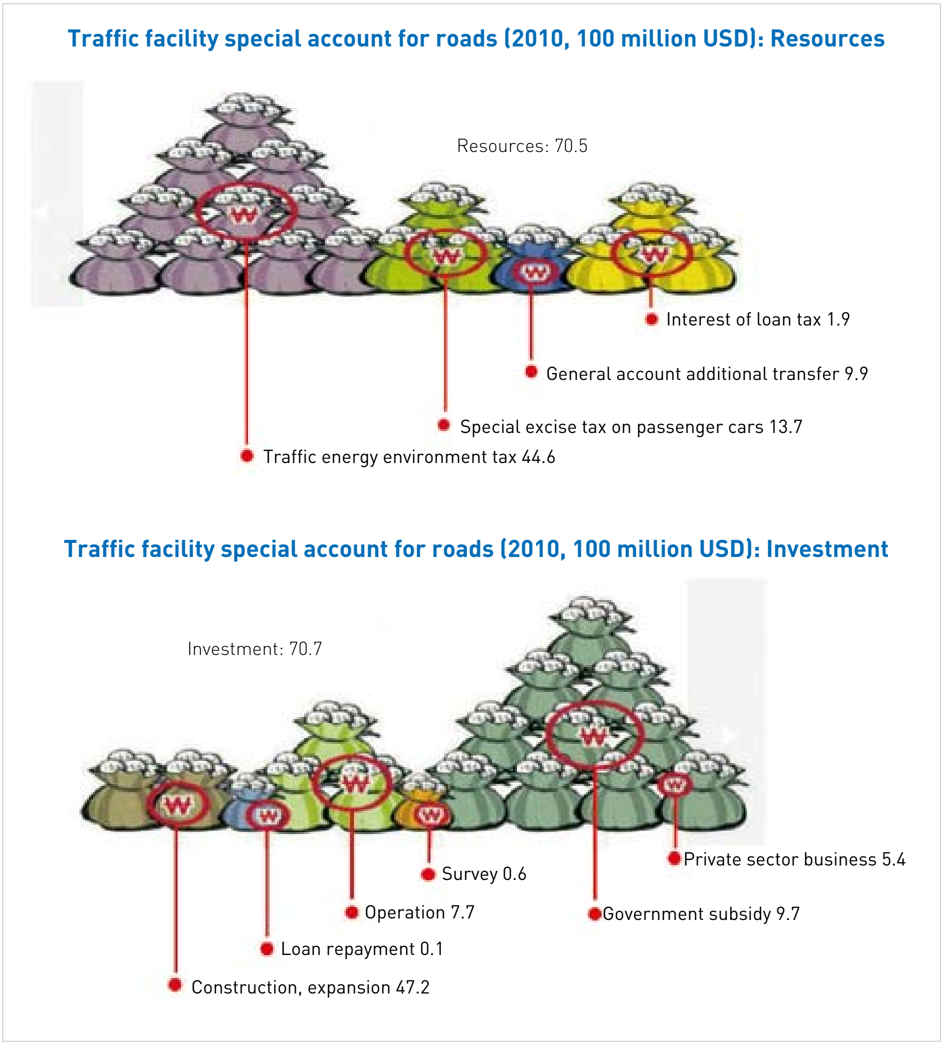
Road Financing Status

Road projects had been financed subject to general accounts until 1988. In order to provide financing for road projects in a stable and efficient manner, Special Accounts for Road Projects were established and operated starting from 1989. In accordance with the polluter pays principle (PPP), major sources of financing include 90% of special excise tax on gasoline, as well as special excise tax on diesel oil and passenger cars and shortages have been additionally funded by general accounts.

Starting from 1994, traffic tax was created under which gasoline tax and diesel oil tax were defined as earmarked tax in order to organize and manage investment in the transport sector in a stable and efficient fashion. The existing Special Accounts for Road Projects were expanded to Special Accounts for Transport Facilities which have six accounts, namely, railway, urban railway, airports, ports and mega-regional transport, as well as roads. Starting from 1996, special excise taxes on gasoline and diesel oil, which were sources of traffic tax, were changed from a value-based charge system to a volume-based charge system.

Due to shortages in road facilities which had been aggravated owing to insufficient road investment in the 1980s and rise in construction costs such as

Figure 1.4. Financial resources from special accounts for transport facilities and investment status

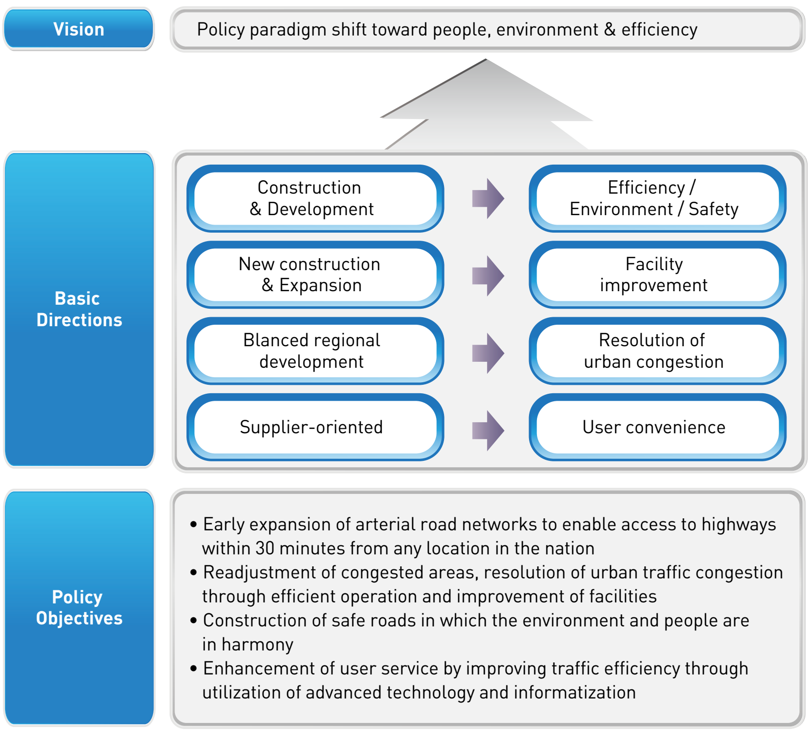


land compensation, despite significant rise in budgets for the road sector with the introduction of the Special Accounts since the late 1980s, road increase has been insignificant compared with investment scale, resulting in increasing social and economic loss such as increased logistics costs amid road congestion and rise in carbon emissions. In order to overcome these problems, multifaceted financial measures are required to promote various road projects. Strategies for road financing include adjustment of fuel tax, utilization of state/public bonds, reasonable utilization of private capital and exploration of new sources of taxation and utilization of toll fees charged on highways and toll roads.

03
Basic Directions of Road Policy

Objectives and Basic Directions of Road Policy

Recent road policy has undergone a paradigm shift amid various changes in internal and external developments related to roads. In particular, changes in national land space policy, restrictions on SOC investment financing, as well as changes in external developments such as the advent of an era of low-carbon,



green growth, acceleration of technology development such as IT advancement and intellectualization, brisk inter-Korean exchanges and globalization/opening are key factors behind changs in road policy.

Paradigm Shift in Road Policy

Paradigm shift in road policy is taking place according to basic directions of road policy established on the basis of changes in road-related conditions as follows:

The first policy change is to enhance investment efficiency of road projects. Unlike previous road projects focusing on construction and expansion of the existing roads, new road projects would be controlled, while efficient investment in road projects would be made by reviewing ways to improve facilities and expand road capacities such as 2+1 lanes, rather than road expansion.

The second policy change is to establish an environmentally friendly green road transport system. To this end, efforts are being made to resolve congestion in downtown areas and to boost operation efficiency of the existing network functions such as revitalization of ITS in order to reduce CO_2 emissions and ease congestion, and to create bicycle lanes and scenic roads, thereby transforming roads into human and environment-friendly living space.

The third policy change is to implement road policy to promote convenience of users such as working-class friendly policy. Policies are being developed to promote a shift from a supplier-led road policy to one aimed to enhance convenience of users and simplify approval/permission procedures.

The fourth policy change is to promote improvement of the nation's international standing by proactively advancing into overseas markets. Efforts are being made to proactively seek ways to make inroads into road-related overseas markets encouraged by the improved national image through such international events as the G20 Summit and the Busan ITS World Congress.

04
Specific Implementation Tasks of Road Policy

Improvement of Road Network Connectivity

Figure 1.5. Arterial Road Networks in Korea

It is intended to boost road network connectivity by incorporating the originally planned nationwide arterial road network plan (7×9) and the metropolitan area highway network plan established to resolve traffic congestion in the Seoul metropolitan area and building a new national road networks based on 7×4+3R networks. More specifically, road networks have been envisioned to integrate the metropolitan area highway networks with the nationwide arterial road networks by transforming the former into branch lines.

Readjustment of Urban Road Networks

The outer ring road network plan for metropolitan cities would be implemented on an ongoing basis, contributing to easing urban congestion. To this end, outer ring highways would be constructed in Busan, Daegu, Gwangju and Ulsan, while striving to increase traffic handling capacity by making road operation more efficient such as ramp metering to expand major highways where it is impossible to resolve traffic congestion and linking disconnected sections.

In order to improve traffic congestion in main arterial roads in metropolitan areas and facilitate the flow of logistics, traffic congested roads in metropolitan areas would be improved by formulating and implementing project plans after analyzing the appropriateness and economic feasibility of 532 traffic congested road improvement projects in six metropolitan areas.

Meanwhile, the projects' effects have been minimal despite various road policy attempts to ease urban congestion, so it is planned to incorporate the existing projects to improve metropolitan arterial roads with projects to improve congested roads into projects to improve urban arterial road networks. Measures to improve junctions of urban arterial road traffic axes or bottleneck areas would be intensively reviewed, while a review is currently being made on designation of arterial road traffic axes by city and evaluation of traffic improvement performance by local governments and differentiation of state financial assistance depending on the results.

In addition, as it is increasingly necessary to address traffic congestion in the already saturated arterial roads in metropolitan cities and implement environmentally friendly and future-oriented road policy, efforts are being made to transform downtown roads into more vibrant and ecological space which are equipped with both "functions" and "environmental friendliness."

Currently under review are projects that construct underground passages in chronic congested areas in the vicinity of large cities, including the Seoul metropolitan city, to secure users' right of seamless way and create parks on the upper side of the underground passages.

Construction of Eco-friendly and Safe Roads

Expansion of Bicycle Roads and Scenic Roads

Amid rising social criticism of environmental degradation of roads and motor-oriented roads, a paradigm shift is under way to address climate change, environmental pollution and traffic congestion by revitalizing the use of bicycles, which are a non-motorized eco-friendly green transport mode. To this end, bicycle lanes are being constructed for commuting to work and going to school to provide convenience in everyday life, while service functions of road facilities are being enhanced and the share of bicycles in passenger transportation is significantly on the rise. The government aims to increase the share of bicycles in passenger transportation from the current 1.2% to 5% by 2013, while planning to build 400km-long bicycle lanes by selecting areas with high demand for bicycles out of national roads near settlement districts across the nation.

Construction of Scenic Roads

With perceptions on a pleasant environment and landscape becoming widespread following improvement of quality of life for people, the government is seeking a shift in concept of roads from mere space for movement to roads offering relaxation, viewing and cultural space. The government has created scenic roads with various themes (green space, waterfront, historical and cultural, etc.) in appropriate locations across the nation, greatly raising the quality of roads. Based on analysis results of effects of pilot projects, the government selected 52 sections as candidates for scenic roads representing Korea and chose final 13 locations and construction of scenic roads in these locations are currently under way in a phased manner. In addition, the government revised scenic road readjustment project enforcement guidelines to create scenic roads in a more systematic fashion. Based on the guidelines, the government has come up with scenic road design procedures and checklists and developed scenic road indicators, while actively promoting exemplary cases of scenic roads through booklets.

Introduction and Implementation of Low Carbon, Eco-friendly Paving Methods

In an effort to join international drive to reduce greenhouse gases, the government has been introducing and invigorating low-carbon, environmentally-friendly asphalt concrete paving methods. Compared to the existing hot-mix asphalt concrete paving, the low-carbon, eco-friendly asphalt concrete paving is produced at lower temperatures by 30-50 degrees and secure the same or more durability and is expected to reduce petrochemical fuel which used to produce mixture as well as greenhouse gas emissions by more than 30%. The government plans to draw up optimal implementation measures and apply them extensively after carefully analyzing results of currently undergoing pilot projects.

Creation of New Added Values through Road Facilities and Space

Utilization of Disused Roads (Abandoned Roads, etc.)

At present, the government is improving the institutional foundation to enhance utilization of disused roads (abandoned roads, etc.). It is drawing up legal grounds for multiple utilization of disused roads, such as auxiliary road facilities and new and renewable energy facilities. Based on researches and analyses on ways to utilize disused roads, the government has drawn up technical guidelines on design and utilization plan by road grade. The government is also seeking ways to utilize sites with value depreciation (sites located between roads or sites located between rivers/mountains and roads, etc.) generated by road projects from the perspective of public good by formulating standards by types and management manuals.

Diversification of Service Facilities and Creation of Roadside Regional Hubs

The government has constructed and operated service facilities on mid-to-long distance motor-only roads (national roads) without service facilities to promote safety and convenience of motorists. In particular, the government plans to build service areas above roads to promote three-dimensional development of highways in the Seoul Metropolitan Area, while developing neighborhood living facilities in the lower part of the elevated bridge. These service facilities depart from simple functions as service areas and gas stations would be developed as multi-purpose service facilities with commercial facilities and youth training facilities. Ways to utilize private proposal projects are also under review.

Furthermore, measures are currently under review to build facilities that can provide added value to attract visitors such as commercial and cultural facilities on the side of national roads, as well as relaxation space for motorists to provide such functions as viewing the surrounding landscape, purchasing of local specialties, and using nearby walking trails and historical sites. Likewise, it is considered to transform the areas into regional hubs through combined development.

Figure 1.6. Creation of new added value through road facilities and space

Strengthening Connectivity among Transport Facilities

Support for Intermodal Transport to Maximize Efficiency of the National Transport System

The government is planning to supply road facilities to support intermodal transport. It is invigorating road adjustment and investment to support efficient connectivity/transfer system centering on transportation nodes, while actively implementing road projects to support inter-modalism such as access roads to intermodal transfer centers, KTX stations, and highway transfer stations.

In addition, in order to revamp roads to support construction of a transport system connecting logistics hubs, the government is building an environment for smooth flow between logistics hubs or between logistics hubs and national arterial road networks where large quantities of traffic and logistics volume are generated. It is also implementing road readjustment projects to build transport networks linking transport and logistics hubs encompassing ports, industrial complexes and logistics complexes.

Strengthening Connection Road Networks (Designated and Branch National Roads, etc.)

The government is implementing projects on branch national roads in order to complement insufficient short-distance connection road networks which are the result of having concentrated on building grid-type arterial road networks crisscrossing the country. This is expected to reduce travel time and detour distance by connecting transport logistics hubs such as roads, railway and ports and linking highway ICs with national roads and linking national roads with other national roads. In order to maintain arterial road functions of national roads in important cities and county areas with heavy traffic congestion, they are designated as national roads and managed directly by the government..

Technological Advancement through Development of Road R&D Projects

Implementation of High Value-added Projects through Convergence with Advanced IT Technology

R&D projects in the road sector are expanded into cutting-edge, high value-added projects not only through their linkage with green technology, but also through advancement of state-of-the-art IT technology and convergence of different technologies. In particular, road projects related to road design, construction and maintenance in preparation for eco-friendly transport modes such as electric cars are given more preference. Currently under development are road technologies that offer integrated management of carbon emissions in the road transport sector, minimize CO_2 emissions during road construction and maintenance, generate energy and utilize water resources. Moreover, the government is intensively cultivating large-scale R&D industries in the road sector to realize low-carbon, green growth as follows:

- Implementation of smart highway project
- Development of Korean-style pavement design methods and research on pavement performance
- Implementation of super long-span bridge projects

Envisioning Road Networks in Preparation for the Era of Inter-Korean Unification

The government is carefully analyzing road traffic status in consideration of rapidly changing inter-Korean relations and coming up with ways to revitalize inter-Korean exchanges based on the analysis.

It is also continuously investigating North Korean roads and connecting road networks of Northeast Asia, mainly the Asian Highway (AH1, AH6) and focuses on monitoring future developments. The government plans to diversify inter-Korean transport axes based on efficient expansion of transport networks in the Seoul Metropolitan Area and the border area, while building comprehensive road networks supporting the formation of a Northeast Asian economic zone by efficiently connecting the Korean peninsula with the Northeast Asian continent. For construction of road networks connecting the South and the North, the government plans not only to review the axis concept that can induce invigoration of transport

Figure 1.7. Asian Highway routes and AH1, AH6 routes

and industries, but also to implement new-concept road development on the continent level which regards the South and the North as a single domain.

05
Conclusion and Implications

Korea is one of the most representative success stories for the development of national arterial road networks by concentrating national resources in a short period of time, which led to revitalization of the national economy. In particular, the fact that the nation constructed the 428km Gyeongbu Expressway as a 4-lane highway within a mere 2 years and 5 months which boosted the national economy, increasing GDP 118-fold within a mere 40 years (9.5 billion USD in 1971 to 1116.4 billion USD in 2010) is an unprecedented case which is difficult to find repeated in other countries.

In addition, the country constructed national arterial road networks in the order of highways, national roads and local roads, expanding the role of roads in the movement of passengers and cargo. The national arterial road networks were constructed in a balanced manner through long-term road construction plans, rather than through one-time plans.

Korea’s success story of road construction and subsequent economic growth provides the following implications:

- Road construction should be implemented by establishing log-term plans based on the comprehensive national development plan.
- The objective of road construction should be determined by considering safety and efficiency rather than seeking quantitative expansion and user-oriented road planning and construction is required.
- Construction of major arterial roads in countries undergoing economic growth should be planned to secure road sites in advance in consideration of future expansion of roads.
- As railway-based transport of passengers and cargo has limitations, thus

road-based transport should be promoted in order to make contributions to economic growth.

- Efforts should be made to build eco-friendly, energy-saving road systems amid international trends where greenhouse gas emissions on the road are pinpointed as one of problems.

Korea has already secured various road technologies as follows through its experience of road construction and will be able to transfer such technology and experience to developing countries:

- Experience and technology of long-span bridge construction (i.e. Yi Sun-sin Bridge)
- Eco-friendly and user-oriented road pavement technology (i.e. warm-mix asphalt pavement, porous pavement technology)
- Experience and construction technology of building urban ring road networks (ring roads in major cities such as Seoul)
- Experience and technology of undersea tunnels (i.e. Geoga Bridge)
- Smart road construction and operation technology (i.e. ITS-related technology, smart highways, smart service areas)

The Korea Transport Institute (KOTI) conducts domestic transport-related researches and is leading policy support. As a leading research institution representing Korea's transport, the KOTI possesses the following strengths and capabilities to support road construction and operation of developing countries.

- Education and training on success stories related to road network construction and economic growth in Korea and transfer of experience
- National arterial road network planning and feasibility analysis for growth of the national economy and balanced development
- Proposal and design of technologies related to advanced road transport systems
- Presentation of road plans and design proposals customized for specific regions and topography
- Proposals on financing and organizing national road network projects

- Presentation of policy measures to minimize road traffic accidents
- Presentation of other measures and policies to enhance efficiency of road operation

CHAPTER 2

RAILWAY

Jinsu MUN
Research Fellow, The Korea Transport Institute

Deok Kwang KIM
Researcher, The Korea Transport Institute

01
Introduction

Transport in Korea

Infrastructure

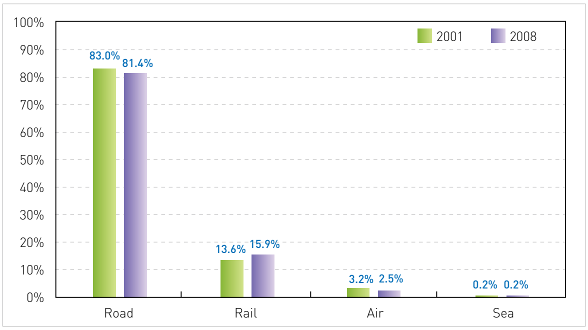
The trend of infrastructure construction in Korea for the past 20 years shows that road length had more than doubled from 47,000km in 1980 to 106,000km in 2010, while rail length had slightly increased from 3,135route-km to 3,557route-km during the same period.

Table 2.1. Infrastructure

	Road (km)	Railway (km)	Airport capacity (1,000 flights)	Port capacity (million tons)
1980	46,951	3,135	1,006	82
1990	56,715	3,091	1,331	224
2000	88,775	3,123	1,882	430
2010	105,565	3,557	2,222	830

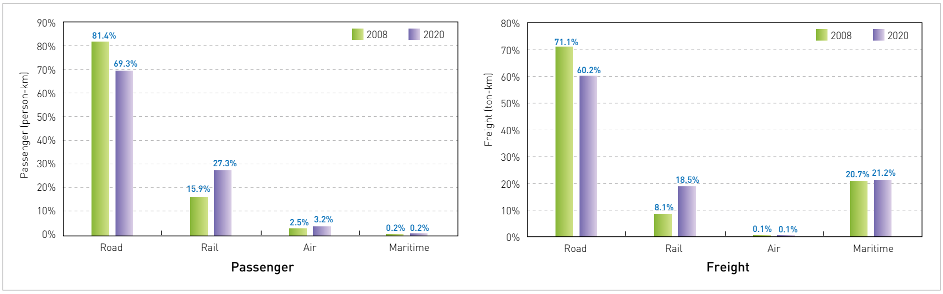
With regards to modal share in 2008 in terms of person-km, roads took the largest share at 81.4% and railways barely reached 15.9%. However, the increase of investment in rail infrastructure and the opening of the KTX (Korea Train eXpress, Korea's high-speed rail system) had raised railways' share of 13.6% in 2001 to 15.9% in 2008.

Figure 2.1. Mode share (Inter-regional)



National intermodal transport plan

Figure 2.2. Mode share target in national intermodal transportation plan



In December 2010 KOTI established the 2nd national intermodal transport plan (2001-2020) at the request of the Ministry of Land, Transport and Maritime Affairs(MLTM). The plan seeks to sharpen the competitive edge of railway to draw changes in modal split as follows: for passenger modal share, road from 81.4% (2008) to 63.9% (2020), railway from 15.9% (2008) to 27.3% (2020); and also for freight modal share, road from 71.1% (2008) to 60.2% (2020), rail from 8.1% (2008) to 18.5% (2020).

Road network plan

The national road network plan (2001-2020) seeks to build more expressways from 3,776km in 2009 to 5,470km by 2020, and more national roads from 13,820 km in 2009 to 14,384km by 2020, establishing a 7×9 corridor road network.

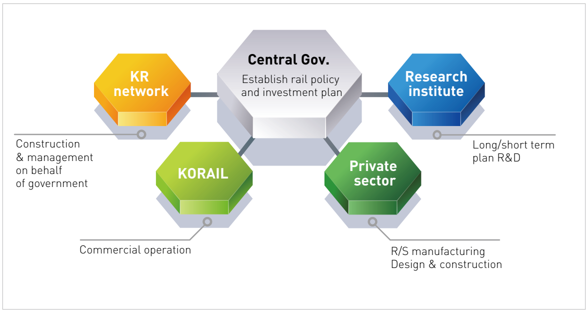
Figure 2.3. Road network plan

Railways in Korea

Railway-Related Organizations

There are several organizations

Figure 2.4. Railway related organizations in Korea



related to interregional railways. The MLTM establishes policies and investment plans. Korea Rail Network Authority is responsible for construction and management. While Korail performs operation, the private sector handles rolling stocks design, manufacturing and construction, and research institutes deal with short-, mid-, long-term plans, and R&D. And local governments are in charge of the construction and operation of their urban railways.

Rail length

The railway projects of the past 20 years had focused on building double tracks and electric railways rather than extending their total length (route-km). Therefore, rail length had increased by a small margin from 3,135km (1980) to 3,557km (2010), while double tracks had increased from 23% (1980) to 50% (2010). Also the electrification had grown drastically from 14% (1980) to 60% (2010), reaching a similar level to that of advanced countries such as Japan and Germany. And track-km in 2010 was 5,784km.

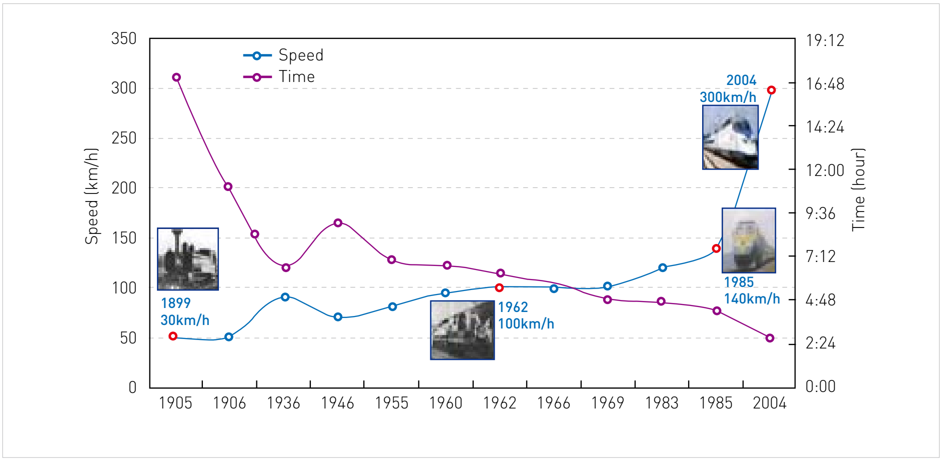
Table 2.2. Track Length

	1980	1990	2000	2004	2010	Remarks
Route length	3,135	3,091	3,123	3,374	3,557	Track Length: 5,784
Double track	720 (23%)	847 (27%)	939 (30%)	1,318 (39%)	1,763 (50%)	Japan 40%, Germany 45%, France 50%
Electrification	428 (14%)	522 (17%)	669 (21%)	1,588 (47%)	2,147 (60%)	Japan 60%, Germany 52%, France 48%

Rail Speed

When a steam locomotive ran for the first time in Korea in 1899, its speed was just 30km/h. Then with the introduction of diesel engines in the 1950s, train speed had

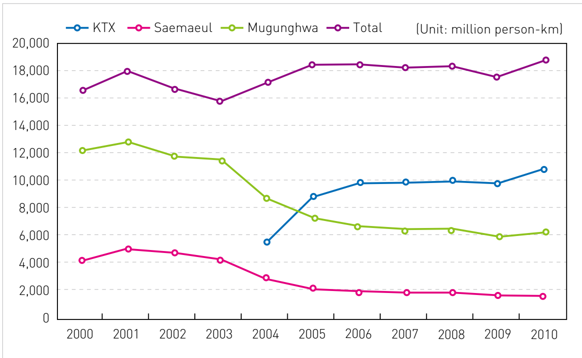
Figure 2.5. Evolution of speed



been increased to 100km/h, and the Saemaul Express train in the 1980s recorded its top speed at 140km/h. With the historical opening of KTX in 2004, Korea has entered the era of the super high-speed train, operating at speeds of 300km/h. Such speed improvements have shortened travel time from Seoul to Busan sharply to 2 hours 20min. now from 17 hours in the early 1900s.

Railway Passenger Transport (Inter-regional)

Figure 2.6. Railway Passenger (Inter-regional)



The introduction of KTX in 2004 has incurred a big drop in the number of passengers travelling with the other types of train. The KTX passenger number is on the rise continuously, but the overall rail passenger numbers show signs of only a slight increase.

Urban Railways in Municipalities

A total of 18 urban railways are running in six major cities such as Seoul, Busan, Daegu, Incheon, etc. Seoul has nine lines totaling 312km in length, which play a pivotal role in urban transport with 35.2% of modal share. Four lines are being operated in Busan with 12.6% of modal share, lower than that of Seoul. Daegu and Dajeon have urban railway modal share of 3.2% and 4.2% respectively.

In case of building urban railways, the central government funds 40-60% of project cost (Seoul 40%, the others 60%) and the relevant municipality should secure approval for its plan from the central government.

Table 2.3. Railway operation in local government

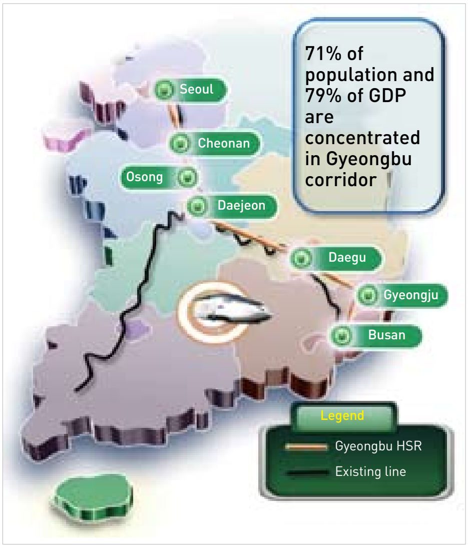
Description		Seoul	Busan	Daegu	Incheon	Daejeon	Gwangju	Total
lines		9	4	2	1	1	1	18
Line length(km)		312.4	107.8	53.9	22.9	20.5	20.5	526
Rridership	Million/year	2,294	257	110	73	29	16	2,779
	Modal split(%)	34.7	12.6	3.2	9.9	4.2	-	-

High Speed Rail (HSR) in Korea

Gyeongbu high speed rail (HSR) started the commercial operation of the 1st phase in 2004, followed by the 2nd phase in 2010, which runs 423.8km at top speeds of 300km/h from Seoul to Busan. Currently relevant construction is still under way in Daejeon and Daegu sections, and will be fully completed by 2014. The new HSR line is 406km long and the section of 17.8km from Seoul to Siheung is a conventional line. Travel time from Seoul to Busan without a stop takes 2 hours and 13 min. The fare is 43.20-46.30 USD and weekend fares are a bit higher than those of weekdays.

The new line for Honam HSR is under constructionand it is expected that the 1st phase(Osong-Gwangju, 182.3km) will be completed in 2014

Figure 2.7. HSR in Korea



and the 2nd phase (Gwangju-Mokpo, 48.7km) in 2017. At present HSR in the Honam region runs on the existing tracks.

HSR Fare

Even when the PPP (Purchasing Power Parity) is considered, HSR fare in Korea is relatively low compared to other countries. In case of other modes of transport, it is less expensive than that of airlines, but more expensive than those of express buses or private cars with more than two occupants.

Figure 2.8. Comparison of each country's HSR fares

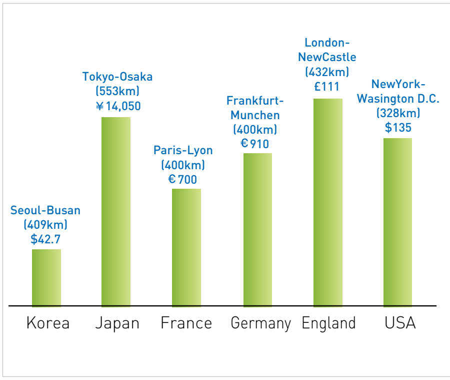
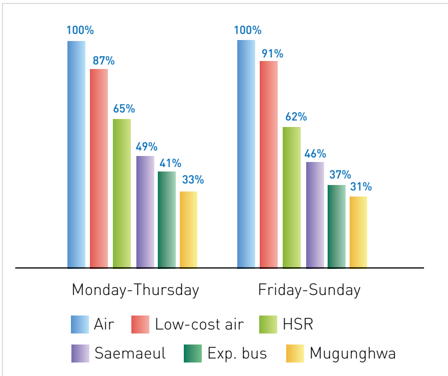


Figure 2.9. Comparison of KTX fares with other modes



HSR Passengers

Since the opening of HSR in 2004 the passenger number has showed a rising trend. Gyeongbu HSR had 107,000 passengers a day in 2011, growing at an 8.5% annual rate. And Honam HSR had 20,000 passengers a day in 2011, growing at a 8.2% annual rate.

Table 2.4. Ridership of KTX (Thousand person/day)

	2004	2005	2006	2007	2008	2009	2010	2011
G-Line	60.7	73.6	82.7	84.9	86.2	85.0	94.5	107.2 (8.5%)
H-Line	11.6	15.1	17.3	17.3	17.7	17.7	18.8	20.1 (8.2%)
Total	72.3	88.7	100.0	102.2	103.9	102.7	113.1	136.7 (8.4%)

• ( ) Indicates average annual growth rate

HSR has enjoyed profitability, operating in the black while the other lines have been in the red. Therefore the overall railway business is suffering a deficit

Table 2.5. Railway ridership and profitability (2009.3)

	Passengers (Ten thousand/day)	Revenue (mil. USD/yr)	Cost (mil. USD/yr)	Rev.-Cost (mil. USD/yr)
KTX	10.3	898	654	243
Conventional train	20.3	513	1,046	Δ532
Metro	243	605	524	81
Freight	127 thousand ton	377	782	Δ405
Total	274	2,393	3,007	Δ614

02
Chronological Review of Railway Policy

Railway Restoration (1950-1960)

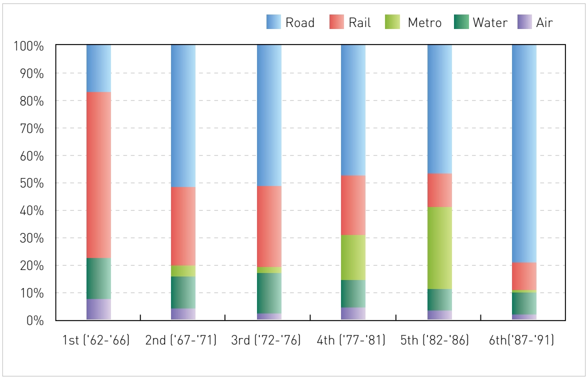
The strategic bombing of transport facilities during the Korean War caused severe damage to railway structure including the loss of 61% of rolling stock, 56% of power supplies and 7.5% of tracks.

The UN and then the Ministry of Transport started an emergency recovery, and had continued to restore and newly construct the relevant facilities and buildings until the early 1960s.

Railway Policies in the Economic Development Period (1961-1980)

Railway policies during the economic development period (1961-1980) put a focus on the road network. According to the five-year economic plans the investment in road infrastructure had increased gradually, showing the growth of road rate, 17% in the 1st plan (1962-1966), 52% in the 3rd plan (1972-1976), then 80% in the 6th plan (1987-1991). On the other hand, investment in railways had decreased from 61% in the 1st plan to 10% in the 6th plan, which implied that transport policies made a shift toward a road-oriented transport system.

Figure 2.10. Transport Infrastructure Investment



The investment in railways was centered on industrial rails and urban railways for Seoul and its suburbs, which improved the carrying capacity to support the five-year economic plans. However while road length had increased in a large scale by more than 60,000km from 27,169km (1962) to 88,775km (2000), railway length showed a small change from 3,032km (1962) to 3,123km (2000). Newly built railways during the same period (1960-2000) were only 1,100 track-km including double tracks.

Table 2.6. Road and railway length

	1962	1970	1980	1990	1995	2000	2005	2010
Road length	27,169	40,244	46,951	56,715	74,237	88,775	102,293	105,565
Railway length	3,032	3,193	3,135	3,091	3,101	3,123	3,392	3,557

Urban growth and economic development created an increase in demand for commuting between Seoul and its surrounding areas, consequently causing road congestion. The government had made urban railways double tracks for Guro-Incheon (27.0km, Gyeongin line), Seoul-Suwon (41.5km, Gyeongbu line) and Yongsan-Sungbuk (18.2km, Gyeongwon line), then provided public transport service in the metropolitan area.

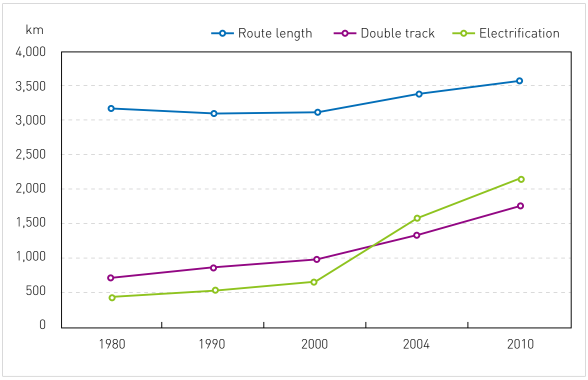
As Seoul city grew and developed, its population had rapidly swelled from 1.69 million in 1950, to 2.45 million in 1960, to 5.43 million in 1970, then to 8.36 million in 1980. The population growth and economic development also had triggered an increase in the number of cars, which was merely about 3,000 in 1961, to 130,000 in 1980, then to 880,000 in 1990. The growing number of cars had contributed to the increasingly worsening traffic congestion. Under this situation, Seoul subway lines 1 and 2 as a mass transit were built as a way to help ease traffic congestion. Line 1 was built in a radial shape to relieve the congestion in the center of the city, and line 2 was circular shaped to distribute the population of central Seoul and to connect Seoul with the other areas.

Railway policies in advanced industrialization (1981-2000)

Even during the advanced industrialization period (1981-2000) road-centered investment was given priority. The rate of road investment increased drastically from 47% in the 5th plan (1982-1986) to 80% in the 6th plan (1987-1991), but the rate of investment in railway decreased from 12% to 10% in the same plans. In 1994 a special account for transport infrastructure had been introduced to secure more stable investment. Then the railway investment showed a big increase from 1.3 billion USD (1987-1991) to 1.9 billion USD (1998), and to 3.3 billion USD (2003), but it was still at a relatively low level compared to the road investment of 7.3 billion USD (2003).

Interregional railways had been improved mainly through double tracks and electrification rather than newly built tracks. Jungang line (64km, 1988), Youngdong line (87km, 1997) and others were electrified to boost the carrying power in the arterial rail networks. And the metropolitan rail networks including Ansan line (19.5km, 1988), Gwacheon line (14.4km, 1994), Bundang line (18.5km, 1994), an Ilsan line (19.2km, 1996) were constructed in line with the

Figure 2.11. Change in railway length



development of new towns outside Seoul.

In spite of Seoul subway lines 1 and 2, the increase of passenger cars exacerbated the traffic conditions in Seoul. So subway lines 3-4 (1980-1985) and 5-8 (1989-2001) were additionally built to mitigate traffic problems and seek balanced development.

Other cities also had traffic problems derived from city growth and increased car ownership, which made them in need of subway construction. As part of this effort, Busan had its first subway line in 1985 and Daegu had one in 1997, making new urban transport system.

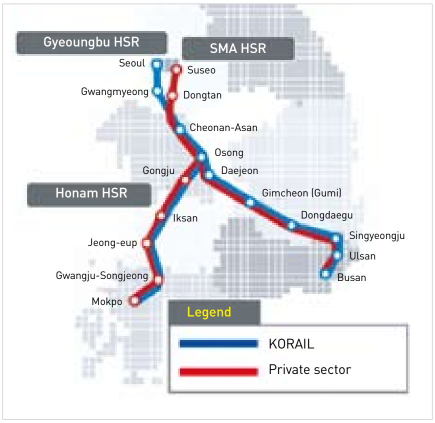
Korea experienced rapid economic growth and industrialization, causing heavy traffic volume among regions, then in the 1980s transport infrastructures such as roads and railways were already saturated along the Gyeongbu (Seoul-Busan) axis. Amid the pressing need for innovative measures, the introduction of HSR for passengers only was decided to boost the transport capacity of the Gyeongbu axis, Korea's main traffic corridor. The 5th five-year plan (1982-1986) included the HSR construction and its technical survey was implemented during 1989-1991. Finally the ground-breaking ceremony officially launched in 1992.

Railway Policies in Recent Years (2001-)

Railway reform was initiated in 2004 to improve the efficiency of management by separating infrastructure and operation. Korea Rail Network Authority is responsible for railway construction and facility management, and Korail is responsible for operation.

Recently the government seeks to introduce competition in the operation of KTX, which will start from Suseo from 2015, to induce the participation of the private sector. It is expected to lower the fare by more than 10% and raise the track

Figure 2.12. HSR operation in 2015



CHAPTER 02

access charge, currently set at 31% of operating revenue, up to more than 40%.

The Public Private Partnership (PPP) has been actively used to cope with the lack of government's budget and to utilize the efficiency of private sectors. Budget for PPP projects increased from 5.6% (1999) to 29.3% (2008) compared to government-financed projects. In the railway sector, PPP projects tend to be on the rise including Seoul subway line 9 (2009), Busan-Gimhae LRT (2011), etc. However, the hasty introduction of minimum revenue guarantee (MRG) in the early stage of private participation caused financing problems due to overestimated traffic demand when the operation started.

Also, recent railway construction is focused on Light Rail Transit (LRT) rather than Heavy Rail Transit (HRT), because it is less expensive considering proper traffic demand. Most of urban railways currently under construction such as Uijeongbu line, Yongin line, etc. are LRT.

Table 2.7. Private sector investment

	1999	2005	2007	2008
Private involvement (Bil. USD)	0.7	2.3	5.1	6.3
Ratio to gov.'s SOC investment	5.6%	10.8%	24.5%	29.3%

As the road network has expanded greatly, railways expansion has been at a small level. Recently, the government changed the focus of transport policies from road to railway, and raised investment in railway projects to boost the rail industry. For the past five years, the rate of road investment was 47% and for railways 24%, only a half the level of road investment. However, the government plans to decrease road investment to 37% and increase railway investment to 39% for the period of 2011-2020.

Table 2.8. Change in length of transport facilities

Year	Rail (km)	Metro (km)	Road (km)
1980	3,135	369	46,951 (9,457)
1990	3,091	522	56,715 (13,712)
2000	3,119	669	88,775 (14,544)
2005	3,392	1,597	102,293 (17,192)
2009	3,378	1,895	104,983 (17,596)

The national rail network plan (2011-2020) includes HSR construction, speed upgrade, etc, seeking the improvement of interregional accessibility through added investment in railway infrastructure. In detail, the area where travel time is within 1 hour 30 minutes. will be expanded to include population from 60% to 83%, and service area from 30% to 76%, and the area where travel time is within two hours will expand to include population from 74% to 96%, and service area from 55% to 90%.

According to the plan, road modal share will decrease from 81.4% (2008) to 69.3% (2020) and railway modal share will increase 15.9% (2008) to 27.3% (2020).

The length of HSR also will be extended from 406km in 2010 to 743km by 2020 including 45km of Daejeon and Daegu sections, 231km of Haman line, 61km of Suseo-Pyeongtaek line. HSR service will be extended into the competitive sections.

Conventional lines' speed improvement from 150km/h to 230-250km/h will be made in order to extend HSR services to broader areas and strengthen the competitiveness of railways in the end.

Figure 2.13. Master Plan for National Rail Network

Figure 2.14. Master plan for HSR network

CHAPTER 02

Figure 2.15. Development of high speed train

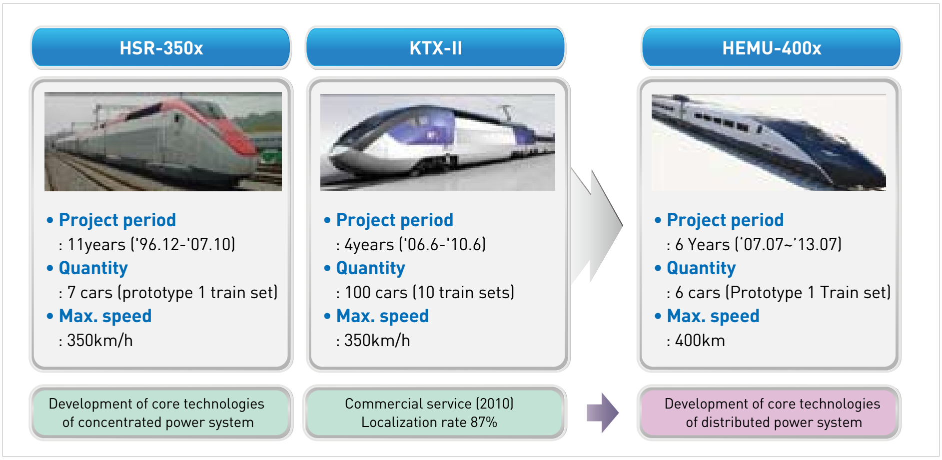
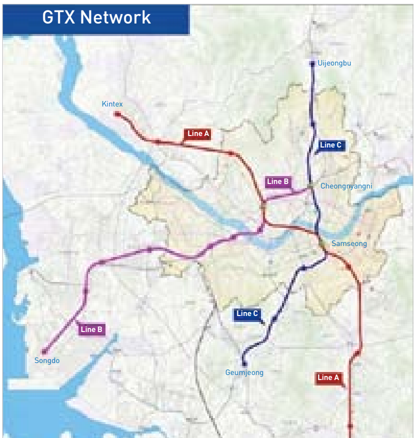


Figure 2.16. Rolling stock development

Figure 2.17. GTX network



Classification	Visiting point	Length (km)	Station (Transfer)
Line A	KINTEX-Dongtan	46.2	9(2)
Line B	Songdo-Cheongnyangni	48.7	9(2)
Line C	Hwaryong-Geumjeong	45.8	7(2)
Total		140.7	22(3)

For the past four years (2006-2010), Korea with its own technology had developed KTX-II, reaching a top speed of 350km/h. And HEMU-430X, the High speed Electric Multiple Unit - 430km/h eXperiment, started development in 2007, and will be completed in 2013. The faster rolling stocks are expected to beef up HSR’s competitive power.

For reference, Korea‘s railway operation started when a steam locomotive ran on the Gyeongin line in 1899. It was made with domestic expertise and the service stopped in 1967 when diesel electric locomotives appeared. The diesel engine was composed of four cars and donated by the UN troops in 1954. Until 1980 most of the rolling stocks were imported with the support of foreign loans, and since 1980 diesel electric locomotives have been domestically manufactured. And owing to the electrification of industrial lines and the opening of urban subways, electric locomotives have been made domestically since 1976. HSR rolling stock was assembled and produced by ROTEM, a domestic company, from 1998 and started commercial operation in 2004. KTX-II (max. speed 350km/h), domestically developed with its own technology, started operation in 2010. And HEMU-430X (max. speed 430km/h), High speed Electric Multiple Unit, will be completely developed by 2013.

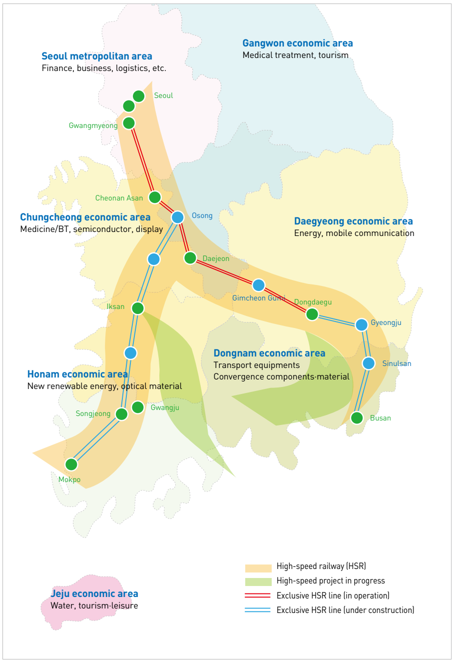
At present, Great Train eXpress (GTX) has been in the process of development to improve accessibility to railways in the metropolitan area. GTX is designed to run in 40-50m deep underground tunnel and have less stops with linear lines. Therefore, its travel speed is expected to be about three times faster than that of current urban lines, which makes the competitive power of public transport much stronger.

Also, it is being considered to have efficient operation schemes such as skip & stop service, express train service, etc. in order to improve train speed.

The government has a plan to build 40 intermodal transport centers by 2020 and establish an efficient intermodal freight system. Major train stations will be transformed into the centers.

Recently the government is preparing strategies to nurture KTX stations as the center of regional economic development, in a way that prevents the 'straw effect' and promotes

Figure 2.18. KTX economic area development plan



CHAPTER 02

the balanced development among local cities. The main work is to develop an economic model fit into relevant cities in connection with the development strategies for 5+2 mega economic zones. To this end the compact development and the establishment of a hub & spoke network are carried out around KTX stations. Now KOTI is conducting research on KTX economic zones.

03
Details of Major Rail Policies

Railway Construction

Organization

Korail, being independent from the Ministry of Transport since 1963, was composed of five offices and 24 departments. It performed mainly operational functions including operation management, fare pricing, facility construction, etc.

Financing and relevant laws

After the Korean War, Korea lacked financial resources, so it acquired various public sector loans from AID, IDA, IBRD and other organizations from the 1960s in order to carry out railway projects. And the Foreign Capital Inducement Act was established in 1960 to promote foreign investment.

Since 1994 a special account for transport facilities has been introduced to secure more stable financial resources, which are composed of transferred money from general accounts, various fees, and tax revenues such as transport tax, energy tax and environment tax. The introduction of the special account facilitated the steady investment in transport infrastructures, showing a noticeable increase from 11.7 billion USD (1987-1991), to 29.2 billion USD (1994-1998), to 54.2 billion USD (1999-2003), and to 61.7 billion USD (2004-2008). Along with this, the rate of investment in railways and subways increased from 11% (1987-1991) to 35%(2010), but in case of road it dropped from 80% (1987-1991) to 52% (2010). The special account budget for year 2011 was allocated to road at 6.1 billion USD (51%) and to railways at 3.2 billion USD (26%). The total budget for transport was 12.1 billion USD and tax revenues accounted for 57%.

In general, railways are totally funded by the state, while HSR is funded 50% by the central government and 50% by the Korea Rail Network Authority.

Figure 2.19. Transport SOC Investment

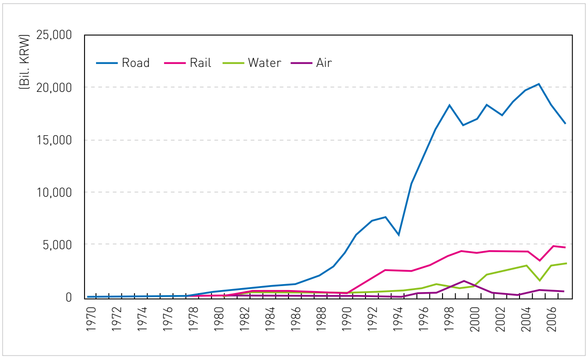


Table 2.9. Public loans for railway projects

Loan source	Amount	Usage	Loan period
AID	37.9 Mil. USD	Purchase of Diesel Loco. &Crane	1962-1986
IDA	40 Mil. USD	Purchase of Passenger Car, Coal Car	1962-1995
IBRD	470 Mil. USD	Purchase of Rail, Gurder, Passenger Car, Freight Car, Crane	1970-1997
OECF (Japan)	2740 Mil. Yen	Purchase of Freight Car, Loco., Machinery Rail Construction	1966-1996
KFW (West Germany)	25 Mil. Mark	Seoul Metropolitan CTC	1970-1997
EXIM/BANK (USA)	91 Mil. USD	Purchase of Diesel Loco., Diesel Engine	1968-1988
UK/L (UK)	0.50 Mil. Pound	Jungang Line CTC	1964-1979
KAF/FNBC	18 Mil. USD	Purchase of Diesel Engine, etc.	1982-1990
50 C/S GROUP (Europe)	83 Mil. Mark2.88 Mil. Pound190 MilFF 770 Mil.BF	Purchase of Electricity Loco. Electrification of Industry lines	1969-1975

Table 2.10. Special account for transport SOC

	2011 Budget (Billion USD)	Ratio
Road	6.1	51%
Rail	3.2	26%
Transport system mana.	0.9	8%
Airport	0.7	6%
Seaport	1.1	9%
Total	12.0 (6.9)	100% (57%)

• (   ) Indicates Transport, Energy& Environment Tax

CHAPTER 02

The Special Act on the Management of Intercity Transport in Metropolitan Areas, enacted in 1997, designated parts of railway projects in metropolitan areas as intercity railways, which can be funded by 75% from the central government and 25% from the relevant local governments.

Currently, in the case of urban railways the state is responsible for 40-60% (Seoul 40%, Others 60%) of the project cost.

Table 2.11. Conventional·Metropolitan rail funding structure

		Central gov.	Local gov.
Conventional rail		100%	-
HSR		50%	50%
Metropolitan rail	Central gov.	75%	25%
	Local gov.	60% (Seoul 40%)	40% (Seoul 60%)

Table 2.12. City rail funding structure

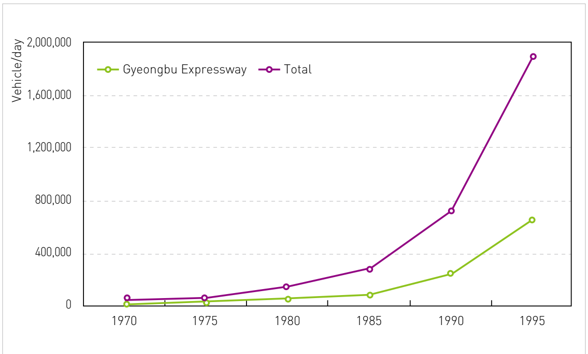
	Seoul		Others	
	Central gov.	Local gov.	Central gov.	Local gov.
1991-1997	25%	75%	30%	70%
1998-2004	40%	60%	50%	50%
Since 2005	40%	60%	60%	40% (Max. Loan 10%)

HSR construction

Background

Traffic volumes along the Gyeongbu axis have soared since the 1980s. Gyeongbu Expressway, for example, carried ten times more traffic volume when comparing 53,000 cars/day in 1980 to 645,000 cars/day

Figure 2.20. Traffic volume in expressway



in 1995.

The nation's rapid economic development led to the growth of inter-regional traffic demand. The existing roads and railways were expected to face difficulties in some sections from the 1990s. And it was expected that in the case of the Gyeongbu line, the Seoul-Suwon section would exceed its capacity in 1995 and similar situation would occur in other sections between 1993 and 1999. Also the Gyeongbu Expressway was expected to have problems in most sections between 1993 and 1994.

Table 2.13. Expected congestion in Gyeongbu railway line

Section	Capacity	'88	'89	'90	'91	'92	'93	'94	'95	'96	'97	'98	'99	'00
Seoul - Suwon	153	101	108	116	125	133	141	150	159	169	179	189	199	210
Suwon - Cheonan	138 (173)	114	123	133	143	152	163	173	185	197	209	222	235	250
Cheonan - Daejeon	134	101	109	117	126	134	143	152	162	173	183	194	206	218
Daejeon - Gimcheon	123	66	71	76	82	87	92	98	104	110	117	124	131	138
Gimcheon - Daegu	132	75	80	85	90	95	100	106	111	117	123	130	136	144
Daegu - Busan	106	60	65	70	75	80	85	90	95	101	107	113	120	127

• (   ) Indicates the rail capacity when 2 double track lines are constructed between Suwon-Chonan

Table 2.14. Expected congestion on Gyeongbu Expressway

Section	'88	'89	'90	'91	'92	'93	'94	'95	'96	'97	'98	'99	'00	'01	'02	'03	'04
Seoul - Suwon	113	122	131	139	148	157	175	192	210	227	245	259	273	286	300	314	328
Suwon - Cheonan	66	68	70	71	73	75	85	95	106	116	126	133	139	145	152	158	165
Cheonan - Daejeon	61	63	64	66	67	69	81	93	106	118	130	135	139	144	148	153	157
Daejeon - Gimcheon	41	43	45	46	48	50	52	54	55	57	59	60	62	63	65	66	67
Gimcheon - Daegu	46	69	53	56	60	63	66	70	73	76	79	82	84	87	89	92	94
Daegu - Busan	49	52	55	58	62	65	67	70	73	76	79	82	85	88	90	93	96

• Pink Color indicates the congested area when Expressway between Seoul and Daejeon is not expaned to 8 lanes

Issues

There was strong opposition from some to the introduction of HSR. They argued that firstly the conventional Gyeongbu line should be upgraded and have double tracks to improve speed and capacity, and HSR should be put on the backburner. And others raised objections, saying HSR would worsen the concentration of population and industry along the Gyeongbu axis, and strengthen the centralization toward Seoul. However, the analysis showed that the Suwon-Daejeon section (125.3km) had already reached its capacity limits, and even if electrification and track capacity expansion works would have been done, the capacity would hit the limits in 2000-2003. And some argued that the rail station for HSR could make a contribution to promoting the balanced development of the regional economy by cultivating the station's sphere of influence.

Organization

The then Ministry of Construction and Transport established the HSR Project Planning Board in 1994, having responsibilities for major policy decision making, planning, supervision, implementation supports, and coordination among relevant bodies. Korail set up an HSR Office in 1989 to carry out maintenance and electrification works for the conventional lines. The Korea High Speed Rail Construction Authority, established in 1989, played a key role as a concessionaire in construction, implementation plan establishment, financing, etc. The SOC Promotion Committee, established in 1989, took charge of the review and mediation of major policies (master plan, financing etc), and coordination among relevant bodies.

Relevant Law Establishment

The Regulation on HSR and New Airport Promotion Committee was enacted in 1989 in order to set up a committee that would deliberate and mediate the master plan and major policies for the construction of HSR and new airport. The Act on Korea High Speed Rail Construction Authority was enacted in 1991 to set up an authority that would construct HSR efficiently with wider networks, to make transport more convenient, and to contribute to sound economic development. The HSR Construction Promotion Act was enacted in 1996 to stipulate certain issues necessary for its rapid construction and to promote the project more efficiently.

Financing

The Gyeongbu HSR was financed by the government and the authority. In the 1st phase, out of 10.6 billion USD 45% was funded by the government and 55% by the authority. In the 2nd phase, out of 6.3 billion USD 50% was funded by the government and 50% by the authority. In an effort to finance the project by itself, the authority issued bonds, took out foreign loans, and induced private capital.

Table 2.15. Gyeongbu High Speed Rail budget plans (Unit: billion USD, basic plan)

	Sum	Government			HSR authority			
		Sub-total	Grant	Loan	Sub-total	Foreign loan	Bonds, etc.	Private financing
Sum	16.9	7.8	6.6	1.2	9.1	2.6	6.3	0.2
1st stage	10.6	4.8	3.7	1.1	5.8	2.6	3.1	0.2
2nd stage	6.3	3.1	2.9	0.2	3.2	-	3.2	-

Difficulties and Problems

While the HSR project was in progress, some expressed concerns about inadequate review and insensitivity toward safety, which was fuelled by the collapse of the Seongsu bridge and Sampoong department store, and insisted on the cancelation of the project. Also, the construction was delayed because of land compensation and regional egoism, that is NIMBY.

Civil complaints about the project to protect Mt. Cheonsung had stopped the construction for six months. Changes in the Gyeongju line had been discussed for four years because of the protection of relics, historic remains, and scenery.

Daejeon and Daegu lines also flip-flopped on how to pass through the centers of the cities: initially underground in 1991, above-ground in 1993 due to the reduction in construction cost and period, underground again in 1995 requested by the municipalities because of urban polarization and environmental damage, then finally above-ground in 2006 due to the problems of the underground method.

Solutions

Wiss, Janney, Elstner Associates, Inc. (WJE) performed a safety inspection during the period of June 1992-April 1996 to quash concerns regarding safety issues about HSR. Based on its results the countermeasures were established to correct the defects and problems through in-depth review.

SYSTRA had involved in design verification during the period of September 1994-August 1998, which served as an opportunity to secure safety and have a sound international credit.

Responsible supervision was provided during the overall construction period, and experts from international consulting engineering firms such as DEC (Germany) and INGEROP (France) carried out on-site inspections. And nationwide public relations for HSR was implemented in an effort to build up public trust and understanding.

04 Evaluations

Railway Construction

Investment in railways

Investment policies centering on road transport weakened the competitiveness of railways, which led to the decrease in passenger and freight volumes and its modal share on a gradual basis. The number of railway passengers per km had declined from 51% in 1962, to 32% in 1970, and to 22% in 1990. On the other hand, the construction of urban railways in Seoul and other major cities since the 1980s pulled its modal share

Figure 2.21. Mode share (Passenger-km)

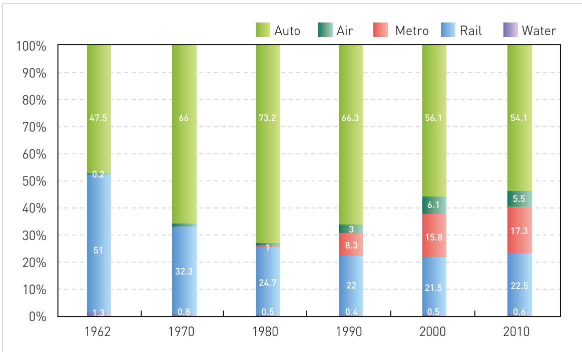
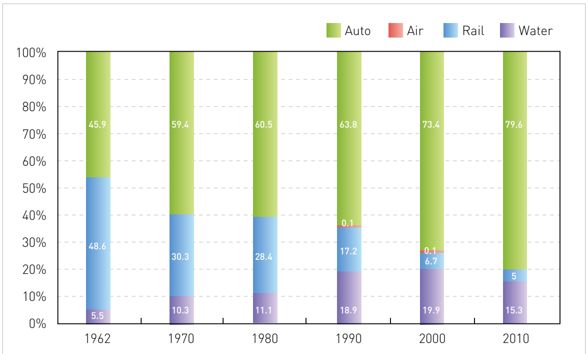


Figure 2.22. Mode share (Freight-ton)



sharply up to 17.3% in 2010 from 8.3% in 1990. In Seoul, especially, the railway modal share marked 35% in 2009.

In the case of freight transport, the railway modal share decreased sharply from 48.6% in 1962, to 28.4% in 1980, and to 5% in 2010, while road modal share increased drastically from 45.9%, to 60.5%, and to 79.6% respectively for the same year.

Private Partnerships

Private partnerships in various formats are under way in railway projects such as Incheon Airport Express, the railway from Sosa to Wonsi. to help ease the government's fiscal burden on investment. As there is uncertainty of traffic demand forecast, the introduction of a minimum revenue guarantee (MRG) scheme should be carefully considered. For example regarding the Incheon Airport Express, low traffic compared to the estimated values required excessive compensation by the government according to the MRG scheme. In the end its operation fell into Korail's hands from a private entity.

Special Account Introduction

A special account for transport facilities, being introduced since 1995, has greatly increased investment in railway projects, from 1.22 billion USD (1987-1991), to 6.1 billion USD (1994-1998), to 12.8 billion USD (1999-2003), and to 14.8 billion USD (2004-2008), which makes the security of stable financial resources possible.

Electrification

Electrification has improved passenger services and augmented freight transport capacity. Electrified railways in metropolitan have increased the efficiency of public transport and its modal share. Also, the electrification of inter regional railways provide better services in connection with KTX. Electrification rate is gradually on the rise, starting from 13.2% (1975), to 17.9% (1995), to 47% (2005), and to 60% (2010).

Speed Upgrade

Railway speed upgrade from 150km/h to 230-250km/h has been under consideration in order to strengthen the competitiveness of railways.

HSR Construction

HSR Effects

HSR Gyeongbu line has shortened travel time among regions and improved railway mobility. For example, travel time between Seoul-Busan (424km) has decreased from 250 min., to 138 min., and 118 min. Railway modal share between Seoul-Busan increased from 27.3% (2003) to 59.7% (2007), while airplane modal share decreased from 45.1% (2003) to 23.8% (2007), and express bus modal share decreased from 16.9% (2003) to 8.1% (2007).

The following <Figure 2.25> shows that the opening of the HSR Gyeongbu shrunk greatly a red-shaded area where travel time previously took more than three hours.

For the section of the Seoul-Daegu(292km), railway modal share jumped from 12% (2003) to 60% (2007), while modal shares of passenger cars and express bus dropped from 41.2% (2003) to 30.2%

Figure 2.23. Mode share change in the Seoul-Busan corridor

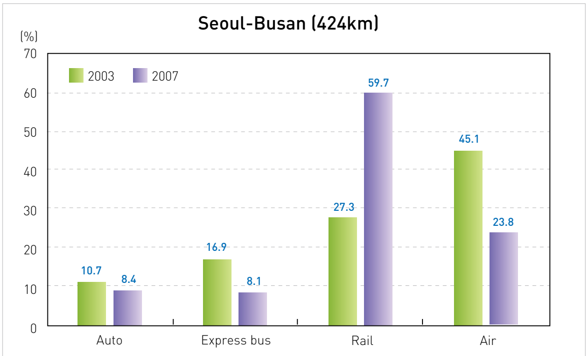


Figure 2.24. Comparison of cost & time in the Seoul-Busan corridor

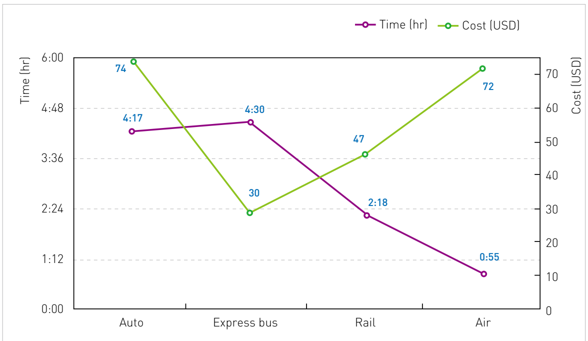
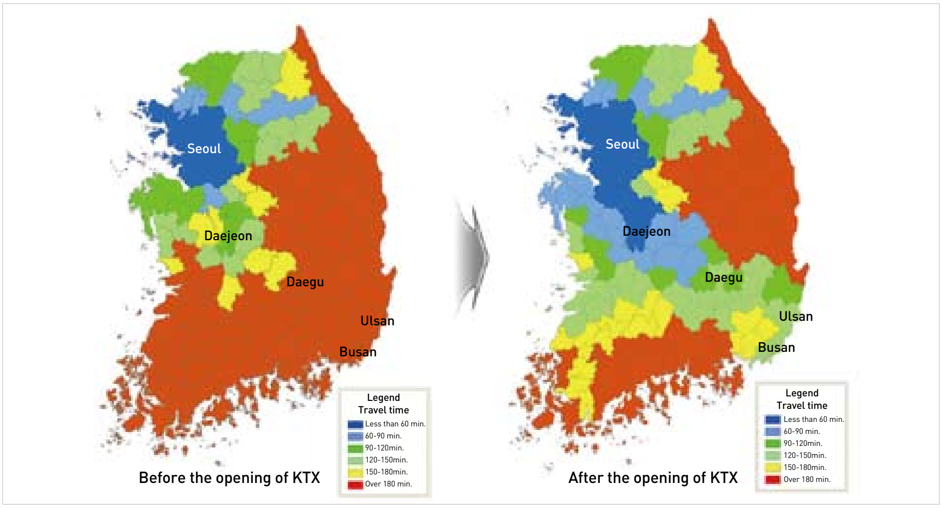


Figure 2.25. Comparison of the transportation time before and after the opening of Gyeongbu High Speed Railway (from Seoul)



(2007), and from 23.3% (2003) to 9.4% (2007) respectively. In particular, there was a huge drop in air travel demand between Seoul and Daegu due to the HSR opening, which in the end brought about the cancellation of the relevant route in 2007.

Figure 2.26. Mode share change in the Seoul-Daegu corridor

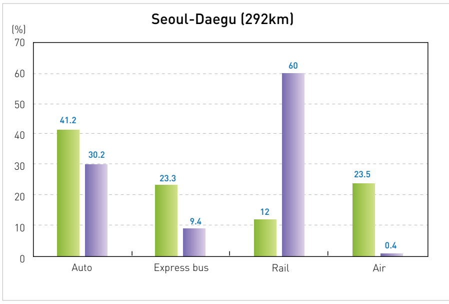
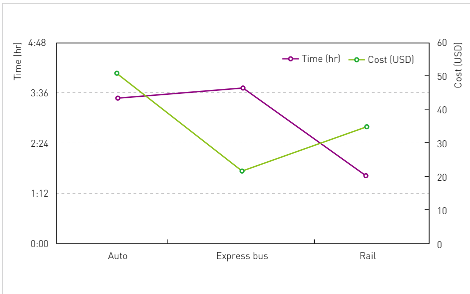


Figure 2.27. Comparison of cost & time in the Seoul-Daegu corridor



Socio-Economic and Environmental Effects

The B/C ratios of HSR were 1.39 (Gyeongbu line) and 0.82 (Honam line), respectively, and those of the general services were 0.69 (Gyeongbu line) and 0.42

(Honam line), respectively, which suggested HSR had much better profitability compared to the conventional lines. HSR enabled long distance commuting due to shorter travel time and also brought about changes in various aspects such as business meetings, cultural activities, medical services.

The construction of the HSR is expected to make a contribution to energy saving of 247 million USD a year, and environmental cost saving of 8 million USD a year due to CO_2 emission reduction. Also it could increase the number of tourists, promote regional development through the improvement of station's sphere of influence, and raise land prices around stations.

Railway Industry Competitiveness Enhancement

The opening of HSR increased the number of passengers by 14% between 2003 and 2009, and its positive effects raised investment in railways, which, in turn, strengthened the competitiveness of the railway industry.

Also railway technology has been improved in rolling stocks, signal/ communication, etc, and KTX-II, domestically developed, has run on the tracks since 2010. At present a next generation HSR, HEMU-430X, that is High speed Electric Multiple Unit - 430km/h eXperiment, is being developed.

Weakness

- **Overestimated Demand**

Actual traffic for HSR was 112,000 persons/day in 2010, which turned out to be only about half of what was projected, namely, 226,000 persons/day. It was because

Figure 2.28. Travel demand of HSR

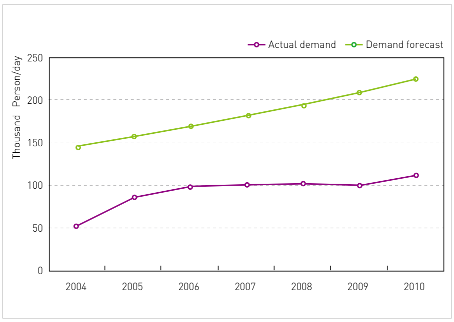
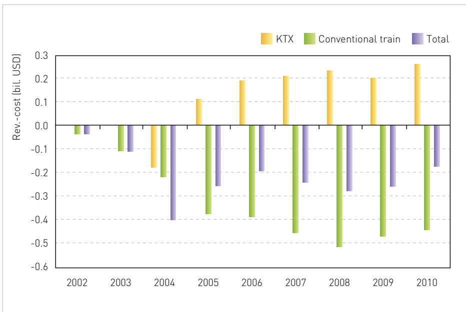


Figure 2.29. Passenger rail earnings of KORAIL

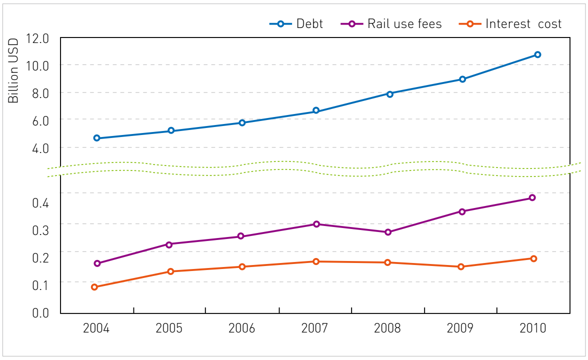


travel time increased a bit more than the target value, and insufficient data made it difficult to draw a reliable demand forecast. Such overestimated traffic affects the revenue. Since HSR started its commercial operation, it maintains a surplus, while the deficits of the other rail services are on the rise, making overall passenger revenue in the red, as much as 0.2 billion USD.

• Accumulated Construction Debt

Korea Rail Network Authority continuously accumulated debt, which reached 10.6 billion USD in 2010. The reasons why the authority suffered from such financial problems are that the actual numbers of passengers were lower than estimated and the track access charge was set at 31% lower than its operating revenue. The charge was not able to cover even the interest payments. And low pricing could be pointed out as one reason also.

Figure 2.30. Construction debt of Korean Railroad



• Poor Accessibility and Connection with Other Modes of Transport

In some cities, train stations are located far away from the city center because of cultural asset protection and negative perceptions on rail penetration of the city center. It brings about poor accessibility, and inconvenience in combination with the lack of connection with other transport modes. These factors cause a decrease in traffic volume and revenue. This is because the construction of HSR lines gained more attention than the network connection with other modes.

CHAPTER 02

05
Suggestions

In developing countries, various loans can be regarded as a financial measure in the early stage of development. However, it is necessary to actively consider introducing a special account to expand and improve transport infrastructure continuously. Korea has benefited from the special account for transport facilities, which makes it possible to have stable financial resources.

Not only in terms of the lack of a nation's budget but also in regard to the need for efficiency of the private sector can the Public Private Partnerships (PPP) be an option to consider. However, considering there was a big issue derived from a difference between actual volume and estimation when the minimum revenue guarantee (MRG) was introduced in PPP projects in Korea, the scheme should be considered carefully.

It is necessary to modify laws and regulations concerned to construct railways. The Land Acquisition Law (1962), which stipulated that private land could be expropriate for public interests, served as an opportunity to trigger the development of various SOC projects.

Metropolitan cities such as Seoul need to establish a railway-centered public transport system. The modal share of railway in Seoul accounted for 35% in 2009, which played an important role in upgrading the city's image and competitiveness. To this end it is necessary for the central government to support the financing of such urban railways.

Korea has constructed industrial railways to support economic growth in the initial stage of economic development, and urban railways amid economic growth and urbanization, then HSR through the advanced development. It is essential for developing countries to adopt step-by-step plans for railway construction according to their socio-economic development level rather than reckless construction.

Railway has received increasing attention in recent years amid the avalanche of interest in global environmental issues. In this mood it is necessary to promote railway projects from an environmental aspect. Korea's policy of low carbon green growth has exerted a great influence on the paradigm shift of transport investment from road-centered to rail-centered. Also the electrification of conventional lines is strongly recommended in a way that seeks sustainable development and upgrades passenger services.

The HSR project served as a momentum to raise Korea's railway technology to a higher level, and also to upgrade design and construction skills in overall industrial sectors. The construction experience and improved expertise from the project is a driving force to enter into the world railway market. Developing countries should take advantage of HSR construction, not by just introducing foreign technology and products but by establishing technology transfer strategies to secure own HSR technology in the end.

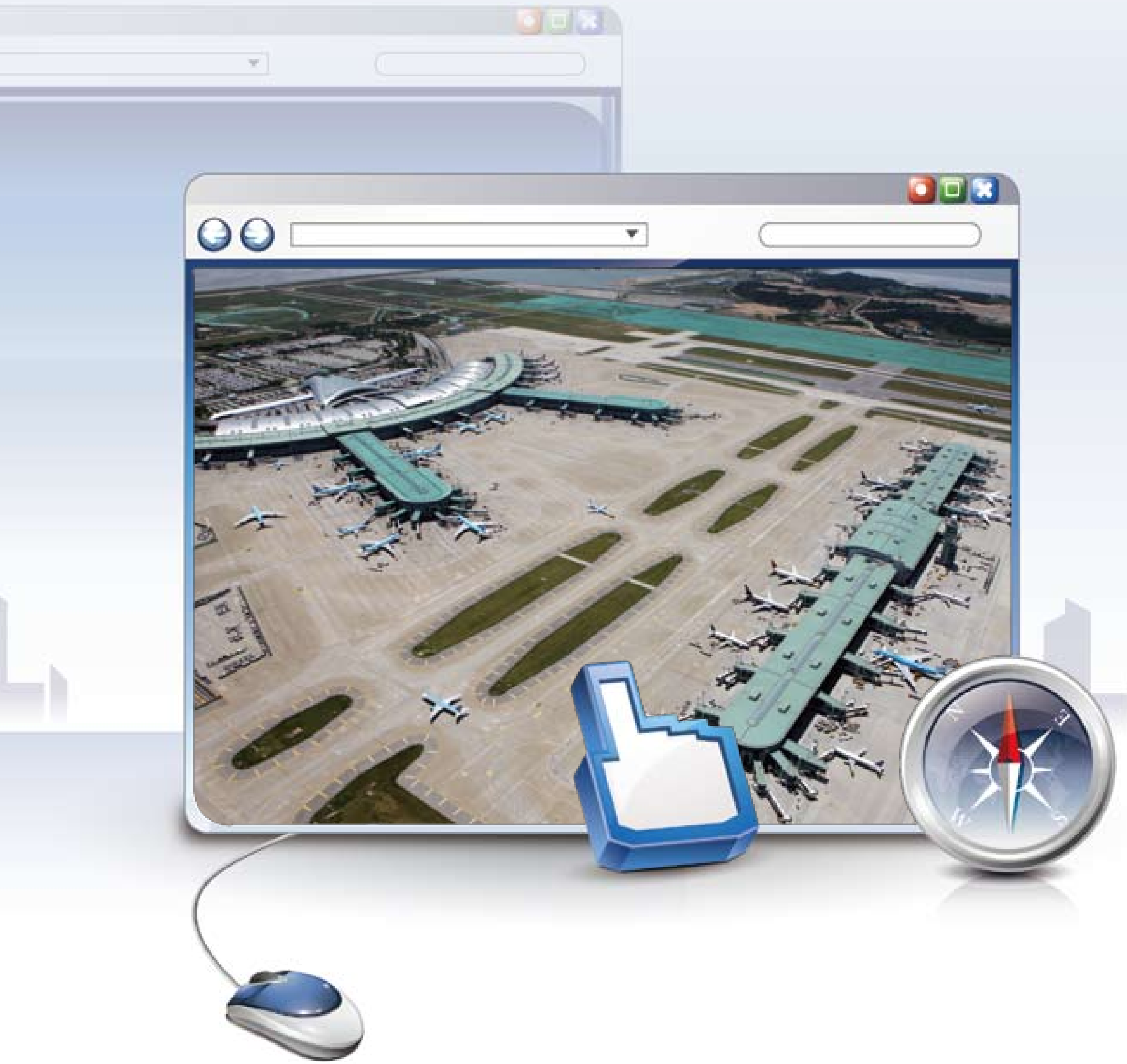
While the HSR project is being carried out, there are opportunities to face many difficulties in every stage such as technical problems, trial and error, and considering objections from various parties concerned. The success of such a large-scale project requires the establishment of a proper system to support the government's strong commitment.

Due to immense project cost, sufficient demand is an essential factor. As the construction debt derived from insufficient demand is transferred to the government, it is necessary to have economically viable lines and thorough review, and also to establish connections with other modes of transport to increase traffic demand.

CHAPTER 3

AVIATION

Jinseo PARK
Associate Research Fellow, The Korea Transport Institute



01
Introduction

Preface

This paper covers Korea's air transport industry, airport infrastructure and aviation safety. As of 2012 Korea has two major airlines, namely Korean Air and Asiana Airlines, and five low-cost carriers. As for airport infrastructure, Incheon International Airport Corporation (IIAC) and Korea Airports Corporation (KAC) are operating and managing Incheon International Airport, and 14 other airports, respectively. And the achievements and significance in terms of safety, as an important matter of aviation industry and infrastructures, also will be discussed in this paper.

Status quo

According to the annual report of the Council 2010 of ICAO, Korea achieved the number six ranking overall in world air transport in 2010, taking the 13th place for passenger transport volume and the 3rd place for cargo transport volume.

During the period of 2001-2010 the traffic volume, international and domestic combined, of passengers and freight annually increased about 4.3% and 5.6% respectively. In terms of total ton-kilometers, Korean Air and Asiana Airlines ranked 10th and 30th, respectively, leading the international air industry.

Air freight in 2010 accounted for a mere 0.3-0.4% of total exports in volume, but about 30% in value.

In 2011, Incheon International Airport was rated as the best airport for its airport services by the Airports Council International for seven consecutive years. Based on the advanced technologies and know-how, the IIAC has been active in overseas business and carved out its place in the business.

The ICAO USOAP (Universal Safety Oversight Audit Programme) audit in 2008 verified that Korea complied with 98.8% of the international standards and recommended practices in every aspect, more than sufficient proof of safety.

Korea, which joined the ICAO council (part III) in 2001 for the first time, came in fourth place in 2010 after 2004 and 2007, strengthening its position in the international aviation community. And it has exerted its efforts to gain a seat in the Part II group. Along with this since November 2005, Korea has played a role in the ANC (Air Navigation Commission), the principal technical decision-making body.

02
Current Status of Air Transport and Problems

Air Transport Industry

Korean Air, which entered the air transport market in 1969, had enjoyed a monopoly power until 1987. This was disadvantageous to customers, obstructing the provision of various services. During the above period as an embryonic stage, aviation law and grounds for aviation industry had been developed. Entering into the 1970s, the five-year plan for economic development accelerated industrialization and export-driven economy, so the air transport industry also recorded high growth. As a part of industry diversification, Asiana Airlines advanced into the market in 1988, and Korea's two major airlines, Korean Air and Asiana Airlines, continued an oligopoly form of market domination until 2005. As the liberalization of overseas travel in the 1990s hiked up air traffic, domestic airfares could be changed through a reporting system.

As the airline industry was deregulated in the 1980s, low-cost carriers thrived in Europe, Japan and the U.S.A. in the 1990s and 2000s. Since 2005 Korea has had five low-cost carriers, and in total seven airlines.

So far the aviation policies in Korea put more focus on the growth of air transport, in favor of large airlines, while much less focus was placed on the expansion of low-cost airlines. Also there are insufficient responses to various needs such as small business, tourism, etc. Such growth-centered policies are weighted toward service providers, so policies for customer protection are relatively unsatisfactory.

Passenger transport has been successful thanks to the harmony with business and tourism, while cargo transport has had a tough time in securing enough volume and making additional revenue because of the absence of appropriate third party logistics (3PL) providers and the lack of value creation.

In the past, a national flag carrier had 70% of flight routes centered on North America, Europe and Southeast Asia including China and Japan, and relatively less flights in Africa, Latin America and Southwest Asia.

On the other hand, as the national income has risen and a better quality of life has been much sought after since the 2000s, the aviation demands for travel and leisure have shot up. However, there have not been established legal and

Table 3.1. Aviation policy trends

Period	1969-1987	1988-1997	1998-2003	2004-present
Stage	Embryonic stage	Continuous growth and internationalization stage	Stable growth and developing stage	Take-off and upheaval stage
Aviation policy	• Industrialization by five-year economic development plan • Export-driven policies • Revision of aviation laws • Establishment of the foundation for the aviation industry	• Expansion of international routes • Upgrade of transport facilities for internationalization (the establishment of the airport development master plan, 1991) • Increasing air traffic demand due to the liberalization on overseas travel	• Acceleration of Open Skies Agreements • Function separation of aviation safety and aviation policy • Introduction of international standards for aviation safety	• Promotion of the Incheon International Airport as a hub • Decrease of air traffic due to alternative transport modes and economic recession
Regulation	• Monopoly structure • Privatization of airlines (Korea Air Lines – Korean Air, Feb. 1969) • Domestic market of air transport	• Multiple carriers by the introduction of competition • Reporting system of air fares(1991)	• Non-scheduled service, licensing system - register system • Change of register criteria (50pax ⇨ 80pax) • Introduction of full time supervision on airlines and airports	• Improvement of regulations to provide air service fir for domestic circumstances • Promotion of the privatization of airports
Remarks	• Appearance of jumbo jets(B707, B747) • U.S.'s deregulation and the 'International Air Transportation Competition Act'	• U.S.'s Open skies Agreement with Netherlands (1992) and 'Neo International Aviation Policy'(1995) • Europe, step-by-step aviation liberalization	• Opening of the Incheon International Airport • Rapid changes in international air transport market (9/11, SARS, oil price hike) • Rated as category 2 by FAA IASA, and enhancement of safety measures • Joined the ICAO council (partIV)	• Discussion on the integrated aviation market among Korea, China and Japan • Opening of high speed rail • Economically depressed local airports

institutional grounds sufficiently to develop aviation industry and to promote business structure for general aviation, airport operation and supporting facilities. Coupled with that, not many efforts were made to provide aviation service to isolated areas such as Ulleung island and Heuksan island, causing an inequality of service provision.

Therefore, it is essential to develop various aviation fields such as aircraft manufacturing and maintenance, air business, etc. for the structural growth of the industry, and to develop general aviation for the expansion of the domestic market.

Airport Infrastructure

In 2012, Korea has a total of 15 airports in operation, including eight international and seven domestic ones. Four airports with civil and military functions together were closed due to the lack of traffic demand. Still today, more than 50% of airports share with military bases, involving lots of operational restrictions:.

- International (8): Incheon, Gimpo, Jeju, Gimhae, Cheonju, Daegu, Yangyang, Muan
- Domestic (7): Gwangju, Gunsan, Yeosu, Pohang, Sacheon, Ulsan, Wonju
- Closed (4): Gangneung, Sokcho, Yecheon, Mokpo

Domestic air traffic is focused on Gimpo, Jeju and Gimhae airports, and international traffic is mainly concentrated in regional hubs such as Incheon, Gimhae and Jeju airports.

Most of the airlines are operating their business from Incheon airport, and other local airports have seen a fall in their traffic volume because of the operation of KTX, the Korean bullet train service, and expanded expressways. Also the development of other modes of transport such as more KTX lines and expressways is expected to lead to a continuous decrease of inland air transport demand.

* Effects of KTX opening: Daegu (△79%), Gimhae (△37%), Gwangju (△28%), Pohang (△25.5%)

Also small aircraft are being replaced with large aircraft, resulting in a decrease of service frequency to small airports. Therefore, air traffic volume in the local airports continues to decline.

In regards to airports revenue, overall they are showing a surplus, including Incheon airport, while airports operating in the red are financed by airports in the black to maintain the publicity.

Table 3.2. Operating balance by airport (2010) (Unit: billion KRW)

Airport	Gimpo	Gimhae	Jeju	Daegu	Gwangju	Cheongju	Yangyang
Profit/loss	52.9	66.4	27.7	-0.5	-1.2	-5.5	-10.1
Airport	Ulsan	Yeosu	Muan	Sacheon	Pohang	Gunsan	Wonju
Profit/loss	-6.1	-7.9	-7.1	-3.5	-5.6	-2.2	-1.6

Airports, especially in the 1990s, were often built for political reasons, citing regional balance or people's needs, rather than based on market logic according to a precise demand forecast. When an airport is developed lacking economic feasibility, it suffers from financial difficulties after the commercial operation, due to overestimated demand and operational incapability. So the airport development driven by politics needs a more prudent approach.

In terms of airport facilities, regional hubs for international routes, such as Incheon, Gimhae and Jeju airports, were built in a timely manner, and can properly handle traffic volume currently. However, Yangyang and Muan airports, built according to political logic, are under-used.

Previous airport development was focused on building large-scale airports, so the airport infrastructures were not established sufficiently to be ready for various paradigms even though there were the needs of the times. In particular, there have been no developments of small-sized airports to provide services to isolated areas, and a water airport and a general aviation airport for tourism and leisure.

In the past, 14 airports were operated in a uniform manner, regardless of the given conditions of each airport, and there was little effort to improve efficiency and lack of means to revitalize the facilities. In the long term, it is necessary to build airports to overcome the limitations of the domestic market and to move abroad with operation techniques and know-how.

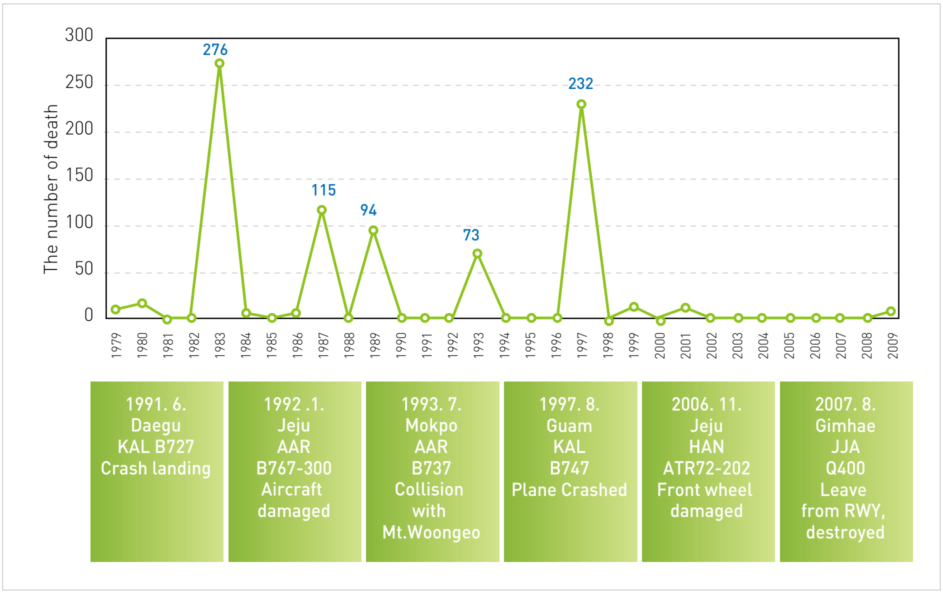
Aviation Safety

Korea had seen high-speed growth in transport volume in the 1980s and 1990s, but rated as category 2 by FAA IASA (International Aviation Safety Assessment) because of the absence of safety standards and management system for the aviation industry and airports. This result took a toll on the aviation industry, because air transport service providers from category 2 countries were allowed to continue operating as before the assessment, but were not allowed to expand their service to the U.S.A.

A total of 91 air traffic accidents occurred during the past 10 years (2001-2010), resulting in 60 deaths, 63 injuries and 95.3 billion KRW in economic loss. In case of light sport aircraft and ultra-light aircraft, a total of 46 accidents occurred involving 34 deaths, 20 injuries and 3 billion KRW in economic loss, and their fatalities are bigger than those of the other aircraft accidents for the recent 10 years. And there were a total of 82 aircraft incidents during the same period (2001-2010), but they are on the increase after hitting the bottom with two cases in 2005.

In the past, whenever a fatal accident took place, air safety policies were introduced hurriedly as temporary measures, which presented mainly short-term

Figure 3.1. Air traffic accident trends



fixes, but they had limitations for solving core problems in the long-term. The government, in charge of safety management, was keen on routine inspections to reduce the number of accidents, but was indifferent to the establishment of sound safety management and a safety culture in the airlines.

Because the training system for airline personnel, the core of te air transport industry, is fragile, most of them have used foreign systems from the U.S.A. and Australia. Over the next five years, about 1,600 pilots are expected to be in demand, and their overseas training will incur a large loss of foreign currency.

Currently the airspace structure over Korea is under the military control, having limited flexibility. The traditional Air Traffic Control (ATC) system, centered on voice communication, seems unsuitable to satisfy future air transport and to secure safety. And it is required to improve airspace infrastructures steadily through efficient airspace operation and the upgrades of ATC and air navigation facilities and systems, in order to promote the continuous growth of the aviation industry.

03 Policy Implementation

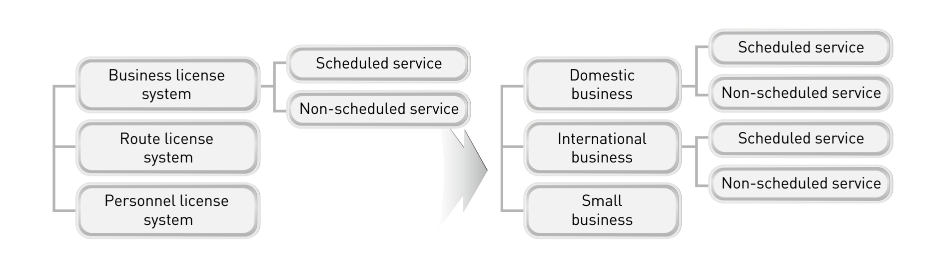
Air Transport Industry

In the past entry into the air transport market was restricted, and under such conditions diverse services were not available. The license system for the air transport industry had the classification changed into domestic, international and small air business, which made it possible to establish an airline to provide a variety of services based on its capabilities.

In 2009, the license system changed the classification of the scheduled/non-scheduled business into domestic/international, then allowed international business free from any restriction on flight operation under the Open Skies policy.

KOTI made great contributions to the top decision-making process and the establishment of a long-term plan by supporting the above licensing system reform

Figure 3.2. Reform of licensing system for air transport business



for the market entry and the establishment of the 'Aviation Master Plan' pursuant to Article 2 of the Aviation Act.

And the institute led the negotiations on an integrated air transport market for Korea, China and Japan and produced tangible achievements of limited Open Skies Agreements, which were made with Shandong Province first in China in June 2006, hoping for a gradual opening, and with Japan, including all the areas except Tokyo, in August 2007. Such proactive efforts have enhanced the competitiveness of national flag carriers and developed the nation as a logistics hub.

Table 3.3. Open Skies partners

Category	Countries
Cargo (10)	India ('91), Austria ('96), Srilanka ('97), Australia ('98), Germany ('01), Scandinabia3 ('02), Ukraine ('07)
Passenger and Cargo (17)	Maldive ('90), US ('98), Chile ('01), Peru ('02), Vietnam ('06), Thailand ('06), China-Shandong ('06), Cambodia ('06), Miyanmar ('06), Malaysia ('07), Japan ('07)

Previously, aviation policies focused on protecting and nurturing the national airlines, and promoted the liberalization of the market at a gradual pace, but after 2005 the government changed its directions to push forward the agreement actively to pursue growth through network expansion and foreign market penetration.

Korean Air developed niche markets by establishing a global cargo network and handling special cargo, thus ranking the world No.1 in terms of international freight ton kilometers.

Airport Infrastructure

In the past the airport infrastructures were built without considering systematic factors at national level, therefore it was impossible to seek the balanced development of airports. In an effort to deal with such problems, KOTI and the Ministry of Land, Transport and Maritime Affairs (MLTM) set up the 'Medium- and Long-term Plan for Airport Development' according to Article 89 of the Aviation Act in pursuit of the balanced development and efficient operation of airports.

The Incheon International Airport opened for business in early 2001 to reduce the load on the older Gimpo International Airport, which could not cope with the increase in air traffic, and to serve as a hub in Northeast Asia. After then, Phase 2 construction including a concourse and a third parallel runway was completed in 2008.

Phase 3 construction began in 2012 including the second passenger terminal (T2) to deal with future traffic demand, which would lead it to get an upper hand in the market. In regard to the development and operation of airports, intense investment was made based on the paradigm of "selection and concentration."

Table 3.4. Airport development system in Korea

Functions and roles of each category	Hub	National representative airport, int'l hub
	Gateway	Base for the given area (large)/dom. Routes + mid. distance short int'l routes
	General	General aviation service for the given area

Also the logistics park around Incheon airport facilitates the provision of high value-added logistics service, which accelerates the acknowledgement of the airport as a logistics hub.

Incheon airport has spared no efforts to become a hub, concentrating on route network expansion, facility expansion, operation improvement, etc. And it is developing as a new growth engine through the upgrade of international status and entry into foreign markets.

And domestic airports have adopted the IATA StB (Simplifying the Business) program and improved the whole work process to function more smoothly.

Since 2011 the government has considered selling its shares of Incheon airport and the right to operate the Cheonju airport in an effort to strengthen the competitiveness through the diversification of operating entities. And the 'Regulation on Charter Flights' was revised to make Gimpo airport specialized in short-haul international flights. There have been endeavors to expand short-, mid-range international routes to revitalize local airports, and reduce facility fees in the airports with small traffic volumes, which are located in Yangyang, Wonju, Sacheon, Pohang to attract air routes.

Aviation Safety

The government has developed several measures as follows to organize the previous unsystematic aviation safety management: 'Aviation Safety Technology Development Plan' pursuant to Article 37(2) of the Aviation Act, 'Aviation Safety Program' pursuant to Article 149 of the Aviation Act, 'Master Plan for Aviation Safety and Security' pursuant to Article 9 of the Act on Aviation Safety and Security.

After been rated as category 2 by FAA IASA (International Aviation Safety Assessment), the government set up a separate organization to manage aviation safety, and the Korea Aviation Accident Investigation Board under the MLTM, which is an independent body with specialties to deal with safety issues.

And related regulations were modified with the target of fatality-free accident for 10 consecutive years, and the 'Aviation Safety Program' was set up according to Article 49 of the Aviation Act, and the practice standards for SMS (Safety Management System) was made and implemented by airport, airlines, ATC, etc.

After going through the FAA s IASA in 2001 and ICAO USOAP in 2008, the aviation safety system safety was greatly reinforced with focus on specialized safety supervision and international standardization.

* ICAO: Global Air Navigation Plan (GANP), Universal Safety Oversight Audit Programme (USOAP), Navigation Systems Panel (NSP), Safety Management System (SMS), etc.

Figure 3.3. IATA aviation safety program

In December 2005, the SMIS (SARPs Management and Implementation System) was developed and distributed as the world's first to manage the systematic SARPs (Standards and Recommended Practices).

Starting off in 2011, KOTI has been performing a joint research on SMART (SARPs Management and Reporting Tools) and TOMS (Total Oversight Management System) with ICAO to support ICAO CMA by 2013.

The ‘Safety A to Z’ program has been implemented to build an aviation safety culture in airlines, airports, governments, to improve the public’s right-to-know, and to help enhance aviation safety. And a new airline should go through a stricter process of air operator certification before service and intensified safety supervision after service, and also foreign airlines operating in Korea face enhanced safety supervision.

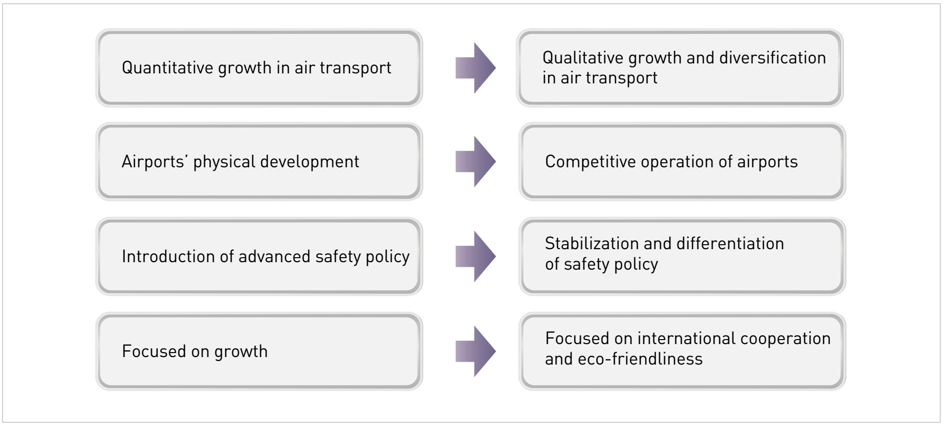
In November 2005 Korea and the United States signed a Bilateral Aviation Safety Agreement (BASA) for the promotion of aviation safety, which helps revise relevant regulations and systems, and promotion of personnel training and technical support.

* A joint workshop with FAA and an international seminar on aviation safety were organized

Figure 3.4. SMIS and SOMS

A safety management plan was established for light sport aircraft and ultra- light aircraft,

Figure 3.5. Paradigm shift in aviation policy



and the legal system for light sports aircraft and their safety regulations were introduced. In the aviation safety and technology areas, the government organizes training programs for aviation personnel from developing countries jointly with ICAO and prepares various seminars, in an effort to upgrade its international status and increase international cooperation.

The above figure shows the changes of keywords in aviation policy.

04

Great Performances

Air Transport Industry

Deregulation in the aviation industry made it possible to set up an airline to offer various air transport services, thus invigorating the start-up of low cost carriers (LCC), which, in turn, increased domestic air traffic demand and customers' benefits.

* After 2005, starting with Hansung Airline, LCC such as Jeju Air, Jin Air • Air Busan, Easter Jet, T'way Air, etc have actively commenced commercial operation.

Table 3.5. National flag carriers' market entry and exit

<table>
<tr><th colspan="3">category</th><th>2005</th><th>2006</th><th>2007</th><th>2008</th><th>2009</th><th>2010</th><th>No. of airlines</th></tr>
<tr><td rowspan="3">International and domestic air transport service provider</td><td colspan="2">FSC</td><td colspan="6">Korean Air, Asiana Airlines</td><td>2</td></tr>
<tr><td rowspan="2">LCC</td><td>entry</td><td>Hansung Airline</td><td>Jeju Air</td><td>Youngnam Air</td><td>Jin Air, Air Busan</td><td>Easter Jet</td><td>T'way Air formerly, Hansung Airline operation resumed</td><td rowspan="2">5</td></tr>
<tr><td>exit</td><td></td><td></td><td></td><td>Hansung Airline (operation stopped)</td><td>Youngnam Air</td><td>-</td></tr>
</table>

• Note: FSC: Full Service Carrier, LCC: Low Coat Carrier

These LCCs entry into the market brought about customer benefits such as extended air transport supply, a variety of services, frozen or decreased air fares, etc. Also at national level it created jobs and exerted ripple effects on related industries.

* LCC's passenger share for domestic routes increased sharply from 0.1% in 2005 to 34.7% in 2010.

Table 3.6. Passenger share of domestic airlines (Unit: persons/% (revenue passenger))

	2005		2008		2009		2010	
	Passengers	%	Passengers	%	Passengers	%	Passengers	%
FSC	17,136,336	99.9	15,338,415	90.3	13120879	72.6	13,204,523	65.3
(+/-)	-		(-3)		(-6)		(0.6)	
LCC	21,259	0.1	1,651,945	9.7	4,940,194	27.4	7,011,832	34.7
(+/-)	-		(54)		(192)		(42)	
Total	17,157,595		16,995,360		18,061,073		20,216,355	

• Note: FSC: Full Service Carrier, LCC: Low Cost Carrier

It also helped boost local airports and air transport related industries. And uncompetitive airlines were naturally displaced based on market logic, which resulted in the reorganization of the market structure.

The Open Skies Agreements promoted bilateral aviation cooperation and produced qualitative and quantitative results such as improved customer convenience and sharpened competitiveness through enhanced autonomous

Figure 3.6. Low-cost carriers

	First Flight	Sphere of Business	Destination • Domestic • international	Aircraft • Passenger • Cargo	Empolyees
JEJU AIR	'06. 6. 5.	• Domestic • International	-3 -8	-3 -8	495
JINAIR	'08. 7. 17.	• Domestic • International	-1 -4	-5 -0	267
AIR BUSAN	'08. 10. 27.	• Domestic • International	-2 -3	-6 -0	318
EASTAR JET	'09. 1. 7.	• Domestic • International	-3 -1	-6 -0	356
t'way	'05. 8. 31.	• Domestic	-1	-2	212

marketing base and expansion of service frequency and routes.

* As of November 2011, the Open Skies Agreements were signed with 92 countries, the airlines operated services of 48 countries (152 cities), 286 lines and 2,653 flights/week.

In terms of aviation liberalization, as of 2010, the Open Skies Agreements were signed with 19 countries in passenger segment and 31 countries in cargo segment. In the future, it is expected that quality growth will be sought through the Open Skies Agreements with the fifth freedom rights, and to diversify services and find new markets.

The training course, co-promoted by ICAO, was certified as international standard course, thus the IAAA (Incheon Airport Aviation Academy) has been recognized as a top-level organization worldwide.

Korea, as one of the advanced countries in aviation, gives generous financial contributions to ICAO and has held a seat on the Council four times in a row since 2001. So it is possible to have a direct influence on the major decision-making process in the civil aviation field. Such a current status has a favorable effect on improving the competitiveness of the nation's aviation industry.

Airport Infrastructure

The medium- and long-term plan for airport development proposed four sites, which was reduced from seven in the previous plan. It has developed through the paradigm shift to "selection and concentration."

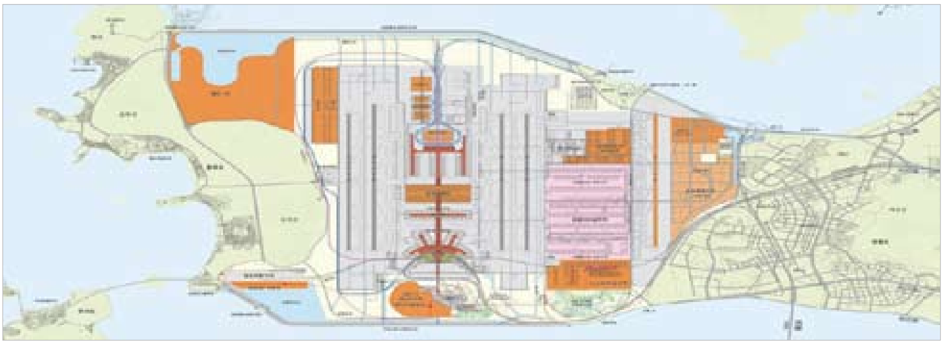
After the opening of Incheon International Airport in 2001, phase 2 construction including a concourse and a third parallel runway was completed in 2008. And phase 3 construction is currently under way including the second passenger terminal(T2) and a fourth runway.

As of 2010, Incheon International Airport carried 33.5 million passengers and 2.7 million tons of cargo, ranking 8th in international passenger traffic and 2nd in international cargo traffic. Also it made a remarkable achievement by ranking 1st in the Airport Service Quality (ASQ) survey for seven consecutive years since 2005. And its transfer rate as a hub airport increased from 11.4% in 2001 to 16.4% in 2011.

And continuous development of logistics parks and support facilities around the airport increases the capacity to handle air cargo and creates higher added value.

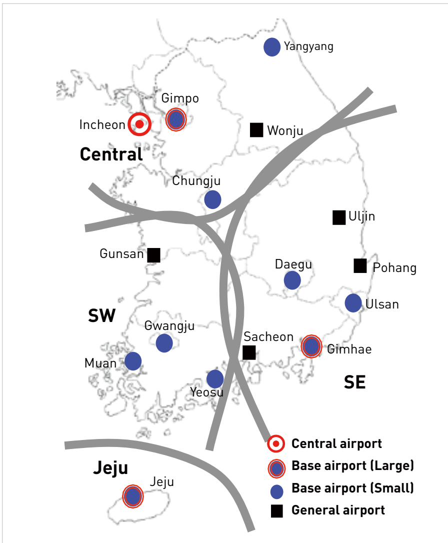
Gimpo International Airport was voted the best mid-sized airport, in the 15-25 million passenger size category, in the world. It plays a role as a specialized airport for short haul international flights and business use.

Figure 3.7. Master plan for the Incheon International airport



Aviation Safety

Figure 3.8. Airport development and operation system



In 2001, after being classified as category 2 by FAA, the government, airlines, airport corporations, institutes come up with systematic measures to secure aviation safety.

After then the result of ICAO USOAP audit showed that Korea complied with 98.8% of the international standards and recommended practices in all of eight elements including legislation and regulations, organization and safety oversight functions, personnel licensing, aircraft operations, airworthiness of aircraft, aerodromes, air navigation system, accident and incident investigation. And It was acknowledged as the world's best, recording fatality-free accident for 10 consecutive years.

CHAPTER 03

05

Evaluation and Conclusion

Performance analysis so far suggests that it is necessary to establish a long-term master plan including te aviation transport industry, airport infrastructure, aviation safety, etc. Before year 2000, there was such a plan, and if any, it was not systematic enough. A master plan is an essential factor in policy-making and implementation as signposts for the future.

Medium-, and long-term master plans and annual action plans facilitate the policy implementation and efficient budget use. Therefore, it is certainly required to establish a medium, and long-term master plan to implement aviation policies systematically. And KOTI established such plans covering aviation transport industry, airport infrastructure, aviation safety for supporting systematic policy establishment and implementation.

In the aviation transport industry sector, given the fact that LCCs' market entry and development makes contributions to customers' benefit and industrial competitiveness, it is desirable to increase customers' benefits such as reduced-fare and expand service choice through industry deregulation and competitive environment, thereby allowing the acceptance of a variety of aviation services and meet latent demand. KOTI proposed and drew up also such deregulation policies.

The Incheon International Airport has continuously improved operation services such as immigration, customs inspection, etc, and promoted marketing policies such as free trade zone for multinational logistics companies, transfer facilities, airport charges, etc, to attract airline companies. These efforts subsequently led Incheon airport to become world-class. KOTI was actively involved in planning and operating of the airport, and recently established a master plan for u-Airport, helping improve the service quality.

On the other hand, it is evident that there is lack of plans to revitalize cash-strapped airports in the local cities. Therefore, airport development should be based on reliable demand forecasting, and local airport construction based on the political issues and logic could incur lots of problems. And it is required to seek to find ways to promote the use of local airports by exploiting the fact that air traffic volume in China is skyrocketing and also China suffers from the lack of aviation infrastructure.

Also, the analysis points out that the airport operation by a private entity could make it possible to secure competitiveness in the market by improving productivity and service level. Because the airport corporations are regulated by the government, it is difficult to show their autonomy and creativity, thus causing inefficiency in the management and resource distribution.

For aviation safety management, it is required to introduce and implement international standards and safety management system, and reinforce relevant organization and personnel.

Ex-post management for aviation safety, focusing on short-term solutions, should be changed to preventive safety management, stressing performance based on reliable data, to maintain compliance with international standards. In terms of aviation safety performance, KOTI supported the set-up for SMS, and made contributions to establishing a preventive safety policy by analyzing aviation safety information and accident cases.

The establishment of such an aviation safety policy requires conducting research on advanced cases continuously, and government's budget support for it is essential.

In order to establish a more advanced industrial structure, Korea will enhance the competitive market structure, amend aviation regulations, shuffle administrative organizations, and promote the general aviation industry.

The government has a plan to improve the aviation service quality up to the international level, and emerge as a leading aviation country. To that end, it seeks to earnestly promote Open Skies Agreements and an integrated aviation transport market, thereby creating a free and fair competitive market environment.

Also, it will exert its efforts to establish infrastructure and institutions necessary for aviation safety and technology, and promote international partnerships and development projects, thereby reducing the dependency on technology and securing source technology.

CHAPTER 4

LOGISTICS

Yeonjoo MIN
Associate Research Fellow, The Korea Transport Institute

01

Functions and Importance of Logistics

International and Domestic Standing of Korea's Logistics Sector

When Korea's logistics sector is assessed from the international perspective, revenues of Korea's top-8 logistics companies accounted for a mere 9.3% of the global top-8 logistics companies. The result shows that logistics companies in Korea are relatively small in terms of business size and significantly lag behind in terms of competitiveness, compared with global logistics companies. In the case of transport infrastructure, Korea's land suitable for road extension ranked No. 25, its land suitable for rail extension ranked No. 27 (as of 2004) and efficiency of transport infrastructure ranked No. 35 in the world, indicating that the country still lags far behind advanced countries.

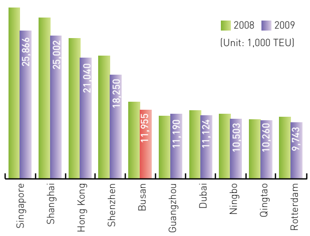
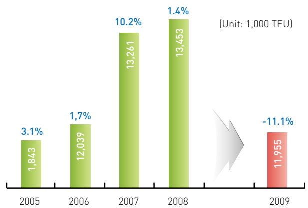
However, Korea's marine transportation, port, aviation and shipbuilding industries have already reached world-class levels. The Incheon International Airport ranked first in the annual Airport Service Quality (ASQ) Awards announced by the Airports Council International for seven consecutive years. Busan Port is ranked fifth in the world in port container handling. Meanwhile, according to the 2nd revision of the National Logistics Basic Plan (2011-2020), total revenue of the nation's logistics industry in 2009 stood at 95 billion USD, ranking 8th in terms of revenues among the nation's entire industries. In addition, the share of the nation's logistics sector per GDP amounted to 9.9%, which is higher than 8.47% of the United States. Moreover, the logistics sector has shifted to upwards trends since 2005 with the government's policy to foster the logistics industry as one of high value-added industries, indicating how important the logistics industry is in the nation's economy.

Korea is seeking to become a "logistics hub in Northeast Asia in the 21st century." The nation's logistics industry is showing phenomenal growth, while companies' logistics service rationalization activities are proceeding at a fast rate. Korea's international standing in the logistics sector is relatively high, as evidenced

Table 4.1. International standing of Korea's logistics service

	Classification	Units	Korea	World ranking	Notes
Logistics	Proportion of GDP, logistics costs ('06)	%	9.9	-	USA (8.47)
	Proportion of Third Party Logistics ('06)	%	38.8	-	USA·Europe (60-90)
	8 logistics company average sales ('05)	88 thousand dollars	8,017	-	8 global logistics company (86,276)
Infrastructure	Land suitable for road extension ('03)	km/km^2	0.98	25	World no.1 Belgium (4.91)
	Land suitable for rail extension ('04)	km/km^2	0.03	27	World no.1 Hong Kong (0.20)
	Efficiency of transport infrastructure ('06)	points	6.21	35	World no.1 Hong Kong (9.57)

Table 4.2. Logistics facility-sea transport

<table>
<tr><th></th><th colspan="2">Notes</th></tr>
<tr><td>Busan Port</td><td>• One of the world's largest container ports, handling 13.5 million TEU in 2008
• Annual container traffic exceeding 240 million tons, and accounts for 66% of total exports and imports.
• T/S container traffic is 6 million TEU, representing 45% of total traffic, greater than Shanghai, Shenzhen, Qingdao, Kobe and Yokohama
• Good connectivity between large-scale ships and feeder ships, or with its cost competitiveness
• Operate 14 berths more than 14m deep and 9 berths more than 15m deep, which together accommodate 8,000 TEU container vessels
• Handling of more than 700,000 TEU per berth</td><td>
</td></tr>
<tr><td>Busan New Port</td><td>• In 2009, Hanjin Shipping Company and Hyundai Merchant Marine Co. opened a terminal 16 m deep to reinforce the role of the new port as a hub in North-east Asia
• Operate 13 berths more than 16 m deep as of 2009
• Sufficiently distant from downtown, local traffic does not interfere with port traffic flow
• Transshipment is efficient as 30 berths are concen-trated in a single site</td><td>
</td></tr>
<tr><td>Gwangyang Port</td><td>• Located in Southwestern part of the Korean peninsula
• Only 35km away from Yeocheon Petrochemical Indus-trial Complex (Second largest industrial complex in Korea)
• Fourteen berths are in service at a depth of 15m, with available terminal length of 600m
• Freight railroad station, with more than 20 trains in service each day
• Handle 1.8 million TEU despite the global financial crisis, putting it on a footing with Kobe and Osaka in 2008</td><td><table>
<tr><th>Facility usage</th><th>Area (1,000 m²)</th><th>Construction time</th></tr>
<tr><td>East (development completed)
West (Under development)
Total</td><td>1,950
1,930
3,880</td><td>-2008
-2011
-2011</td></tr>
<tr><td>Logistics complex
Support facility
Public facility</td><td>2,306
285
1,289</td><td>2006-2015</td></tr>
<tr><td>Total</td><td>3,880</td><td></td></tr>
</table></td></tr>
<tr><td>Incheon Port</td><td>• Gateway to Seoul and its metropolitan area, at only 35km from Seoul
• 15 hours from the Port of Incheon to Dalian, 18 hours to Qingdao, and 26 hours to Shanghai by a container carrier
• Car ferry service to Dalian, Rongcheng, Tianjin, Qingdao, Weihai, and Dandong
• 70% of container traffic handled at the Port of Incheon is bound to or from China
• The lock gate is the biggest in the world, with 50,000 ton vessels (32.3m wide, 230m long, 18.5m deep) and 10,000 ton vessels (19.2 m wide, 150 m long, 18.5 m deep)</td><td></td></tr>
</table>

by such phrases as “a world’s leading marine power,” “a country with companies leading the world’s air cargo markets,” “an international logistics hub with world-class container terminals,” and “a country with the world’s top-tier IT technology.”

International and domestic standing of Korea’s logistics sector can be easily understood by examining the current state of the nation’s logistics facilities linked to major international hubs and railway infrastructure. <Table 4.2> shows the current state of major sea transport, aviation and railway logistics hubs which have been invigorated through their connectivity to the nation’s road networks.

Table 4.3. Logistics facility-air transport

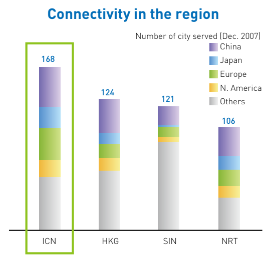
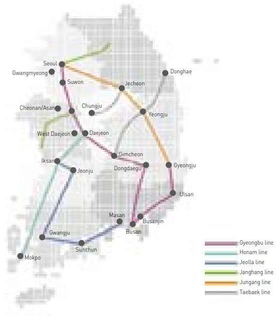
<table>
<tr><th></th><th colspan="5">Notes</th></tr>
<tr><td>Incheon Airport</td><td colspan="4">• Hub of Air Freight in Northeast Asia
• 30% of the world’s trade traffic and at least 40% of worldwide air cargo originates
• Connected to about 167 cities worldwide and more than 70 global airlines
• Handles the second highest quantity of international air cargo (based on tonnage)
• Annual average growth rate of 9% since its opening in 2001
• The weight of transshipment cargo as a portion of total traffic is approximately 50%</td><td>
</td></tr>
<tr><td rowspan="4">Incheon FEZ</td><td colspan="4">• Area of 2,093,000 m², and is expanded to an area of 3,015,000 m² by 2011
• Tax Incentives</td><td rowspan="13"></td></tr>
<tr><td>Type</td><td>Applicable Tax</td><td>Reduction Period/Rate</td><td>Requirement</td></tr>
<tr><td>National Tax</td><td>Corporate Tax
Income Tax
Value Added Tax</td><td>100% for the first 3 years & 50% for the following 2 years</td><td>Manufacturing : investing over 10 mln USD</td></tr>
<tr><td>Local Tax</td><td>Acquisition Tax
Registration Tax
Property Tax</td><td>100% for 10-15 years</td><td>Logistics : Local Tax investing over 5 mln USD</td></tr>
<tr><td rowspan="7">Air cargo facility</td><td colspan="4">• Area of 2.15 million m²
• Terminal facilities at Incheon airport</td></tr>
<tr><td></td><td>Companies</td><td>Size (m²)</td><td>Capacity (ton)</td></tr>
<tr><td>South cargo terminal</td><td>Korean Air Cargo
Asian Cargo
Foreign Airlines
Int’l Express Mail Center
U.S Military Mail Center</td><td>91,900
50,400
50,400
33,800
2,000</td><td>1,420,000
1,160,000
1,400,000
350,000
20,000</td></tr>
<tr><td>Subtotal</td><td></td><td>228,500</td><td>4,350,000</td></tr>
<tr><td>North cargo terminal</td><td>DHL
Polar Air Cargo
Air Cargo Warehouse</td><td>20,000
17,000
16,180</td><td>100,000
120,000
110,000</td></tr>
<tr><td>Subtotal</td><td></td><td>53,180</td><td>330,000</td></tr>
<tr><td>Total</td><td></td><td>281,680</td><td>4,680,000</td></tr>
</table>

Table 4.4. Logistics facility-rail transport

	Notes
Railroad Network and Rail Cargo	• 46.81 million tons of cargo are transported annually on Korea's railroads with 24 routes spanning a length of 3,381km • The quantity of cargo transported has changed relatively little since 2000, and is smaller than the 57.92 million tons transported in 1990 • Individual items tend to decrease, but by and large, containers have a tendency of steady rates of increase
Railroad Freight Centers	• CYs (Container Yards) with an area of 843,000 m² in 26 stations • CFSs (Container Freight Stations) with an area of 34,064 m² in three stations • 95 cement stock facilities in 37 stations • Branch centers with an area of 97,000 m² • Vehicle yard with an area of 20,690 m²



Roles of the Government in the Logistics Sector

Logistics activities comprise such functions as transportation, storage, unloading, packaging and information and logistics decision-making is made according to market principles. In the decision-making process, the government formulates and implements policies on building infrastructure and networks, fostering specialized workforce, promoting R&D projects and cultivating logistics companies at home and abroad in order to support efficient logistics activities carried out by businesses.

In the transportation and storage process, the government should provide appropriate social infrastructure such as roads, railways, ports, airports and cargo terminals and, if there exist factors of market failure in the logistics activity process, the government intervenes from the perspective of efficiency of resource distribution. In this light, since the 1950s, the Korean government has been expanding freeway, railway, port and airport infrastructure and networks on an ongoing basis. In particular, the construction of Gyeongbu Expressway and subsequent construction of nationwide road networks made it possible for road cargo transportation to realize door-to-door service within a day, leading to epoch-making customer price reduction thanks to reduced national logistics costs and transportation costs. In addition, split of export and import container transportation along the Gyeongbu Expressway between the Seoul metropolitan area and the

Busan metropolitan area is deemed to have greatly contributed to reducing road congestion and boosting export/import competitiveness.

Logistics policies prior to the 1990s were formulated and implemented on an individual dimension by transportation mode and focus was placed on road-oriented truck transportation industrial policy, railway transport policy and sea transport policy. In the 1990s, comprehensive logistics plans were formulated and logistics policies were established in an independent and comprehensive manner. Cargo Logistics Basic Plan (1994-2003) was established and logistics facility plans were introduced in full swing, thereby expanding the scope of logistics policy. During this period, Gyeongin/ Uiwang ICD (inland container depot), Yangsan IFT (integrated freight terminal) and Gunpo IFT were constructed. Construction of such logistics facilities continued to 2000s and inland container depots were constructed

Figure 4.1. The Government's roles in the logistics sector

Infrastructure and connections — Domestic and international infrastructure

- Road/railway/sea network
- Port and airport
- FEZ
- Integrated freight terminal
- Inland container depots

Know-how — Education and R&D

- Graduate school of logistics
  - Inha University and Incheon University
- R&D project
  - Establish the Korea Institute of Construction and Transportation Technology & Planning in 2002

Market — Legislation and procedures

- Act on the development and management of logistics facilities
- Framework act on logistics policies
- Trucking transport business act
- Policy support for integrated logistics company
  - Certification program and tax exemption benefit

in the nation's central, southeastern and southwestern regions.

Since 2000, logistics policies underwent a shift from a concept of supporting logistical activities of businesses to one of national growth engines and logistics policies emphasizing software aspect emerged such as fostering global companies, developing new logistics technology and cultivating specialized workforce, further expanding the scope of logistics policy. In 2001, the Cargo Logistics Basic Plan was renamed as the National Logistics Basic Plan and a strategy to transform the nation into a logistics hub in Northeast Asia emerged as an objective for key logistics policies. As a result, a wide range of policies were implemented to enhance competitiveness of logistics companies and support their globalization, including logistics R&D projects such as establishment of graduate schools of logistics, introduction of certified professional logistician system, logistics standardization and development of packaging containers, introduction of certified integrated logistics company system, as well as establishment of tax break systems.

02

The Development History of the Logistics Industry

The Birth of the Logistics Industry

Truck transportation emerged as one of transportation industries with sharp rise of the numbers of forwarders and registered trucks in Korea from 60 forwarders and 1,772 registered trucks in April, 1945 to 242 forwarders and 3,120 registered trucks in 1950 just before the Korean War. From the late 1954, a system called *Jiipje* was wide spread where trucks with individual ownership were registered with forwarders with transportation business license in the transportation market. In August 1962, the Freight Department was established under the Land Transportation Bureau of the Transportation Ministry. In 1964, Korea Express acquired a transport service license for the first time in the country as a private company.

Figure 4.2. Growth of the cargo transportation market in 1940-1950

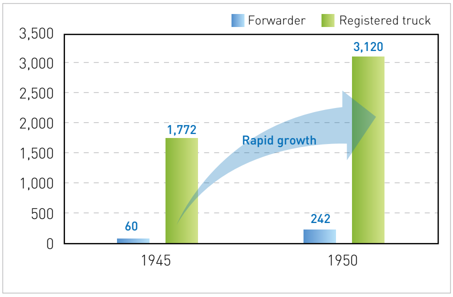
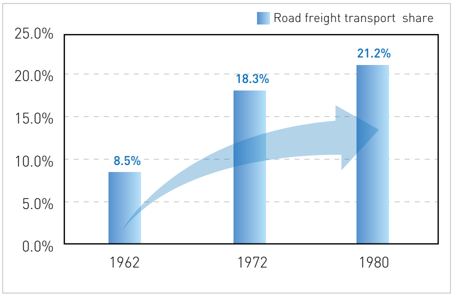


Figure 4.3. Road freight transport share between 1962 and 1980



During the Five-year Economic Development Plan period, the share of road freight transport started to increase since the mid-1960s. Road freight transport share (tons-km) stood at around 8.5% in 1962, yet the figure greatly rose to 18.3% in 1972 and 21.2% in 1980. The increase in the road freight transport share was attributable to the fact that competitiveness of road freight transport was superior to that of railway freight transport with significant expansion of road networks such as construction of the Gyeongbu Expressway.

In September 1972, regulations on international ocean container freight transport were enacted (Notification No.55) in response to increase in container freight and container freight transport was launched. In September 1975, a Korean container train started its first operation between Seoul and Busan, yet the roles of road and sea transport started to increase, as rising freight demand as a result of economic growth was not satisfied only with rail transport.

Construction of Logistics Infrastructure

The construction of Suwon Inland Container Depot was completed in June 1983 and an inland container depot (Uiwang ICD Co., Ltd.) within the Nambu (South) Freight Terminal was completed in July 1984, and Dongbu (East) Freight Terminal was completed at Seongbuk Station in September 1984. In the case of railroad, container yards were constructed as containerization of freight was increasingly adopted in the 1980s.

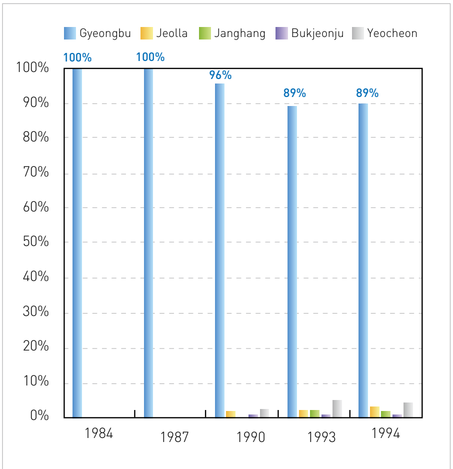
In April 1992, Gyeongin ICD (Uiwang ICD) was established to operate a rail inland container depot and rail transport of automobiles took place between Uiwang Station and Sinchangwon Station in May 1992. Uiwang ICD is the first inland container depot in Korea. It not only plays a pivotal role in the national logistics, but also acts as an inland hub for processing customs clearance and serving as a rail transport base, greatly contributing to reducing national logistics costs and enhancing international logistics competitiveness.

The construction of Yangsan Integrated Freight Terminal (IFT) for the Busan region commenced in December 1994 on a site of 317,000m^2 and it started operation from June 1999. Located in the vicinity of Busan Port and Gimhae Airport, Yangsan IFT acts as a transport hub for export/import cargo.

The construction of Gunpo Integrated Freight Terminal (IFT) in the Seoul metropolitan area commenced in May 1995 on a site of 382,000m^2 and partially opened in March 1997 and was completed in December 1998. Completion of Gunpo IFT in connection with major railway networks enabled large quantity freight transport, significantly reducing transport costs and time. Expansion of Gunpo IFT is currently under way with rise in freight demand in the capital area.

In the case of the nation's southwestern Honam region, the first phase of the Jangseong Inland Container Depot project based in Jangseong-gun, Jeollanamdo was completed and started operation in June 2005. When its second phase project is complete, Jangseong ICD will serve as a logistics hub for Jeollanam-do and Jeollabuk-do provinces. As for freight terminals in the capital area and Busan area, integrated freight terminals (IFT) and inland container depots (ICD) had been separately constructed and operated. However, since the construction of an inland freight depot in the Honam region, IFTs and ICDs will be constructed simultaneously.

Figure 4.4. Rail freight lines and rail freight transport performance between 1984 and 1994



CHAPTER 04

Figure 4.5. Gyeongin ICD

Figure 4.6. Gunpo ICD & IFT

Therefore, the term "inland logistics depot" came to be used to refer to these two terminals simultaneously.

As for inland logistics depots for the central and southeastern Yeongnam region, which will act as freight transport hubs for Cheongcheong province and Gyeongsangbuk-do Province, private companies to implement the projects were selected in March 2005 and construction is currently under way. The Jungbu (central) Inland Logistics Depots to be located in Cheongwon-gun and Yeongi-gun of Chungcheongnam-do Province will be constructed on a site of 481,000m^2 and such facilities as freight shed, delivery center and container yard are currently under construction. An inland logistics depot for the nation's southeastern Yeongnam region is currently under construction in Chilgok-gun of Gyeongsangbuk-do Province on a site of 456,000m^2. Its construction commenced in February 2007.

Expansion of the Foundation for Efficient Logistics Operation

In December 1991, the Freight Distribution Promotion Act was enacted to promote freight distribution and reduce logistics costs with the aim of rationalizing the logistics system and promoting sound development of businesses related to freight distribution, thereby contributing to the development of the national economy. The act regulates matters related to standardization and informatization of logistics, as well as forwarding, freight terminal projects and warehousing. In December 1995, the Promotion of Distribution Complex Development Act was enacted for the first time with the aim of promoting the construction of value-added logistics centers with distribution functions.

In April 1996, improvement was made in a system of offering discounts for container freight charges to resolve chronic traffic congestion of road transport. In November 1997, one round trip of refrigerated container rail service per day was launched between Uiwang Station and Sinseondae Station of Busan Port. In addition, courier transport services were launched, enabling door-to-door transport. In August of the same year, the Trucking Transport Business Act was enacted after being separated from the Automobile Transport Business Act.

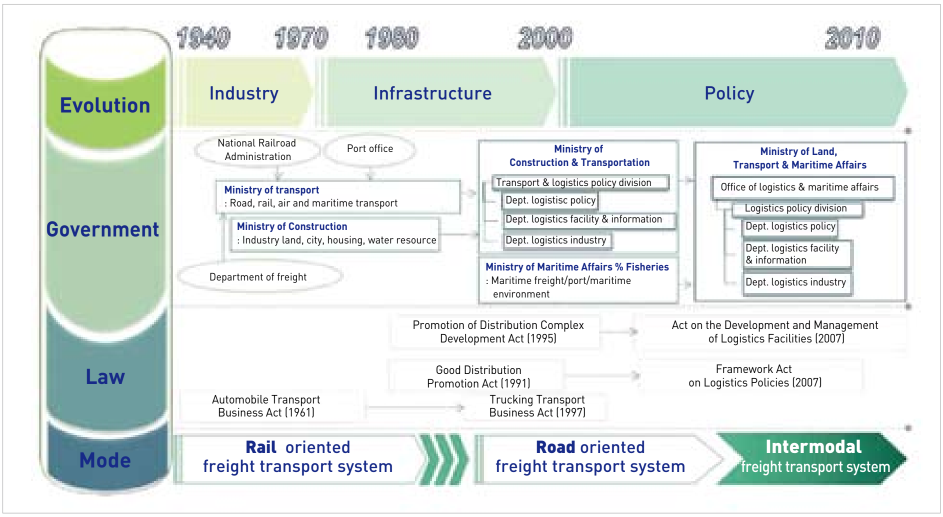
In addition to efforts to make logistics more efficient, informatization of logistics was also implemented. As e-business started to become a mainstream with the development of the IT sector, WMS/TMS was introduced in the logistics sector. In February 2006, Korea built the world's first 100% electronic clearance portal system named "UNI-PASS" and in January 2007 the nation came up with a strategy to set up the National Logistics Integrated Information Center.

Starting from late 1990s, various regulations on the logistics industry were either eased or abolished in advanced countries, resulting in even more intense competition among companies. Amid change in business conditions, logistics companies departed from simple transport services and started to pursue advancement and rationalization of logistics services for customer companies, such as logistics consulting and information management. In particular, manufacturers and retailers achieved specialization and rationalization in the logistics center by outsourcing the logistics sector, which is their non-core sector, thereby expanding the markets and creating profits, while attaining logistics advancement.

In February 2001, CY (container yard) gate automation system went into operation at Busanjin Station, while the Railway Logistics Information System, which offers information related to rail freight transport such as location tracking of rail freight, train service information and Internet EDI (electronic data interchange), was launched.

In addition, policies aimed at fostering specialized logistics companies with national competitiveness were also formulated and implemented. In August 2004 an integrated logistics company certification system was introduced and since 2006 a total of 31 companies (groups) received certification. In January 2005, measures to foster integrated logistics business were legalized to cultivate specialized logistics companies. According to the measures, specialized logistics companies were permitted to engage in clearance business and logistics companies were admitted to move in zoning districts of factory facilities in industrial complexes. Companies outsourcing logistics were eligible for tax breaks such as tax credit for three years and separate taxation of composite land tax for companied engaged in integrated logistics business. In September 2006 graduate schools of logistics were established to cultivate specialized logistics manpower equipped with expertise and international outlook. In August 2007, Promotion of Distribution Complex Development Act and Freight Distribution Promotion Act were revised to Act on the Development and Management of Logistics Facilities and Framework Act on Logistics Policies, respectively. In April 2000, express delivery freight train service in the Honam region went into operation for the first time between Gunpo IFT and Imgok Station. In December 2003, Korail Logis in the railway sector was established to meet demand for intermodal transportation service for export/import containers. Korail Logis is an integrated logistics company that offers intermodal transporta-

Figure 4.7. Evolution of Korea's logistics policy



tion service linking various transport modes, encompassing railway, road, sea and air transport, as well as storage service (warehousing). It not only offers intermodal transportation service domestically, but also provides Korea-Japan intermodal transportation service.

In the air transport sector, Incheon International Airport became a world-class logistics hub airport in 2001. In 2003, Customs-Free Zones Act and Free Trade Zone Act were integrated to overcome problems that the manufacturing sector is not allowed to move in customs-free zones. In December 2004, free trade zones were designated in Busan Port and Gwangyang Port. As part of a strategy to promote advancement and new growth of the domestic economy by attracting foreign investment and creating added values and jobs, Incheon, Busan-Jinhae, and Gwangyangman were designated as free economic zones (Aug.-Oct. 2003). In April 2008, three more districts, namely, Hwanghae, Daegu-Gyeongbuk, Saemangeum-Gunsan were added to the list.

History of Logistics-Related Laws

Table 4.5. Logistics-related laws

Law t	Purpose	Revised law Title	Purpose
Promotion of Distribution Development Act (Enacted in Dec. 1995)	The Act aims to enhance industrial competitiveness and promote balanced development, contribute to sound development of the national economy by improving distribution structure and accelerating the development of the distribution industry.	Act on the Development and Management of Logistics Facilities (Enacted in Aug. 2007)	The Act aims to enhance national competitiveness, promote balanced development of national land and contribute to the development of the national economy by deploying and operating logistics facilities in a reasonable manner and seamlessly supplying sites for logistics facilities.
Good Distribution Promotion Act (Enacted in Dec. 1991)	The Act aims to reduce logistics costs by promoting distribution of freight through rationalization of logistics system and seeking sound development of the logistics distribution business, thereby contributing to the development of the national economy.	Framework Act on Logistics Policies (Enacted in Aug. 2007)	The Act aims to define basic matters related to establishment, implementation and support for domestic and international logistics policies and plans in order to make the logistics system more efficient, enhance the competitiveness of the logistics industry and promote advancement and globalization of logistics, thereby contributing to the development of the national economy.
Automobile Transport Business Act (Enacted in Dec. 1961)	The Act aims to establish order in the automobile transport business and seek comprehensive development of the automobile transport business, thereby promoting public welfare.	Trucking Transport Business Act (Enacted in Aug. 1997)	The Act aims to promote seamless freight transport by managing trucking transport business efficiently and fostering it in a sound manner, thereby contributing to promotion of public welfare.

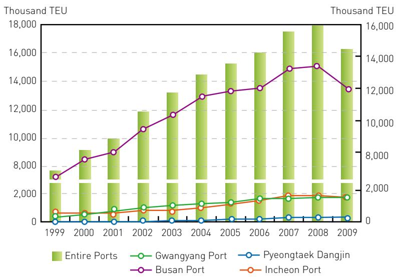
03
Latest Issues in the Logistics Sector and Assessment of Logistics Policies

H/W Infrastructure

Despite the integration of related ministries in recent years, plans to develop ports/hinterland, inland logistics depots/ freight terminals, and airport/hinterland have been formulated separately and individually, indicating that linkage among policies on different transport modes still requires improvement. Meanwhile, the performances of public logistics facilities have worsened continuously. Yangsan ICD had maintained steady performance of handling more than 1 million TEUs annually, peaked in 2005 with 1.33 million TEUs. However, with the opening of the New Port in Busan Port the quantity of goods transported in Yangsan ICD sharply decreased, starting from 2009. In the meantime, as for Jangseong Inland Logistics Depot in the Honam region (the 1st phase operation commenced in 2005), the operating company passively responded to facility investment citing the problem of profitability, resulting in suspension of development. Moreover, controversies over excessive investment in Cheongju Airport, Muan Airport and Gwangyang Port continued due to their low performances.

Furthermore, infrastructure for handling regional logistics and urban logistics is still insufficient and operation of the majority of downtown freight terminals has been suspended due to worsening profitability. Although demand for urban logistics such as courier service and distribution is on the rise, they cause traffic congestion due to lack of infrastructure, leading to constant increase in social costs. In addition, truck-oriented transportation system is becoming increasingly fixated and thus the share of road transport exceeds 70%, whereas the share of railway and sea transport is decreasing steadily (Although the share of railway and sea transport partially increased in 2008, it showed overall downward trends over the past decade.). Owing to lack of linked transport system around logistics hubs such as industrial complexes and ports, integrated transport which can boost efficiency of

Figure 4.8. Container freight handling status in major ports in Korea (Unit: 1,000 TEUs)



Category		2007	2008	2009
Entire Ports	Total	17,544	17,927	16,341
	Import	5,652	5,853	5,128
	Export	5,602	5,753	5,242
	Transshipment	6,155	6,186	5,719
	Coastal	135	135	253
Busan Port		13,261 (5,811)	13,453 (5,808)	11,980 (5,372)
Gwangyang Port		1,723 (314)	1,810 (322)	1,810 (306)
Incheon Port		1,664 (18)	1,703 (24)	1,578 (19)

- Note: Figures in parentheses refer to quantity of transshipment cargo.
- Source: Ministry of Land, Transport and Maritime Affairs (Port-MIS statistics)

Table 4.6. Transport performance trends by freight transport modes in Korea (ton-km)

Category	Road			Railway	Sea Transport	Air Transport	Total
	Business purpose	Non-business purpose	Sub Total				
2004	36,571	64,486	101,057	10,641	25,840	164	137,702
	(26.56)	(46.83)	(73.39)	(7.73)	(18.77)	(0.12)	(100.00)
2005	38,241	67,432	105,673	10,108	26,590	151	142,522
	(26.83)	(47.31)	(74.15)	(7.09)	(18.66)	(0.11)	(100.00)
2006	39,448	69,560	109,008	10,554	26,478	145	146,185
	(26.99)	(47.58)	(74.57)	(7.22)	(18.11)	(0.10)	(100.0)
2007	38,078	67,144	105,222	10,927	27,998	128	144,275
	(26.39)	(46.54)	(72.93)	(7.57)	(19.41)	(0.09)	(100.0)
2008	36,708	64,729	101,437	11,547	29,590	125	142,699
	(25.72)	(45.36)	(71.08)	(8.09)	(20.74)	(0.09)	(100.00)
Annual average growth/decrease	0.09	0.09	0.09	2.06	3.45	▽6.56	0.90

- Notes: 1. Parentheses ( ) refer to the share as opposed to the total.
  2. As road transport performance by business purpose and non-business purpose was not separated, ratios were thus divided by applying the ratios of the previous year.
- Source: "Aviation Statistics" by the Ministry of Land, Transport and Maritime Affairs, "An Analysis of Freight Traffic Volume by Regions" editions of respective years, by the Korea Transport Institute, "Freight Transport Statistics" by the Korea Railroad Corporation.

logistics flow is still not in place.

S/W Infrastructure

Since 2006, the capacity for implementing logistics policies has sharply weakened. Given characteristics of the logistics industry, various government ministries are involved in the industry, including the Ministry of Land, Transport and Maritime Affairs, the Ministry of Knowledge Economy, the Ministry of Agriculture, Fisheries and Forestry and Korea Customs Service. However, policy coordination function to coordinate different interests of related government ministries is virtually non-existent, thus awareness of the importance of the logistics industry is relatively low, compared to its actual significance of the industry, indicated by the fact that the industry is not reflected in policy priorities, except for construction of some international logistics infrastructure. Failure to establish logistics-related statistics survey and management system undermines reliability of national policy, while questions are continuously raised over reliability and timeliness of logistics-related statistics which is used as source data in numerous policy-making processes. With low employment status in the logistics sector and worsening working conditions, the nation's employment creation levels in the logistic sector are low, compared to advanced countries, although the industry has high job creation potential (employment inducement coefficient of the logistics industry (person/0.9 million USD) (2007)[1]: transport/storage industry-14.4 (coefficient for the total service industry-18.1)/ the entire industry-13.9, manufacturing industry-9.2, construction industry-16.8 (Bank of Korea, 2009)). In addition, the logistics industry has low employment preference and residents oppose moving-in of logistics facilities in their communities, thus it is considered an industry shunned by people. Under the circumstances, backwardness in the service structure provided by logistics

1) The numbers of employees directly or indirectly generated in the entire industries, including the given industry when the final demand for a specific industry is generated by 0.9 million USD (the numbers of employed persons required for production)

companies in the nation and low profitability have direct impact on working conditions and wage levels. Meanwhile, inefficiency is existent due to low performance of standardization policy implementation and lack of linkage with international standards. Even though the government is implementing policies to spread standardization, such as logistics standard facility certification system, there has been little substantial effect, except for pallet standardization. Lack of policy capabilities to lead international standards causes confusion in standardization policy, while standardization is being implemented separately by government ministries and by transport modes, making the related industries find it difficult to respond. Furthermore, if China adopts T12 as pallet standard, it is likely to significantly undermine global interoperability and it is concerned that global interoperability of T11, which has been adopted as Korea's pallet standard, would be undermined. Moreover, social awareness of logistics cooperation is relatively low, thus logistics efficiency in the nation has been undermined compared with advanced countries and there are virtually no success stories of logistics cooperation as logistics companies fail to share the importance of logistics cooperation. Due to such lack of successful case studies, it is difficult to induce participation of businesses, further aggravating the vicious circle. Japan and European countries are actively inducing participation of businesses by adopting a method to regulate first and provide assistance later. On the other hand, most policies in Korea focus on assistance schemes and pilot projects, thus the effect of policy implementation is still unsatisfactory.

Sustainability

The national-level response system to environmentally friendly logistics in Korea is still insufficient. As of 2006, the transport sector accounted for 18.09% in the nation's greenhouse gas emissions caused by energy consumption. By transport mode, the share of road transport has been increasing, whereas the share of eco-friendly rail transport has been decreasing. Advanced countries are shifting their policies from road transport to rail transport which is more environmentally friendly and has greater effects in cutting back on energy costs. Meanwhile, systems contradictory to policy goals such as fuel subsidies are still in place in the nation, while environmentally-friendly transport modes such as railway and coastal shipping are less competitive than road transport in terms of costs and time. In addition, there is still a lack of logistics infrastructure linking large-scale arterial road transport systems with secondary road collection/delivery systems.

Table 4.7. Outlook for freight transport performance by transport modes

Categories	Road		Rail		Sea		Air		Total	
	Ton-km (mil)	%	Ton-km (mil)	%	Ton-km (mil)	%	Ton-km (mil)	%	Ton-km (mil)	%
2011	114,458	74.3	11,391	7.4	27,998	18.3	157	0.10	154,005	100
2012	116,864	74.6	11,693	7.5	27,998	17.9	163.2	0.10	156,719	100
2016	126,486	75.5	12,903	7.7	27,998	16.7	188	0.11	167,575	100
2020	137,054	76.3	14,305	8.0	27,998	15.6	219	0.12	179,577	100
2021	139,696	76.5	14,656	8	27,998	15.3	227	0.12	182,577	100

Inflow of talented workforce to the logistics industry is weak owing to low wage levels and poor working conditions, thus the average wage of the logistics sector is 90% of the manufacturing industry and 82% of the retail industry. Wage levels of educated workforce (working for large companies, university graduates) in the logistics industry are merely 94% of the manufacturing industry and 89% of the retail industry. As most workplaces are located in suburb areas, housing and commuting conditions are unfavorable, while labor intensity is high due to the fact that work is mainly performed on site. Safety management on freight transport and logistics center is emerging as a social issue, while drivers are exposed to sometimes fatal accidents caused by drowsy driving and speeding owing to poor working conditions. The logistics industry is facing difficulties in responding to introduction of logistics security system. Meanwhile, different government ministries are introducing international logistics security systems individually and thus administrative implementers of the systems are diffused, failing to come up with integrated response system and further aggravating difficulties of the logistics industry.

Table 4.8. Implementation status of international logistics security-related systems by government ministries

Category	Related systems	Description
Ministry of Land, Transport & Maritime Affairs	International Ship and Port Facility Security Code (ISPS code)	• Security check and security certificate related to ship and port facility security
	Known Shipper System for Air Cargo	• If certain security standards are met, freight security check is approved in areas other than airports.
Ministry of Knowledge Economy	KS V ISO 28000, etc.	• A private certification by International Organization for Standardization. A certification on corporate logistics secueity management system.
Korea Customs Service	AEO System (Authorized Economic Operator System)	• Who: A party involved in the international movement of goods, including shippers, shipping companies, carriers, warehouses, and customs brokers • Authorization: Economic operators approved by customs administration in terms of reliability and safety after examining their compliance of laws and safety management standards
National Intelligence Service	-	• NIS approaches logistics security from the national security perspective and leads private/government/academia logistics security council.

Conflicts and structural problems among various parties within the logistics industry are exacerbating and strikes by unionized truck drivers took place on a continuous basis (the two massive strikes by truckers incurred loss of 633 million USD) since the first massive strike logistics in 2003 due to imbalance in supply and demand of trucks and worsening multi-level unfair transaction structure. Structural contradictions are widespread, evidenced by lack of awareness of shared growth between shippers and logistics companies, and between large enterprises and small and medium-sized enterprises, bankruptcies of logistics companies caused by overheated competition within the industry and social corruption such as amassing secret funds. Policy considerations for guaranteeing basic rights (right of equality) and protecting the socially disadvantaged from the logistics viewpoint are still insufficient.

In the meantime, the number of using home delivery service per person sharply rose from nine times in 2002 to 21 times in 2009, indicating that home delivery system is rapidly becoming a basic service. In the case of residents living in remote islands they have to pay additional charges resulting from ferry charges, thus they have to pay home delivery service charges 2-3 times higher than residents living in other areas, indicating that they have to endure discriminatory treatment. Compared with general home delivery charges (2.03 USD), residents living in islands pay 4.42-7.07 USD, meaning that additional costs of 2,219,000 USD have to be paid annually. However, in the case of passenger transport, support from the central government and local governments is available in the form of remote island public service routes and public transport service for remote areas.

Globalization

The nation's service levels as an international logistics hub such as customs clearance are relatively high, yet inland logistics services lag far behind advanced countries including Japan. Considerations from the perspective of integrated networks are insufficient and hub-oriented infrastructure policy is still continued. From the viewpoint of linkage logistics connecting international logistics hubs with domestic industrial and consumption hubs, timely delivery capabilities, logistics infrastructure, shipper response services such as freight tracking and service capabilities of logistics companies are still weak (according to World Bank). Global standing of Korean logistics companies is also low. Leading specialized logistics companies in the country lag behind global logistics companies in terms of revenues and profitability (as of 2009, Glovis-2.8 billion USD, Korea Express-1.3 billion USD, DHL-68 billion USD, UPS SCS-48.3 billion USD). Logistics companies in charge of international transport such as sea and air transport are considered to have reached global levels, whereas the nation's specialized logistics companies in charge of corporate logistics lag far behind in terms of international competitiveness. World Bank assessment results show that Korea's international sea transport service levels ranks No. 15 in the world, relatively high compared with other sectors (23rd-28th). Four Korean companies including Hanjin Shipping (8th) are within the world's top 30 in international sea transport, while in the air transport sector Korean Air ranked first for six consecutive years from 2004 to 2009 in air freight transport. In recent years, logistics subsidiaries of large conglomerates have been entering overseas markets in conjunction with overseas advancement of their mother companies. However, due to their heavy dependence on quantities of their mother companies, they are yet to reach levels in which they can compete with local companies. On the other hand, specialized logistics companies in the country do not possess capabilities to go abroad due to lack of experience in overseas business, investment, and experts.

Domestic Industry

The ratio of specialized logistics company (third party logistics) utilization by shipper companies in Korea shows upward trends, standing at 48.2%, yet the speed of increase is gradually decreasing, indicating that the speed of growth of the third party logistics market is on the decline[2]. Third party logistics utilization ratios in the nation showed the following trend: 25.7% (2002)→30.0% (2004)→38.8% (2006)→46.3% (2008)→48.2% (2009). On the other hand, ratios of third party logistics utilization in advanced countries are as follows: Europe (80%), United States (79%), Japan (70%), and Singapore/Australia (60%). Shipper companies consider that specialized logistics companies in Korea are not capable of doing logistics business for them and making continuous improvement. It is also found that specialized logistics companies had poor business management resources such as manpower, expertise and capital, compared with shippers. Shipper companies increase total value of their companies by generating additional revenues through internal quantities and irregularities such as amassing illegal funds in the internal trading process also occurred. What is more, profitability of the nation's specialized logistics companies is falling[3]. Average profitability rate of logistics companies stood at 4.1% level, a decrease by 4.2% from 2007 and profitability of specialized logistics companies is below 3%, showing that they have no room

2) Survey Results on Third Party Logistics Utilization Status, Korea International Trade Association, Nov.17, 2009

3) 2009 Third Party Logistics Company Business Status, International Logistics Support Unit of Korea International Trade Association, July 7, 2010; 2010 Korea Logistics Business Directory, Logistics Newspaper, Nov. 17, 2009

for re-investment. Operating margin of the entire transport industry stood at 1.4% as of 2009, significantly lower than the manufacturing industry (6.2%) and the service industry (4.0%). Domestic specialized logistics companies had grown on the basis of traditional logistics services, thus their capabilities to generate added value are weaker than those of leading companies. In addition, their negotiation power is decreasing amid unilateral demands of lowering service fees by shipping companies, while pressures of rising costs such as oil prices and labor costs continue to grow.

Table 4.9. The share of the logistics industry in the entire industry

Category	Entire Industry (A)	Logistics Industry (B)	Share (%, B/A)
No. of companies	3,264,782	167,998	5.15%
No. of employees	16,288,280	556,607	3.42%
Revenues (1 bil. KRW)	2,481,230	90,600	3.65%

• Notes: 1) As of 2008
2) Numbers of companies and employees are derived from "Report on Industrial Census," Statistics Korea; revenues of the entire industry are derived from "Financial Statement Analysis," The Bank of Korea.
3) Statistics on revenues of the logistics industry are derived from logistics industry section in the "Report on the Transportation Survey" released by Statistics Korea

04
National Logistics Master Plan

Background of the National Logistics Master Plan

The Korean government announced the National Logistics Master Plan (2001-2020) in 2001 and updated the Master Plan reflecting the rapidly changing environment of the early 2000s and released an updated version of the National Logistics Master Plan (2006-2020) in September 2006. The Basic Logistics Policy Act enacted in 2008 changed the planning period for the National Logistics Master Plan to 10 years and stipulated that the Master Plan would be replanned by every 5 years.

With the launch of the current Ministry of Land, Transport and Maritime Affairs (MLTM) in 2008 by merging the former Ministry of Construction and Transportation and the former Ministry of Maritime Affairs and Fisheries, there was a need for establishing a new logistics plan from an integrated viewpoint encompassing land, sea and air transport. In addition, the strategy of "building a logistics hub in Northeast Asia" which merely focuses on cargo volumes showed limitations, raising a need for formulating new global logistics strategy to replace it. This amplified a need for reflecting new policy issues at home and abroad, including response to global economic crisis, green growth and logistics security.

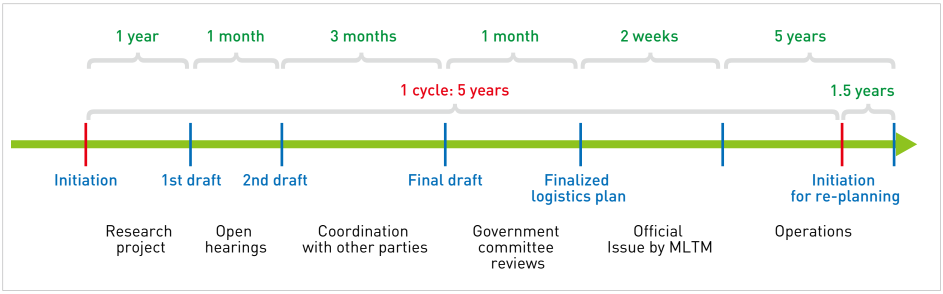
Table 4.10. Timeline of the national logistics master plan

Year	Description
Apr. 1999-Apr. 2000	1st related research(funded by MOCT processed by KOTI)
Jan. 28, 2000	related law ("Goods Distribution Promotion Act") had been established by the national assembly
Jul. 2000-Nov. 2000	derived 1st Draft by MOCT and communicated with some related ministries
Dec. 20-27, 2000	reviewed in the Committee of Logistics Policy
Jan. 2001	officially issued by the minister of MOCT
Mar. 2005-Dec. 2005	2nd related research for correcting the National Logistics Master Plan(2001-2020) (funded by MOCT processed by KOTI)
Jan. 2006-Jul. 2006	communicated with other ministries and reviewed in the Committee of Logistics Policy
Aug. 2006	1st updated Master plan (2006-2020) officially issued by the minister of MOCT
Sept. 2008	The related law had been changed into "Basic Logistics Policy Act" and planning period is changed to 10 years
Aug. 2009-Oct. 2010	3rd related research for re-planning the National Logistics Master plan (2011-2020) (funded by MLTM processed by KOTI)
Apr. 2011	1st 10 years Logistics Master plan was officially issued by the minister of MLTM after some communicating with the other ministries and reviewing by the Committee of Logistics Policy during 4 or 5 months

The updated National Logistics Master Plan aims to be the driving force to implement national logistics policies for the next 10 years based on the revised Basic Logistics Policy Act. It intended to present directions and enhance the ability to take action to make the National Logistics Master Plan obtain the status as the highest-level logistics-related plan. The planning period was set on 10 years from 2011 to 2020 and its spatial scope was the entire land in the nation under the sovereignty of the Republic of Korea and, if deemed necessary, the scope could be expanded to include the Korean Peninsula and East Asia.

The process of establishing the National Logistics Master Plan is as follows:

Figure 4.9. National logistics master plan establishment process



Visions and Objectives

Figure 4.10. Visions and objectives of the national logistics master plan

21 century's global logistics power leading green growth

Logistics hub leading North East Asian economy

Improving cost competency of domestic industry by 3.6%p

Logistics industrialization creating a global value-added

Revenue rank of logistics industry reaches to the 5th rank

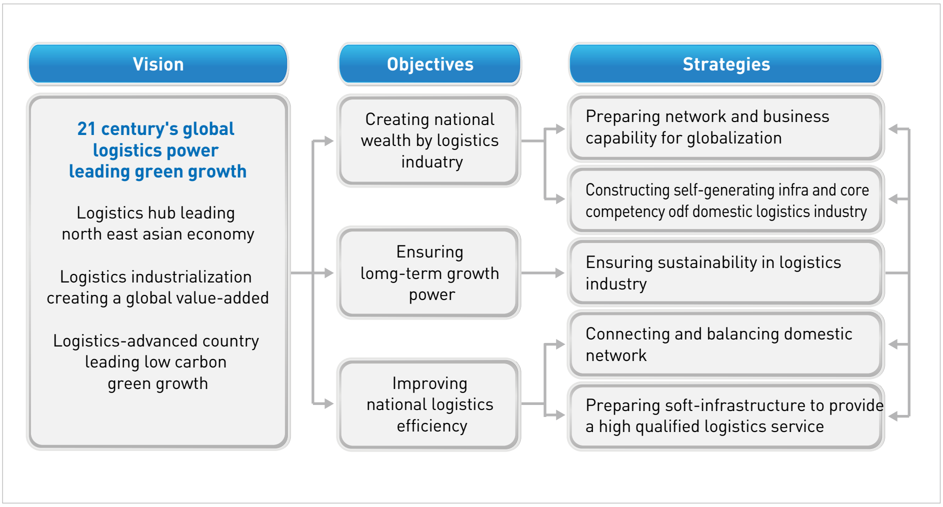
Logistics-advanced country leading low carbon green growth

CO_2 emission in logistics division reduces 16.7% of BAU standard

The National Logistics Master Plan set its vision to become a "global logistics power leading low-carbon, green growth of the 21st century" and expressed policy commitment to build an economic leadership in East Asia going beyond Northeast Asia through the logistics industry and achieve the objective through cooperative competition with neighboring countries. The visions were formulated out of the wish that the logistics industry would contribute to enhancing international competitiveness of national infrastructure industries, including manufacturing and service industries, and establish itself as a new growth engine for the national economy. The visions also express that Korea will come up with a national system comparable to that of advanced countries to secure international leadership in East Asia and occupy new issues first in the international community through green growth and international cooperation.

The goal of the Master Plan is to become a "global logistics power" by strengthening external competitiveness of national industries, developing the logistics industry as a new growth engine industry contributing to generation of national wealth and lay the foundation for sustainable logistics industry. Specific objectives are as follows: 1) Lower logistics costs as opposed to revenues from 9.1% to 5.5% by enhancing the efficiency of the national logistics system, thereby boosting global price competitiveness of Korean companies by 3.6%; 2) Increase the share of the logistics industry's revenues in the revenues of the entire industries of the nation from 3.65% to 5% by creating national wealth through logistics, thereby fostering the logistics industry to become one of leading industries in the nation, ranking fifth in revenues; and 3) Reduce CO_2 emissions in the logistics sector by 16.7% from BAU by enhancing sustainability of the national logistics system and lay the foundation for fair trading order between shippers and logistics companies.

Figure 4.11. Implementation strategies of the national logistics master plan



CHAPTER 04

Implementation Tasks

H/W Infrastructure

Implementation tasks for the hardware infrastructure consist of six specific tasks. They include “systematic development of logistics facilities and invigoration of their operation”; “securing competitiveness of urban logistics to promote efficient regional logistics”; “implementation of R&D projects to introduce and spread new concept freight transport system”; “establishment of comprehensive support system to invigorate rail logistics and make it more efficient”; strengthening support for revitalizing coastal shipping and making it more efficient”; and “laying the foundation for competitiveness enhancement of major trading ports.”

The first task is to develop logistics facilities in a systematic manner and revitalize their operation. The concept and hierarchy of logistics facilities should be fully reviewed from the integrated viewpoint encompassing land, sea and air transport to come up with ways to invigorate integrated management and operation of logistics facilities. Basis for establishing integrated development plan, which takes into consideration a shift of concept of logistics facilities and industrial complexes, should be prepared to review concept shift and integration of logistics facilities at the time of modifying comprehensive plan on logistics facility development and improve the hierarchy of logistics facilities. The operation status of logistics facilities currently in operation should be assessed by improving operation strategy of the existing logistics facilities from the perspective of efficiency and invigoration, while it should be decided on whether invigoration of the facilities is possible from a comprehensive viewpoint and future action plans should be established on the basis of assessment results. The scope of logistics facilities includes inland logistics depots, logistics complexes, freight terminals, ports and their hinterland complexes, airports and their hinterland complexes, railway stations and rail CYs. Mechanization and automation would be pursued for logistics facilities which are possible to be invigorated to spread multimodal system and enhance operation efficiency and support would be made to build transport networks connecting the facilities with ports, airports and industrial complexes. Review on the introduction of two-tier and automated facilities will be performed to make the existing ports with insufficient hinterland more efficient. Facilities which are possibly invigorated through shift of usage will be converted into facilities that actively utilize already invested infrastructure such as inland railways, seeking their revitalization (Yangsan ICD, Honam Integrated Freight Terminal, etc.) Second, the Master Plan was established to secure competitiveness of urban logistics for efficient regional logistics. According to the Master Plan, guidelines on the establishment of urban logistics master plan aimed to improve logistics system in downtown cities would be formulated and the metropolitan city logistics master plan (7 metropolitan cities) would be modified by reflecting the guidelines. In addition, ways to achieve legal and institutional improvement to facilitate linkage between logistics facilities and urban planning would be drawn up, and improvement of logistics would become mandatory in case of urban environment renewal projects such as reconstruction and redevelopment to analyze regulations restricting location of city-type logistics facilities and come up with improvement measures. The number of public truck depots would be raised from 24 in 2010 to up to 35 in 2012 by making continuous efforts to secure public truck depots. With the revision of Railroad Act and Urban Railroad Act, in the case of railway station redevelopment projects, it would be mandatory to include logistics functions such as home delivery terminals.

The third task is to implement R&D projects to introduce and spread new-concept freight transport system. R&D implementation plan would be established to develop future-oriented logistics system of a new concept with eco-friendliness, safety and efficiency by developing new-concept logistics system technology. In order to promote a paradigm shift of freight transport such as environmentally friendly automated container transport system, feasibility review on the introduction of new technology would be conducted and technology development would be also implemented. In addition, the intermodal transport system would be expanded by developing technology to link other transport modes. Meanwhile, support would be provided to introduce electric vehicles and hybrid cars for collection/delivery vehicles in downtown areas.

The fourth task is to set up a comprehensive support system to revitalize rail logistics and make it more efficient. Modal shift of railroad would be accelerated, while regulations and financial resources would be prepared to provide incentives (shift subsidies, fuel subsidies, freight car purchasing subsidies, etc.) to intermodal transport companies using railway. Support measures to facilitate the use of railway would be actively introduced, such as improving track access charge calculation system and Uiwang ICD site occupation charges, while review would be conducted whether to make it obligatory to use railroad when transporting heavy freight in long distance and dangerous goods. Furthermore, in order to strengthen the intermodal transport system, railway operation system would be improved, and rail transport facilities within international logistics hubs would be improved and additionally secured. The intermodal transport system would be further facilitated by connecting with inland freight depots. Home delivery and special delivery system utilizing railway and high-speed railway would be established by exploring logistics improvement projects utilizing rail facilities, while efforts would be made to transform railway stations and rail-related facilities into home delivery terminals.

The fifth task is to enhance support for invigorating the coastal shipping industry and making it more efficient. Berths exclusive for coastal freight would be expanded by creating social infrastructure aimed to facilitate the use of coastal shipping, while services would be improved through informatization. In addition, related laws would be revised in order to strengthen financial support for securing coastal vessels, allowing bank guarantee for funds for shipbuilding (opening an account at Korea Credit Guarantee Fund). Routes to facilitate the use of inter-Korean coastal sea transport would be expanded and reviewed by enlarging coastal shipping networks and encouraging demands, while logistics facilities would be expanded and business models would be developed to invigorate the Gyeongin Ara Waterway.

The sixth task is to create the foundation for strengthening competitiveness of key trading ports. Competitiveness of hub ports (Busan Port, Gwangyang Port, Ulsan Port) would be enhanced through selection and concentration, while port functions would be specialized by regions to boost export/import competitiveness. Busan Port would expand container terminals in a timely manner and build clusters through its hinterland complex to secure competitiveness in securing transshipment freight over competing ports, while improving infrastructure such as dredging for easy port calls by 10,000 TEU-level ships. Designation of major trading ports as pubic workplace would be pursued, while operation stability would be promoted by expanding commercialization of port unions and trainee-oriented training operation system for port workers would be established.

S/W Infrastructure

Implementation tasks for the software infrastructure consist of six specific tasks. They include “strengthening implementation drive of logistics policies”; Building statistics management system to enhance reliability of logistics policies”; “expanding IT infrastructure of key logistics hubs”; “fostering and securing customized manpower”; “strengthening the system to analyze and disseminate national logistics standardization status” and “enhancing capabilities for pan-social logistics cooperation.”

The first task is to strengthen implementation drive of logistics policies. Continuous policy drive would be secured by setting up a policy coordination body in charge of integrated coordination and management of logistics-related policies (provisionally titled “National Logistics Competitiveness Enhancement Committee). It is also necessary to set up support system such as funding and dedicated unit for ongoing development and implementation of logistics policies such as fostering specialized logistics companies. Year-round support system on key pending issues such as logistics cooperation, advancement of logistics by small and medium-sized companies, attracting foreign companies and establishing overseas presence would be established by creating funds for supporting logistics advancement and setting up dedicated organization to boost long-term growth potential of the logistics companies.

The second task is to build statistics management system to enhance reliability of logistics policies. There is a need to establish a permanent organization to manage logistics statistics and data in a systematic fashion and secure them on a regular basis. More accurate statistics collection system on the logistics industry would be established through partnership with Statistics Korea, while organic collaborative system with Statistics Korea would be established by including logistics-related items in “Report on Industrial Census” and “Report on the

Transportation Survey."

The third task is to expand IT infrastructure of key logistics hubs. IT infrastructure would be secured to ensure smooth connectivity of information among logistics hubs. Nationwide comprehensive logistics information infrastructure utilizing latest technology such as RFID would be established to distribute freight tracking system in real time, spreading the use of the system.

The fourth task is to foster and secure customized manpower. Systematic mid-to-long term logistics manpower cultivation plan would be established by analyzing anticipated demands for and needs of logistics manpower. In addition, logistics-related national certificate system needs to be improved to boost work performance of logistics personnel and foster skilled logistics manpower. To this end, qualifications for certified professional logisticians should be shifted from written tests to work performance-type tests, while certificate system by field would be introduced, such as green logistics and logistics security and skilled manpower needs to be fostered such as logistics technicians. Tax benefits for specialized logistics companies in conducting research and human resource development would be expanded by providing assistance for securing workforce and balancing labor demand and supply. In addition, inflow of talented manpower would be accelerated by allowing industrial and professional and specialized workforce to work at those companies instead of serving in the military. Furthermore, overseas logistics (technology) manpower would be invited to facilitate balanced supply and demand of logistics workforce, while non-skilled workforce working on site would be secured by permitting foreign worker employment.

The fifth task is to enhance the system to analyze and disseminate the current status of national logistics standardization. Status of logistics standardization by specific fields and functions would be analyzed by realizing the national logistics standardization master plan and integrating logistics standardization functions which are different by government ministries. Moreover, Logistics standardization promotion system, which is implemented by individual government ministry would be expanded and reshuffled to logistics standards certification system encompassing all ministries, while support measures such as incentives would be introduced.

The sixth task is to strengthen pan-social logistics cooperation capabilities.

Logistics cooperation master plan would be established and various regulation improvement, assistance policies and business models required for implementing logistics cooperation would be explored, promoting its institutionalization. By doing so, all-directional support measures would be formulated and implemented involving planning-investment-project implementation-post-management for logistics cooperation.

Sustainability

Specific implementation tasks include "establishing environmentally-friendly logistics system to respond to global environmental regulations"; "expanding welfare in the logistics industry and improving working conditions"; "improving logistics infrastructure and institutional systems to strengthen social safety"; "establishing and distributing integrated logistics security system on the state level"; "enhancing social regulations and support to ease conflicts in the logistics market"; and "building the social foundation for securing long-term growth capabilities of the logistics industry."

The first task is to establish environmentally-friendly logistics system to respond to global environmental regulations. To this end, Korean-style green logistics mid-to-long term plan would be established to respond to future environment. Comprehensive plan to reduce greenhouse gas emissions in the logistics sector would be formulated and efforts to secure related budgets would be made, while monitoring on green logistics projects and policies would be strengthened by setting up green logistics performance management system which would be used in decision-making process for policy development. In addition, the government's guidelines (standards) on green logistics and evaluation criteria would be prepared and distributed, while phased implementation measures reflecting the unique conditions of the logistics industry would be presented and related guidelines would be also prepared and implemented. Moreover, social and institutional foundation would be created to induce voluntary participation of companies. Policy effect would be maximized by providing both regulations and assistance such as green logistics company certification system, target management system, and provision of subsidies for CO_2 emission reduction projects. Voluntary participation of companies would be further induced by exploring case studies where logistics costs and environmental costs have been reduced simultaneously meanwhile, regulations would be eased for eco-friendly logistics companies and efforts to secure social consensus on providing incentives to eco-friendly companies would be made.

The second task is to expand welfare in the logistics industry and improve working conditions. Efforts would be made to improve working conditions to induce inflow of workforce to the logistics industry, while welfare system for the logistics industry would be expanded on a continual basis and introduction of additional welfare system would be reviewed such as providing assistance to the socially vulnerable. Working conditions of the sea transport industry would be improved and exemplary cases would be explored and this would be adopted in other industries. Ongoing efforts would be made to realize advancement in working conditions by expanding welfare projects for marine officers and supporting career development of long-time marine personnel.

The third task is to improve logistics infrastructure and institutional systems to strengthen social safety. Logistics plans designed to support disaster prevention would be formulated to prepare for state emergencies and natural disasters by securing response system of the logistics sector, while measures to advance national logistics system in response to energy crisis would be also prepared. In addition, institutional mechanism to strengthen safety in the logistics and distribution sector would be improved. Safety management system on transport of dangerous goods such as harmful substances and wastes would be also established.

The fourth task is to establish and disseminate state-level integrated logistics security system. Related laws and institutional systems would be integrated to bolster capabilities to implement logistics security policies, while cooperative system among government agencies concerned including the Ministry of Land, Transport and Maritime Affairs, the Ministry of Knowledge Economy, Korea Customs Service and the National Intelligence Service needs to be established to ensure integrated operation of logistics security certification system. In addition, what is also needed is to establish integrated response system to respond to various logistics security regulations required by major trading countries and international organizations. Meanwhile, support should be provided to SMEs with poorer financial and human resource foundation than large conglomerates to help them set up logistics security system, thereby incorporating laws and institutional systems related to logistics security, as well as main players of implementation.

The fifth task is to enhance social regulations and support for easing conflicts in the logistics market. Social regulations on securing market transparency, as well as safety and disaster prevention need to be toughened up and institutional support for prompt establishment would be strengthened. Transaction stages would be scaled down and transparency would be secured by offering tax benefits to shippers utilizing the government-certified freight information networks. Punishment would be strengthened in the case of unfair trade transactions such as illegal multi-level transactions, while institutional measures would be in place to help the main players of the freight transport market perform their fundamental functions (transport obligation, transport management, etc.). Furthermore, driving hours would be restricted, while overloaded vehicles and speeding vehicles would be subject to driving restricts. Safety and disaster-related education would be obligated, while guidelines on safety of storage facilities and disaster prevention would be prepared. In order to improve wage levels and working conditions of truck drivers, support would be provided to reduce multi-level transactions and form appropriate freight charges.

The sixth task is to establish social foundation to secure long-term growth capabilities of the logistics industry. To this end, institutional support measures would be drawn up to secure capabilities to create jobs in the logistics industry, while job-housing proximity would be strengthened between logistics workplace and residential areas by developing downtown integrated logistics facilities. In addition, logistics outsourcing in the public sector such as national defense logistics, public medical system and public construction projects would be expanded, while recruitment of specialized workforce in such fields as logistics security, the environment and safety management would be obligated, inducing more jobs. Mid-to-long term logistics strategies in preparation for the era of ageing society would be established to induce change in employment policy, employment environment and corporate human resource policy, while development of automation and mechanization technology would be pursued to improve labor productivity of aged workers. Furthermore, logistics service and technology in response to change in distribution/retail structure due to increase in ageing population would be developed, thereby establishing a logistics response system in preparation for the ageing society.

Globalization

Implementation tasks for globalization include “securing international logistics hubs and invigorating their operation”; “making pro-active efforts to expand global transport networks”; “securing global growth capabilities of the international logistics industry”; and “expanding international cooperation to strengthen global connectivity.”

The first task is to secure international logistics hubs and invigorate their operation. International logistics hubs and hinterland would be developed from the integrated perspective considering land, sea, and air transport, as well as manufacturing, logistics and distribution by creating high value-added international logistics hubs. In addition, efforts would be made to induce transformation of industrial facilities into complexes equipped with air ports/ports and hinterland and demand creation function. Efforts would be made to develop hinterland of international logistics hubs such as Incheon International Airport, New Port of Busan Port, Incheon Port and Gwangyang Port on an ongoing basis, while a paradigm shift would be induced by focusing on creating added value in connection with manufacturing, logistics, transportation, urban support facilities, tourism and education functions. In addition, customized business models would be developed by hubs, reflecting characteristics of trade with countries seeking free trade agreements. Meanwhile, improvement would be made to imbalance in facility acquisition ratios by ports and items, while development of specialized ports taking characteristics of different ports into consideration would be implemented such as container transshipment hubs, oil hub in Northeast Asia, ports specialized in export/import of raw materials and support ports for industrial complexes. The central government and local governments would establish cooperation schemes to attract companies in hinterland and free trade areas, while ways to make institutional improvement would be sought, encompassing customs clearance, customs duties, bonded area and employment. When attracting companies, differentiated incentives would be provided such as lowering rental charges by assessing the company's contributions such as appropriateness of business model, container volume creation effect, and job creation.

The second task is to make pro-active efforts to expand global transport networks. By implementing active diplomacy aimed at strengthening the nation's global leadership in the air transport market, international cooperation would be strengthened to resolve the problem of regional concentration of air routes, which are heavily concentrated in Northeast Asia, Southeast Asia, North America and Europe, thereby enhancing competitiveness of flagship carriers. In addition, liberalization of air transport would be pursued to transform Incheon International Airport into an air logistics hub. Efforts would be made to open air services for South America, CIS and Africa which have insufficient air services. Through Korea-China-Japan air cooperation, the foundation for an integrated air market in Northeast Asia would be established, which would compete with air markets centering in the United States and Europe. In addition, air negotiations would be carried out on an ongoing basis to pro-actively respond to change in the air environment by strengthening functions of analysing trends of international and domestic air transport markets and forecasting demands, thereby promoting air liberalization in advance to expand international air networks. International cooperation and technology development would be strengthened to revitalize sea-air intermodal transport in Northeast Asia by expanding global shipping network including the North Pole route. Status of sea transport in Korea, China and Japan would be examined, while efforts would be made to come up with measures to invigorate intermodal transport through linkage between inland and air transport. Port alliance with ports in China and Japan would be enhanced, while coastal freight transport business would be newly launched. Cutting-edge transport technology and intermodal transport business models would be developed to strengthen coastal feeder network. In addition, international cooperation would be sought to secure land logistics network linked to continents. While striving to open up logistics infrastructure of North Korea on a continuous basis, improvement would be made to related domestic transport infrastructure. Strategic plans would be formulated on the development and utilization of logistics infrastructure in North Korea. Consultations on the master plan on connecting railways with roads would be performed, while securing logistics networks such as connecting disconnected sections of the East Sea Line and constructing a logistics complex in the Gaeseong Industrial Complex.

The third task is to secure global growth capabilities of the international logistics industry. To this end, global specialized logistics companies would be fostered and they would be induced to expand their market entry. Specialized logistics companies would be induced to go global and big, while support measures would be explored by considering various aspects ranging from urgent assistance such as procuring overseas investment funds with low interest rates to long-term growth foundation for the logistics industry such as cultivating global logistics manpower. In addition, consulting service would be provided to facilitate global M&As and direct overseas investment. Funding would be facilitated through the Korea Finance Corporation and state-invested banks. Furthermore, global logistics company certification and international logistics forwarding business certification would be introduced to foster global logistics companies, while logistics functions of the Korea Post and Korea Railroad Corporation would be separated and privatized to become global logistics companies. Various models to support overseas market advancement would be developed and differentiated support would be provided by models, while support measures, including offering information on related laws such as taxation systems and local business information, providing consulting service and procuring M&A funds would be formulated to facilitate M&As of local companies. When companies tap into new logistics markets, inter-governmental cooperation would be pursued to minimize business risks such as securing business rights, divestment and tax-related matters. In addition, the foundation for continuous growth of shipping companies would be established. Support would be provided to help shipping companies to boost their global competitiveness. For large shipping companies, support would be provided to help them become one of global top 10 shipping companies through expansion of ships and M&As. Medium-standing shipping companies would be induced to generate high profits and go larger through specialization by field. Shipping companies would be encouraged to strengthen shared growth and cooperation among them, while long-term transport contract would be induced between large domestic shippers and national flag carriers, while logistics models would be reviewed in preparation for commercialization of the North Pole Route.

The fourth task is to expand international cooperation to strengthen global connectivity. Institutional foundation in preparation for integration of the global logistics market would be created by continuously expanding international cooperation to build global intermodal transport networks. Strategies for international cooperation by country would be formulated by analyzing regional characteristics and seeking possibilities of cooperation, while measures to protect domestic investors would be prepared to create a stable and predictable investment environment. Support would be provided to eliminate entry barriers such as easing unreasonable regulations related to local investment, while prospective countries would be selected and action plans by country would be established. As part of the Korea -ASEAN logistics cooperation projects, logistics manpower would be cultivated, technical support would be provided, while advanced expertise would be transferred and experience in building infrastructure would be shared. In addition, the Korea-China-Japan transport and logistics minister meetings would be held on a regular basis, while specific matters for cooperation would be explored and implemented through cooperation channels such as Northeast Asia port director meetings. Response strategy on the Northeast Asia level would be formulated in response to the trend of strengthened international logistics security, while infrastructure would be established such as DB standardization to facilitate smooth connectivity of information. The Korea-China-Japan joint logistics research would be conducted to expand mutual exchanges and cooperation, while exemplary case studies would be explored and benchmarked by neighboring countries.

Domestic Industry

Specific implementation tasks taking problems of the domestic industry into consideration include “establishing systems to promote structural stabilization and advancement of the logistics industry”; “building support system for stabilization and advancement by industry”; “supporting enhancement of competitiveness through expansion of scale of the logistics market"; and "building comprehensive support system to enhance competitiveness of logistics companies."

The first task is to establish systems to promote structural stabilization and advancement of the logistics industry. Measures to stabilize and advance the logistics industry befitting characteristics of respective business categories would be formulated by revising the Logistics Industry Act (presently "Trucking Transport Business Act") to determine whether short-term regulation policies such as adjustment of truck demand and supply and prohibition of multi-level transactions would be sustainable and future countermeasures would be devised. In addition, good logistics companies would be selected to offer policy support comparable to that of the manufacturing industry, thereby inducing natural restructuring.

The second task is to establish support system for stabilization and advancement by industry. To this end, stability and reasonability of the freight transport market would be enhanced, while structural improvement of the freight transport market would be induced. Supply and demand structure of the land transport business would be stabilized on the basis of market functions, while specialization of small transport companies would be promoted. The current permit system based on adjustment of supply and demand would be shifted to a permit system based on qualification for access, while the principle of market competition would be guaranteed to the maximum and regulations related to fair transactions inside the market would become stricter. Support systems would be established to induce formation of transport unions by region and industry, M&As, as well as to help individual transport service providers pursue corporatization. Policy priorities of various support systems for the freight transport industry would be improved according to policy directions (coastal shipping/rail > commercial road > non-commercial road) by improving and expanding support system to rationalize the freight transport market. Support would be provided to commercial transport modes from the equal perspective of providing support for public transport. Efforts would be made to improve transport productivity by offering discount for expressway tollgate fees for commercial trucks, supporting establishment of rest areas exclusive for freight trucks and improving the freight transport consignment fee system and unreasonable regulations. A shift to registration system would be pursued in order to overcome the small scale of small businesses and improve their business environment and regular review would be made to secure registration standards. Companies failing to meet standards would be removed from the registration. When selecting resident companies for port hinterland areas, support would be made to boost competitiveness by offering preferential treatment to the international logistics forwarding industry and permitting them to handle customs clearance. In addition, programs to support companies removed from the registration list to change businesses would be operated through related organizations such as the Korea Integrated Logistics Association. In the meantime, advancement of the home delivery service industry would be promoted. In order to secure legal grounds to support the home delivery service industry, creation of new businesses would be reviewed, while measures to secure workforce would be reviewed such as easing qualifications for drivers of home delivery vehicles and permitting employment of foreign workers, if necessary. In addition, measures to rationalize home delivery charges would be reviewed, while working conditions would be improved by expanding parking areas on arterial roads and installing unnamed delivery boxes. Service quality would be also improved by enhancing efficiency through pick-up/delivery system cooperation and implementing home delivery service assessment system.

The third task is to support enhancement of competitiveness through scope expansion of the logistics market. Shift from first-party logistics to third-party logistics would be induced on a continual basis by seeking scope expansion of the logistics market by revitalizing third-party logistics. Tax break measures for shippers would be implemented on an ongoing basis and the systems would be improved to boost actual effects, while consulting service on shift to third-party logistics would be increasingly expanded and intensive support would be provided to logistics cooperation among SMEs which have relatively higher shares of first-party logistics and logistics costs than large enterprises. In addition, active inducement policy would be implemented such as including records of shift to third-party logistics as one of evaluation indices in the evaluation categories of the logistics industry, thereby seeking change in perceptions of shippers. By doing so, public institutions would be induced to outsource logistics to certified logistics companies, while advanced case studies on logistics outsourcing would be explored and promoted to induce shippers' logistics outsourcing.

The fourth task is to establish a comprehensive support system to enhance competitiveness of logistics companies. Global logistics company certification systems would be introduced, while measures for integrated management of various logistics company certification systems would be formed. Certification systems by individual business category within the logistics industry would be introduced to induce natural restructuring through differentiation and support for certified companies would be enhanced. Efforts would be made to permit special cases on military service allowing industrial personnel to work at certified integrated logistics companies instead of serving in the military, while permission of employing foreign workers would be reviewed by considering working conditions and workforce shortage rates. When certified integrated logistics companies develop logistics facilities, regulations would be eased and a raise in the number of trucks would be permitted. Furthermore, when they bid for government procurement projects by the Public Procurement Service and other public agencies, they would enjoy preferential treatment.

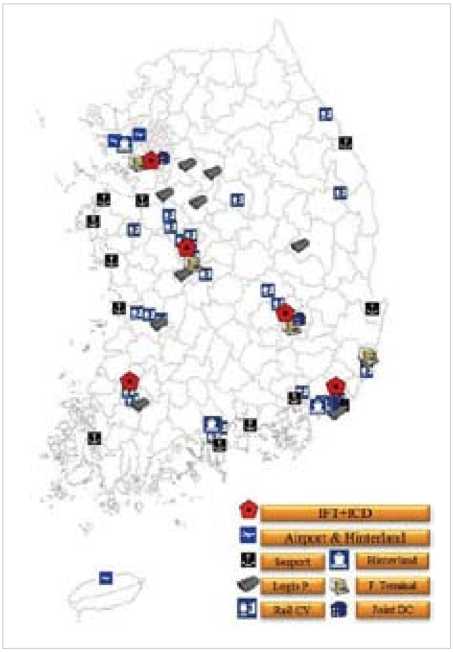
05
Logistics Facility Plan

Definition and Categories of Logistics Facilities

According to the Act on the Development and Management of Logistics Facilities in Korea, logistics facilities are defined as facilities for transport, storage and unloading of cargo and facilities where such related activities as processing, assembly, classification, repair, packaging, labeling, sales, and information and communication additionally take place.

In terms of the existing Comprehensive Plan on the Development of Logistics Facilities, logistics facilities are largely divided into three types of facilities for

Figure 4.12. Logistics hub facilities in Korea



international service, facilities for mega-regional service and facilities for local service, depending on functions, service region and location. Logistics hubs in Korea are classified into 10 types, which include seaports/airports (freight terminal), port hinterland complexes, airport logistics parks, integrated freight terminals (IFT), inland container depots (ICS), logistics complexes, general logistics terminals, joint distribution centers and railway station container yards (CY).

Figure 4.13. Sites designated as port hinterland complexes

Figure 4.14. Railway station CYs

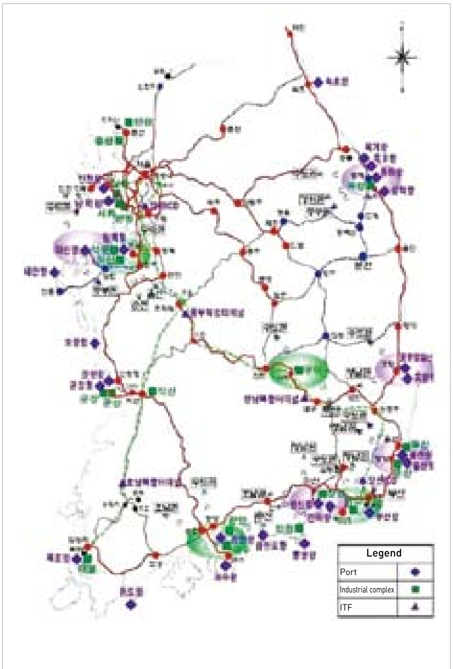


Table 4.11. Classification of logistics facilities

	Facilities for international service	Facilities for mega-regional service	Facilities for local service
Service region	Northeast countries (Exports &Import, Transshipment, Value-added logistics)	2-3 provinces (Inter-regional logistics)	A province or 2-5districts (Intra-regional logistics)
Examples	Airport, seaport, Hinterland(air&sea)	Integrated Freight Terminal, Inland Container Depot	Freight Terminal, Distribution center, Railway station CY

Logistics hub facilities in the nation are either briskly under operation across the country in various forms or under construction.

Table 4.12. Status of logistics hub facilities in Korea

Classification			Sites
Facilities for International service	Seaport (terminal)		28
	Airport (terminal)		11
	Seaport hinterland		8
	Airport logistics park		2
Facilities for mega-regional service	Inland clearance depot	Integrated freight terminal	6
		Inland container depot	6
Facilities for local service	Logistics park		15
	Joint distribution center		6
	Freight terminal		30
	(Railway station) CY		26

Port Hinterland Complexes

Port hinterland complexes located in the hinterland of sea ports are facilities that carry out three functions of integrated logistics facilities, logistics service support facilities and public facilities. Integrated logistics facilities are designed for storage/distribution, assembly/processing, transshipment, and management of vacant containers. For storage/distribution, such facilities as CFS, warehouse complexes, wholesale complexes, joint distribution centers and international logistics centers can be established. For assembly/processing, such facilities as processing and assembly centers for such industries as automobile parts, textile and footwear, as well as reclassification and packaging complexes can be constructed. Logistics service support facilities include direct support facilities designed for effective management and operation of hinterland complexes, as well as commercial facilities and research and venture facilities, whereas public facilities include port waterfront facilities, buffer green space and road and railway facilities to secure access to hinterland complexes.

Table 4.13. Sites designated as port hinterland complexes

<table>
<tr><th colspan="2">Port</th><th>Size (thousand m²)</th><th>Construction period</th><th>Companies</th><th>Operator</th></tr>
<tr><td rowspan="3">Busan (New Port)</td><td>North</td><td>1,702</td><td>2005-2010</td><td>22</td><td rowspan="3">Busan Port Authority</td></tr>
<tr><td>South</td><td>1,421</td><td>Not confirmed</td><td>-</td></tr>
<tr><td>Ungdong</td><td>3,579</td><td>2011-2015</td><td>-</td></tr>
<tr><td colspan="2">Gwangyang</td><td>3,878</td><td>2003-2011</td><td>25</td><td>Korea Container Terminal Corporation</td></tr>
<tr><td rowspan="3">Incheon</td><td>North</td><td>374</td><td>2006-2011</td><td>-</td><td rowspan="3">Incheon Port Authority</td></tr>
<tr><td>South</td><td>2,288</td><td>2003-2013</td><td>17</td></tr>
<tr><td>New</td><td>2,485</td><td>2006-2015</td><td>-</td></tr>
<tr><td colspan="2" rowspan="3">Pyeongtaek/Dangjin</td><td rowspan="3">2,627</td><td>2005-2010</td><td>-</td><td rowspan="3">Gyeonggi Pyeongtaek Port Authority</td></tr>
<tr><td>2008-2015</td><td>-</td></tr>
<tr><td>2006-2020</td><td>-</td></tr>
<tr><td colspan="2">Ulsan</td><td>456</td><td>2008-2011</td><td>-</td><td>Ulsan Port Authority</td></tr>
<tr><td colspan="2">Mokpo</td><td>474</td><td>2006-2015</td><td>-</td><td>Mokpo Regional Maritime Affairs and Port Office</td></tr>
<tr><td colspan="2">Pohang</td><td>690</td><td>2006-2015</td><td>-</td><td>Pohang Regional Maritime Affairs and Port Office</td></tr>
<tr><td colspan="2">Masan</td><td>330</td><td>2006-2015</td><td>-</td><td>Masan Regional Maritime Affairs and Port Office</td></tr>
</table>

Integrated Freight Terminals

Integrated freight terminals (IFT) are integrated logistics facilities comprising logistics handing facilities such as freight sheds and distribution centers, support facilities such as convenience facilities, gas stations and car wash facilities, and public facilities such as roads, railways and parking lots. IFTs had been mainly designed for intermodal transport using both roads and railway, yet most of them are operated mainly for freight trucks. Even though IFTs had been designed to allow small and medium-sized manufacturers and logistics companies to move in, large companies mainly rent wings in IFTs. On the other hand, inland container depots (ICD) are inland logistics facilities handling export/import containers. It is commonplace to develop ICDs in the form of inland freight hubs by combining them with IFTs. ICDs refer to sheds located in industrial districts with convenient access to ports and inland transport modes and designed for collection and consolidation of containers. They have such functions as container stacking/storage, collection/classification and customs clearance.

IFTs and ICDs have been constructed in five regions, including the Seoul Metropolitan Area (Gunpo, Bukbu, Nambu), the Busan Metropolitan area, the Honam area, the Jungbu (central) area and the Yeongnam area. As of November 2009, three IFCs and two ICDs are under operations in the Seoul Metropolitan area, the Busan area, and the Honam area.

Table 4.14. The current status and plans of inland logistics bases

Region	Site Name (Private operator)	Location (Size)	Construction Cost (million USD)	Construction Period	Main Facilities	Capacity	Opening
Seoul Metropolitan Area	Gunpo IFT (KIFT)	Gunpo City (381,736m^2)	217.2	1992-1998	FS (9 buildings) DC (8 buildings)	General Cargo 5,810,000t/year	March. 1997
	Gunpo IFT, 2nd xtension (KIFT)	Gunpo City (346,770m^2)	395.9	2003-2012	FS (2 buildings) Warehouse (2 buildings) DC (7 buildings)	General Cargo 5,650,000t/year	Under Construction
	Uiwang ICD (Uiwang ICD, Limited)	Uiwang City (753,127m^2)	29.3	1992-1996	CFS (3 buildings) CY (42,000m^2)	Container 1,370,000TEU/ year	July, 1993
Busan Metropolitan Area	Yangsan IFT (KIFT)	Yangsan City (316,944m^2)	224.8	1992-1999	FS (7 buildings) DC (6 buildings)	General Cargo 3,710,000/year	July, 1999
	Yangsan ICD (Yangsan ICD, Limited)	Yangsan City (951,940m^2)	246.0	1992-2000	CFS (10 bulidings) CY (780,000m^2)	Container 1,400,000TEU/ year	April, 2000
Honam Area	Changsung IFT / ICD (KIFT)	Changsung Gun (520,782m^2)	293.8	1998-2010	FS (4 buildings) DC (10 buildings) CFS (2 buildings) CY (60,000m^2)	General Cargo 4,700,000t/year Container 340,000TEU/year	May, 2005
Joongbu (Central) Area	Joongbu IFT / ICD (KIFT)	Cheongwon/ Yeongi Gun (480,736m^2)	1,793	2000-2010	FS (4 buildings) DC (4 buildings) CFS (1 building) CY (60,000m^2)	General Cargo 2,360,000t/year Container 350,000TEU/year	June, 2010
Youngnam (Kyongsang) Area	Chilgok IFT / ICD (YIFT)	ChilgokGun (456,499m^2)	218.2	2004-2010	FS (7 buildings) DC (3 buildings) CFS (1 building) CY (90,000m^2)	General Cargo 3,570,000t/year Container 330,000TEU/year	January, 2010

• Note: As of May 2012, 1 USD=1.128.70 KRW

There are a total of 26 railway station CYs under operation in the area of 850,000m^2 and their annual container handling volumes amount to approximately 2.82 million TEUs.

Table 4.15. Current status of railway station CYs

Region	Line	Station	Size (m²)	Capacity (TEU/year)	Opening	Throughput(TEU)	
						2007	2008
Total		26	849,080	2,822,000	-	1,687,521	1,844,297
Jungbu area	Sub-total	10	515,575	1,734,000	-	815,735	871,180
	-	Obong	419,050	1,409,000	1984. 7	580,342	621,913
	Gyeongbu	Doojeong	12,568	42,000	2002. 7	31,908	34,572
	Gyeongbu	Maepo	4,233	14,000	2006.11	8,603	9,517
	Janghang	Sapgyo	4,220	14,000	1993. 1	32,404	43,193
	Gyeongbu	Bugang	7,003	25,000	1994. 1	22,292	20,487
	Gyeongbu	Shintanjin	18,190	61,000	1998. 9	42,118	38,035
	Gyeongbu	Sojeongri	5,632	19,000	1999.12	15,584	12,226
	Gyeongbu	Okcheon	5,449	18,000	1996. 1	7,642	7,507
	Gyeongbu	Jochiwon	12,108	41,000	1994. 8	27,941	31,312
	Choongbook	Cheongju	18,862	63,000	1995. 9	36,354	38,184
	Choongbook	Choongju	8,260	28,000	2007. 1	10,547	14,234
Honam area	Sub-total	7	66,488	192,000	-	126,454	186,731
	Gunsan	Daeya	16,500	24,000	2000. 7	-	50,012
	Jeolla	Dongsan	4,650	16,000	1989. 1	11,048	10,139
	Jeolla	Dongiksan	9,860	33,000	1994. 1	43,883	38,746
	Honam	Songjeongri	14,057	47,000	1996.11	9,394	17,038
	Honam	Imgok	8,662	29,000	1996. 9	9,044	12,373
	Gwangyangjecheol	Taegum	7,648	26,000	1999. 7	35,669	41,435
	Yeocheon	Heungguksa	5,111	17,000	1994.12	17,416	16,988
Yeongnam area	Sub-total	2	52,902	177,000	-	101,645	103,336
	Gyeongbu	Apo	4,824	16,000	1998. 7	1,254	-
	Gyeongbu	Yakmok	48,078	161,000	1995. 2	100,391	103,336
Busan area	Sub-total	5	211,615	711,000	-	626,190	664,879
	Gaya	Gaya	13,683	46,000	1996. 4	23,958	17,727
	Gyeongbu	Busanjin	129,177	434,000	1972. 9	568,260	611,796
	Jinhae	Shinchangwon	36,249	122,000	2004.11	2,982	5,223
	Onsan	Onsan	19,060	64,000	1997.10	3,736	3,343
	Ulsan Port	Ulsan Port	13,446	45,000	1996. 3	27,254	26,790
Others	Sub-total	2	2,500	8,000	-	17,497	18,171
	Yeongdong	Seokpo	1,500	5,000	2003. 3	11,762	13,155
	Yeongdong	Gangnung	1,000	3,000	2005. 4	5,735	5,016

Operation and Management of Logistics Facilities

Logistics hub facilities are constructed by types and authorities in charge of their operation and management vary significantly. Companies performing logistics activities in those facilities are moved in by individually signing rental contracts (purchasing the ownership).

Table 4.16. Differences in operation and management authorities of logistics hub facilities

Classification	Port (Terminal)	Airport (Terminal)	Port Hinterland	Airport logistics park	IFT	ICD	CY	Logistics park	Freight terminal	Joint DC
Basic plan (Land development)	Central gov. Seaport Authority	Central gov. Airport Authority	Central gov. Seaport Authority	Central gov. Airport Authority	Central gov. Private Sector	Central gov. Private Sector	Central gov. Korail	Central & Local gov. LH Corp.	Central & Local gov.	Central & Local gov.
Finance	Public, Private	Public, Private	Public, Private	Public, Private	Public, Private	Public, Private	Public, Private	Public, Private	Public, Private	Public, Private
Management & operation	Private sector, Seaport Authority	Airport Authority, Private sector	Private sector, Seaport Authority	Airport Authority, Private sector	Private sector	Private sector	Korail, Private sector	Private sector	Private sector	Private sector
Ownership	Rent	Rent	Rent	Rent	Rent	Rent	Rent	Sale, Rent	Sale, Rent	Sale, Rent

06

Measures to Advance the Freight Transport Market

Institutional Improvement of the Freight Transport Market

Prior to the 1960s, the automobile transportation industry had not received any policy support and financial assistance from the government and small automobile owners started to operate the transport business sporadically with little capital investment, non-specialized business knowledge, and pre-modern management methods. Therefore, the industry developed an abnormal management form called Jiipje in which trucks owners were registered with those who had obtained licenses for truck transport business to perform the truck transport business. As this system became prolonged and fixated in the 1960s, the government obligated them to pursue corporatization under the Commerce Act to improve the situation and encourage them to play their original role as the transport business. In 1965, notifications of the Ministry of Transport readjusted unilateral corporatization on going public and sought improvement measures to boost efficiency by consideration types by business category. However, a series of administrative measures announced in 1961 and 1965 did not reap any tangible effects in improving the Jiipse system due to lack of necessary conditions.

In the 1980s, direct management of the truck transport business continued and in the mid-1980s improvement of the Jiipje system was made to individualize truck owners registered with freight transport companies. In the 1990s, the old artificial direct management system was rejected by deregulation such as business simplification and easing regulations on minimum numbers of trucks. The government expected that business rationalization would be achieved through voluntary competition within the transport market through such deregulation measures. However, it was difficult for truck owners with inability to secure freight orders to terminate contracts with transport companies, thus few truck owners registered with transport companies became individual business owners.

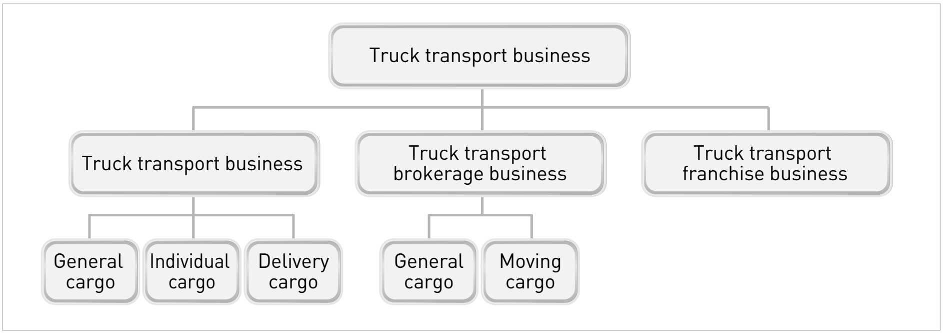
Since 2000, the required number of registered freight vehicles has eased sharply from 25 to 5. In April 2004, the Registration system was replaced by the Permit system and the required number of freight vehicles was eased to just one, providing a legal foundation for one-truck owners to have access to the market.

Truck transport franchise business is a business category newly introduced at the time of replacement of the registration system to the permit system in 2004. The truck transport franchise business refers to either transporting cargo with charges by

Figure 4.15. Change in freight transport market policies in Korea

1960-80s	Focused on corporatization & direct management of trucking transport business (license system)
1990s	Promoting deregulation & industry simplification about trucking transport business (registration system)
2000s	Tighten regulations for the supply and demand imbalances of freight transport market (permit system)

Figure 4.16. Truck transport business map



using the truck owner's truck upon demand of others or requesting franchise stores of the freight transport company the truck owner is registered with to transport cargo.

The number of vehicles currently registered as freight vehicles stood at 380,000 as of 2009 and since the shift to the Permit system, annual growth rate has been on the decline. Freight vehicles showed increase rate of 8.9% between 1995 and 1999, the time when the License system was implemented and showed an even higher 10.7% during the period of the Registration system. However, since the introduction of the Permit system, the annual increase rate of trucks has recorded a mere 1.4%.

Table 4.17. Numbers of registered freight vehicles

Year	'97	'99	'03	'04	'05	'06	'07	'08	'09.6
Total	202,742	236,863	349,504	357,276	358,123	364,095	373,647	378,603	379,690
Increase rate	6.4%	16.8%	4.5%	2.2%	0.2%	1.7%	2.6%	1.3%	-
Sub-total general freight	175,874	210,011	314,864	321,104	321,700	326,794	334,584	338,711	339,680
General			236,348	238,386	234,266	232,284	233,207	231,450	230,489
Dump			3,966	3,981	3,834	3,647	3,406	3,404	3,504
Van			18,209	18,892	19,404	20,135	20,067	20,535	20,629
Specific			56,341	59,845	64,196	70,728	77,904	83,322	85,058
Sub-total special motor vehicle	26,868	26,852	34,640	36,172	36,423	37,301	39,063	39,892	40,010
Tow car			6,249	6,635	6,836	7,060	7,382	7,250	7,193
Tractors			27,082	27,942	27,985	28,256	28,549	28,708	28,684
Special work			1,309	1,595	1,602	1,985	3,132	3,934	4,133

The implementation of the Permit system in 2004 is considered to have greatly eased imbalances in supply and demand in the truck transport market. However, in reality other problems exist in the truck transport market, including multi-level transport structure, the market structure centering on Jiipje, poor conditions for welfare and industrial development. The government is laying the institutional foundation to help transport companies provide transport service (direct transport function), which is their fundamental function. The government is also building the institutions foundation to form role-sharing structure where large transport companies lead the market, medium-sized companies cooperation, and individual truck owners fill the gap generated by forwarders in order to induce the formation of shared growth structure among market players. The government strives to prevent possible disputes by clarifying rights and obligations of transport companies and truck owners to resolve problems caused by the consignment-oriented market structure which is unique to Korea.

Recent government policies toward the freight transport market include implementation of a direct transport obligation system in which truck transport companies are obligated to directly transport certain amounts of consigned cargo with vehicles owned by the companies (direct consignment) to prevent multi-level transactions due to package consignment. The government is also assigning forwarders and transport companies with obligations to check transport capabilities and transport intervals of partner transport service providers, while improving institutional systems to enhance the efficacy of the measures. In addition, the government has established “freight transport performance management system” to boost transparency of market transactions and institutionalized reporting of transport/brokerage performance through the system as obligatory. Moreover, the government plans to introduce freight information network certification system and implement measures to facilitate the information network by granting incentives to companies using the information network. The government also extended the freight vehicle supply limitation period by analyzing supply and demand conditions by business category and types of vehicles in order to stabilize supply and demand in the freight market. Furthermore, the government established freight welfare foundation to improve welfare conditions of truck owners, while compensating those who desire freight truck reduction to support freight truck owners who have reached limitations.

Fuel Subsidy System

The Korean government has offered fuel subsidies, which correspond to increased portion of fuel tax for a certain period of time to ease the burden of the transport industry as it raised tax rates levied on fuel such as diesel oil and LPG in a phased manner, according to energy tax reform in 2001. Those who are eligible for fuel subsidies are commercial freight vehicles in accordance with Truck Transport Business Act. In principle, the subsidies would be provided to truck transport service providers, yet if another party pays for fuel, the subsidies may be provided to the party. Yet, fuel subsidies are provided to transport companies for directly operated trucks and to truck owners in consignment cases. In October 2003, the

Table 4.18. Fuel subsidy status (Unit: million USD)

Category	Total	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2001
Total	143,834	1,293	2,161	5,062	9,963	13,194	16,617	20,229	19,492	17,833	17,439	20,553
Truck	84,302	302	561	1,675	3,867	5,683	8,345	11,415	12,486	13,295	13,148	13,524
Bus	26,989	354	516	1,221	2,018	2,692	3,388	3,848	3,547	3,368	3,140	2,897
Taxi	30,882	618	1,054	2,097	4,004	4,682	4,697	4,753	3,241	932	929	3,875
Coastal cargo ships	1,661	19	29	69	73	137	187	214	217	239	221	256

• Note: As of May 2012 USD=1,128.70 KRW

Table 4.19. Fuel subsidy ceilings (Unit: l/month, USD/month)

Category		1 ton or less	3 ton or less	5 ton or less	8 ton or less	10 ton or less	12 ton or less	12 ton or over
Standard amount (Diesel oil)		455	676	1,031	1,480	1,800	2,039	2,872
Diesel oil vehicles (0.31 USD/l)	Ceiling quantity	683	1,014	1,547	2,220	2,700	3,059	4,308
	Ceiling amount	209	310	473	678	825	934	1,316
LPG Vehicles (0.18 USD/l)	Ceiling quantity	1,024	1,521	2,320	-	-	-	-
	Ceiling amount	179	266	406	-	-	-	-

• Note: As of May 2012 USD=1,128.70 KRW

introduction of fuel subsidy card system was decided and in 2008 it was decided to make the use of fuel purchase cards obligatory. Fuel subsidies worth 9 billion USD had been provided to truck transport service providers by 2009. In 2011 fuel subsidies paid to trucks amounted to 1.3 billion USD. The freight sector accounts for 66% of fuel subsidies for all sectors.

Construction of Service Areas for Truck Drivers and Public Garages

In order to improve welfare and driving efficiency of truck drivers, the Korea Road Corporation installed service areas for truck drivers on expressways and offered rest areas located in the service areas free of charge from 2010. Currently, there are 16 service areas for truck drivers on expressways and truck drivers can use convenience facilities free of charge such as shower rooms, sleep room and washing rooms installed in all service areas for truck drivers, including 8 service areas such as Chilgok Service Area for Truck Drivers, which are operated free of charge.

Table 4.20. Truck service areas on expressways

Route	Location	Total
Gyeongbu line	Chilgok (Busan), Gimcheon (Seoul), Gimcheon (Busan), Sintanjin (Seoul), Gyeongju (Busan), Ipjang (Seoul), Cheongwon (Seoul), Oksan (Busan)m Okcheon (Seoul)	9
Jungbu Inland line	Mungyeong (Yangpyeong), Mungyeong (Masan)	2
Honam line	Iseo (Daejeon), Iseo (Gwangju)	2
Daejeon Tongyeong line	Goseong (Tongyeong)	1
Daegu Pohang line	Yeongcheon (Daegu), Yeongcheon (Pohang)	2

The government is providing assistance from state coffer for part of total project costs to build public garages constructed by local government to resolve serious truck parking lot shortages in downtown areas. Construction of public garages is a government policy presented to address problems caused by parking large freight

CHAPTER 04

trucks on large streets and roads near residential districts such as inconvenience to passage of residents, high traffic accident risks, and generation of crime-prone areas in residential areas. Increase in such infrastructure as garages exclusive for freight trucks is considered having positive effects, including improvement of working conditions for truck drivers, resolving inconveniences in passage, parking lot shortages and creating a pleasant residential environment.

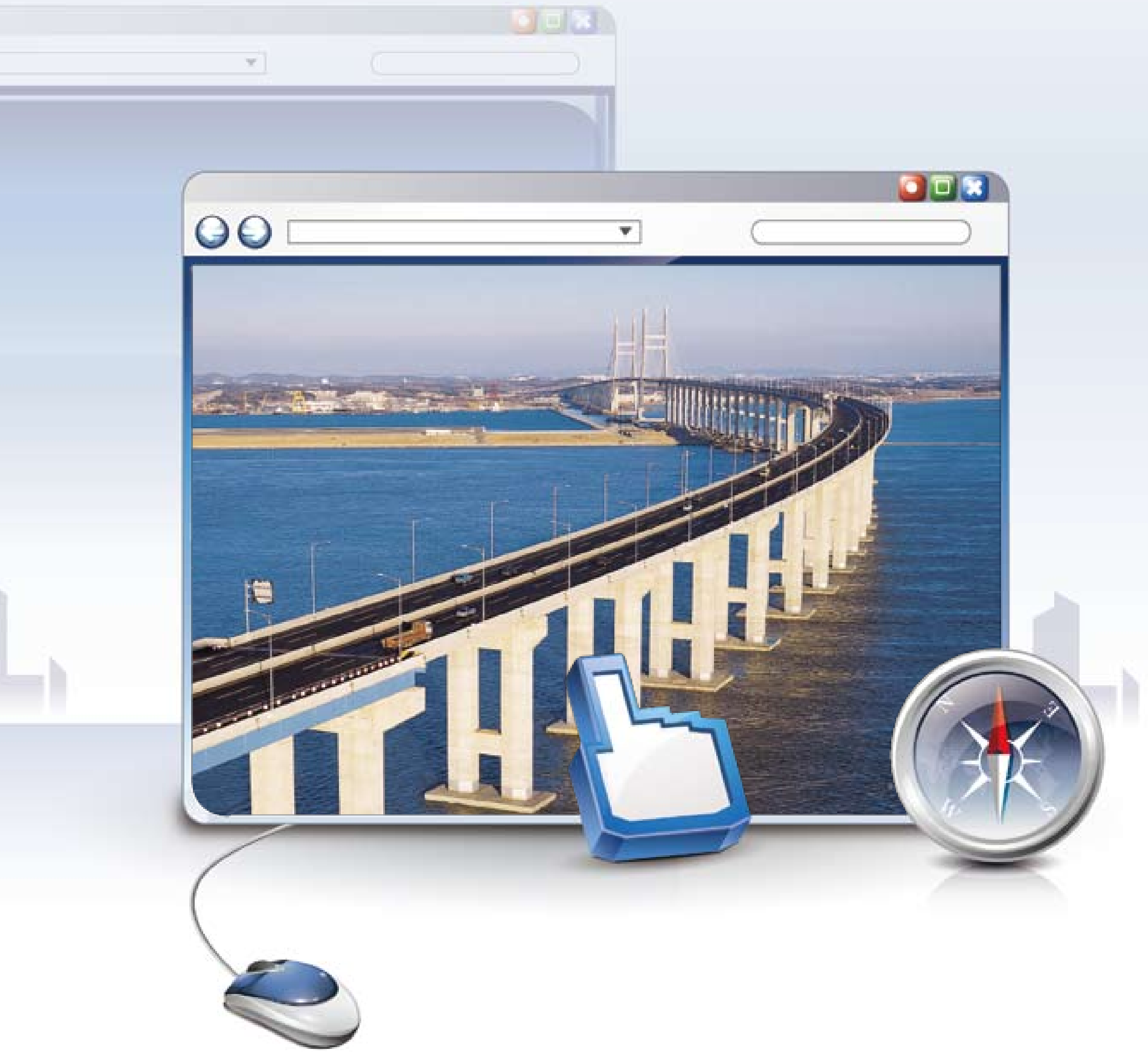
As of 2011, public garages for trucks were operational in 25 locations, including Daegu, Jeju, Jinhae, Gangjin, Suncheon and Mokpo and they are constructed and operated through subsidies from local governments.

- Assistance for public garages
  - Jeju (2004-2005): 1.3 million USD in 2004, and 1.3 million USD in 2005
  - Daegu (2005-2006): 0.9 million USD in 2005, and 1.0 million USD in 2006
  - Jinhae (2006-2007): 0.3 million USD in 2006, and 0.3 million USD in 2007
  - Kangjin-gun (2007-2008): 0.66 million USD in 2007, and 0.66 million USD in 2008

CHAPTER 5

TRANSPORT INFRASTRUCTURE INVESTMENT

Hee-Kyung KIM
Associate Research Fellow, The Korea Transport Institute



01
Introduction

Social infrastructure is state capital that should be essentially provided to facilitate people's economic activities and daily living, although not used directly in production. Mostly large in size and similar in characteristics to public goods, the social infrastructure facilities are not supplied through a market mechanism. Their provision is determined by the government or relevant public institutions, which provide necessary goods and services. Transport facilities, like dams and electricity supply systems, are major constituents of social infrastructure. Social infrastructure is a major yardstick for evaluating a nation's industrial competitiveness and public welfare level. So, infrastructure investment plans are usually high on the government's development agenda.

Building transport infrastructure requires proactive investment decisions. Preemptive decisions are needed because of the nature of transport infrastructure facilities, whose construction takes at least several years after making the investment decision. Because of this nature, once a problem occurs, it is difficult to solve it within a short period of time. Such a problem could cause public inconvenience and enormous damage to the national economy. The role of transport infrastructure is to facilitate the flow of people and commodities so that they can be placed in the right place at the right time expeditiously and effectively at the lowest possible cost. This process helps to create high market value for particular goods or services, thereby raising their economic value and ultimately contributing to the nation's economic growth. Transport infrastructure has been a crucial factor in Korea's recovery from the Korean War and rapid economic growth. As a result of the implementation of a series of national economic development plans that started in the early 1960s, the nation's economic size expanded along with its production capacity. The consequent improvement in the people's income levels led to an increase in transport demand, which necessitated making investments in transport infrastructure. Relevant investments were made appropriately, thereby accommodating the increased transport demand and eventually helping to accelerate the nation's economic growth.

Transport infrastructure, which has the nature of public goods, is generally supplied within the scope of limited state resources. So, related investment decisions are made based on the principle of effective allocation of resources. To ensure effective allocation of resources, the priorities need to be determined based on the amount of social benefits generated by individual projects. The result may differ depending on the definition of social benefits and the composition of target items. Normally, however, the emphasis is placed on economic effects. So, the priorities are determined based on the evaluation of target items whose monetary value can be objectively estimated.

In the early stages of economic development when transport facilities are conspicuously in short supply, investment efficiency can turn out to be high for most transport infrastructure projects. Consequently, speedy supply of transport infrastructure tends to be given relative importance over the need for systematic investment planning. However, transport infrastructure, by its nature, involves huge amounts of expenses during a short period of time, whereas its benefits are generated gradually over a long period of time. And, once constructed, the facilities are hard to remove. In this regard, it is very important to plan transport infrastructure projects from mid- to long-term perspectives. Once a nation has secured a certain level of transport infrastructure, it becomes particularly crucial to make infrastructure investment decisions based on a system of determining objective priorities. In this stage, it becomes further necessary to determine the distribution of national resources through systematic approaches as well as objective and efficient investment and evaluation procedures. Transport infrastructure includes such facilities as roads, railways, airports and seaports. These facilities provide services of mutually different natures. So, there is a need to establish an investment system from comprehensive and systematic perspectives based on the consideration of the need to maximize intermodal characteristics and regional equity.

This paper examines the process of supplying transport infrastructure and its key roles in the context of changes in the nation's social and political circumstances. It includes the introduction of major government policies in terms of the nurturing of professionals (organizations), the securing of financial resources, and the improvement of laws and institutions. These contents can certainly be used as reference materials when devising similar ones in the future, and represent the efforts to share the nation's experience with various countries of the world.

02
Changes in Political and Social Conditions Related to Transport Infrastructure

Before the 1960s

The nation's first-ever transport infrastructure investment can be traced back to the late Joseon Dynasty when road maintenance and rail construction projects were initiated as part of modernization efforts. These projects were conducted mostly at quite insignificant levels. Afterwards during the Japanese colonial period, railway lines were developed for the exploitation of the nation's capital and resources, causing significant changes in national land structures and the living circumstances of the people. In particular, their abnormal development later served as a factor causing unbalanced development of the national land. Meanwhile, investments in the road sector were also made through the construction of new roads for security and military purposes, although at low levels compared to railways.

Table 5.1. Transport conditions in Korea when it was liberated from Japanese colonial rule

Category	Railways		Public roads	
Content	Operation distance (km)	6,362	National road (km)	5,263
	Stations (number)	762	Provincial road (km)	9,997
	Locomotives (number)	1,167	Municipal/county road (km)	8,771
	Passenger train cars (number)	2,027	Cars (number)	7,326
	Freight train cars (number)	15,352		

• Source: Extracted from "Transport Annals" (Gyotong Shinmun, 1976), "Korean Roads" (Korea Expressway Corporation, 1981)

Following the nation's liberation from the Japanese colonial rule, the Korean government carried out projects to build a road connecting Seoul and Gangneung, pave the national road linking Seoul and Busan, and construct a railway line between Jecheon and Punggi. However, about 60% of the nation's roads and most bridges were destroyed during the Korean War. Also, most railway lines were gone, except for the Gyeongbu line south of Jicheon, the Donghae line south of Gyeongju, and the Jinju line south of Haman. During the 1950s after the truce, the government concentrated its efforts on recovering from the war, especially on restoring urban infrastructure and transport facilities. Various road and bridge construction projects were conducted with resources fostered through foreign aid. The major achievements included the restoration of the Han River Pedestrian Bridge in 1958 and the start of the Seoul-Busan national road paving project in 1957.

The 1960s & 1970s

With the nation gradually recovering from the scars of war, the Korean government strongly pursued a policy of ensuring economic rehabilitation through industrial restructuring. Under this policy, the nation started in 1962 a series of five-year economic development plans aimed at promoting industrialization through transformation of the nation's agriculture-centered industrial structure. The industrialization policy eventually bore fruit as the nation secured a firm basis for realizing an advanced industrial structure in the late 1980s. However, as sufficient transport infrastructure was not available in the beginning stages of the economic development, the government pursued an approach of focusing on the development of major cities as a way to minimize transport time and cost. As a result, the Seoul metropolitan area and the southeastern coastal area with relatively favorable transport conditions at that time were given priorities in the allocation of resources. The capital area was equipped with advantageous conditions for locating industrial sites compared to other areas. First of all, there was the Incheon port, which facilitated the transportation of raw materials for the capital area in the early 1960s. Furthermore, it had relatively favorable rail systems and other transport conditions. In addition, the southeastern coastal area was selected to become the nation's largest industrial region under the government's policy to promote heavy and chemical industries. The decisive factors for its selection were the Gyeongbu Line, which was the nation's only double-track electrified railway system at that time, and the nation's largest port, Busan.

Modernization projects involving the national land spaces were conducted during the early 20th century. But, they were carried out to meet the Japanese colonialists' aim to exploit the Korean national resources and turn the nation into a military depot for aggression into the continent. So, they were not designed for strategic development based on long-term perspectives. As such, they consequently caused unbalanced development of the national land. Full-fledged national land development started with the five-year economic development plans launched in the early 1960s, which made it possible to draw up plans for regional infrastructure expansion to secure engines for economic growth. So, it can be said that mid- and long-term transport infrastructure expansion began in the 1960s, although at meager levels. Particularly noteworthy was that the Gyeongin Expressway opened in 1969. It had normally taken 50 minutes to one hour to travel from Seoul to Incheon, but the travel time shortened to around 18 minutes with the opening of the expressway.

In the 1970s, national land development plans were aimed at promoting the national land's economic, social and cultural development through the use, development and preservation of the land's natural conditions as well as through optimization of industrial locations and living environments. Departing from the previous lopsided development method focused on a few selected areas, the government adopted a new approach based on the growth center developmental strategy. The government applied the new strategy after dividing the nation into several zones based on social and economic conditions of the regions. It also tried to motivate the zones to pursue economic growth in a way suitable for their regional characteristics. Social infrastructure played a key role in supporting this growth center development approach, eventually helping to lay the groundwork for achieving further economic growth. In particular, priority in infrastructure construction was given to large projects that were expected to have huge economic impacts and cause trickle-down effects throughout the nation.

In the 1970s, expressways were actively built as a way to effectively address commodity transport problems caused by the insufficient capacity of the existing rail network. The expressway network, designed to link major areas of the nation with the Seoul metropolitan area as the hub, helped increase the interregional accessibility, thereby accelerating the nation's industrial development. The Gyeongin and Gyeongbu expressways played particularly important roles in promoting the industrial progress along the Seoul-Incheon industrial corridor and the industrial belt in the nation's southeastern coastal area, which served as drivers of the nation's rapid economic growth.

The 1980s

Korea experienced the phenomenon of people moving into cities as early as in the 1950s, following the Korean War. It was related to the political and social upheaval at that time. In the 1980s, the nation came to witness another wave of population concentration in cities. This time, it was the result of urbanization related to the implementation of the growth center strategy implemented throughout the 1960s and 1970s for regional development. In the process of implementing full-scale economic development plans, urban areas with large industrial sites increasingly needed cheap labor force. This led to migration of young people from rural areas to cities, resulting in rapid urbanization of some cities.

Table 5.2. Urbanization trends through the 1980s (Unit: 1,000 people, %)

Category	1960	1966	1970	1975	1980	1985
National population	24,989	29,193	31,435	34,679	37,449	40,432
Urban population	9,784	12,440	15,750	20,480	25,738	31,496
Rural population	15,205	16,753	15,685	14,199	11,711	8,936
Urbanization rate	39.15	42.61	50.10	59.06	68.73	77.90

- Note: Urban population includes the population of eup-level towns with 20,000 residents or more.
- Source : Ministry of Home Affairs, Korean Urban Annuals of each year

The growth center approach was originally aimed at ensuring balanced development among regions through the fostering of industrial complexes in each major region. However, it rather contributed to accelerating imbalances among different regions. Voices were raised calling for the development of remedial measures to ensure balanced development of the national land. The Seoul metropolitan area attracted particularly keen attention as it showed a conspicuously high level of population concentration. The urban population concentration combined with the explosive growth in private car ownership in the 1980s caused serious urban traffic problems, which developed into a pressing social concern. Amid such growing concern about the urban traffic problem, the nation's first subway system opened in Seoul in 1974, ushering in the era of urban rail. With the subway's modal share maintaining its upward trend, the second subway line opened in Seoul in 1984. Since then, the total length of subways has kept expanding. Previously, transport infrastructure investment policy had focused on building major transport arteries between regions to support economic growth through regional industrial development. So, policy-level securing of resources and investment aimed at resolving urban traffic problems had remained at relatively low levels. Changes in circumstances afterwards led to a shift in the economic growth-oriented supply of infrastructure, enhancing the awareness of the importance of infrastructure investment based on the consideration of the need for balanced development of national land.

The 1990s

In the 1990s, the awareness grew that transport infrastructure investment plans should be devised independently and systematically instead of being established as part of other comprehensive plans. In addition, the continued population growth and the explosive expansion in private car ownership seriously aggravated urban and intercity traffic conditions, causing inconvenience to the people and lowering the national competitiveness due to an increase in congestion costs related to commodity transport. However, it was difficult to find proper ways to supply long-term resources required to secure needed transport infrastructure. To address this problem, the government in 1993 established the Transportation Tax and the Special Account for Transport Infrastructure which it said would exist temporarily for 10 years. The government measure proved to be helpful in ensuring stable financial resources needed for SOC projects. In addition, to diversify funding sources and utilizing the private sector's creative technological prowess, the government enacted the Act on Public-Private Partnerships in Infrastructure in 1994, allowing for private-sector participation in the construction of transport SOC facilities, which had long been considered the supply domain of the government. The preparation of such diverse ways to secure financial resources laid the groundwork for the implementation of large-scale national projects.

In addition, the government enacted the National Transportation System Efficiency Act in 1999 to enhance the efficiency of transport facilities and establish effective and systematic short- and long-term transport plans. This Act contains a variety of contents, the most important of which are the provisions calling for the development of a 20-year plan for a national core transport network and a five-year mid-term investment plan to carry out projects included in the national core transport network plan. Unlike other related plans developed separately for different modes like road and rail transport, these plans were intended to devise comprehensive plans encompassing the overall modes of road, rail, aviation, harbors and logistics. These comprehensive plans were aimed to ensure the connectivity between modes, resolve the problem of overlapping investment, and ensure balanced distribution of investment resources by region and category, thereby effectively realizing the national transport policy goals.

03
Major Transport Infrastructure Investment Policies in Korea

Nurturing Experts (Institutions)

Establishment of Korea Expressway Corporation

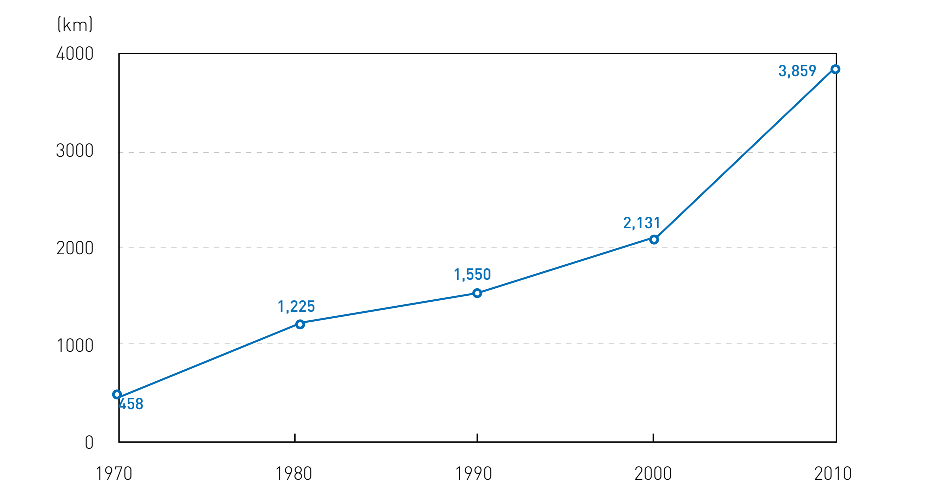
Roads for car travel were planned and built in the nation even in the late Joseon

Dynasty and during the Japanese colonial rule. Yet, full-fledged construction of roads can be said to have started with the establishment of national economic development plans in the 1960s following years devoted to recovery from damage caused by the Korean War. In the early 1960s, efforts were concentrated on improving the existing national roads by using foreign aid. Afterwards, the nation became increasingly aware of the need to build expressways with arterial road network functions to improve the nation's industrial competitiveness. This led to the planning and construction of the Gyeongin and Gyeongbu expressways. Amid these developments, the Korea Expressway Corporation was founded out of the need to ensure systematic management of the construction and operation of expressway toll roads.

The Korea Expressway Corporation is a quasi-market-based public corporation established in 1969 for road maintenance and the development of road traffic through the construction and maintenance of expressways and the implementation of related projects. Its primary role is to supervise the planning and construction of new expressways as well as the maintenance of the paving and structure of the existing facilities so that the expressways can fully execute their interregional transport functions. Lately, the corporation has come to take charge of the management and maintenance of state-of-the-art road facilities and related projects, and the Hi-pass and related facilities, keeping up with the diversification of the expressway functions and services.

As already mentioned, the corporation was founded to take over and manage expressway roll roads, following the opening of the nation's first highway, Gyeongin Expressway, and prior to the opening of the Gyeongbu Expressway. Since its establishment, the nation's expressways have expanded remarkably in length, from merely 458km in 1970 to nearly 10 times longer within 40 years to 3,859km in 2010. Expressway traffic volume, measured at 825 million vehicles in 1998, more than doubled over the next 10 years to 1,727 million in 2008. The nationwide expansion of the expressways with such a superb transport capacity laid the groundwork for transforming the nation into a one-day living sphere, thus playing a key role in supporting the nation's economic growth as the main logistics artery.

Figure 5.1. Trends in expansion of Korean expressways



Restructuring the Rail Industry to Reinforce Its Competitiveness

The nation's railroad industry has its origin in the opening of the Gyeongin Line between Noryangjin and Jemulpo by Gyeongin Joint Venture Rail Co. in 1899. Since the establishment of the Ministry of Transportation within the first Republic of Korea government in 1948, the rail industry had been under direct control of the government until the establishment of the Korean National Railroad as an independent agency affiliated with the ministry in 1963. Recognizing the importance of railroads as core infrastructure needed for economic growth, the government sought to pursue an autonomous and flexible operation and management of rail projects, instead of relying on the traditional method of controlling the budget.

In the 1960s when road construction was not sufficiently conducted, the railways had an edge in mass transporting people and freight, thus securing a high market share. However, in the 1970s, the expansion of arterial roads such as expressways and the increase in the supply of private cars led to a reduction in demand for rail, which was suffering from problems related to its inflexible service networks and operation hours. Furthermore, due to the characteristics of the rail projects which required large-scale construction costs, the rail sector was facing

CHAPTER 05

various problems in administration, registering a huge deficit.

The major causes cited for the administrative problems were the centralized decision-making process and the inflexible operation method, indiscriminate expansion of the organizational structure, and the command chain system lacking in clear accountability. It began to be pointed out that with these problems, the rail sector could not cope with new challenges ahead. In addition, the Korean National Railroad, which was in charge of the construction and management of rail, inevitably suffered from enormous financial difficulties with just transport revenue, due to the huge costs needed for construction of rail facilities. Also, questions were raised concerning the low quality of service, which was attributable to the intrinsic nature of a state organization. Facing these problems, the government sought to carry out restructuring designed to separate the facilities and operation sectors of the agency. The goal was to ensure the advancement of the rail industry through resolving the chronic deficit problem and the improvement of services. The restructuring scheme envisioned dividing the state rail management into two categories – construction and operation. For the construction sector that required large-scale financial resources, the government would launch an authority with investment in kind and let it carry out facility and construction-related affairs. For the operation sector, the government meant to establish a rational management system by launching a corporation that would be given full authority in carrying out various business activities such as marketing, advertisement and various related business activities.

In 1985, the Ministry of Transport began to study a scheme to turn Korean National Railroad into a government-invested corporation. Three years later, the ministry drafted the Korea Railroad Corporation bill, which was declared as law in 1989 after gaining approval of the National Assembly. The legislation, however, did not immediately lead to the inauguration of the corporation, because of various reasons such as the handling of the existing agency's debt, financial support, the replacement of laid-off workers, and union strikes. After being delayed for years, the project was scrapped in 1995. The government decided to give autonomy to the Korean National Railroad and reinforce its support to improve its financial conditions while maintaining its existing structure.

But, the agency's financial conditions did not improve. So, the government decided in March 1999 to combine the agency's construction sector with the Korea High Speed Rail Construction Authority to launch the Korea Rail Network Authority. And, it decided to complete the privatization of the operation sector by 2001. Implementation of these plans was delayed due to confusion related to the policy making process. Then, in July 2003, three mainstay laws for rail reform were enacted – the Railway Industry Development Act, the Korea Rail Network Authority Act, and the Korea Railroad Corporation Act. The Korea Rail Network Authority was inaugurated in January 2004, and KORAIL was launched one year later in January 2005, completing the long-delayed rail structuring project.

As a result of the restructuring, the business of the Korean National Railroad was turned over to the Korean Rail Network Authority and Korea Railroad Corporation. The corporation, founded with government investment, is in charge of commercial business activities such as passenger attraction, ticket sales, passenger transport and rolling stock maintenance. The authority is charged with the mission of railway construction and the maintenance of facilities such as tracks, under government ownership, as in the case of roads, airports and harbors.

Establishment of the Korea Transport Institute

Due to rapid urbanization and the explosive growth in the number of cars in the 1980s, the urban traffic problem surfaced as a pressing issue of social concern, necessitating the establishment of a research institute specializing in affairs related to domestic transportation. Against this backdrop, the Korea Transport Institute (KOTI) was launched as a foundation in 1985, and two years later turned into a government-invested institute conducting comprehensive research in the fields of transportation and logistics, particularly focusing on transport technology-related R&D activities and the development and coordination of government transport policies.

As a research institute, KOTI was originally placed under the Ministry of Land, Transport and Maritime Affairs. But, it later became affiliated with the National Research Council for Economics, Humanities and Social Sciences, which was inaugurated under the Prime Minister's Office in 1999 to ensure the independence of government-funded research institutes. With about 40% of its budget funded by the government, KOTI is under supervision of the Prime Minister's Office regarding its staff management and budget spending. The institute secures its additional sources of revenue through implementation of transport policy-related tasks commissioned by the central government ministries such as the Ministry of Land, Transport and Maritime Affairs and local governments.

As of 2012, KOTI is comprised of seven departments (transport strategy, roads, railways, transport economics, logistics, aviation, national transport) and 25 centers. While making continuous efforts to reinforce its professional expertise, the institute is operating its organization flexibly depending on social issues to be dealt with. The institute has 298 employees, 87% of whom are research staff, including 90 at associate research fellow or higher-level positions. The remaining 13% are administrative staff. The research staff include 73 doctoral degree holders. Forty-five of them are transport engineering majors, accounting for the largest share (55%). Those who gained their doctoral degree in urban planning and transport economics make up about 10%.

KOTI has played a central role in supporting the nation's economic growth by actively engaging in conducting research related to the construction of major transport infrastructure such as the expressway network, the high-speed railway (KTX), Incheon International Airport, and integrated logistics terminals. It has also contributed a lot to developing national transport policies by making proactive proposals and suggestions. For example, it has been actively involved in endeavors to amend transport laws, ensure efficient operation of transport systems, promote public transportation, establish proper pricing schemes, and develop new transport technologies. Through these activities, it tried to ensure interregional traffic integration, create the opportunities for economic activities, and develop policies that can help reduce socioeconomic costs caused by problems related to the transport of people and freight. In addition, the institute is exerting efforts to share its knowledge and experience with other countries. As part of these endeavors, it is participating in overseas consulting projects while actively promoting the knowledge sharing program designed to provide policy consulting, training/education, and data publishing services for developing countries.

Securing Financial Resources

Foreign Aid

Following the Korean War, the Korean government desperately needed financial resources for its war recovery efforts. Through the war, which broke out just several years after the nation was liberated from the Japanese colonial rule, the nation lost 60% of its roads and most of its rail facilities. As such, it had no choice but to resort to foreign aid. Through negotiations with the allies that participated in the Korean War, the nation could secure aid from the ICA (International Cooperation Administration) in 1954. The aid amounted to 236.7 million USD in 1955, 326.7 million USD in 1956, and 382.8 million USD in 1957. It continued through 1962. Meanwhile, the nation obtained grants worth 15,076,623 USD from 1954 through 1962 from the ICA and the AID (Agency for International Development) exclusively for the reconstruction of roads and bridges. With the foreign aid, the government completed the Han River Pedestrian Bridge restoration project in 1958, and began a project to pave the Seoul-Busan national road in 1957. Aid from the ICA and AID was also used for the rail sector, especially in securing diesel electric locomotives and freight trains.

In 1963, AID was replaced with EXIM Bank and IBRD as the chief loan providers for Korea. Later, the Ministry of Transportation commissioned IBRD to conduct research on the nation's modal imbalance in transport demand, which surfaced as a problem hampering economic growth during the first economic and social development plan period. Through the research, IBRD suggested drastically increasing investments in road infrastructure and reducing investment in the rail sector. The suggestion led to an organization reshuffle elevating the status of the ministry's road department into a bureau. The ministry also temporarily concluded that construction of toll roads would not be appropriate unless needed to obtain loans. Beginning in 1972, a total of 764.5 million USD worth of IBRD loans was secured by the nation for road projects. The loans surely contributed a lot to Korea's economic development by being spent on constructing expressways, whose total length reached 571km, expanding 300km of national roads and paving 2,968km of national roads.

Introduction of the Special Account for Transport Infrastructure

The number of cars in the nation shot up in the 1980s while transport infrastructure investment remained at relatively low levels. This led to serious deterioration of traffic flow conditions in the 1990s. Over a roughly 10-year period from the early 1980s to the early 1990s, the nation's economic size almost doubled and the number of cars increased by more than five times. However, transport infrastructure expanded by less than 20% during the same period. Naturally, traffic exceeded the capacity of most transport infrastructure facilities. The resultant nationwide transport bottleneck phenomenon seriously hindered industrial growth and caused an increase in social and economic costs. There was growing concern that if left unchecked, the traffic problem would become the greatest obstacle to economic growth in the 1990s and beyond.

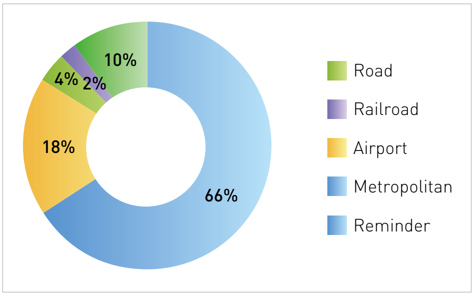
Cognizant of the seriousness of the situation, the government enacted the "Transportation Tax Act"[1] in 1993 to ensure a stable supply of transport facilities. It went on to enact the Act on the Special Account for Roads and Other Transport Infrastructure Facilities in 1994 to promote smooth expansion of transport facilities and build an effective investment system (this law was revised the next year and renamed the "Act on the Special Account for Transport Infrastructure"). Funded mainly by transportation tax revenues, the special account for transport infrastructure was originally slated for temporary operation between 1994 and 2003. The account was created by combining the existing special accounts for road and urban rail projects and absorbing the scope of general-account funding of high-speed rail, airport and harbor projects. To ensure stable supply of resources for transport infrastructure investment, the government extended three times the operation period of the special account by three years, in 2004, 2006 and 2009, respectively.

The revenues of the special account for transport infrastructure mainly come from three sources - the Traffic, Energy and Environment Tax, non-tax receipts like facility user fees, and funds transferred from the general account. The special

1) Later, changed to the tax, energy and environment, tax

account's largest source of revenue is the Traffic, Energy and Environment Tax, which is virtually the excise tax imposed on gasoline and diesel. Currently, 858/1000ths of the tax receipts are deposited in the special account, accounting for about 70% of its revenues. Other revenue sources of the account include the car excise tax, car import duties, reserve funds of the special account of government investment and financing, airport passenger service charges, and money transferred from the general account.

Figure 5.2. Allocation ratios of the Special Account for Transport Infrastructure



The special account's revenue allocation ratios among its sub accounts are prescribed in the enforcement regulations of the Act on the Special Account for Transport Infrastructure decreed by the Ministry of Construction and Transportation. The special account has five sub accounts – road, rail, airport, wide area, and reserve. The ratios allotted to each category are 65.5% for roads, 18.2% for rail, 4.3% for airports, 2% for wide areas, and 10% for the reserve account.

Since the opening of the special account, transport investment has steadily increased in scale. This indicates that the account has helped ensure stable and continuous expansion of social infrastructure for the continued growth of the Korean economy.

Promotion of Pubic-Private Partnerships in Infrastructure

Public-private partnerships in infrastructure refers to private-sector participation in the construction and operation of social infrastructure facilities normally supplied and managed by the government, such as roads, railways, schools and sewage systems. This scheme is aimed at expanding the vitally needed facilities and improving the quality of related services through the attraction of investment from the private sector. This approach is applied to essential projects the public sector cannot afford to implement due to budgetary restrictions, or those whose efficiency is expected to be enhanced through participation of the private sector. Private-sector corporations are motivated to participate in such projects by the prospect of creating new profit models. In 1994, the government enacted the Act on Private-Sector Investment in Infrastructure in an effort to make up for the shortage of financial resources and make use of the private sector's creativity and efficiency. The next year, private participation projects were launched pursuant to the law. In 1999, the law was revised and renamed the Act on Public-Private Partnerships in Infrastructure.

Generally, private participation projects implemented in Korea can be classified into two categories depending on the financing methods: the BOT (Build-Own-Transfer) or BTO (Build-Transfer-Operate) type and the BTL (Build-Transfer-Lease) type. The first scheme refers to a type of financing in which private-sector concessionaires build infrastructure facilities with their funding, operate them and recover their investment by collecting fees. By 2010, 227 domestic infrastructure projects had been conducted under the BOT or BTO scheme, with their total investments amounting to 70 billion USD. Of them, 62 projects were carried out under the supervision of the Ministry of Land, Transport and Maritime Affairs, with a combined total investment of 44 billion USD. The BTL-type refers to private participation projects wherein the government guarantees appropriate profits. This scheme is applied when the concessionaire is expected to suffer trouble in collecting user fees or recovering the investment from the user fees alone. The number of BTL-type projects implemented in the nation (based on the government announcement) by 2010 reached 401, whose total investment amounted to 25.7 billion USD. About 20% of them were built under the auspices of the Ministry of Land, Transport and Maritime Affairs, with total investment costs of 5.2 billion USD.

In the road sector, 11 infrastructure facilities were under construction or operation as of 2011. Of them, nine facilities, including the Incheon Airport Highway, the Seoul Outer Circular Expressway and the Incheon Bridge, were in operation after completion of construction. The remaining two, including the Pyeongtaek-Siheung Expressway, were being constructed. Fourteen projects were in the planning stages, comprising two projects (the Anyang-Seongnam and Gwangju-Wonju expressways) in the ground-breaking stage, four in the implementation planning stage, three in the project negotiation stage, and the remaining five in the research stage.

Types of Private Participation Projects and Their Operation Methods

BOT (Build-Own-Transfer) is a form of financing wherein the concessionaire assumes the ownership of the infrastructure facilities for a specified period after completion of the construction. The ownership is transferred to the state or a local government upon termination of the concession period. This method was applied to the construction of the inland container depot in Paju, north of the Seoul metropolitan area.

In the BTO (Build-Transfer-Operate) scheme, the concessionaire transfers the ownership of the infrastructure to the state or a local government upon completion of its construction. Instead, the concessionaire has the right to manage and operate the infrastructure facilities for a specified period (usually 30 years). Based on this right, it collects user fees to recover its investment.

BTL (Build-Transfer-Lease) is a type of financing in which the state or a local government receives the ownership of SOC facilities (as a kind of contributed acceptance) from the concessionaire upon completion of their construction. Instead, the state or a local government rents them to the ncessionaire for a specified period as provided for in the concession agreement, letting the concessionaire use them and make profits.

Improvement of Relevant Laws and Systems

Enactment of the National Transportation System Efficiency Act

For economic rehabilitation, various national plans were developed, such as the five-year economic development plans in the 1960s and the comprehensive national land development plans in the 1970s. These included plans for construction of transport infrastructure as one of the mainstays for the nation’s industrial development. However, these plans had limitations in devising long-term transport infrastructure plans to cope with increases in passenger and freight transport demand that featured fluctuations based on complicated interrelated connections in various aspects. In particular, transport facilities built just for particular individual routes resulted in lowering the efficiency in terms of the transport network that should be based on mutually complementary effects involving other routes. That was due to the lack of transport plans developed from mid- and long-term perspectives. The absence of such plans caused imbalance in the supply of transport facilities between modes and regions, eventually leading to increases in congestion or logistics costs despite the construction of related facilities.

In the late 1990s, the nation became seriously aware of the need to prepare measures to ensure transport infrastructure investment based on mid- and long-term perspectives as well as integrated use of facilities. In this context, the National Transportation System Efficiency Act was enacted in 1999 to strengthen the capacity for comprehensive coordination of transport policies and build an effective transport system combining various transport facilities. The Act required the development of a "plan for a national core transport network," a "plan for investment in transport facilities,"[2] and a "framework plan for an intelligent transport system." In March 1998, the government announced its decision to develop a national core transport network plan as a state policy task, setting related guidelines and forming a task force. In October 1998, a public hearing was held to accommodate the views of people from various walks of life on a draft plan. In February 1999, the National Transportation System Efficiency Act was enacted through revision of the draft and consultations among relevant government ministries. The act, which has undergone a number of revisions, has various provisions on feasibility evaluation and other measures needed for promoting the efficiency of transport infrastructure investment projects. In addition, it has stipulations concerning transport and logistics hubs, advancement of connecting transport systems, development of intermodal transfer centers, and promotion of transport technologies. The law prescribes matters needed for planning, evaluation, organization and budget establishment in relation to above-mentioned tasks.

2) Later, changed to mid-term plan for investment in transport facilities

Establishment of a Comprehensive National Transport Plan

The foremost significance of the National Transportation System Efficiency Act is that it prescribes the development of a comprehensive national transport plan. Transport infrastructure investment had been continuously made through the 1990s, but the overall transport system did not effectively function. This was due to the fact that core transport facilities such as roads, railways, airports and harbors were expanded independently irrespective of mutual connections. The imbalance in the supply of transport facilities between regions and modes was also ascribable to the weakening in the government investment coordination functions. The transport-related government structure was organized based on mode-oriented classification, and its extremely compartmentalized operation of budget made it difficult to build interconnected plans. In addition, the government also needed to draw up a long-term transport plan to prepare for the coming era of Northeast Asia. Thus, in December 1999, the government finalized the "National Core Transport Network Plan (2000-2019)" through deliberations by the Transport Policy Committee headed by the Prime Minister.

The national core transport network plan is supposed to be developed every 20 years to present directions for constructing an effective comprehensive transport system encompassing land, marine and air transport as well as logistics. As such, it provides long-term and comprehensive guidelines for infrastructure investment. By law, it should include the following matters:

- Status and problems of the national core transport infrastructure;
- Forecast of future transport conditions and an estimate of transport demand;
- Overall direction of transport policy and transport facility investments;
- National core transport network construction objectives and implementation strategy in stages;
- Implementation strategy by project and a rough ordering of investment priorities;
- Estimation of required investments and directions for securing the finances;
- Analysis of investment effects and future prospects

The mid-term plan for investment in transport facilities is supposed to be drawn up every five years pursuant to the National Transportation System Efficiency Act. Its primary purpose is to ensure concrete and effective implementation of projects promoted under the national core transport network plan. Its first plan for the 2000-2004 period included an action program for the core transport network plan, setting the investment scale of relevant projects, determining the priorities, and presenting the resources allocation scheme. The first plan was followed by the second (2005-2009) and third (2011-2015) ones. By law, the mid-term plan should include the following matters:

- Objectives related to supply of transport facilities and the basic direction of investment;
- Scale of the national core transport infrastructure development projects;
- The ordering of investment priorities and the funds required;
- Setting a proper modal split structure
- Development of links between the national core transport infrastructure development projects and local transport infrastructure development projects

Investment Feasibility Assessment

The appropriateness of individual transport infrastructure projects is determined through roughly two processes – the preliminary feasibility study conducted by the Ministry of Strategy and Finance and the feasibility assessment by the Ministry of Land, Transport and Maritime Affairs.

The preliminary feasibility study was introduced as part of public-sector reform efforts initiated by the “People’s Government” launched in 1998 with the task of overcoming the financial economic crisis that hit the nation in the late 1990s. The idea of conducting preliminary feasibility studies for infrastructure projects was first discussed by the Ministry of Construction and Transportation in 1999 as part of “comprehensive measures to ensure effective implementation of public projects.” Then, the scheme was formally introduced through the amendment of the Enforcement Decree of the Budget and Accounting Act in April 1999. The basic operation guidelines were prepared in 2006, being prescribed in Article 38 of the National Finance Act and Article 13 of the act’s enforcement decree. Under the provisions, the preliminary feasibility study should be conducted when the project cost and the state financial support amount to 50 billion KRW and 30 billion KRW or more, respectively. Its purpose is to improve the financial productivity of infrastructure projects by verifying their appropriateness through economic feasibility analysis, policy analysis and examination of investment timing and funding methods. Basically, the preliminary study uses economic feasibility analysis as the most important criteria for judgment. Yet, policy analysis and the evaluation of other matters are carried out in a phased manner to consider various aspects other than the economic feasibility as well.

Projects that pass the preliminary appropriateness evaluation process are required to be subject to full-fledged feasibility assessment pursuant to Article 18 of the National Transportation System Efficiency Act and Article 17 of its enforcement decree. Every transport infrastructure project amounting to 30 billion won or more in the estimated construction cost should be subject to the assessment designed to analyze its appropriateness. Article 18 of the National Transportation System Efficiency Act stipulates that the investment appraisal guidelines regarding public transport development projects be devised and publicly announced as a way to ensure rational and objective analysis and evaluation of relevant projects. Article 18 of the Act's enforcement decree requires that the guidelines should include the transport demand prediction method, the cost/benefit estimation items and analysis method, and the economic feasibility analysis method.

In the full-scale feasibility assessment, the foremost emphasis is placed on determining the economic feasibility of a project because of the need to ensure effective spending of state budget. The appraisal of the economic feasibility of individual projects is generally conducted through the benefit/cost analysis, which is based on the calculation of the ratio of the social benefits accrued from the project to the costs put into the project for the construction of relevant facilities and their maintenance and management.

The benefits accruing from any transport infrastructure project can be defined as the expenses travelers would incur should the project not be implemented, or the change in the amount of expenses (increase or decrease in expenses) occurring as a result of the project. Calculation of the travel expenses or social costs requires transport demand analysis. For transport demand analysis for the feasibility assessment of domestic transport SOC projects, the use of the Korea Transport Database is essentially required. Provided by the KTDB center of KOTI, the database contains data related to O/D demand and networks for current and future target years.

The benefits from the transport infrastructure investment projects can be divided into direct benefits directly affecting transport facility users and indirect benefits generated for the entire society through improvement of traffic conditions regardless of the use of the relevant facility. In Korea, direct benefits are estimated on the basis of the benefits accruing from reductions in travel time, operation costs and traffic accidents, whose monetary values can easily be calculated. The current trend in estimating indirect benefits is that the monetary values of environmental benefits related to reductions in air pollution and greenhouse gas emissions are increasingly taken into account.

04
Transport SOC Investment Effects

The steady implementation of transport SOC investment policies has contributed a lot to expanding core transport facilities such as roads and railways. Attention has been paid consistently to building arterial traffic networks for the transport of freight and the promotion of regional development since the days when the national resources were focused on war recovery efforts under the motto of realizing economic development through industrialization. The construction and expansion of such transport SOC facilities helped to ensure smooth movement of people and commodities, thereby strengthening the national competitiveness and facilitating the development of the national economy.

Expansion of Road and Rail Facilities

The total road length in Korea increased by 2.25 times from 46,950km to 105,565km during the period from 1980 to 2010. In particular, the length of expressways serving as high-speed arterial roads between regions more than tripled from 1,225km to 3,859km during the same period. As for railroads, the total length rose by a meager 1.31 times from 3,134km in 1980 to 4,094km in 2010. Yet, the project to expand double-track railways, which began in earnest in 1990, achieved a remarkable outcome. The total length of double-track lines, which measured at just 847km in 1990, increased to 2,301km in 2010. It represented a 3.2-fold growth from the level of 1980. The Seoul-Busan high-speed railroad, which opened in 2004, expanded to cover a distance of 368.5km as of 2010, turning the nation into a half-day living sphere.

Table 5.3. Trends concerning the expansion of road and rail facilities

Classification		1980(A)	1990	2000	2010(C)	C/A
Roads	Total length (km)	46,950	56,715	88,775	105,565	2.25
	Length of expressways (km)	1,225	1,551	2,131	3,859	3.15
Railroads	Total length (km)	3,134	3,091	3,516	4,094	1.31
	Length of double-track lines (km)	720	847	1,332	2,301	3.20
	Length of high-speed railroads (km)				368.5	

• Source : "Major national transport SOC statistics," 2011, Ministry of Land, Transport and Maritime Affairs

Slowdown in Growth Rate of Logistics Costs

Expansion of transport SOC in the early stages of industrialization has a positive impact on the improvement of national competitiveness by increasing the transport capacity. But, the resultant increase in the economic size and rapid expansion in commodity traffic volume causes the transport and logistics costs to rise again. To lower logistics costs by addressing this cyclical problem, comprehensive and systematic transport plans are vitally needed. Logistics costs include the expenses for the following activities: transport, maintenance/management, packing, loading/

unloading, information handling, and general management.

The share of transport expenses in the total logistics costs rose from 58.9% in 1991 to 70.4% in 2008. This shows that reduction of transport expenses is crucially needed to slash logistics costs and eventually improve the nation's industrial competitiveness. The following table summarizes the results of a comparison of logistics costs during periods before and after the National Core Transport Network Plan (2000-2009) was developed in 1999. The transport costs climbed by an annual average of 14.4% between 1991 and 1999. The increase rate, however, fell by nearly a half to 7.7% during the period from 2000 to 2008.

Table 5.4. Trends in logistic costs

(Unit: 1 million USD, %)

Classification		Total	Transport costs	Maintenance/ management costs	Packing costs	Loading/ unloading costs	Logistics information costs	General management costs
1991		31,989	18,857	9,147	865	642	1,180	1,298
1999		78,892	55,178	14,300	1,721	1,055	3,340	3,298
2000		77,119	49,909	19,803	1,644	1,144	2,359	2,260
2001		80,792	55,016	18,353	1,741	1,140	2,297	2,245
2005		101,019	76,957	16,889	2,063	1,809	1,621	1,680
2006		106,193	80,398	18,085	2,123	1,974	1,774	1,840
2007		117,112	88,127	21,318	2,278	1,991	1,668	1,730
2008		128,304	90,315	29,059	2,423	2,519	1,958	2,031
Yearly average growth rate	1991-2008	8.5	9.7	7.0	6.2	8.4	3.0	2.7
	1991-1999	11.9	14.4	5.7	9.0	6.4	13.9	12.4
	2000-2008	6.6	7.7	4.9	5.0	10.4	-2.3	-1.3

• Note : International freight transport costs not included in transport costs
• Source : "Major national transport SOC statistics," 2011, Ministry of Land, Transport and Maritime Affairs

Slowdown in Growth Rate of Traffic Congestion Costs

The nation experienced rapid population concentration in large cities in the 1980s. This phenomenon coupled with the drastic increase in the number of cars to significantly worsen traffic conditions in urban areas. This triggered concern as a serious social problem causing an increase in congestion and other social costs.

The congestion costs, which began to soar in the early 1990s, rose by an annual average rate of 21% on intercity roads during the period from 1991 to 1999. However, the growth rate somewhat lowered to an annual average of around 2.2% for the period between 2000 and 2008. During the same period, the annual growth rate for urban roads went down from 15.9% to 5.4%, indicating a dwindling trend for the congestion costs.

Table 5.5. Trends in traffic congestion costs (Unit: 1 million USD, %)

Classification		Interregional roads				Urban roads[1]	Total
		National highways	National roads	Provincial roads	Total		
1991		260	1,231	167	1,658	2,906	4,564
1999		2,693	3,857	1,086	7,635	9,478	17,113
2000		2,151	5,138	1,010	8,299	11,149	19,448
2001		1,985	5,607	1,197	8,789	12,321	21,110
2005		2,279	5,126	1,728	9,134	14,564	23,698
2006		2,413	4,920	1,847	9,180	15,441	24,621
2007		2,675	4,932	1,767	9,373	16,489	25,862
2008		2,831	5,097	1,953	9,881	17,022	26,903
Yearly average growth rate	1991-2008	15.1	8.7	15.6	11.1	11.0	11.0
	1991-1999	33.9	15.3	26.3	21.0	15.9	18.0
	2000-2008	3.5	-0.1	8.6	2.2	5.4	4.1

- Note : 1) Special city, metropolitan city and common city roads
- Source : "Major national transport SOC statistics," 2011, Ministry of Land, Transport and Maritime Affairs

05 Conclusions and Policy Suggestions

CHAPTER 05

National Economic Growth Linked to Transport Infrastructure

It would not be an exaggeration to say that the nation's economic growth, which started with the five-year economic development plans launched in 1962, owes much to the rapid development of the land transport infrastructure centered on roads and railroads. During the first economic development plan period (1962-1966), the nation's GDP was about 3.38 billion USD. The expenses spent for building transport infrastructure amounted to 36 million USD, accounting for about 1.05% of the GDP. In the second economic development period (1967-1971), the transport infrastructure investment's percentage of GDP exceeded 2%, with the road-sector investment alone accounting for 1.07% of GDP. Since then, the transport infrastructure investment's share of GDP had remained at over 2% through the fifth economic development period (1982-1986). During the third economic development period (1972-1976), expressways and seaports occupied particularly a large portion of the transport infrastructure investment. During the fourth and fifth periods, investments in roads, railroads and seaports suffered a relative setback, a development related to the need for funding the Seoul subway construction.

In the late 1980s during the sixth five-year economic development plan period (1987-1991), the share of roads in transport infrastructure investment rose sharply, whereas the shares for other modes dropped without exception. It was the period when the transport infrastructure investment as a percentage of the national

Table 5.6. Trends in transport infrastructure investment as a percentage of GDP

(Unit : 100,000 USD (current price), %)

Economic development plan periods	GDP	Transport facilities					Total
		Road	Railway	Subway	Airport	Seaport	
1th(1962-1966)	33,753	61 (0.18)	215 (0.64)	-	26 (0.07)	52 (0.16)	355 (1.05)
2th(1967-1971)	106,901	1,147 (1.07)	634 (0.59)	83 (0.08)	76 (0.07)	267 (0.25)	2,207 (2.06)
3th(1972-1976)	413,723	4,674 (1.13)	2,669 (0.65)	248 (0.06)	189 (0.05)	1,284 (0.31)	9,064 (2.19)
4th(1977-1981)	1,583,855	16,302 (1.03)	7,434 (0.47)	5,532 (0.35)	1,469 (0.09)	3,451 (0.22)	34,188 (2.16)
5th(1982-1986)	3,674,664	37,191 (1.01)	9,647 (0.26)	24,379 (0.66)	2,223 (0.06)	6,186 (0.17)	79,626 (2.17)
6th(1987-1991)	7,868,142	115,225 (1.46)	14,620 (0.19)	789 (0.01)	2,538 (0.03)	11,538 (0.15)	144,710 (1.84)
7th(1992-1996)	16,424,035	189,693 (1.15)	73,162 (0.45)	30,523 (0.19)	13,944 (0.08)	20,655 (0.13)	327,977 (2.00)
(1997-2000)	24,368,166	526,943) (2.16)	117,890 (0.48)	86,276 (0.35)	36,161 (0.15)	48,373 (0.20)	815,643 (3.35)

• Note : Rail investment includes high-speed rail investment and the account for extended metropolitan areas (since 1998).
• Source : Heon Gu HA•Cheon Gon KIM, 2000

GDP went down below 2% for the first time since the implementation of the first economic development plan. The rate rose again to the 2% level during the seventh development period (1992-1996) thanks to rail investment, which rose significantly to the extent that it accounted for 0.34% of the GDP. In 1997 and the following few years, which would have been the eighth period had the government continued to implement the national economic development plan, transport investment showed remarkable growth for all the sectors of road, railway, subway, airport and seaports. The investments in road and rail sectors alone accounted for 2.64% of the GDP. The percentage of GDP of all the transport infrastructure investments surpassed 3%.

As explained so far, the nation's transport SOC investment is closely related to the process of its economic growth. During the national economic development plan periods, the growth rate of transport infrastructure investment always exceeded that of GDP, except for the late 1970s and late 1980s. The continued transport SOC expansion policy certainly played an important part in leading the nation's impressive economic growth.

Importance of a Systematic and Comprehensive Investment Plan

It was explained above that the supply of transport facilities has been closely related to the nation's industrialization and economic growth stages. This cannot be denied. However, beginning in the 1990s, questions were raised as to the desirability of the conventional method. Critics asserted that construction of transport facilities without considering their mutually complementary nature would result in lowering the investment efficiency of the entire transport network. They called for efforts to build a unified national transport system based on the awareness that the transport modes need to be organically linked. The critics cited as an example the road-centric investment that had continued through the late 1990s, which eventually caused an imbalance between the road and other sectors, including rail.

It was against this backdrop that the government came to develop the national core transport network plan and the mid-term investment plan for transport facilities in the 2000s. The establishment of these plans as transport blueprints at the highest hierarchical level led to the drawing up of a comprehensive transport plan encompassing the overall transport SOC sectors without pursuing lopsided development of any particular mode or facility. Furthermore, to achieve the goals and implementation strategies presented in such higher-level plans, the rail and road sectors established their own framework plans, which provided the basis for making specific transport infrastructure investment. Pursuance of transport investment projects through the systematic planning stages has undoubtedly helped ensure the implementation of mutually complementary functions among transport modes and enhance the efficiency of relevant investments.

Developing countries in the beginning stage of economic development may not acutely feel the need for a systematic and comprehensive transport plan. They may not be actively interested in developing such a plan, because it would take a long period of time and involve complicated matters. Furthermore, they may place the utmost value on the speedy supply of facilities required for rapid economic growth. However, they should not overlook the importance of establishing a comprehensive plan. Korea's experience shows that transport SOC investment made without a comprehensive transport plan results in investment overlapping or lowers intermodal connection effects, negatively affecting the network effects measured against the costs.

Development of Measures to Secure Stable Financial Resources

It is vitally necessary to devise measures to secure a stable supply of financial resources needed for transport SOC investment. The supply of facilities through infrastructure investment generates the effects of lowering transport and social costs by ensuring smooth flow of passenger and freight traffic. It also plays a crucial role in promoting economic growth by strengthening the nation's industrial competitiveness. In this regard, the input of public funds into this area can be justified. In addition, of the state expenditure accounts, the construction sector generates relatively large indirect effects such as production inducement and additional value inducement. So, it needs to be given priority in allocating the state budget. However, transport infrastructure projects are not completed in a short period of time. Their implementation normally requires a lot of investments over years, the scale often reaching enormous levels. And, when the construction does not proceed as planned, additional costs are incurred. So, it is very important to secure a stable funding scheme.

In the 1990s, the nation experienced problems with implementation of major infrastructure projects. Funding resources were not secured as had been planned, causing construction delays and related inefficiency. Furthermore, the government was about to pursue new infrastructure projects vitally needed for the nation. These circumstances prompted the government to step up efforts to secure a stable funding scheme for SOC projects. The endeavors led to the introduction of the aforementioned “Special Account for Transport Infrastructure” in 1994. The government went further to establish the Transport Tax, the entire revenues of which were made to be transferred to the special account. This new earmarked tax was imposed on gasoline and light oil, which had been subject to the special excise tax, as well as alternative petroleum products. Funds secured through the special account helped a lot in promoting large state projects in a stable manner.

Pubic-private partnerships in infrastructure also played an important role in funding major transport infrastructure projects. This method was introduced to implement projects which were vitally needed for the national economy but being delayed due to the shortage of the government’s financial resources. It was also aimed at enhancing the efficiency of infrastructure projects by utilizing the capital and creativity of the private sector. Since the introduction of this scheme, the nation has gone through various trial-and-error experiences. Lately, controversy has arisen over the “guarantee of minimum profit” system, which caused negative views in some sectors of society. The profit guarantee scheme was originally introduced to actively attract private-sector investment in infrastructure projects. In the early stages of implementing the public-private partnership policy, private corporations were naturally hesitant to participate as they were unsure of investment stability. To induce capital from the private sector, the government needed to establish a system designed to guarantee private-sector participants profits from their investment. For private corporations, the investment profits are estimated based on the ratio of user fee revenues to the construction costs they spend. In private participation projects, user fees can normally be collected for 30 years. Future revenues are estimated on the basis of projected future transport demand. In case actual transport demand falls short of the forecasted demand, the government guarantees to pay the investor a certain percentage of the difference between the projected and actual profits. This is how the "guarantee of minimum profit" system operates. Through this method, the government could induce private-sector participation in infrastructure investment. However, questions have been raised over whether such a mechanism can be of help in utilizing the private sector's creativity and efficiency. Currently, the government is trying to resolve this problem by studying various aspects related to the system.

Improvement of Laws and Systems to Properly Cope With Changing Conditions at Home and Abroad

In previous sections, this paper emphasized the need to develop a comprehensive transport plan and secure a stable funding scheme. To meet this requirement, it is vitally necessary to establish proper laws and institutions. National policies with binding legal power can be implemented much more effectively than those without such authority. Various countries around the world have different social conditions and need different types of transport policies. So, they ought to develop laws and institutions suitable to their respective circumstances in order to effectively execute their transport policies.

Korea has consistently made efforts to improve relevant laws and systems so that they can properly reflect changes in domestic and international circumstances. The enactment of the National Transportation System Efficiency Act in 1999 is of particular importance as it opened the way for establishing a national transport master plan. Specifically, the law allowed for the development of a long-term comprehensive transport plan and its action program. It also provided for objective evaluation of transport SOC investment projects. Previously, there had been limitations in making transport infrastructure investments based on fair reflection of modal and regional characteristics. Improvement was also made in the government organization handling transport affairs. The Ministry of Land, Transport and Maritime Affairs had organized its transport-related departments on the basis of modes, in a scheme to ensure devising specialized transport plans for each category. Although this system had strengths in developing professional expertise for each infrastructure type, it had turned out to have limitations in establishing an effective transport network by reinforcing inter-facility connectivity and mutual complementary functions. In particular, the system was liable to cause compartmentalized investment lacking in coordination among departments and investment policies. To tackle these problems, an organizational reshuffle was carried out, establishing an upper-echelon division taking charge of comprehensive transport policies. Through this measure and the enactment of the National Transportation System Efficiency Act, which represented the improvement of relevant laws and systems, the government could significantly increase the effects of policy implementation.

Projects that require large-scale funding by government ought to be pursued on the basis of consensus among various parties with vested interests. The process of building consensus can be facilitated by the presence of proper laws and systems. Ahead of implementing national policies, the government needs to secure their objectivity by making appropriate changes to relevant laws and systems. By so doing, it can facilitate the process of building consensus among stakeholders, thereby avoiding unnecessary social costs.

Nurturing Experts (Organizations) and Their Leadership Qualities

Transport SOC facilities play an important role in facilitating the nation’s economic growth and promoting public welfare related to mobility and transport accessibility. However, transport infrastructure construction takes a lot of time. Once constructed, the facilities are so hard to get rid of. So, careful preparations are required in the planning stage. It is also necessary to ensure their effective maintenance and management during the stage of operating the facilities after completion of construction. By so doing, the effects of their supply can be maximized. In this regard, it would be worthwhile to utilize expert groups or organizations with relevant professional expertise in the stages of planning, supplying and operating infrastructure facilities.

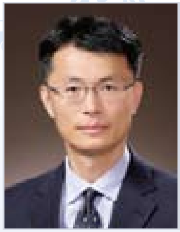
Korea Expressway Corporation is in charge of the construction, maintenance and operation of expressway toll roads. Through its establishment, the nation has been able to implement expressway supply and related policies very effectively and successfully. In the rail sector, a government agency named the Korean National Railroad was originally in charge of the construction and operation of rail facilities. But, due to large costs needed for rail construction, the agency suffered from chronic financial difficulties. The deficit-ridden agency has eventually been replaced with two newly inaugurated organizations: Korea Rail Network Authority and Korea Rail Corporation. Under a scheme to maximize their respective professional expertise, the authority is in charge of construction of rail facilities while the corporation controls the business and operation sector.

Rapid urbanization and explosive growth in the number of cars in the 1980s caused serious traffic problems, raising social concern. Created against this backdrop, the Korea Transport Institute has played an important role in establishing and executing government transport policies. Although it partially functions as a public institution, KOTI has been awarded an independent status to ensure the objectivity and reliability of its research as well as the accumulation of its professional expertise. Recently, the institute has been pursuing various ODA (Official Development Assistance) projects for its expertise to be utilized internationally. In Korea, national leaders with strong leadership and drive as well as professional groups' planning based on ex ante research played a decisive role in implementing large-scale state projects in the transport sector. A good example is the Gyeongbu Expressway built as the nation's second highway in the early 1970s. The project had faced strong opposition, with skeptics raising questions about the necessity of an expressway linking Seoul and Busan. Despite the opposition, the President and the government strongly pushed for the project and completed the construction of the expressway. The expressway has since been recognized as an absolutely essential element for the national economy. More recent examples include the construction of the high-speed railway and the Incheon International Airport. These projects have once again demonstrated the significance of top leaders' roles in ensuring that large-scale state projects can be conducted on the basis of social consensus as well as sufficient advance research.

Based on the nation's experience of achieving its relatively rapid economic growth, this paper has emphasized the need for transport infrastructure investment and presented some related suggestions. The Korean examples introduced in this paper may not be suitable for direct application in other countries. But, if amended and supplemented properly, they could provide useful material for countries that want to establish efficient transport policies on the basis of review of Korean experience from their own social, economic, political and spatial perspectives.

CHAPTER 6

URBAN TRANSPORT



Youngkook KIM
Associate Research Fellow, The Korea Transport Institute

01
Introduction

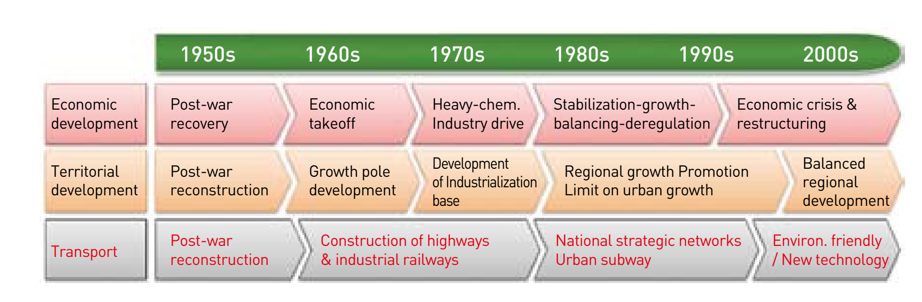
The development of urban transport in Korea can be summarized in four ways in terms of transport policy. Firstly, it focused on establishing countermeasures to tackle traffic caused by population concentration in the city along with the nation's rapid industrialization. Secondly, economic growth and income increase led to the skyrocketing ownership of private cars, which, in turn, produced heavy traffic. Therefore, the government focused on setting up a public transport system to cope with traffic demand and mitigate congestion. Thirdly, as the cities sprawled, the intercity public transport system was the main issue of the nation's transport policy. Lastly, the paradigm of transport policy was shifted from mobility and efficiency in the time of industrialization to human-centered, eco-friendliness, and equity improvement. In this regard, the urban transport policy started to be focused on pedestrian safety and convenience, remove overpasses in the city, and restore the natural environment.

Historically, the appearance of tram in 1899 marked the start of the urban transport in modern Korea. As the economic development earnestly began since the 1960s, city buses played an important role, as a daily mode of transport, in dealing with increasing traffic demand. Transport policy in the 1980s had put more focus on the public transport system, but the continuously growing number of cars worsened the traffic situation in the cities. The transport policy in the 1990s was designed mainly to restrain private car use, and promote public transport use. Before the ownership of private car was widespread, the expansion of public transport facilities was given top priority. City buses were developed as the core mode of transport, and the subway system was introduced to meet rising traffic demand. Since 1990 the bus passenger volume started to decrease, but it began to increase again after the reform of Seoul bus system in 2004. Seoul opened its first subway line in 1974, and now operates nine lines. Such urban railways play an important role in public transport to meet the massive traffic demand. With widespread ownership of private vehicles, it was difficult for a supply-centered policy such as road expansion to handle the increased traffic demand. Therefore, the transport demand management (TDM) programs such as congestion fee, garage certification, parking management, etc, have been introduced to ease traffic congestion fundamentally in the city center, but there have been difficulties in expanding the implementation of such programs.

As land demand increased, the Korean government promoted the construction of new towns around the Seoul metropolitan area and other major cities. This new town development produced intercity traffic between existing and new cities, resulting in traffic jams and hold-ups on arterial roads. Intercity bus runs to manage traffic demand between cities, and the bus rapid transit (BRT) system has been introduced on intercity arterial roads, the lanes of which tend to expand.

It was evaluated that buses and subways, major modes of public transport, could have a win-win relationship when connected through seamless transfer rather than competing with each other. Before the public transport reforms in 2004, bus and subway systems were not smoothly connected, so there were limitations to encouraging the use of public transport. In terms of fares, the weak incentives for transfer made it difficult to attract people. Reduced public transport demand led to deficit operation, thus affecting the quality of service. This, in turn, caused a decrease in traffic demand for public transport, which resulted in a vicious cycle. The 2004 public transport reforms introduced a quasi-public operating system for buses, which gives the right to coordinate the bus routes to the public authority and financial support to the private operating companies. This system laid the foundation for more efficient public transport by connecting bus and subway

Figure 6.1. Korea's economic development history and transport measures



services. This seamless connection of metro and bus stimulated the use of public transport and increased the number of passengers transferring between services. However, as the financial support, such as subsidy provision for operation losses and transfer discount, to private bus companies had expanded, the governments suffered from financial difficulties. In spite of such problems, the public transport reforms are praised as a success in urban transport thanks to the efficient bus operating system and the smooth transfers between subway and bus.

02

Development of Urban Transport in Korea

Advent of Modern Transport Modes

Korea's modern urban transport is said to start with the operation of trams in 1899. At first, the city of Seoul had three lines: Seodaemun-Whasinap, Whasinap-Dongdaemun, Dongdaemun-Cheongnyangni. Later, as Seoul city sprawled and traffic demand increased, the tram lines were extended to connect Hawangsimmi, Wonhyoro, Mapo, Youngcheon, Hyojadong, Donamdong, and even Yeungdeungpo across the Han River. At that time, the tram functioned as the most important mode of urban transport.

Entering into the 1960s, city buses ran on the streets and the use of trams decreased gradually. There were several problems in the tram service, for it caused traffic congestion due to low operating speed, spoilt the beauty of the streets, and had an ever-present danger of accidents. And investment to restore the deterioration of tram cars was required also, but the fare freeze left little room for improvements. Increases in labor costs and charges for exclusive use of streets resulted in the aggravating deficits of the tram business. In 1966, Seoul city came up with an idea to establish a subway system in the long term to alleviate traffic congestion, then removed the trams from the streets and stopped all the tram lines completely on November 30, 1968. After this, until the subway line started to operate in 1974, buses replaced the position as a main mode of public transport. However, the increasing car traffic volume aggravated street congestion, which adversely affected the punctuality of the bus services. And air pollution, caused by the use of diesel-powered buses, emerged growing social concern.

City Buses: Axis of Urban Transport

The bus transport business started in 1912, providing intercity service only, and city bus transport service commenced in 1928. As the bus service was doing brisk business, related laws, regulations, and institutions were established for it as follows: "Automobile Transport Service Act" and the "Road Transport Vehicle Act" of 1961, the "Act on Guarantee of Compensation for Loss Caused by Automobiles" of 1963, and "Automobile Regular Inspection System" of 1967. These legal works acted as an institutional framework to improve bus transport. Along with the legal arrangements, the enterprization of bus business was promoted. The purpose of the enterprization was to make its size bigger, and bring business under the direct control of company management, which had more focus. In 1966, Seoul city issued a municipal ordinance for setting up a transport office and operated buses directly in the remote areas where private companies were reluctant to serve for fear of deficit in revenue. The total of 17 municipal buses run by Seoul city was then increased to 200. In 1968 the Ministry of Transportation held an open license policy temporarily, so the number of operating buses almost doubled, creating fierce competition in bus routes. Consequently, most of the companies wanted to operate high-yielding routes only and avoided routes with smaller numbers of passengers.

People preferred the convenient use of private cars along with surging car ownership. As the increase of passenger car use exacerbated the traffic congestion, it got to the point where buses ran longer times than before and were not punctual any more. Therefore, bus users shifted their mode of transport to subway which guaranteed punctual service. Private car users showed a rapid increase until the mid 1990s, but after the financial crisis at the end of the 1990s, the increasing trend abated slightly. However, the number of bus passengers continued to decline. The increase of private cars resulted in a decrease of public transport demand, and also the subway-centered policy was another factor to lower the bus share.

Table 6.1. Trends of the increase of private cars and the decrease of bus passengers

Category		1980	1990	1995	2000	2005
Private cars	No. of cars (thousand)	178	1,902	5,778	7,798	8,834
	Increase/decrease (%)	-	324	204	35	13
Bus passengers	No. of passengers (million)	6,090	8,145	6,274	5,241	4,820
	Increase/decrease (%)	-	8	-23	-16	-8

• Source: Yearly Transport Statistics, The Ministry of Construction and Transportation

Financial problems of bus operating companies came from the increase in operation costs and the decrease in revenue. The biggest part of the operation cost was labor, followed by fuel. The government regulated bus fare increases in order to stabilize living costs and not to impose a financial burden on bus users. Continuous cost increases in labor and fuel, and institutional regulations to prevent fare hikes pushed bus companies into financial difficulties. Under these conditions, the companies had a huge accumulated deficit and kept losing their competitiveness over the subway in terms with punctuality and speed of service.

Increasing revenue losses of bus companies in the 1990s had an adverse effect on their financial situation. And the chronic traffic congestion on main roads dropped bus speed and level of punctuality, which worsened the bus operating environment. In Seoul, the average travel speed of cars was 19.5km/h while that of buses was only 18.8km/h, lower than that of cars. Bus service had several problems in operation such as irregular intervals, low operating speeds, long travel times, overlapped routes, etc. In an effort to resolve such problems, the government introduced an exclusive bus lane system, which made slight speed improvements, but still had limitations in improving bus speed on curb-side bus lane. Enormous financial burdens on extending subway lines forced government officials to inevitably introduce public transport reforms centering on the bus transport system. In 2004, a quasi-public operating system for buses, as a part of bus transport reforms, was introduced to make city buses play a more important role as a public service. The major contents of the reforms included the following: Introduction of a quasi-public operating system for buses; redesign of bus routes viz. hub-and-spokes network; an integrated fare structure including transfer discount; improvements of bus management systems and infrastructures such as dedicated bus median lanes.

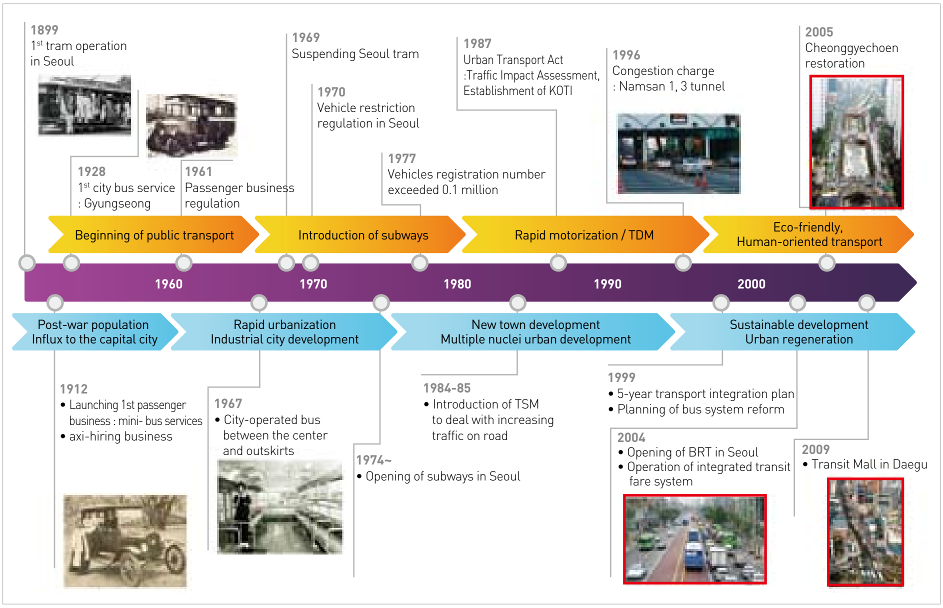
The evaluation of the quasi-public operating system showed that, in Seoul, Daejeon, and Daegu, subsidies for bus companies increased from two-fold to five-fold, and the increasing trend of government's financial support was expected to continue. And the government's financial burden was an obstacle to the application of this system in other cities. In light of its effectiveness, survey results showed that declining bus passenger volume swung to an increase, route efficiency, and customers' satisfaction started to improve.

Table 6.2. Main contents of Seoul public transport system reforms

Category	Contents	
Bus-centered public transport system establishment	Bus route system reforms	•Shift of bus network to a hub-and-spokes •Bus type and operating practice reform by function •Bus numbering system reform
	Bus operating support system reforms	•Median bus lane installation •Curb-side bus lane improvements •BMS(Bus Management System) establishment and operation management
	Bus company operation system reforms	•Quasi-public operation introduction •Bus company operation system reforms •Service quality assessment, personnel welfare improvement
Integrated fare system establishment	Reasonable fare structure reforms	
	Value-stored smart card system (T-Money)	
Public transport infrastructure expansion	Urban railway service expansion	
	Transit center construction	

In Seoul, the public transport reforms boosted the number of bus passengers. Continuously declining bus transport volume from 1990 started to rise in 2004 when the reforms were implemented. The quasi-public operating system, especially, helped redesign the bus network reasonably by giving the government much more flexibility on route coordination. Also, according to the agreements signed at the time of the introduction of the system, the bus companies were granted a revenue guarantee when they offered over a certain level of quality service. Therefore, there was no need to compete fiercely against one another to secure more passengers. Other benefits of the bus reforms were shown by a decline in bus-related accidents and improvements of customer service.

Figure 6.2. Overview of Korea's urban transport policy



Subway: Being a Major Mode of Public Transport

Seoul's population increased from 1 million in the 1950s to 4.3 million in the late 1960s. That was the time when a rapid population concentration started. Seoul city extended bus routes to serve increased traffic demand due to the dense population, but faced limitations in increasing transport capacity. As a solution to solve this problem, subway construction commenced. The first subway line was 9km long from Seoul Station to Jongno and Cheongyangni. The construction cost was jointly borne by the central government and Seoul city, and financing loans were also acquired. In 1970, the municipal government officially established the "Seoul Metropolitan Government Office of Subway Construction" then drew up a master plan of subway construction for the metropolitan and neighboring areas, together with experts from the Japanese Association for Railway Technical Survey. In March 1971, subway line 1 received approval from the Ministry of Construction, and construction started on 15 sections step-by-step, culminating in the launch of its commercial operation in 1974. At the time of opening, the daily frequency of service was only 210 runs, which later then increased to 526 in 1978. Even after the opening of subway line 1, the population density of Seoul was growing, naturally causing an increase in traffic demand and heavy congestion. It was thus necessary to construct more facilities. So subway lines 2, 3 and 4 were built to relieve these problems. The Seoul government shifted its development direction for urban structure from single-nucleus to multi-nuclei. Based on the new direction, it established a "Seoul Master Plan," under which subway line 2 was revised to have a circular line connecting three nuclei including the center of northern Seoul, Youngdeungpo, and Youngdong.

The subway construction had problems such as the capacity to build underground railways, the supply of required materials, and the security of financial resources. Based on the experiences from the operation and construction of railways, rolling stocks and necessary parts could be manufactured domestically to some degree, but the most difficult issue was to look for investment funding for the construction.

The city failed to acquire foreign loans, and used as much as 100 million USD of foreign capital in government hands. The rest of the investment comprised subway construction bonds, municipal budget, central government financing, national subsidy, etc. In case of subway line 2, the project cost was funded by only domestic capital without any foreign loans. In particular, as the subway line circulated the northern and southern parts of Seoul, there were technical difficulties in crossing the Han River. This served as a momentum to develop a variety of techniques for subway construction. Subway lines 3 and 4 started construction in February 1980. The network formed an "X" shape, criss-crossing the center of Seoul, because it was considered that the existing line 1 and circular line 2 were not enough to solve traffic congestion caused by increased traffic demand. Also Seoul city aimed to seek balanced development along the north-south and west-east axes, and to establish the backbone of public transport with subway lines. In August 1981, the Seoul Metro Subway Corporation was established and assumed responsibility for building subway lines 3 and 4.

It is a clear fact that the introduction of subways is essential to solve the traffic problems in a cities. However, local governments, which promoted the construction of subway lines beyond their financial capabilities, suffered from the deterioration of their overall financial situations. Even when the subway, which was constructed with huge amounts of investment, has fewer passengers than estimated, the operating deficit could exacerbate the financial situation. Recently, it was claimed that LRT (Light Rail Transit) and BRT (Bus Rapid Transit) are more reasonable, because they require less investment, although they can carry less passengers than subways. Now, LRT are operating in Seoul's neighboring cities and the Busan area, and also BRT is implemented on major arterial roads and is tending to expand its routes.

Before the public transport reforms, its fare systems, such as bus and subway, offered transfer discounts, but they were not large enough to strongly persuade people to use the transfer system. As a part of the 2004 reforms, the Seoul government implemented an integrated fare system, under which fares are based only on distances travelled, with free transfers permitted between bus lines and as well as subway and bus. And there is no additional payment on transfer within 10km travel distance, which encourages public transport use as a result. The fare payment, which was made possible by using wireless communications and a stored-value smartcard, allowed the introduction of such an integrated fare collection system.

Taxis : As a Mode of Public Transport

The first taxi, 'Gyeongsung Taxi', appeared in 1912 in Seoul, Korea. The taxi service was available mainly for hire by the hour. Through the Korean War and the subsequent industrialization in the 1960s, small-sized taxi operating companies had incessantly developed. The "Automobile Transport Service Act," enacted in 1961, promoted the development of taxi businesses into corporations and the introduction of a taxi license system, which led to brisk business. Taxi companies were developed into bigger and more organized ones, and good drivers with long experience in taxi companies were granted rights to operate private taxis as an incentive. However, private taxi license could be inherited, and this later became a stumbling block to reform of taxi service. In particular, while taxi license holders increased in number, the issued licenses have remained in the market permanently. This caused the problem of an oversupply of taxi licenses. As of 2008, taxis account for over 9% of total traffic volume, serving as a public transport mode. Meanwhile, taxi business has developed a variety of services such as language interpretation for foreigners, wheelchair accessible call-taxis for disabled people, etc. Taxis, however, still have a various problems, but as a high-quality public transport mode, they play an important role in urban transport.

Popularization of Private Passenger Cars

In 1970, the total number of registered cars in Korea was 128,000. After the mid-1980s, the increase of national income led to the popularization of private car ownership. In 1985, the number of registered cars exceeded one million, and hit two million in 1988 at the time of the Seoul Olympics. After then, the number of cars increased by one million every year, and recorded three million in 1990, five million in 1992, and finally ten million at the end of 1997. The annual average growth in the number of cars from 1980 to 1990 was 20.5%, an unprecedented record in the world. In 2008, the number of registered cars amounted to 16.8 million, 74% of which, or 12.5 million, were private passenger cars.

The skyrocketing increase in the number of cars was attributed to the successful implementation of six five-year economic development plans from 1962 to 1991, which resulted in a ten-fold increase in national income and the large scale expansion of road facilities. Also the other factors contributing to the increased car numbers were the development of the domestic automobile manufacturing industry and the government's policy to promote car sales to boost the domestic market. Driving subsidies, which were given to public officials driving their own cars, was a typical promotion policy of the government. Another example was the "Act on Special Cases Concerning the Settlement of Traffic Accidents," which stipulates that a driver shall not receive a criminal penalty for a traffic accident if the accident does not involve the violation of ten major regulations. However, in the light of safety, the Act Increasing number of cars, as a problem.

Increasing number of cars, along with the development of the car industry and the modernization of the transport system, stimulated the development of other industries. And it also resulted in changes in the city such as broader one-day living zones and expanded urban space. The increase of cars and transport services produced severe traffic congestion on the roads not only in the Seoul metropolitan area but also in other cities. As of 2005, the cost of traffic congestion in the nation's seven major cities amounted to 14.5 billion USD, while that of Seoul alone was 6.2 billion USD. It is alarming that traffic jams occur so frequently. Together with traffic congestion, parking problems are also acute because they occur in the residential areas as well as in the commercial areas. The lack of parking spaces leads to reckless parking in residential areas, which lowers road capacity, blocks streets used for firefighting purposes, and creates inconvenience and friction among residents. In that sense, parking issues are emerging as a growing social problem.

As car dependency increased, the use of public transport decreased, and investment in public transport was relatively low. Also, the mobility-centered transport policy showed limitations in securing a safe environment for walking and bicycling. Even people who have short-distance trips tend to use private cars, and it was a widespread habit to use cars for shopping trip. Due to high car-dependency and the unsafe transport environment, Korea had the highest number of traffic accidents among OECD nations. The total number of accidents in 2008 amounted to 215,822 cases, causing 5,870 deaths and 338,962 injuries. In 2008 the comprehensive cost of traffic accidents, considering human casualty cost, property damages, administrative expenses, and social cost such as pain, grief and suffering (PGS), reached 9.1 billion USD, or 1.1% of GDP. Although cars provide fast and comfortable travel, socio-economic costs are incurred in various aspects. In the coming days, the continuous increase in income level will obviously result in an increase in traffic demand of private cars. Therefore, it is expected, that without restraint on traffic demand, the quality of life and national competitiveness will not improve.

03

Transport Policy Implementation and Evaluation

A “Master Plan for Seoul and Incheon,” established in the 1960s, was the first attempt to resolve the urban transport problems. In 1975, the Korea Institute of Science and Technology (KIST), drew up a full-fledged plan called the “Comprehensive Transport Plan for Seoul.” Starting in 1982, a regional development institute under KIST established transport plans for domestic cities assisted by foreign experts funded by the World Bank. And after 1985 KOTI has drawn up various transport policies and plans at national or local levels according to the “Urban Traffic Improvement Promotion Act.” In 1986, Transport System Management (TSM) was introduced on arterial roads in Seoul in order to improve traffic flow. Since 1987, the government has implemented the urban transport master plan, the parking lot maintenance plan, the public transport improvement plan, the urban railway construction plan, the regional transport improvement project, etc. These efforts made great contributions to enhancing the quality of urban transport. As the cities grew bigger from the mid-1990s, it became important to set up a transport plan for the metropolitan area including Seoul and its neighboring areas. The plan was established and currently is under implementation. Since 2000, people and the environment have been at the center of the agenda, so environmentally friendly policies have been introduced in the transport sector. Some such examples are as follows: the promotion of bus and subway use through public transport reforms, the introduction of public transport only areas, the restoration of Cheonggye stream project, and the introduction of multimodal transit center. Such human- and environment-centered policies promote public transport use and improve walking conditions for pedestrians. And sustainable transport projects, such as natural stream restoration and walking trail construction, are being implemented as important policy agendas.

History of Transport Policy

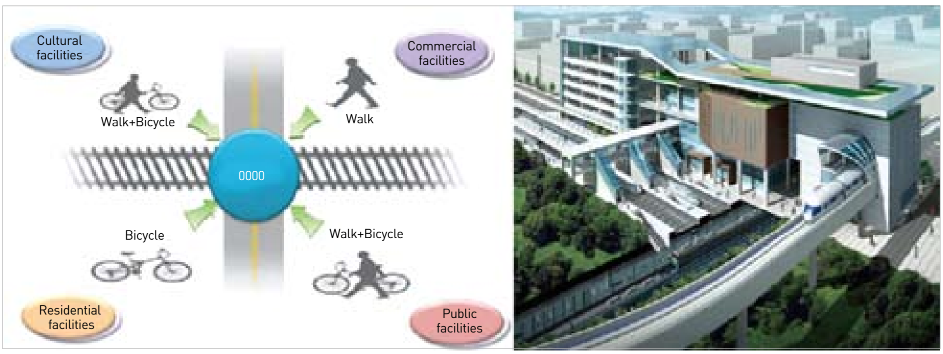
In the mid-1970s, the advisory panel from the World Bank pointed out the upcoming urban transport problems of Seoul and counseled the government to prepare a comprehensive transport plan. In response, the government expanded bus routes and arterial roads serving heavy traffic. The urban transport improvement plan for five cities was established in 1980 for the first time, but without success. Until the 1990s, the main objective of the projects was the expansion of roads and bus routes. Later, the soaring land compensation costs made it difficult to build more roads. So the government had turned its attention to enhance public transport measures mainly for buses and subways. The Ministry of Transport, currently the Ministry of Land, Transport and Maritime Affairs, enacted the "Urban Transport Management Promotion Act" in 1985 to establish an organized urban transport system. The purpose of this Act is to ensure smooth traffic and promote traffic convenience in urban areas by promoting the improvement of traffic facilities and by efficiently operating and managing traffic modes and systems. The areas designated as urban traffic improvement districts required a basic plan for improving urban transport, which enabled relevant governments to tackle the transport problems more actively on their own. And a building or a structure that would attract large amounts of traffic was required to have a traffic impact analysis and improvement measures. However, in spite of such measures, urban transport conditions were not improved much.

From the mid-1990s, the transport policy shifted its paradigm from increasing the supply of transport facilities to improve the efficiency of existing infrastructures, and to place restraints on traffic demand. Major policies were TSM for smooth traffic flow and TDM for various programs. They are mutually complementary, when implemented simultaneously. The TDM policy included a variety of comprehensive measures such as parking demand management, congestion fee collection, number plate control, ramp metering, telecommuting, etc. And in order to ameliorate traffic conditions, the "Urban Transport Management Promotion Act" stipulates the owner of traffic generating facilities should pay traffic generation charges each year according to the principle that causers bear the burden. The charges can be reduced when the owner of facilities implements a program designed to reduce traffic volume entering the facilities.

In an effort to improve the efficiency of the transport system, the Intelligent Transport Systems (ITS) projects were developed. In 1993, the SOC Investment Planning Group reviewed the introduction of ITS into the country and set it as a "department-wide agenda." In 1997, the government drew up an "ITS Master Plan" and started to implement yearly plans. And the "Transportation System Efficiency Act" was enacted in August 1999 to give legal support to the project. The Act was revised as the "National Transportation System Efficiency Act" and a "multimodal transit center" was introduced.

A transit center, in general, refers to a facility located at a major transport node, where passengers can transfer safely and conveniently from one transport mode to another. A multimodal transit center refers to a facility where transfers are made among various modes of transport such as high-speed rail, express bus, subway, general bus, taxi, private cars, bicycle and walk. The multimodal transit center is a large-scale structure composed of various spaces such as platform, ticket booth, concourse, rest area, parking lot, etc. Generally the center offers commercial and business facilities as well as various convenient ones. As it has transfer and support functions in one place, it facilitates the transfer process among various modes of transport, which improves the efficiency of transport operation and users' convenience. The transit center is classified into national, regional and general level according to the characteristics of functions.

Figure 6.3. Concept of multimodal transit center



TDM Evaluation

The most strong TMD measure was number plate control, which was implemented at 1988 Seoul Olympic. AT that time, cars was banned to run on alternate days depending on whether their number plates end in odd or even numbers. Such a measure was implemented again in 1994 for four month repair time period at the collapse of Seongsu bridge. During that time, people were not allowed to drive cars, when the last digit of plate number matched that of the date. After then, the number plate control was used, when necessary, as a short-term measure to control car use. Entering into the 2000s, several cities implement a voluntary car use restriction system, under which people do not drive their cars on a voluntarily designated day out of the week. However, such a traffic restrictive TDM evoked resistance from those who drive cars for their living. Also people in high income class buy additional car and evade the restrictions. The effect of the measure are doubtful.

Congestion fee has less side effects because it is based on the willingness to pay. For the time being from the 1980s, the imposition of congestion fee was presented, but it was delayed due to insufficient conditions, then finally introduced at Namsan tunnel 1 and 3 as a pilot operation. After the implementation, traffic volume plummeted and travel speed increased dramatically. Before the fee imposition, daily traffic for 14 hours amounted to 90,000 cars, it dropped to 78,000 cars at the first year of the implementation. The congestion fee collection showed the decrease in traffic volume passing through the tunnels. However, over time the passing traffic increased and the original effects was not maintained.

In order to relieve traffic congestion in big cities, garage certification was considered. However, for several reasons the implementation was delayed then failed to be introduced. Parking measures, including the expansion of pay parking lots and the introduction of residential parking permit, were implemented, but neither parking nor traffic problems were settled satisfactorily. Parking measures including garage certification should have been implemented at the initial stage of time when private car ownership had just started to be popularized, but at that time it was not possible in reality because of the lack of administrative power and resistance from interest groups. Policy establishment and implementation require a proper time window, if missed, as this case shows, it is impossible to realize it.

04
City Sprawl and Intercity Transport Plan

Suburbanization and Intercity Transport Problems

Since the 1960s, people flocked to Seoul, which experienced extensive suburbanization and sprawl in 1990s. Urban transport usually treated traffic volume which generated within the administrative boundary of the city. As the widespread ownership of private cars facilitated intercity trips, the government started to develop new towns around the Seoul metropolitan area. The purpose of the new town project was to slow down the population concentration in Seoul and to provide adequate housing. The central government developed new towns in phase 1 including Bundang, Ilsan, Pyungchon, Jungdong, Sanbon. A phase 2 included several areas around the metropolitan such as Pangyo, Ieui, Paju, Gimpo, Dongtan, etc, for the purpose of housing supply and price stabilization. However, the phase 2 was evaluated to have more focus on increasing housing stock in a short term, rather than stabilizing home prices. As new towns were developed outside a green belt area, intercity traffic volume increased, resulting in the increase of travel distance. Because the newly developed towns had low self-sufficiency and functioned as a bed-town, intercity traffic demand naturally increased. At the time of new town development, the excessive supply of road infrastructure and the lack of public transport service exacerbated intercity transport problems. Also reckless small-scale land development around the new towns, which were free from any restraint, aggravated the traffic situation.

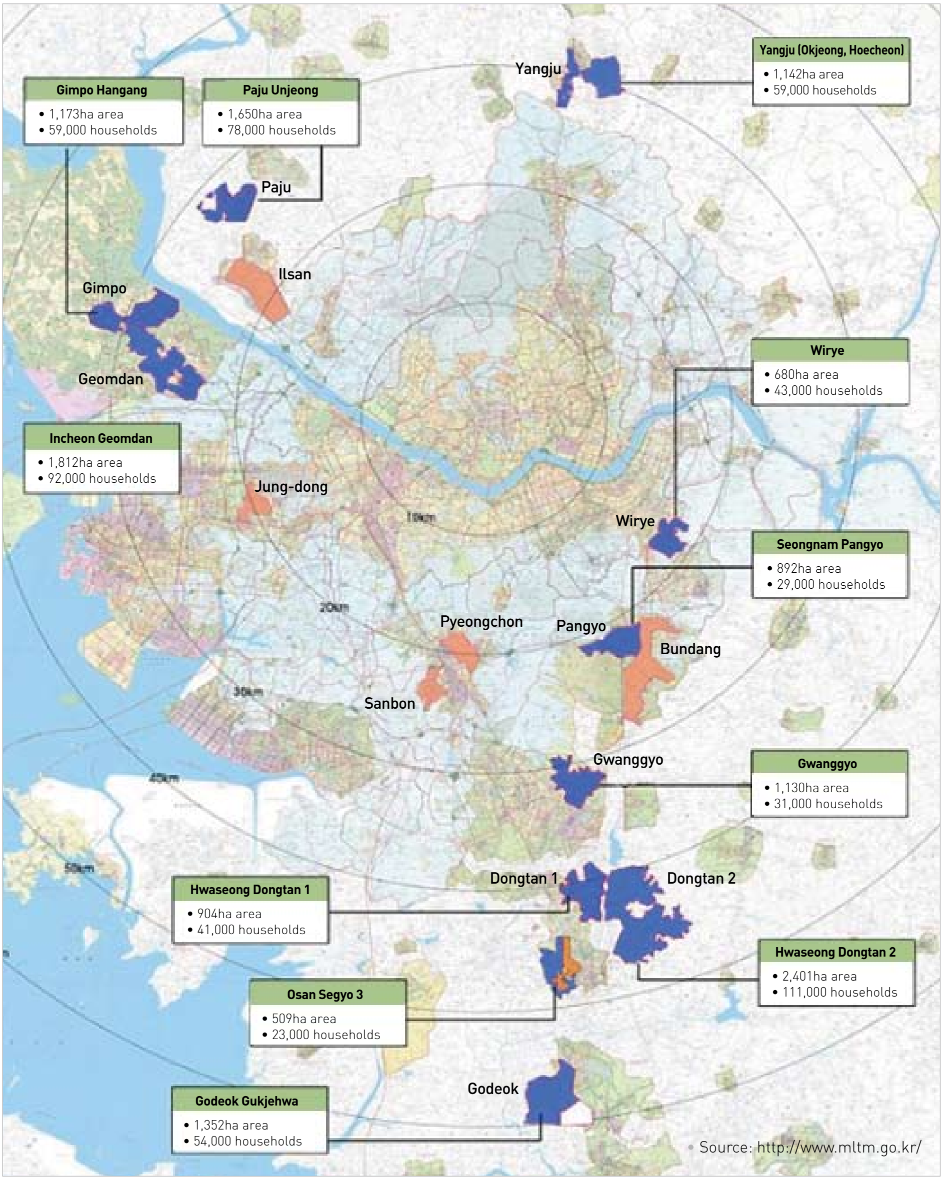
The government established the "Special Act on the Management of Intercity Transport in Metropolitan Areas" in 1997 and made an intercity transport plan compulsory. The intercity plan is for metropolitan city and has attributes between a ‘urban transport plan’ at a municipal level and a ‘plan for the key national traffic network’ at a national level. In 1999, the first five-year intercity transport plan was established, followed by the second plan for five local cities in 2000. In 2001, the guidelines on improvement measures for public transport were made for the large-scale development in the metropolitan cities. And the Special Act was revised to formulate a 20-year master plan and a five-year implementation plan. Accordingly, Seoul and other metropolitan cities set up mater plans(2007-2026) and implementation plans(2007-2011).

Expansion of Intercity Transport Service Expansion

Buses running in the Seoul’s neighboring areas turned back at city boundaries or subcenters because of bus-related regulations and conflicting interests among bus companies. So people who want to go to the city center, they need transfers to get to the destination, causing inconvenience. Also because it took long time to construct and operate intercity railways, it was required to have intercity bus service before the start of railway service. In this regard, intercity bus service connecting the center of Seoul and Bundang commenced in 1998 as a pilot program. Intercity bus was differentiated from other buses in that it operated routes to the center of Seoul directly. It passed through the major parts of Seoul but minimized stops as less as possible, serving rapid transport service between the city center and new towns. Differentiated intercity bus service was considered a success, and extended to Ilsan and other new towns

Since the 1970s, Seoul city and other municipalities have constructed and operated urban railways continuously to combat traffic congestion. Intercity railway network had its start in 1972 through the railway electrification of Gyeongin line (Seoul-Incheon). The electrification was expanded to Gyeongbu line and Gyeongwon line. The electrified lines absorbed a certain amount of traffic demand, which made contributions toward alleviating traffic problems and dispersing the population of Seoul to nearby areas. However, as the costly operation of heavy railway transit incurred increasing deficits, LRT and BRT were considered as alternative modes of public transport in the 2000s.

Figure 6.4. New towns and intercity road network



Source: http://www.mltm.go.kr/

Local governments as well as the central government competitively consider planning and promoting the introduction of such modes. LRT and BRT have strong points in that they serve the mid-level demand between subway and bus, and require less cost than heavy rail in operation and construction. The comparative advantages of the two modes were discussed in terms of traffic attraction effect and flexible route coordination. LRT has high traffic attraction effects and low flexibility in route control, and vice versa for BRT. It is necessary to choose the mode of transport fit for the conditions of areas considering road expansion and land availability as well as pros and cons about the alternative modes.

05

Eco-Friendly and Human-Centered Transport System

Cheonggye Stream Restoration

The restoration of Cheonggye stream, measuring 5.84km in length, started in 2003 and was completed in 2005 with the removal of the overpass and the improvement of waterways. The reason why this project attracted so much attention both at home and abroad was that it was the first large-scale project that introduced a new paradigm of “From Development to the Environment.” Behind the implementation of this restoration project there were three major reasons: Firstly, a safety analysis of structure concluded that repair works to the overpass would have cost about 88 million USD, and during the repairing period the overpass would be closed to traffic. And even after that, the repair should be done continuously. Secondly, the overpass located in the center of Seoul blocked the redevelopment around Cheonggye stream. This acted as a major obstacle to urban regeneration. Thirdly, there was the recognition that a major reason for the imbalance in the economy, housing, education, and culture between northern and southern Seoul was the difference in urban structures, which were not eco-friendly on the north side of the Han River, such as the overpasses densely located in northern Seoul. The restoration project thus became a milestone in a paradigm shift in urban planning and transport. Previous policies were focused on cars and the supply of transport facilities, but the new paradigm put emphasis on environment and traffic management for public transport and walking as well. So it was possible to introduce a variety of projects that could not be implemented under the previous car-centered policy. These new transport policies include drastic bus reforms, improvement of the traffic circulation system in front of the Seoul city hall, overpass removal, etc.

Figure 6.5. After the restoration of Cheonggye stream

Environmental benefits resulting from the Cheonggye stream restoration led to the initiation of other restoration projects for Seongbuk stream and Jeongneung stream. Also feasibility studies for restoring other streams were promoted. And major cities including Busan are currently in the process of waterway improvement and restoration. Also it influenced other international projects like Tokyo's Sibuya stream restoration and the Osaka Water City project.

Transport Policy for the Less Mobile

In 1981 the "Welfare of Mentally Disabled Persons Act" was introduced to improve mobility for the less mobile people. However, in reality it was just an announcement, for it did not contain any detailed regulations and guidelines. In 1989, the Act was replaced by the "Welfare of Disabled Persons Act," which stipulated that the central and local governments should seek measures to establish convenient facilities for people with disabilities, and standards for relevant facilities could be prescribed in a presidential decree. In 1994, the "Regulations for the Installation Standards for Convenient Facilities and Equipment for the Disabled" were set up as guidelines to prescribe the types and standards of relevant facilities. In 1997, the "Act on Promotion of Convenience for the Disabled, Senior Citizens and Pregnant Women" was enacted. Since then, the application of the Act was extended to senior citizens and pregnant women, whose access rights were legally protected.

In 2005, the government drew up the "Act on Promotion of the Transport

Convenience of the Mobility Disadvantaged," which greatly enhanced the types and standards of convenient facilities and equipment in the public transport sector as pointed out for the time being. It provides legal grounds to promote "Barrier-Free" projects systematically and mandatorily in various passenger facilities, transport modes, roads, etc. According to this Act, the Minister of Land, Transport and Maritime Affairs should establish a "Plan for the Promotion of the Transport Convenience of the Mobility Disadvantaged" in every five year period, and accordingly mayors and the heads of local governments should prepare their own plans. For the future, the government needs to secure budget, decide the share of investment by project among governments, enhance training programs for relevant public officials and transport business workers, and establish a unit to have responsibility for facilitating the mobility of disabled persons. It is also required to set up a regular inspection system for the convenient facilities built by local governments.

06
Achievements and Challenges

The main accomplishment of the government was the expansion of the public transport facilities to cope with increasing traffic demand more efficiently. After car ownership being popularized, the establishments of the TDM and green transport system were the main results of the policy implementation to control the excessive use of cars. Therefore, urban transport policies can be summarized as follows; firstly the restraints of private car use and secondly the promotion of public transport use. First of all, trams, the first public transport mode, started operation in 1899 and served as a public transport mode until local buses appeared on the streets. The tram service stopped in 1968 as it interfered with the traffic flow. In Europe, trams are still in use and are recognized as an eco-friendly mode of transport. Tram run along with cars on the street, where trams tracks can be installed, not spoiling the cityscape, through the improvement of power supply facilities. In that sense, it is necessary to review the re-introduction of tram services as an environmentally friendly mode of transport in urban regions.

After the trams disappeared, buses featured as the main urban transport mode. In the beginning, city buses were operated by private companies without financial support from the government, and made great contributions as an ordinary mode of urban and regional transport. However, increased car use and subway expansions caused financial hardship to bus companies, pushing most of them to the brink of bankruptcy. However, the newly introduced quasi-public bus operation system has revitalized the bus industry, but the municipalities which implemented the new system have suffered from financial difficulties due to public subsidies for the operation losses of bus companies. However, in spite of these negative aspects, the quasi-public bus operation system plays an important role in making buses a major public transport mode. It is judged that the government should come up with improvement measures to implement financial support more efficiently in order to reap the benefits of the system.

Meanwhile, it was an effective policy to construct subways, at the time when the popularization of car ownership just started to emerge, to absorb large amounts of traffic demand. However, it should be noted that most of the municipalities invested in subway construction beyond their financial capacities and suffered from financial difficulties after construction. Also, it is desirable to have a BRT system between CBD and satellite cities or new towns where subway construction cannot be easily developed.

Seoul city implemented TDM programs to ease traffic congestion, but the effects were not considered satisfactory. Strong TDM policies, such as the expansion of congestion fees and the introduction of garage certification, have not been implemented in earnest. Recently, the government is placing a new emphasis on a more people-centered transport policy, it strives to create a walking environment favorable to pedestrians rather than to expand road facilities. Also in preparation for aging society, it was a good practice to establish a variety of acts and regulations for people with disability or less mobility. Lastly, future urban transport policy should promote eco-friendliness and public transport use such as the Cheonggye stream restoration project and public transport system reforms. These policies need to be combined and implemented simultaneously.

CHAPTER 7

PUBLIC TRANSPORT

Wonjae JANG
Research Fellow, The Korea Transport Institute

01
Introduction

Public transport provides people with the mobility necessary to perform the activities of daily life, and also allows people to commute, thereby contributing to the nation's economic development. An efficient public transport system is very important in terms of not only transport convenience, but also national economic growth. As there are various forms of public transport, the overall transport system depends on what kind of transport mode is given investment priority. The system can be operated at a low cost or high cost. Consequently, the government's selection of public transport system is directly related to the convenience and happiness of the people. This paper summarizes the evolution of public transport in Korea, in the hope that it will be a useful reference for devising the future public transport system.

Relationship between Income and Energy Consumption

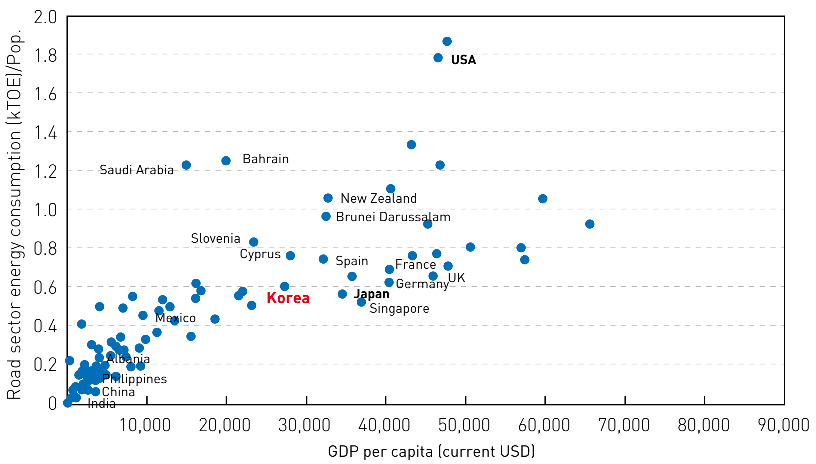
The relationship between income and road sector energy consumption per capita shows that as the income level goes up, so does the energy used in road transport. In the United States where the car-oriented transport system has developed because of the lack of public transport, the energy consumption per capita doubled the level of the UK's with a similar income level. On the other hand, in Japan where the railway-oriented transport system has developed, the road energy consumption per capita is far lower than that of New Zealand with a similar income level.

In Korea, the road energy consumption per capita is lower than that of other countries with similar income levels. It is estimated that the relatively well-developed public transport system in Korea encourages people to use it.

Importance of a Proper Public Transport System

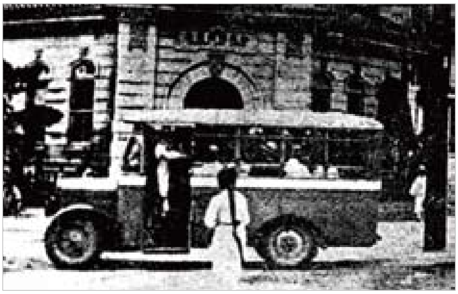
The transport system is very closely related to a nation's growth. Therefore, it is important to decide what kind of transport system to establish in the long run. The car-oriented transport system like that of the United States is not desirable due to the excessive energy consumption, and a rail-oriented transport system like Japan's, although highly energy efficient, will likely take a long time to establish. For instance, a delay of road construction has adverse effects on freight transport, which in turn badly affects the economic growth. Korea has a relatively well-balanced transport system including the services of buses and railways, which means that the flexibility of the road transport and the efficiency of massive railway transport all exist. Under such a system it is possible to choose the transport mode, when necessary, and to establish the road network fast, which is advantageous to economic development.

Figure 7.1. Road sector energy consumption as a percentage of GDP by nation



02
First Public Transport in Korea

Figure 7.2. First bus in Korea (1928)



First Urban Public Transport

Tram cars first appeared on the streets of Korea in May 1899. At that time there were only rickshaws and bicycles as transport modes in Seoul. Henry Collbran, an American businessman, was granted a concession to build a tramway. The construction started in 1898, then one and a half years later the tram service started. The fee was quite expensive, as much as five jeon, a monetary unit used in those days, when 80kg of rice cost four jeon.

The first buses, the Gyeongseong Buyoung bus, started operating on the streets of Seoul in 1928, run by the Japanese government in the colonial period, rather than a private company. In 1927 two private developers asked for permission to run bus businesses, but finally it was decided that the Gyeongseong-bu, the former name of Seoul under the Japanese rule, would operate it directly. The service started with ten buses and 15 drivers, and the fee was about five jeon. Thereafter, the number of buses increased to 50, but due to the deficit caused by lower demands than expected, it was acquired by a private company, Gyeonseong Jeongi. The company, who had the right to operate trams also, coordinated bus routes not to compete with those of trams, and also provided transfer services with one ticket.

First Regional Public Transport

The first regional railroad, 33.2km long, linking Seoul and Incheon opened in 1899. It offered the service once in the morning and afternoon each with a maximum speed of 60km/h and an average speed of 20-22km/h. The ticket prices were 50 jeon for the 1st class, 80 jeon for the 2nd class, and 40 jeon for the 3rd class.

The first regional intercity bus service started in 1912 from Masan to Jinju with the operation permission obtained in 1911. The coach was a Ford model carrying about ten passengers. The fare was quite expensive, as much as 3 won 80 jeon per ride. And it took four hours to travel the 70km from Masan to Jinju.

Figure 7.3. First intercity railways (1899)

03

Surge in Transport Demand (-1990)

Economic development generates traffic. Therefore, the increases in traffic demand and economic growth have shown a similar trend. Korea's GDP per capita in 1970 was a mere 249 USD, but it increased to 5,886 USD in 1990, a 24-fold increase. Along with this, the public transport demand had also exploded, increasing by five times more in 1990 compared to that of 1970.

Table 7.1. Annual passenger volume of the public transport by mode (-1990) (Unit: 1,000 passengers/year)

Year	Bus	Railway	Taxi	Marine	Air	Total
1970	2,045,464	131,251	692,476	5,869	917	2,875,977
1975	3,718,032	255,240	808,433	5,908	906	4,788,519
1980	6,090,034	495,849	1,908,933	8,580	1,481	8,504,877
1985	7,522,848	828,360	3,020,121	8,534	3,467	11,383,330
1990	8,144,555	1,746,491	4,503,317	8,260	11,064	14,413,687

The changes in transport demand have depended on what kind of public transport mode has been expanded. Before 1970 railway was the major mode of transport. The railway modal shares in 1960 were 53% for passengers and 88% for freight. However, as the nation's economy had developed and the road networks had expanded, buses emerged a major mode of transport.

Urban Public Transport

At the end of the 1960s, the trams stopped service due to the weak profitability and vehicle deterioration. After then the bus got its footing as the main mode of transport, accounting for two-thirds of traffic demand.

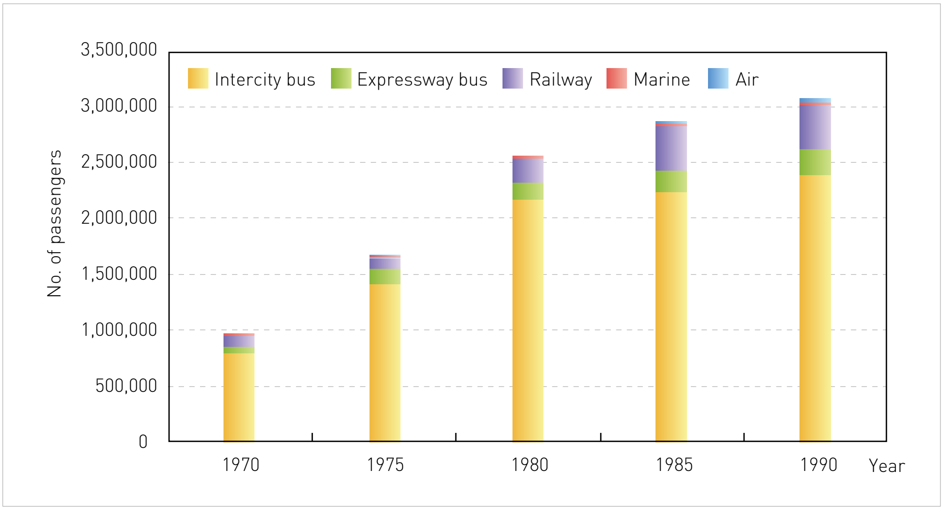
In the 1970s Seoul city introduced the urban railway system, because it was required to have a high-capacity mode of transport to tackle increasing traffic. In this regard, Seoul Subway line 1 started its commercial operation in 1974. The subway service began to expand its network in earnest in the 1980s. Subway line 2 with a total length of 51.5km was fully opened in 1984. Among other cities, Busan, the second largest city in Korea, had its first subway line in 1985, which triggered the widespread use of urban railways throughout the country.

Intercity Public Transport

The intercity bus and express bus played a strong part in intercity public transport. The intercity buses acted as arteries connecting every corner of the country, handling about 85% of intercity trips in the early 1970s. The increasing traffic demand of the intercity bus reached its peak at about 2.4 million trips per day in 1990.

The express bus commenced its operation with the opening of the express way in the end of the 1960s. With the expansion of the expressway network, the number of users soared greatly. The number of daily passengers of express buses was only 45,000 in 1970 then skyrocketed to 210,000 in the early 1990s, and its modal share also increased to 6.7%. However, because expressways were established connecting mainly major cities, express buses, providing only a limited service, had a low modal share compared to that of intercity bus. In the case of railways, the number

Figure 7.4. Passenger volume for intercity public transport (1970-1990)



of passengers barely changed, because rail tracks had hardly ever been extended but road networks including national roads and local roads were developed at a fast pace. Instead, the railways sector exerted an effort to enhance the quality of service by improving the operating speed. Saemaeul train, then Gwangwang train, had a top speed of 110km/h in 1969, then later 120km/h in 1983, and 150km/h in 1985, which reduced travel time from Seoul to Busan up to four hours and ten minutes. The daily passenger volume also increased from 100,000 in 1970 to 410,000 in 1990.

Related Laws

The Automobile Transport Service Act was enacted in 1961 for the purpose of establishing a system for the relevant business, promoting the development of the businesses, then ultimately improving public welfare. The automobile transport service was classified into three categories: transport business, road construction business, and forwarding business. And the transport business had eight categories including bus service, chartered vehicle service, taxi service, etc. The transport service required a license from the Minister of Transportation, and fares were supervised by the related administrative department. There were requirements to obtain a business license as follows: traffic volume in the business plan should meet the criteria provided by the decree of the Ministry of Transportation; the business should have a long-term viable plan; related capabilities and facilities should be all prepared; and the operation of the business should be necessary and also good for the public interest. The transfer and acquisition of business, and the merging and dissolution of a company, required the approval of the Minister of Transportation. Also, the Act stipulated activities passengers and business should be prohibited from engaging in, and orders to improve business operation.

In 1979 the government took measures to make transport companies incorporated, bringing them under direct management. At this time, bus companies were independently operated and taxis with temporary licenses appeared, which led to an increase in the numbers of buses and taxis, and the introduction of seat-only bus services with direct routes.

Table 7.2. Changes in the number of buses by type (-1990)

Category	Total	Local	Intercity	Express	Chartered
1975	17,695	8,502	7,290	848	1,055
1980	33,471	19,270	9,972	1,401	2,828
1985	39,172	20,667	12,111	1,768	4,626
1990	46,098	25,314	12,657	1,993	6,134

The Urban Railway Act, enacted in 1979, aimed to build urban railways and operate them efficiently. For the first time it was the ‘Underground Railways Construction Promotion Act’, then in 1986 some parts were amended and had the name changed to the ‘Act on Construction and Operation of Underground Railways.’ Later, in 1990, it was renamed to the ‘Urban Railway Act’ with some parts revised. The term ‘Urban Railway’ in the Act refers to track transport facilities and modes, including railway, monorail, streetcar, linear induction motor and magnetic levitation train which are constructed and operated in urban transport areas to decongest traffic.

Major Problems

The urban railways were operated by the government unlike the bus service run by private companies. Therefore there was a limitation on making profits like Japan where private companies operate railways. Also because the service was recognised as a public system, there were great restraints on fare raise, causing financial problems and increasing debt.

The bus service was provided by private companies which designed routes based on revenue logic, therefore, they often operated the service against the convenience of the public. In case of the drop in profits, the quality of service also dropped, causing long intervals, crooked routes, crammed with full of people in commuting times, etc. The low quality of the public transport service, along with the increase of car ownership due to the economic growth, brought about the shift of the transport mode to private cars.

04

Public Transport in the Era of Passenger Car (-2000)

Entering into the 1990s, the car ownership exploded. The number of passenger cars greatly increased from 60,000 in 1970, to 2,250,000 in 1990, then to 8,000,000 in 2000. As the private car ownership was on the increase, the upward trend of the public transport demand was converted downward.

Table 7.3. Changes in the number of registered cars (Unit: 1,000 vehicles)

Year	Passenger car	Bus	Truck	Others
1970	60	15	48	1
1980	249	42	226	9
1990	2,252	397	980	12
2000	8,083	1,427	2,510	37
2009	13,023	1,080	3,166	54

At its peak in 1992, the demand for public transport reached 15,135 million trips a year. After then in 2000 the trips decreased to 13,515 million. Over the same period the transport volumes of subways and railways were on the increase, while the number of bus users was on the decrease. And also air traffic climbed from 11 million to 23 million, a two-fold increase, but these were quite minor changes compared to those of railways and buses.

Table 7.4. Changes in annual passenger volume of the public transport by mode (1990-)

(Unit: 1,000 passengers/year)

Year	Bus	Railway	Taxi	Marine	Air	Total
1990	8,144,555	1,746,491	4,503,317	8,260	11,064	14,413,687
1995	6,274,400	2,240,191	4,920,413	8,702	21,009	13,464,715
2000	5,240,857	3,072,489	5,038,802	9,702	22,515	13,384,365
2005	4,819,999	2,971,355	3,824,166	11,100	17,158	11,643,778
2009	5,306,164	3,201,665	4,105,240	14,868	18,061	12,645,998

Urban public transport

In the urban transport system, the subway system made a remarkable development. Seoul constructed 204km of subway line in the second phase, including extended lines 2, 3, 4 and new lines 5-9. The subway lines 5, 7 and 8 broke the ground in 1990 and completed the construction before 2000, line 6 was completed in 2001. Busan line 2 was built in 1999, and the first urban railways in Daegu was built in 1998. As the subway network was greatly expanded in the major cities, the number of subway passengers jumped from 1,103 million in 1990 up to 2,235 in 2000, more than two-fold increase.

Figure 7.5. Seoul subway map (in the 1990s)

Most of subway traffics were shifted from buses, which had seen 30% drop in passenger number, from 7,188 million in 1990 to 4,824 million in 2000. In particular, the number of bus users plummeted at routes competing against subway lines. In the end, this caused the financial loss of the bus companies. As an effort to tackle this problem, Seoul city set up a median bus-only lane on the Cheonho bridge, 4.5km long, for the first time in Korea.

Intercity Public Transport

In terms of traffic demand, the urban public transport is not less affected by the passenger cars in that the road expansion in the city is relatively difficult compared to that of intercity. However, the growing car ownership exerted a strong influence on the intercity public transport.

Table 7.5. Changes in the passenger volume of the intercity public transport (1990-)

Year	Total	Intercity bus	Express bus	Railways
1990	3,032,531	2,411,765	209,602	411,164
1995	1,977,532	1,459,198	146,683	371,652
2000	1,458,664	1,024,482	116,609	317,573
2005	1,003,462	673,092	103,252	227,118
2010	918,467	618,586	104,461	195,419

The intercity public transport carried about 3 million people per day in 1990, but the number plunged to 1.5 million, almost by a half, then kept decreasing to 900,000 in 2010, a mere one-third passenger volume compared to that in 1990. Passenger cars rapidly replaced the intercity modes of transport, because the national roads and express ways to connect cities increased dramatically.

Figure 7.6. Exclusive bus lanes on the Gyeongbu Expressway

As the surge in the passenger vehicle usage exacerbated the traffic conditions of expressways, in 1994, median bus-only lanes were designated on the Gyeongbu expressway, No. 1 Expressway connecting Seoul and Busan. The dedicated bus lane was 134km long, from Yangjae to Shintanjin, and only buses and vans with more than six occupants had the right to drive on the lane. It is a very rare case in the world that a bus-only lane is operated on expressways. The exclusive bus lane on the Gyeongbu expressway triggered the introduction of such an operation on the roads in the city.

Related Laws (in the 1990s)

In 1997 the Automobile Transport Service Act was amended to the Passenger Transport Service Act by removing the truck service part from the Act, and incorporating the Land Transport Promotion Act and the Passenger Car Terminal Act. The passenger transport service includes a passenger transport business, car rental business, bus terminal business. And the passenger transport business was classified into two parts: route passenger transport business (local bus, rural bus, community bus, intercity bus); and area passenger transport business (chartered bus, special passenger car, corporate taxi, private taxi).

In 2000 the Act stipulated that a private passenger car, in principle, should not be used as a shuttle bus for commercial facilities such as to department stores, to prevent the shuttle service from damaging the function of the public bus service and to secure passengers' safety.

In 1994 a special account for transport facilities was established to secure more stable financial resources, which covered roads, railways, airports, metropolitan transports, etc. And the auto fuel tax is the primary source of the tax revenue. At that time, it was unusual that the tax revenue paid by road vehicle users was passed on to the other public transport facilities such as railways. Also there was another difference from other countries in that the new town development was tied to the railway projects in order to make up for financial resources to build urban railways.

Major Problems

The public transport in the 1990s witnessed a decrease in traffic demand, never seen before, because of the skyrocketing car ownership and road network expansion. Also the low quality of service caused by the crowded cars during the peak commuting periods and the crooked bus routes, and the absence of intermodal cooperation played an important role in causing such a decrease. In fact, it was almost impossible to have the intermodal cooperation system because each mode of transport was operated under the respective administrative unit.

Another factor was the increase of the operation deficit caused by the urban railway construction and operating losses, which placed a heavy burden on the financial condition of the governments operating urban railways.

05

Evolution of the Public Transport (In the 2000s)

Bus Reforms in Seoul

In the 1900s, the bus system in Seoul faced with severe problems due to the reduced number of passengers, which led to deficit operations, thus affecting the quality

Figure 7.7. Roads before and after the bus reforms

Before

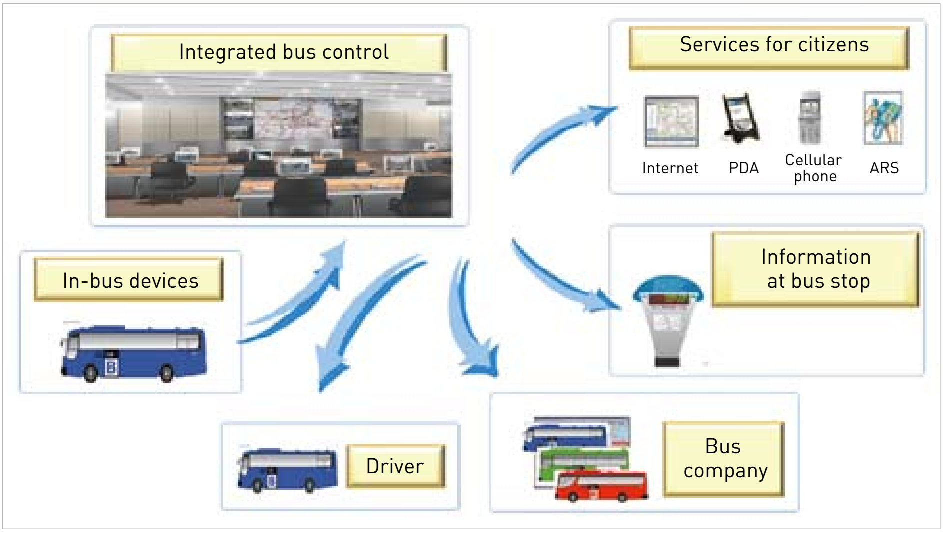
After

of service. This, in turn, caused a decrease in passenger volume, which resulted in a vicious cycle. Under these circumstances, the integration operation system along with Bus Rapid Transit (BRT) was introduced to reform the bus service extensively. The previous bus route network, which was formed unsystematically based on public demand, has changed to a hub-and-spokes network. And, there was a redesign of bus types. All the bus services were grouped into four types, with buses color-coded to help passenger distinguish more easily among them.

The major change was the introduction of dedicated bus median lanes, which made great contributions to the improvement of punctuality. And when moving to the city center, the buses on this lane could run as fast as private cars. The exclusive bus lanes were established in 12 axes, 100.4km in length, in Seoul and five axes, 90.4km in length, in Gyeonggi province.

One of the major changes was the application of information and communication technology. The technologies used in the bus management and the smart card led to service improvement and the rationalization of the bus management. The real-time bus management enabled buses to run at definite intervals. And the installation of GPS on board allowed traffic control centers to determine the real-time location of running buses. This system prevents buses with the same route from running in

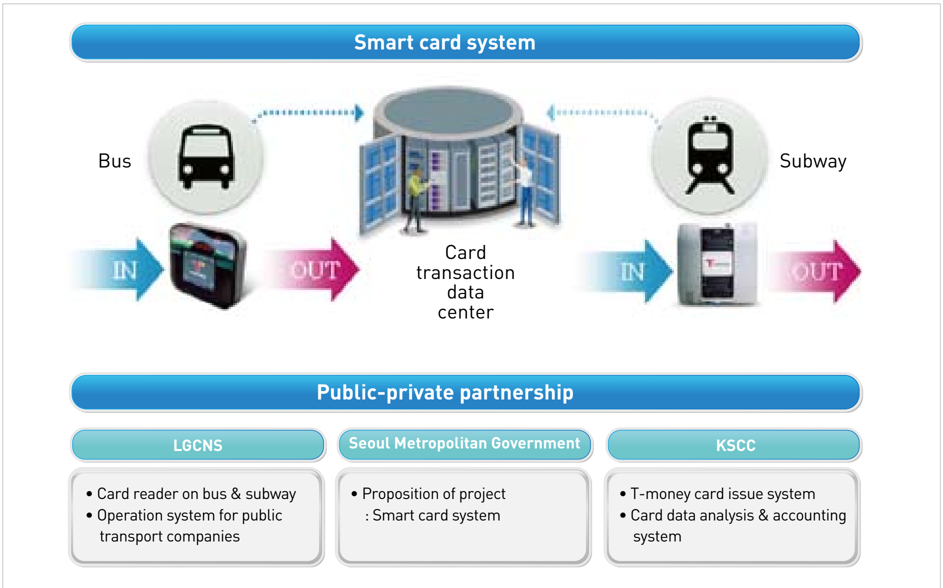
Figure 7.8. Structure of the bus operation management system



groups. From the passengers' point of view, it is an innovative service because they can expect buses to arrive within a definite period of time. Also, a communication system between traffic control centers and drivers was established to make quick responses in case of emergencies. And the real-time records can be established as a database, facilitating the exact understanding of the operation of individual buses such as travel distance, travel time, etc. Because this system enables the precise allocation of the operation revenue among bus companies, and the understanding of the bus operation interval, it contributes to optimizing the bus management such as the coordination of routes and intervals. The strongest point is that it is possible to provide the real-time transport information. The bus location is processed into the estimated time of arrival through the center, then displayed on the terminals located in bus stops. Later, the Bus Information System (BIS) has been widespread over the country. Also, with the rapid spread of smartphones, it is easy to access public transport information by using smartphones.

The introduction of a transport card reduces the time for payment, to maintain revenue transparency, and to understand the O/D patterns precisely. Users have no need to carry cash for fares, bringing the convenience for public transport use.

Figure 7.9. Fare payment system with smart card

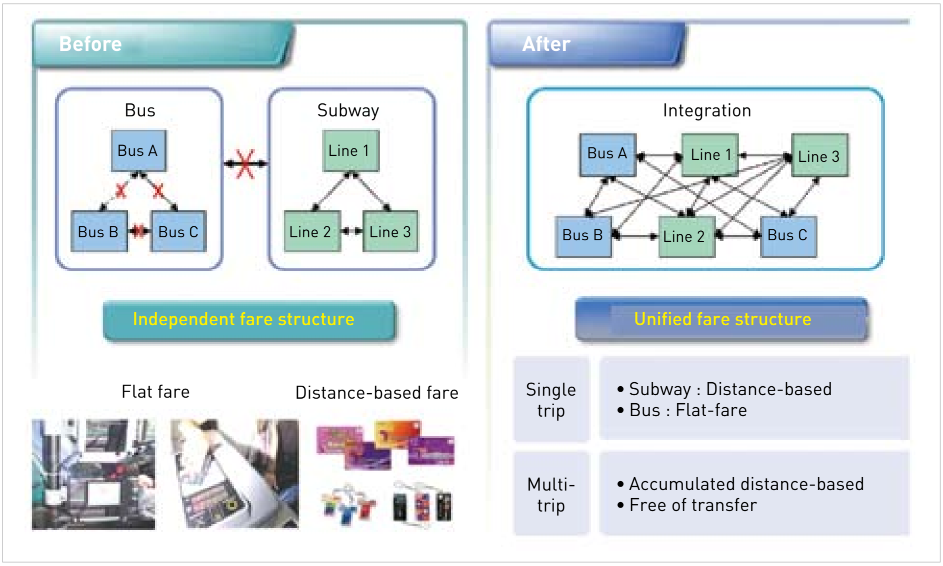


With regard to bus operation, the government introduced what it calls a 'quasi-public operation system', under which the government manages buses and routes that private companies own and operate, and reimburses bus companies on the basis of vehicle km of service instead of real operation revenue from passenger trips. With this new system, the city has the right to coordinate the privately owned bus routes, and offers more stable service to non-profitable routes. The bus companies can avoid operating deficits through the revenue guarantee, and stabilize the livelihood of bus drivers. Also, it was possible to improve the previous poor services such as speeding, traffic signal violation, impolite manner to passengers, etc. On the other hand, the city government has shouldered the operating deficits of the private companies, which adversely affects its financial conditions. And as the new bus operation system has public characteristics more than before, it has been difficult to improve the operating balance through fare increases, etc.

Public Transport Integration in the Metropolitan City

Coupled with the bus reforms, Seoul city has implemented an integrated public

Figure 7.10. Before and after the integrated fare system



transport system, which integrated the fare systems of subways and buses. Under this new system, fares are based only on distance traveled, regardless of transport modes. The fare consists of basic fare and additional fare. When travelling with various modes, the highest basic fare will be applied over a given distance, and beyond this point, passengers will be charged a certain extra fare for a certain distance traveled. Therefore, there is no financial burden on transfer. However, the calculation of the distance traveled is applied to one unit trip, which includes transfers within 30 minutes, and a maximum of four transfers is allowed per trip considering the convenience of the system establishment and real travel patterns. This fare system is quite beneficial to passengers. Instead of paying a separate fare upon transferring, passengers are charged only once without any charge for transfer, saving travel costs by a large margin.

Initially, the transfer discount was applied only to city buses and subways in Seoul. However, with the participation of Gyeonggi province and Incheon city, the discount benefits were expanded to all the transport modes in the metropolitan area.

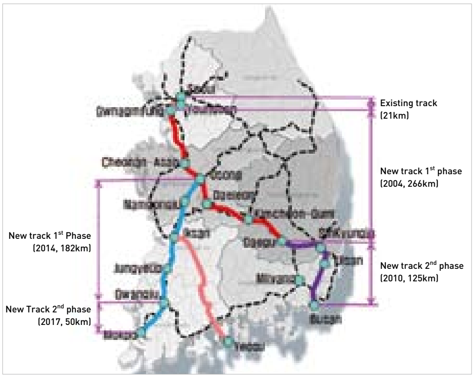
For the discount benefit, passengers must place the transport card on the card sensor whenever they get on or off. It is a little troublesome from passengers' point of view, but it is essential to calculate the fare based on the distance traveled. This travel distance-based fare system is much more economical than the previous system which gave simple discounts whenever transferring. The contact of the transport card on the sensor when disembarking identifies the total travel itinerary. This information is used to understand the current service quality such as occupancy, and to adjust bus routes flexibly according to traffic demand.

Continuous Construction of the Urban Railways

In the urban transport sector, the urban railways such as subway kept being built. As the construction spread out to other regions, then the major cities all had their own urban railways. In Seoul, Subway line 9, a part of the third phase, opened in 2002. And in 2005 Busan opened subway lines 3 and 4, and Daegu opened subway line 2. Gwangju and Daejeon got their first subways in 2004 and 2006 respectively.

Advent of the KTX Era

Figure 7.11. KTX establishment plan by phase



The Korea Train eXpress (KTX), with operating speed of 300km/h, went into service on April 1, 2004. The track length was 266km at the time of opening, then extended to 391km in 2010 at the completion of the second phase of Gyeongbu High Speed Rail (HSR). In fact, with the KTX, people can travel anywhere in the country within a day. Also, it makes it possible to take one-day business trips and commute long distances. With the opening of the Honam HSR in 2014, the KTX length will be 573km, and 623km in 2017 at the completion of the second phase. After then Korea will enter into the era of high-speed railway, which will form the backbone of the national transport network, heralding the new era of transport.

Multimodal Transit Center

The connectivity among the modes of transport, whether the same or different kinds, is very important. However, the construction and the operation were managed by each party concerned, which made it difficult to establish a connection or transfer system. For this reason, public transport was seen as a much less convenient mode compared to private passenger cars. Traveling with the various modes of transport inevitably requires transfers.

Figure 7.12. Aerial view of the multimodal transit center

Therefore, the poor transfer system became a typical factor to lower the quality of the public transport service. The government is in the process of promoting a multimodal transit center to improve such conditions.

The multimodal transit center refers to a facility offering the transfer service and supporting facilities. It facilitates smooth connections and transfers among transport modes such as railways, airplanes, ships, and subways, buses, and socio-economic activities in commercial and business areas.

The multimodal transit center provides various services including culture, commerce, residence, and public service. The purpose of this center is to induce multi-purpose trips and ultimately to reduce the inconvenience of transferring. The transit center is classified into national, regional and general levels according to the characteristics of trips. The national and regional centers are entitled to some financial assistance for the construction from the government.

Introduction of the Metropolitan Rapid Transit

The metropolitan rapid transit bus is a part of the BRT (Bus Rapid Transit) system established by the MLTM. As the Seoul metropolitan area sprawled, the intercity traffic soared. So it was necessary to set up the public transport service for the Seoul Metropolitan Area to tackle this problem. There were already intercity railways and buses as a metropolitan public transport mode, but vehicles were crammed with commuters during the peak times, because the trips were generated intensively during commuting times. The metropolitan rapid bus has two different points from the previous service. Firstly, the number of stops, which are less than eight in total, having four stops each within five km from starting and ending points. It was modified from

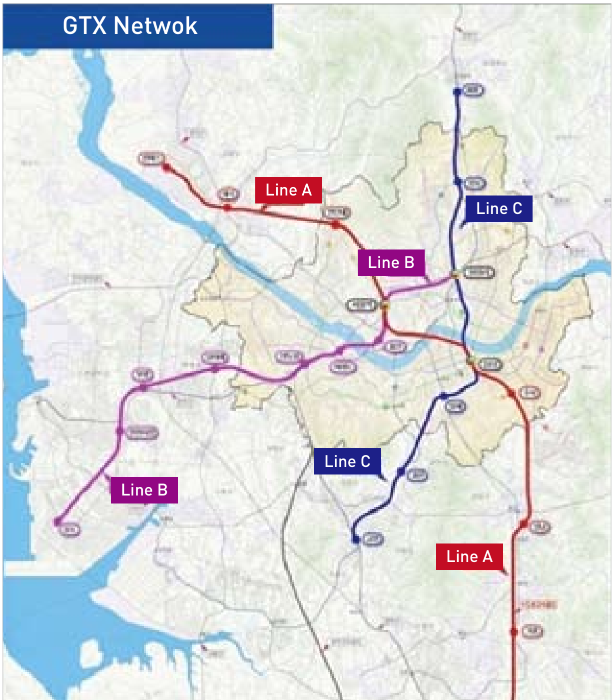
Figure 7.13. Metropolitan rapid transit

the 2011 version, which had six stops each within 7.5km from starting and ending points, or a total of 12 stops. Because there is no stop in the middle section of the routes, rapid transit service is possible. Secondly, they are all-seated passenger buses, which creates a more comfortable environment for the public transport use.

The metropolitan rapid bus started with six pilot lines from August 2001, and the number of service lines has continued to increase based on public demand. In November 2010, an additional seven lines started operating. The pilot operation revealed that travel time decreased 10 to 20 min. on average, with 8% of passengers foregoing their cars, and 76.6% responding as satisfied.

The intercity rapid train is a kind of urban railway to establish an efficient transport network connecting the nodes of more than two cities, dealing with daily traffic and operating at more than 100km/h. Such rapid trains run in other countries under different names such as CrossRail in the U.K., to be opened in 2017, the Tokyo Metro in Japan, and the GTX in Korea. In April 2009, Gyeonggi province proposed the GTX project, standing for Great Train eXpress, to the MLTM in an effort to solve traffic problems in the metropolitan areas including Seoul and Gyeonggi province.

Figure 7.14. Route map of the intercity rapid train



Classification	Visiting point	Length (km)	Station (Transfer)
Line A	KINTEX-Dongtan	46.2	9(2)
Line B	Songdo-Cheongnyangni	48.7	9(2)
Line C	Hwaryong-Geumjeong	45.8	7(2)
Total		140.7	22(3)

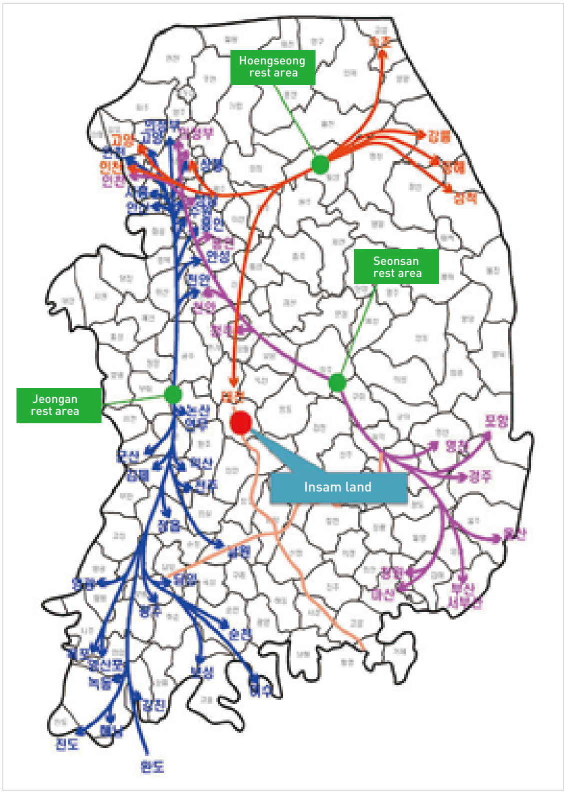
The proposed GTX project consists of three lines, from Dongtan to KINTEX, from Songdo to Cheongnyangni, and from Geumjeong to Euijeongbu, with a total length of 145.5km. It will make use of land located 40 to 50m deep underground to reduce the land compensation cost, and improve scheduled speed, and average speed including dwell time, to 100km/h by making the route a straight line, which enables the GTX to run 18 minutes for a distance where the existing trains take more than one hour.

The GTX operation is expected to ease traffic jams greatly in the Seoul Metropolitan Area. The number of private cars, especially, entering Seoul from the Gyeonggi province will decrease, which, in turn, mitigates road congestion.

Transfers at the Expressway Rest Areas

The expressway network connects mainly the major cities with the local cities. Because the express buses for medium-and small-sized cities run low-frequency service, passengers have to wait a long time for buses or use other terminals located in the neighboring big cities, causing much inconvenience. The MLTM provided four transfer areas at the major express services (rest areas) to relieve inconvenience to passengers and it started a pilot operation in November 2009 (Mon.-Thur., 8:00-20:00, except public holidays). At the time of the introduction of this system, there were only an average of

Figure 7.15. Transfers on the expressway rest areas



150 daily users, but in 2011 the number of daily users was 660, more than a four-fold increase. According to a recent survey the number of passengers using the transfer systems at the express services reached 260,000 as of the end of May 2011.

The pilot operation was implemented on 25 lines of the Honam axis and the Youngdong axis, which had the effect of creating 45 new lines, increasing to 70 lines in total. The express bus transfers were made between six cities in the metropolitan area and nine cities in Jeolla province on Honam axis, and between four cities of Seoul, Incheon, Goyang and Daejeon, and four cities of Gangneung, Sokcho, Donghae, Samcheok on Youngdong axis.

After the pilot operation, the Sunsan rest area on the Gyeongbu expressway and the Jinseng Land rest area on the Daejeon-Tongyoung expressway were additionally designated as transfer areas.

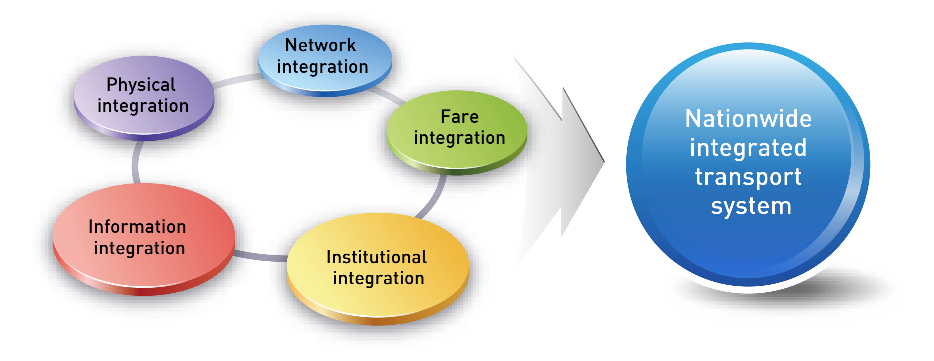
Toward a Fully Integrated Public Transport

Starting with Seoul's public transport reforms in 2004, the government had shifted its service provision paradigm from individual transport services to integrated transport services. From the standpoint of public transport users, various services, such as urban railway, intercity railway, local bus, intercity bus, etc, are actually integrated. And the other local big cities also provide such services as free transfers and transfer discounts between buses and urban railways.

The intercity transport modes have not been integrated yet, causing a loss of competitiveness in the intercity public transport. In the areas where the KTX service is provided, the number of KTX users is on the increase, but the number of passengers travelling between cities by general trains or buses continues to decrease.

It is essential to establish an integrated system for intercity trips, similar to the metropolitan public transport system, to improve the intercity public transport service and to increase the number of passengers. To that end, it is necessary to arrange the schedules of different modes such as express bus, intercity bus, high-speed railway and general railway, and to improve the transfer system.

Figure 7.16. Five components of the integrated public transport system



The integration of the intercity public transport system should be conducted in five sectors. 1) The network integration is to establish an integrated route system by arranging the independent network system by mode with a focus on the network connection. 2) The physical integration is to arrange the operation schedules of major stops (nodes) systematically, to install proper facilities to minimize the inconvenience of users, and to expand the connectivity. 3) The fare integration is to change the current individual fare systems to the integrated fare system which is affected by distance traveled and service level. 4) The information integration is to integrate the transport information individually provided by each mode of transport, and also the reservation and payment systems of the transport modes. 5) The institutional integration is to arrange related systems to realize the integration actually.

The integration of the intercity public transport system is expected to be the first step to getting closer to the full-fledged integration of the public transport. After then, if the intercity public transport and the urban public transport are integrated, the integration of the public transport is completely fulfilled. It is expected that people can use the public transport system just like one transport mode regardless of where they live or where they go.

Major Problems

In the 2000s, over-investment in railway projects was still controversial. The investment in LRT and urban railways projects continued due to the local government's high preference and the higher level of the financial support from the government compared with other modes. In cases of PPP projects which have benefited from the Minimum Revenue Guarantee (MRG), some of the local governments are suffering from severe financial constraints because of the grossly over-estimated demand. The errors of the traffic demand forecast, as a basis for the MRG, attracted the criticism

Another problem is that although continuous efforts have been made to develop public transport in a variety of ways, then public transport demand has not been accomplished yet. While urban public transport demand has picked up since 2005 after the Seoul public transport reforms, by introducing transfer discount in the local metropolitan cities, the bus information system, etc. However, the intercity public transport demand has remained at one-third of the highest level in 1990. This suggests that the intercity public transport is still inconvenient compared to private cars.

Related Laws (in the 2000s)

In February 2004, the government revised the enforcement decree of the Passenger Transport Service Act to grant a restricted license (within six years) to the passenger transport business prescribed by the municipal/provincial ordinance to promote the bus systems, and to offer financial support to businesses.

In 2005 the Act on the Support and Promotion of Utilization of Mass Transit System was enacted to promote the use of public transport. The Act stipulates that the central government should establish a five-year plan every fiver year, and based on this, local governments should establish their own.

The National Transport System Efficiency Act, enacted in 2011, includes the enhancement of the connection system among transport modes, and the designation and implementation of the multimodal transit center.

06
Lessons Learned

Public transport plays an important role in the national economic growth because it provides people with the opportunities for daily economic activity. Therefore, the government requires every endeavor to be made to offer proper public transport services. However, people's needs for public transport service have changed with the times. According to the economic growth level, people require different levels of service. In this regard, it is essential to offer a suitable public transport service matching the people's needs to maintain the demand for public transport. It is more advantageous to have this kind of public transport plan set up at the initial stage of economic growth. Therefore, it is important to plan a public transport system with a long-term perspective.

In most cases regarding public transport, more than one transport mode involves the movement from the origin to a destination. Consequently transfers are required, causing inconvenience to the public. Therefore, the government seeks to enhance the connections among modes of transport and reduce the discomfort of transfers, thereby improving the service quality of public transport. To this end, it is necessary to establish an integrated system, that combines the various modes of public transport into one system. And in order to increase the benefit of connections among modes, it is advisable to thoroughly review the operation of public transport facilities, and consider the integration at the beginning stage of the system establishment of public transport.

CHAPTER 8

URBAN RAILWAY

Hun KIM
Research Fellow, The Korea Transport Institute

01
Introduction

Economic Development Support

In general, a nation's economic growth entails the development of secondary and tertiary industries in the urban areas. As non-urban residents flock to cities for new economic opportunities, the urban population density is increasing dramatically. When the central city has enormous socio-economic functions, there is some spillover into the neighboring areas, forming part of the extended Seoul Metropolitan Area. Accordingly, the central city increases urban and intercity traffic demand by a great margin.

So far, when promoting economic growth, the developed countries keep seeking to develop transport modes fit for the overall conditions of the country, and to make investments in the transport infrastructure. The biggest effect of the transport investment is to reduce travel costs and to increase peoples' opportunities to move from one place to another, which, in turn, expands the mobility space. Such spatial expansion enhances the connection with adjacent areas, thus improving the flexibility and efficiency of the labor market for access to the workplace. And it supports the concentration of economic activities, thus creating the synergy effects of forming a cluster.

In Korea, the first successful five-year economic development plan (1962-1966) and the following second five-year plan (1967-1971) made contributions to the industrialization and advanced growth of the nation. Meanwhile, the urbanization had been promoted, and the population of Seoul

Figure 8.1. Increasing trends of socioeconomic index of Seoul

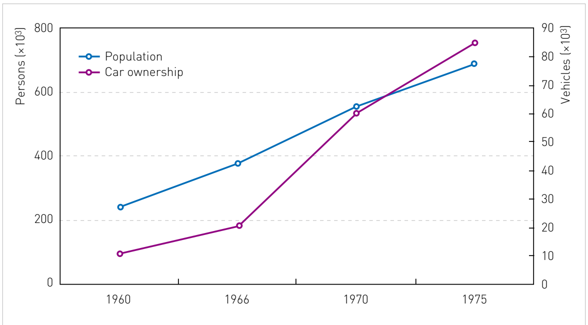


Figure 8.2. Road transport in the 1960s (Seoul)

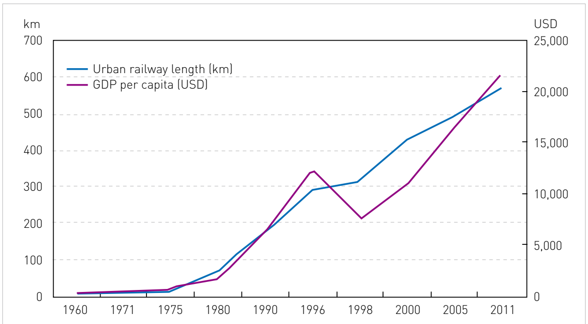
had skyrocketed. Such population growth and brisk industrial activities sharply increased urban traffic demand. And the exploding number of registered vehicles has exacerbated the road conditions.

The government judged that the population concentration in the city would be an inevitable phenomenon while continuing the economic development, and recognized the needs for improving urban transport. In particular, it was expected that Seoul would face a surge in the number of commuters from neighboring areas because of the lack of housing inside Seoul. Accordingly, the government judged the improvement of the intercity transport was necessary also.

From the late 1950s to the 1960s, trams and buses were the main modes of public transport. However, the space for the tram service inside Seoul was limited, so its role diminished, and bus commuters greatly increased in number. However, because it was difficult to construct sufficient roads to accommodate the increasing numbers of buses and cars, the road expansion was inadequate to solve the transport problems.

Therefore, subway construction came to the fore as a long-term solution, for it was able to alleviate the road transport inadequacies, having no difficulty in passing through the CBD and densely built-

Figure 8.3. Trends of urban railway length and GDP per capita



up areas with high-rise buildings, and carry massive volume of passengers. The trend of urban railway lines increased after 1970 showing a similar pattern to that of GDP increase per capita. This suggests that in Korea economic growth has been very closely tied to the urban railway infrastructure.

Benefit Creation

Urban transport is characteristized by short-distance trips, AM/PM peak periods, concentrated trips in a certain areas, etc. In particular, the city center has a high possibility of traffic congestion in peak periods because of intercity traffic coming from other areas outside the city as well as intra-city traffic. Therefore, in order to improve transport efficiency, it is essential to provide a proper public transport facility to meet the capacity corresponding to the demand.

The urban railway, running on dedicated tracks with several cars, offers the advantages of transport efficiency and punctuality over other modes. And in terms of air pollution, energy consumption and transport safety, it has a favorable edge over cars. Accordingly, urban railways are considered the most desirable mode of transport to handle intra-city traffic in metropolitan cities in Korea.

Table 8.1. Energy consumption and environmental pollution by mode of transport

Category	Energy consumption (kcal/person·km)	Air pollution emissions (g/person·km)
Private cars	546	1.56
Buses	251	2.74
Subway	100	0.008

Urban Development Support

The urban railway transit needs stations, and for their easy access, high-density land use and connection system with other modes around the stations are established. Therefore, the station's sphere of influence is developed actively and plays a role as

Figure 8.4. Development of Gangnam station's sphere of influence

In the 1980s | Present

a growth center. In particular, because in many cases, railway stations are located in places where available land is limited, it is possible to have rich and active space by accommodating various needs to satisfy increasing land use demand.

In Korea, the government sought to promote underground space, which was secured in the process of developing the urban railway, as a key commercial sphere in the area. As the railway line had a sharp competitive edge in transport capacity, the development demand for areas around the stations increased, promoting growth in the areas.

It is common that while the central city grows, the development of the large-scale new towns and industrial complexes leads to an increase in intercity traffic demand. In Korea, as people from the rural areas moved to Seoul, transport facilities to connect Seoul and neighboring cities were required. Accordingly, in 1971 at the time of the construction of subway line 1, the government undertook the electrified double track projects at the same time. This implies that it is important to consider intercity traffic as much as urban traffic. While the government promoted the metropolitan development since the 1980s, the new town projects were developed along with the intercity railway project, because it was assessed that the success of the new town project would depend on the transport connection with Seoul.

02 History

Seoul Subway Construction Phase 1

Seoul Subway Line 1

In April 1971, the government broke ground for subway line 1 connecting Seoul Station and Cheonngnyangni to ease traffic congestion. The line was only 7.8km long but it played an important role in metropolitan railway network, because the metropolitan lines such as Gyeongbu line, Gyeongin line, Gyeongwon line, etc. could run on line 1 directly.

Figure 8.5. Opening ceremony of subway line 1

The total project cost for subway line 1 exceeded way beyond the equity that Seoul City could support. Because massive financing was directed toward the country's continuous economic development, government's financial support was far from enough. So, the government held a Korea-Japan ministerial meeting and concluded a loan agreement with the Overseas Economic Cooperation Fund (OECF). The loan amounted to 35 million USD, or 48% of the total project cost, including 20 million USD of resources such as rolling stock and 15 million USD in cash.

The urban railway project was run by the municipality, but it required huge amounts of budget, so there were limitations in funding the project independently. Considering the fact that Korea was a developing country at that time, a government-led loan agreement became a big driving force for the urban railway project.

Seoul City enacted a 'Provisions on Public Bond for Seoul Subway' in 1973 to finance the construction of subway line 1. The issued bonds reached 10% of the total project cost, and in 1975 after 2 years of the issuance, repayment was made with financial help from the government. Therefore, in reality it had subsidies from the national coffers.

During the construction of subway line 1, the Japanese advisory group reviewed the dispatch of experts from Japan in case that there was no expertise in constructing subways in Korea. However, Korea conducted most of the construction on its own except some parts requiring high-technology such as rolling stock, signal communications, etc, and Japan supervised the construction. The subway operating equipment and rolling stocks were imported, but construction materials were all domestic products. Therefore, it was possible to use domestic equipment and construction methods from planning to design, thereby saving huge amount of foreign capital and increasing the use of heavy equipment.

Seoul Subway Lines 2, 3, and 4

In 1975, the government started to construct subway line 2 to support the new development policy including Gangnam area, a southern part of Seoul. However, the roads in the city spread out like the spokes of a wheel, so the circular shaped subway line 2 was inadequate to cover the traffic and made little contribution to the city's balanced development. So, in an effort to maximize the function of line 2 and also to increase the subway share, subway lines 3 and 4 were built.

Originally the construction of subway lines 3 and 4 was a privately funded project. However, after the construction started, severe inflation and the increase of construction costs precluded the private company from continuing to make progress. In the end, the private company was dismissed, and Seoul Metro, a municipal corporation, was established to undertake it as a public project.

Out of the total project cost for phase 1, the equity was 27%, or only 772 million USD. So, Seoul City had a financial burden of about 2.1 billion USD in construction debt. Above all, the operation revenue was lower than expected, which put more pressure on repayment of loans. Finally, since 1986 Seoul City was forced to give financial support of about 10% of city tax revenue to repay the Seoul Metro's principal and interest.

Table 8.2. Financing summary for Seoul subway line 1 (Unit : million USD)

Classification		Total	Line 1	Line 2	Line 3·4
Total Investment		2,885	73	1,068	1,744
Equity	Sub-total	772	33	399	340
	Municipal budget	656	33	307	316
	National budget	77	0	72	5
	Others	36	0	19	17
Debt	Sub-total	2,111	40	668	1,403
	Government fund	373	5	18	350
	Financing fund	440	0	223	217
	Loans	472	35	67	370
	Foreign debt	19	0	19	0
	Public bonds	805	0	339	466

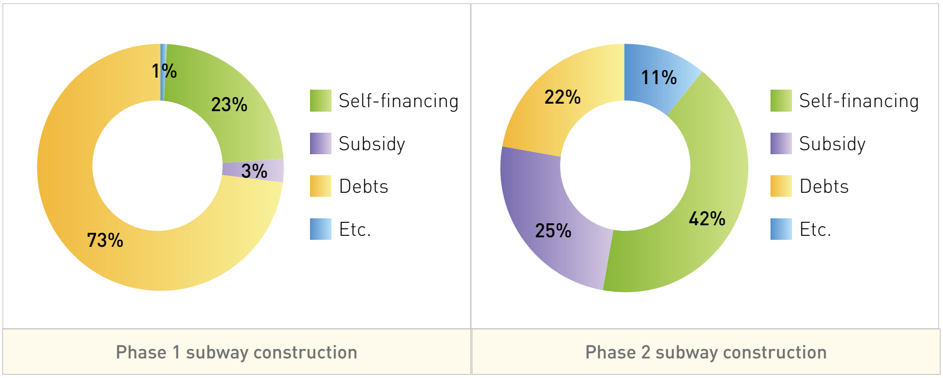
Seoul Subway Construction Phase 2

After the construction of Seoul subway phase 1, the huge construction debt, the repayment problems, and the accumulated operational deficits due to less demand than expected emerged as social issues. In such an environment, it was difficult to discuss additional construction of subways. However, with the number of subway passengers rising rapidly, the congestion became severe since the late 1980s. And as political and social conditions turned favorable toward the subway construction, the phase 2 subway construction was promoted from 1990 to 2000 including the construction of four new lines and existing line extension.

Figure 8.6. Subway congestion in subway line 2

The phase 2 project extended the application of tunneling methods to minimize inconvenience to the people. The tunneling methods were applied 16.9% at phase 1 and increased to 49.3% at phase 2. And when the subway was built in open cut, lining

Figure 8.7. Financing comparison between phase 1 and 2



works were done step-by-step to minimize the traffic disturbance.

Phase 2 did not consider direct operation with the intercity subway to prevent excessive investment in the introduction of dual voltage AC/DC electric rolling stock. Therefore, according to a wiring plan, the terminal stations of lines 6, 7, and 8 were designed to be extended to subway lines of Incheon or Gyeonggi province areas, and lines 5 and 8, and lines 6 and 7 were designed to connect each other. And thanks to the Automatic Train Control (ATO) signal system, the number of drivers decreased 2 to 1.

The government offered full-fledged financial support to the phase 2 construction. Furthermore, the general accounts budget, considered as municipal resources, increased by a great margin, and the land development charge and the development benefits were newly included, then self-supporting resources exceeded more than 50%. So, the debt ratio was decreased greatly compared to that of phase 1.

The analysis to decide an operating entity for phase 2 subways concluded it was desirable to set up a separate corporation other than the Seoul Metro. And the phase 2 adopted the Automatic Fare Collection (AFC) system and ATO system, which required less operation personnel compared to phase 1. So, it was more efficient to have another independent organization. And the Seoul Metro had poor financial integrity because of the huge debts incurred by the construction of subway lines 3 and 4. It was evaluated that such managerial problems resulted in the entity separation not to impose any burden on phase 2 operation.

Seoul Subway Construction Phase 3

Seoul City reviewed a plan for subway construction phase 3 to establish a subway-centered public transport system in preparation for being a multi-core and grand metropolitan city of Seoul. However, due to the IMF crisis in the 1990s, it was difficult to secure financial resources, so the government decided to construct a new line 9 and extend only line 3.

The subway line 9 planned a combination of express trains, stopping at the major transfer stations, and all-stop trains to improve the scheduled speed. So several stations are installed with side tracks. And a medium-sized train, having a narrower and shorter body than that of other lines in Seoul subway, was introduced to save costs.

Figure 8.8. Express service in Subway line 9

Seoul City invited private developers for construction of section 1 of the subway line 9 including rolling stock supply, system installation, and depot construction, except civil works and land compensation. Section 1 has many transfer stations, so even if a private party runs the line, it is not allowed to raise the fares at its discretion. The private developer was designated as a concessionaire under the condition that it would not change the current fare system. The developer invests about 53% of the project cost for buying rolling stock and installing systems, and has the right to operate it for 30 years after the opening.

Now, Seoul City is conducting phases 2 and 3 of subway line 9, and also it is implementing or considering LRT transit as PPP projects to expand subway service.

Intercity Railway Construction

The government came up with a plan to electrify the existing tracks in an effort to ease the traffic situation, extend city functions further, and disperse the population from the center to the suburban areas. And in 1968 Gyeongwon line (Yongsan-Sungbuk) was first electrified, and since then the electrification project has continued. Currently, most of the railways connecting Seoul have been electrified and handle intercity traffic. In particular, Gyeongin line, which had lots of intercity traffic, was electrified with two double-tracks, express and non-express lines.

Figure 8.9. Electrified double-track in Gyeongin line

Figure 8.10. Driverless car in Shinbundang line

Since the 1980s, several intercity railways were constructed along with new town development around Seoul. Ansan line was built to promote the development of Ansan city, a newly-industrialized city, and Gwacheon line, Ilsan line and Bundang line were built to help better connect with Seoul and new towns for the population dispersion. And the project costs of these lines were mostly borne by the private developers.

The recently opened Bundang line was developed on a BTO (Build-Transfer-Operation) basis, under which a private developer is responsible for more than 50% of the total project cost. Because most of the financing burden was shouldered by the Pangyo newtown developer, the government and the municipality had very little financial burden. This line runs based on the CBTC (Communication Based Train Control) system without a driver.

Urban Railways in Local Major Cities

Among local major cities, Busan, the second largest in Korea, commenced the subway line 1 construction in 1981. And in the 1990s the government stipulated the financial support for the urban railway construction as a part of the improvement measures for large cities, following which Daegu, Incheon, Daejeon and Gwangju started the project in earnest. Urban railways running in the local cities

Figure 8.11. K-AGT(Rubber-wheeled LRT) in Busan subway line 4

Table 8.3. Completion of urban railways and intercity railways by time period

Period	Seoul		Other
	Urban railway	Intercity railway	Urban railway
1970s	line 1	Gyeongeon line (Yongsan-Sungbuk) double-track electrification	-
1980s	lines 2, 3, 4	Gyeongbu line (Seoul-Suwon) 2 double-track electrification Gyeongwon line (Sungbuk-Uijeongbu) double-track electrification Ansan line newly built	Busan line 1
1990s	lines 5, 6, 7, 8	Gyeongbu line (Seoul-Guro) 3 double-track electrification Gyeongin line 2 double-track electrification Gwacheon line, Ilsan line, Bundang line newly built	Busan line 2, Daegu line 1
2000s	line 9 (stage 1)	Gyeongbu line (Suwon-Cheonan) 2 double-track electrification Gyeongwon line (Uijeongbu-Dongducheon) double-track electrification Jungang line double-track electrification Gyeongui line (Munsan-DMC) double-track electrification	Busan line3, Daegu line 2, Incheon line 1, Gwangju line 1, Daejeon line 1
-2011	-	Gyeongchun line double-track electrification Shinbundang line newly built	Busan line 4, Busan-Gimhae LRT
※under construction	line 7 extension line 9 (phase 2, 3) Ui LRT	Bundang line extension, Gyeongui line (DMC-Yongsan) Suin line	Daegu line 3, Incheon line 2 Youngin LRT, Uijeongbu LRT

are medium-sized cars, Busan metro line 4 introduced the domestically developed rubber-wheeled LRT system.

In the 2000s, based on the government's policy to promote the LRT system, middle-, and small-sized cities such as Youngin, Gimhae and Uijeongbu developed various types of LRT projects as PPP projects. Busan-Gimhae LRT is open in 2011 and currently in operation.

03
Status

Railways in Operation

Since the 1970s, the government continuously has supplied the urban railways to tackle the transport problems incurred in the process of industrialization and urbanization. As of the end of 2011, 19 lines were in operation and the length amounted to 571.6km. Among them, 17 lines were run by local corporations and two lines by private companies.

The urban railway as an eco-friendly mode of transport still receives attention in an energy efficiency aspect, and also the government keeps establishing urban railway networks by introducing proper systems taking into consideration the economic efficiency.

According to the 'Special Act on the Management of Intercity Transport in Metropolitan Areas,' the term 'intercity railway' refers to railways that are constructed and operated to decongest traffic in more than two metropolitan areas or to connect them. The urban railway runs a section that has a linear distance of 50km, within one hour at the scheduled speed of 50km/h. However, in general, except legally designated railways, the intercity railway includes intercity subways run by Korail in the metropolitan areas.

Currently, the intercity railways in operation are 554.2km long with 12 lines. Korail operates 478.9km long with 10 lines, and AREX, a subsidiary of Korail,

Table 8.4. Urban railways in operation

City	Operator	Line	Length (km)	No. of stations	No. of passengers (mil. people/year)	Rolling stock
Total		19	571.6	554		
Seoul (9)	Seoul Metro	1	7.8	10	164	Large-sized car
		2	60.2	50	732	〃
		3	38.2	34	275	〃
		4	31.7	26	304	〃
	Seoul Metropolitan Rapid Transit corp.	5	52.3	51	296	〃
		6	35.1	38	178	〃
		7	46.9	42	316	〃
		8	17.7	17	84	〃
	Seoul Metro Line 9 Corp.	9	27.0	25	97	Medium-sized car
	Subtotal		316.9	293	2,447	
Busan (5)	Busan Transportation Corporation	1	32.5	34	151	Medium-sized car
		2	45.2	43	97	〃
		3	18.1	17	27	〃
		4	12.0	14	-	Rubber-wheeled AGT
	Busan Gimhae Light Rail Transit	Busan-Gimhae LRT	22.6	21	-	Steel-wheeled AGT
	Subtotal		130.4	129	275	
Daegu (2)	Daegu Metropolitan Transit corp.	1	25.9	30	62	Medium-sized car
		2	28.0	26	53	〃
	Subtotal		53.9	56	115	
Incheon	Incheon Transit Corporation	1	29.4	29	80	Medium-sized car
Gwangju	Gwangju Metropolitan Rapid Transit corp.	1	20.5	20	17	〃
Daejeon	Daejeon Metropolitan Express Transit corp.	1	20.3	22	35	〃

• Note: facility info. (as of 2001), passenger volume(as of 2010)

operates a 58km long line connecting Seoul st. and the Incheon International Airport. And Shinbundang line, opened in 2011, runs 17.3km long, and as a PPP project it is being operated by a private developer.

Table 8.5. Intercity railways in operation (as of the end of 2011)

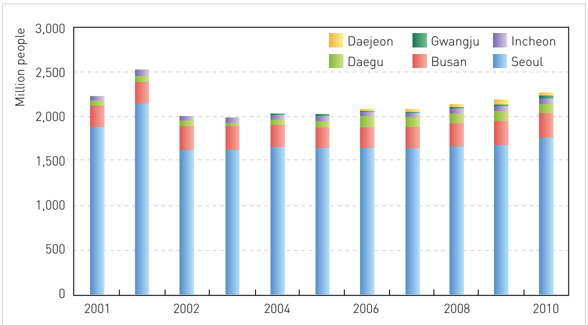
Category	Operator	Length (km)	No. of stations	2010 Passenger volume (mil. people/year)	Signal system
Total		554.2	215		
Gyeongbu (Janghang) line	Korail	122.9	45	269.9	ATP
Gyeongin line		27.0	20	201.4	ATS
Gyeongwon line		42.9	24	159.0	〃
Jungang line		71.2	24	29.7	〃
Ansan line		26.0	13	56.7	〃
Gwacheon line		14.4	8	52.7	ATC
Bundang line		27.7	20	110.3	〃
Ilsan line		19.2	10	49.0	〃
Gyeongui line		46.3	18	19.4	ATS
Gyeongchun line		81.3	18	-	ATP
AREX	Korail Airport Railroad	58.0	9	10.0	ATO
Shinbundang line	Neo Trans	17.3	6	-	CBTC

Urban Railway Modal Share

The opening of Seoul subway 1 in 1974 heralded an era of urban railway. When subway lines 5, 6, 7 and 8 completely opened in 1999, the number of annual passengers exceeded two billions. Entering into the 2000s, as the urban railways in local cities started operation, the yearly passenger number increased gradually to 2.273 billion. And people who use the railway systems in Seoul comprised 80% of the total number of passengers.

As Seoul City has relatively well developed railway networks for the urban and intercity trains, the share of railways in the overall modes is quite high. As of 2009, the

Figure 8.12. Passenger volume of the urban railways in Korea



urban railway modal share hit 35.2%, the highest. And the share including bus and railways together reached 63%, which was a similar level to the public transport share in other major cities in the developed countries.

Table 8.6. Modal share in Seoul

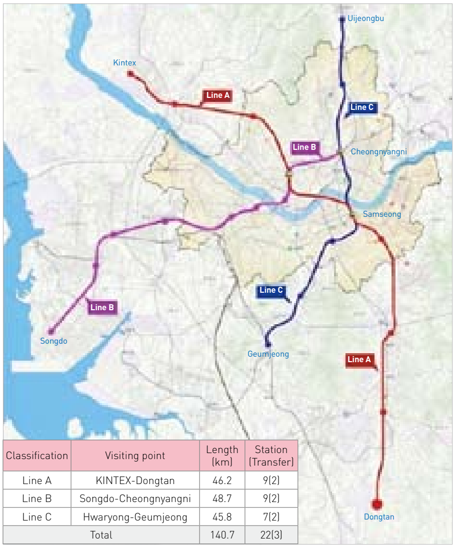
Year	Total	Subway	Bus	Taxi	Car	Other
2003	100(%)	35.6	25.6	7.1	26.4	5.3
	2,938(ten thousand people/day)	1,046	752	209	775	156
2004	100(%)	35.8	26.2	6.6	26.4	5.0
	3,034(ten thousand people/day)	1,086	795	200	801	152
2005	100(%)	35.9	26.8	6.2	26.3	4.8
	3,100(ten thousand people/day)	1,079	853	202	815	152
2006	100(%)	34.7	27.6	6.3	26.3	5.1
	3,120(ten thousand people/day)	1,086	861	197	821	159
2007	100(%)	34.9	27.6	6.2	26.3	5.0
	3,151(ten thousand people/day)	1,100	870	195	829	158
2008	100(%)	35.0	27.8	6.2	26.0	5.0
	3,171(ten thousand people/day)	1,110	882	197	824	159
2009	100(%)	35.2	27.8	6.2	25.9	4.9
	3,195(ten thousand people/day)	1,125	888	198	828	157

GTX (Great Train eXpress)

The continuous land development in the Seoul Metropolitan Area makes the distance of linked trips much longer. However, due to the lack of road capacity in Seoul, the road-centered intercity transport measures have limitations in dealing with the relevant traffic. And the existing intercity railways run at a low scheduled speed, which is a weak point in terms of competitiveness compared to roads. In particular, because the intercity railways has limited access in the Gangnam area where major business building are concentrated, railway users suffer much inconvenience.

Against this backdrop, the government is considering constructing GTX to address traffic problems in the Seoul Metropolitan Area. GTX is designed to run at a scheduled speed of 100km/h to have competitiveness in speed. It will be constructed about 40 meters below ground with a maximum speed of 200km/h, a 7km distance between stations, and have EMU (Electric Multiple Units) trains with a top speed of 180km/h. For better accessibility, the GTX line will be built on the similar axis which intercity railway lines are located, and most of the GTX stations will be connected with the existing stations for transfers.

Figure 8.13. GTX Route map



Classification	Visiting point	Length (km)	Station (Transfer)
Line A	KINTEX-Dongtan	46.2	9(2)
Line B	Songdo-Cheongnyangni	48.7	9(2)
Line C	Hwaryong-Geumjeong	45.8	7(2)
Total		140.7	22(3)

Currently, three lines are under consideration, 140.7km long in construction and 167km long in operation. Part of the lines will use the Suseo-Pyungtake line together.

04
Policy Development

Development of Urban Railway Project

A local government is responsible for an urban railway project. However, the project requires securing the feasibility first, followed by the official approval for the established plan from the central government. In the past, local governments examined the validity of the project, but since 1999 the central government, the Ministry of Strategy and Finance, has carried out a preliminary feasibility study for an objective evaluation and efficient fiscal support. An urban railway project should pass the preliminary feasibility study, when the government subsidy exceeds by KRW 30 billion. And in order to proceed with the railway project, which is proved feasible, the heads of local governments should establish a master plan and secure approval from the central government, the Minister of Land, Transport and Marine Affairs, and then obtain a business license.

The central government supports financially the urban railway projects. From 1970 to 1990, there were no certain criteria for financial support for the construction of the urban railways. So, the size of the government's help, including fiscal support and loans, was subject to its financial conditions at that time. However, starting in 1999, the guidelines for the financial support were set up to promote the urban railway project more systematically.

A local government, as a competent authority, has the responsibility for financing. Except for fiscal support, a local government seeks to find various funding sources, including municipal subsidies from the general accounts, issuance of railway bonds, loans from financial institutions, etc. Therefore, the construction management is performed by a local government itself or commissioned to a professional entity.

Currently, local corporations, affiliated organizations of local governments, are in charge of the operation of government projects. Local cities have one corporation for railways operation, but Seoul has two entities, one for phase 1, Seoul Metro, and the other for phase 2, Seoul Metropolitan Rapid Transit Corporation. One reason why Seoul has two different entities is for operational efficiency. Because phase 2 subways introduced AFC and ATO systems, they require less operation personnel compared to phase 1. And the operating entity of phase 1 suffered from huge financial difficulties caused by the construction of subway lines 3 and 4, and in the end, the separation of operating entity was decided not to impose any burden on phase 2.

The intercity railway projects can be managed by either the central or local governments, but up to now, all the lines have been put under the responsibility of the central government. The construction of the intercity railway to be developed as a government project should pass through a preliminary feasibility study. And Korea Rail Network Authority, a public organization, is in charge of the construction plan and management. A local government is supposed to bear some part of the project cost.

Table 8.7. Roles of urban railway and intercity railway by entity

Main party		Urban railway	Intercity railway
Central government	Ministry of Strategy and Finance	•Preliminary feasibility study •Financial support	•Preliminary feasibility study •Financial support
	Ministry of Land, Transport and Maritime Affairs	•Approval of master plan and project plan •Issuance of business license	•Approval of the master plan and project plan
Local municipalities		•Establishment of master plan and project plan •Construction management •Financing	Financial support
Others	Urban railway corporations	Railway operation	-
	Korea Rail Network Authority	-	•Establishment of master plan and project plan •Construction and facility maintenance
	Korail	-	•Railway operation •Commissioned works of maintenance

Relevant Law Establishment

In 1971 when the subway construction initiated, there was no act or regulation for the urban railway development, so the project was promoted based on the Railway Act. The Act stipulated the fare and operation of railway, so it had limitations in providing insufficient grounds for details for the urban railway construction.

In 1979, the Subway Construction Promotion Act was passed to promote the construction of subways. This Act included land expropriation, financing, government support, etc. When the construction of phase 1 subways was entirely completed in 1985, the Act was revised to the Act on the Establishment and Operation of Subways including the subway operation.

In 1990, the government enacted the Urban Railway Act to include a variety of railway systems as an urban railway for the development of the LRT projects, and simplify the administrative process for the urban railway project. The current Urban Railway Act' stipulates the following:

- Master plan for the construction and operation of the urban railway
- Route designation, business license, standards for license
- Project for the development for station's influence area

- Compensation for underground section, expropriation and use of land
- Consultation about the removal of obstacles to works, and the measures for the transfer of residents
- Restrictions on the disposal of the national and public land
- financing planning for the construction and operation of the urban railway
- entrust of the construction and operation
- Report of fares, order for service improvements
- Connection transport
- Supply and demand of the urban railway operation manpower
- Standard specification, safety standard, performance test, quality certifications of the urban railway supplies

As not only Seoul but also local governments promote urban railway projects in earnest, the government has drawn up sub-regulations to give technical support for the construction and operation.

Table 8.8. Regulations regarding technology of urban railway

Regulations	Key contents
Construction regulations	•Installation standards for tracks, stations, equipments, etc. •Special notes for LRT
Operation regulations	•Performance management for tracks, equipments and rolling stocks •Train operation and operating speed •Signal
Safety standards regulations for facilities	•Safety standards for the installation and operation of track and equipment •Maintenance plan for urban railway facilities
Safety standards regulations for rolling stocks	•Safety regulations for structure and apparatus of rolling stocks
Safety standards regulations for rolling stock maintenance	•Performance test for rolling stocks •Qualify certification for supplies

Financing

Foreign Loans

The total project cost for subway line 1 exceeded way beyond the equity that Seoul City could support. Because a massive budget was paid for the nation's continuous economic development, government's financial support was far from enough. So, the government held the Korea-Japan ministerial meeting and concluded a loan agreement with the Overseas Economic Cooperation Fund (OECF). The loan amounted to 35 million USD, or 48% of the total project cost, including 20 million USD of resources such as rolling stock and 15 million USD in cash.

Seoul subway phase 1, developed in the 1980s, and Busan subway line 1 also received financial support through the loan programs, but their ratios of loans out of the total project cost were lower than that of Seoul subway line 1. And as the central government started to establish relevant laws and regulations in the 1990s, loans were rarely required in the projects. The urban railway project was run by the municipality, but it cost huge amounts of budget, so there were limitations in funding the project independently. Considering the fact that Korea was a developing country at that time, a government-led loan agreement became a big driving force for the urban railway project.

Subway Bond Issuance

Seoul City enacted the 'Provisions on Public Bond for Seoul Subway' in 1973 to finance the construction of subway line 1. The issued bonds reached 10% of the total project cost, and in 1975 after two years of the issuance, the repayment was made with financial help from the government. Therefore, in reality it had characteristics of subsidies from the national coffers. As the issuance of subway bonds was stipulated in the 'Subway Construction Promotion Act' and the 'Urban Railway Act', the financing through the public bonds increased. Seoul subway line 2, Daegu subway line 1 and Gwangju subway line 1 were financed more than 30% of the total project costs by the issuance of subway bonds. In order to facilitate the bond issuance the 'Urban Railway Act' stipulates any person falling under the following description should purchase the bond:

- Any person who obtains license, permission or authorization from the state or local government;
- Any person who applies for registration or entry, provided, however, that the person who applies for registration of compact cars;
- Any person who makes a construction contract with the state, local government or public institutions; or

- Any person who makes a contract for construction, service or goods supply necessary for construction or operation of the Urban Railway.

Fiscal Support

In the 1980s, the government offered subsidies or loans, when deemed necessary for the financial support, for the construction of urban railways. And the full-fledged support started with the establishment of the Urban Railway Act in the early 1990s. At first, the fiscal support was 30% including 15% of subsidy and 15% of loans, then it changed to 30% of national subsidy in 1996. And the subsidy increased to 50% in 1998 and 60% in 2005. Of special note, 60% of subsidy rate was applied to construction cost, which was already calculated from 1990 to 2004, so the government paid the difference for the principal repayment of subway debt.

Table 8.9. Trend of the national support for the urban railway

Region	1980s	early 1990s	mid 1990s	late 1990s	2000s
Seoul	3%	15%	30%	40%	40%
Other	15%	15%	30%	50%	60%

In 1993, the Act on Special Accounts for Transport Facilities and the Transport Tax Act were set up to secure more stable financial support from the central government.

The transferred money from the general accounts to the special accounts includes transport tax revenue pursuant to the Transport Tax Act and the special consumption tax revenue imposed on private passenger cars pursuant to the Special Consumption Tax Act. The transport tax is a newly established object tax to secure the financial resources for the expansion of SOC facilities such as roads, railways, etc. It is imposed to the objects of the special consumption tax such gasoline, diesel, and other alternative fuels.

Currently, the government provides the fiscal support to the railway project which is proved feasible and has confirmed routes with the master plan according to the Urban Railway Act. The same rate of financial support to the construction cost is applied based on the total project cost regardless of heavy or light railways, for example, up to 40% in Seoul City, and up to 60% in other local governments. However, in principle, the government does not provide financial help for operational costs. When municipalities are lacking the financial resources to deal with railway project debt, the support to new projects or projects in process could be reduced or postponed. The debit paying ability can be determined to see if a local government is able to cover more than 30 - 40% of its own costs.

And the financial subsidies for a central government-initiated project are borne 75% by the nation and 25% by a local government.

Development Gains Restitution

In 1989, the president ordered to find measures to capture the development profits incurred through the subway construction and the public development. The development of land or city was a planned high-density development to maximize the efficiency of land use, thereby inevitably creating traffic demand. In case of large-scale cities, there were limitations in meeting traffic demand by expanding road transport facilities. Thus, it was essential to construct a subway line passing through the development area. In case a part of the subway construction cost comprised the land development, it could lead to increases in housing land prices. However, as most of the development areas were undeveloped green spaces, the cost for housing land development was relatively low and the development induced new traffic demand, which did not exist before. In that sense, the development gains restitution was considered reasonable.

Based on this principle, when Seoul city developed phase 2 subway construction, the construction cost was reflected on the housing land development prices of five development areas. The rate of the subway construction charge out of the development cost depended on projects, but it was 10% on average.

A similar method of the development gains restitution was applied to metropolitan subway projects. As the large new towns such as Ansan, Sanbon, Bundang, and Ilsan. were built outside Seoul in the 1980s, it was required to have railway facilities connecting Seoul and these towns. Therefore, public entities, new town developers, shouldered most of the construction costs for the metropolitan subways.

Figure 8.14. New town development and connecting railways

Ilsan new town | Ilsan line

Meanwhile, in 1999, the government enacted the Special Act on the Management of Intercity Transport in Metropolitan Areas to solve the transport problems in the metropolitan areas efficiently at a broader level. According to this Act, any developer who performs a housing land development project, urban development project, housing construction project, etc. in the metropolitan areas is obliged to pay the metropolitan transport facility charge, which goes to the construction or improvement of the relevant transport facilities. And this charge can be used for the urban railway projects. For instance, the intercity railway lines such as the Gyeonghun line and Jungang line were financed by the metropolitan transport facility charge collected from the housing land development around the railway lines, and the Shinbundang line, developed as a PPP project, also received the metropolitan transport facility charge, accounting for the most of the financial subsidy (48%).

Private Fund Introduction

In the 1990s, for the promotion of the LRT projects, the government recommended the use of the third sector where local governments and private entities work together. And the relevant legal systems were revised to attract the participation of the private companies. Against this backdrop, the LRT projects in Gimhae, Yongin and Uijeongbu areas were promoted, and private partners covered 50% of the total project cost. And the central and local governments shouldered their shares, based on the decided rate, of the rest of the project costs, except those of private companies.

At present, the development of the LRT project in the BTO form requires a private developer to bear more than 50% of the total project cost and secure the development charges up to 20% of the total project cost. However, in case of insufficient development charges, a local government should bear the cost.

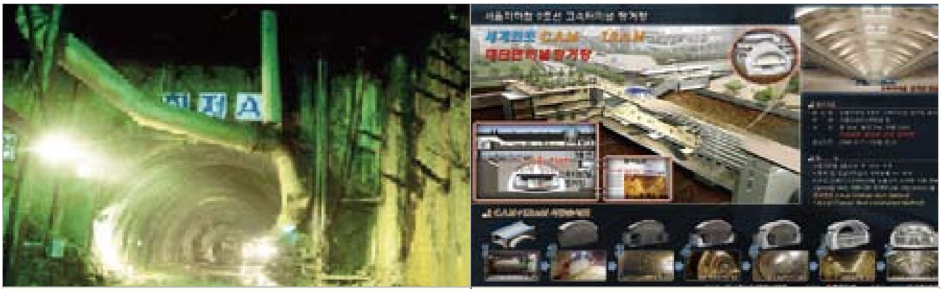
The government actively sought to introduce private capital to relieve the financial pressure on the projects for the central and local governments. In 1994, the Promotion of Private Capital into Social Overhead Capital Investment Act was enacted to give support for the systematic implementation of the private investment. In 1999, the Minimum Revenue Guarantee (MRG) scheme was introduced, under which the local governments are allowed to subsidize the differences in the event that actual operating revenue fell below 90% of the projected revenue specified in the Implementation Agreement. Based on this scheme, the LRT projects in Gimhae, Yongin, Uijeongbu areas were promoted as PPP projects. However, as the actual operation revenue is lower or expected to be lower than the projected value, they are putting a financial strain on the governments.

Technical Development

As a subway project requires a well-balanced combination of various technologies such as civil engineering, architecture, electricity, signal, communications, and vehicles, it is essential to have expertise in each sector. Therefore, it was quite a tough challenge for Korea, which did not have any experience of the design and construction of subways. In particular, because when there occurred a mistake in building an underground subway, it was not easy to make corrections. Accordingly, exact and precise construction was required.

In the process of civil works, there existed technically difficult sections. For example, during the construction period of Seoul subway lines 3 and 4 in the 1980s, there were buildings and underground utilities concentrated near the roads of the construction sections in the city center. And Busan subway line 1 had difficulties in excavating an area located below sea level, and Seoul subway line 5 also had a

Figure 8.15. Seoul subway construction process



Subway line 5, tunneling under the Han River	Subway line 9, Express Terminal station construction

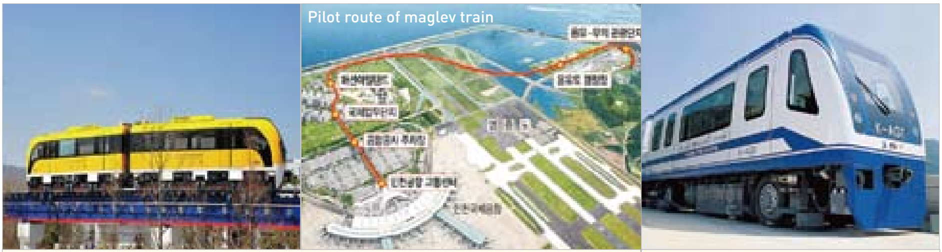
section passing through below the river-bed level. And when Seoul subway line 9 was constructed, there were obstacles in a section for the express terminal station, but with the help of the advanced technology, the construction ended successfully. Such experience in the technical development of subway construction helped Korea's civil engineering technology advance to the highest level.

At the time of opening Seoul subway line 1, the rolling stock comprised imported products made in Japan. However, in expectation of the demand increase of rolling stocks, the government focused its efforts on securing the manufacturing technology. In 1972, the government planned to initiate the development of domestic rolling stock, but as private companies showed their willingness to get involved, the rolling stock development was passed on to them.

In 1976, the first rolling stock made in Korea was composed of only 28% of domestic components. As the subway projects were continuously promoted, most of the parts, except for the main technologies, were localized. In the 1980s, as a part of efforts to encourage the use of local products, the imported parts to be used in rolling stock were forced to pass through the approval process of the Ministry of Commerce and Industry. And in the 1990s when Korea's technology level improved to a certain degree, it was obligatory to utilize more than 50% of local parts in making rolling stock for Seoul subway line 6.

Entering the 2000s, as the demand for LRT increased, the government promoted a project for the national research development for the various LRT systems such as rubber-wheeled AGT, urban magnetic levitation (Maglev) trains, trams, etc. And for their commercial use, the government has constructed pilot lines for operation

Figure 8.16. Domestically developed LRT systems



Urban maglev | Rubber-wheeled AGT

and recommended the use of local products. For example, the urban Maglev train uses a powerful magnetic field to float above the rails, causing less noise, friction and vibration than the conventional ones, and its pilot line is under construction around the Incheon International Airport. On its completion, Korea will become the third country where a Maglev train starts commercial operation.

Optimum System Selection

As an urban railway project required huge amounts of investment, it was planned at an optimum scale fit for the size of a city. In the case of subways, especially, when stations are located underground, the construction involves fairly huge project costs. Therefore, the stations were designed considering traffic demand. The government has drawn up the guidelines for construction, taking into consideration population, traffic demand, financial conditions, etc, and encouraged municipalities to plan optimum railways.

The guidelines specify the standards for population, traffic demand and financial conditions. According to the guidelines, in principle, the heavy rail transit falls on a city with a population of over one million, and if passenger volume within 10 years of opening is expected to be 40,000 per hour per direction at peak hours, large trains will be reasonable, and medium trains for 20,000 passengers. And LRT applies to a city with a population of over 0.5 million, and passenger volume within 10 years of opening is expected to be 10,000 per hour per direction at peak hours.

However, there are some subway lines that fail to meet governmental standards because of the overestimated demand in the process of planning.

At present, when compared to the train systems and the size of the train set of the urban railways in operation in the metropolitan cities, the carrying capacity per train set has gradually decreased. Although this fact reflects the size of city and traffic demand volume, it does not imply that the current system and the size of trains are the most suitable for the relevant cities, considering the passenger volumes of these lines.

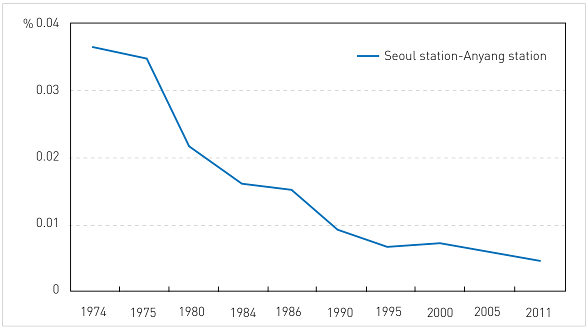
Table 8.10. Trend of the rolling stock size of urban railways in operation

Opening period	City	Lines	Rolling stock	1 Train set (cars)
1970s	Seoul	Line 1	Large	10
1980s	Seoul	Lines 2-4	Large	10
	Busan	Line 1	Medium	8
1990s	Seoul	Lines 5-7	Large	8
		Line 8	Large	6
	Busan	Line 2	Medium	6
	Daegu	Line 1	Medium	6
2000s	Seoul	Line 9	Medium	4
	Busan	Line 3	Medium	4
	Daegu	Line 2	Medium	6
	Incheon	Line 1	Medium	8
	Gwangju	Line 1	Medium	4
	Daejeon	line 1	Medium	4
2010s	Busan	line 4	Light	6
		Busan-Gimhae line	Light	2

Fare Policy

The subway fare system was based on the distance travelled from 1974 at the time of subway line 1 opening until the introduction of AFC system in 1985, because although the subway line 1 was only eight km long, it was directly connected to other metropolitan subways, which had a distance-based fare system.

Figure 8.17. Railway fare vs. GDP per capita



After Seoul subway phase 1 was completed in 1985, the number of stations increased. So, it was necessary to simplify the complicated fare system. Accordingly, Seoul City introduced a zone-fare system for application inside the city. And in outside areas, the basic fare and the additional fare per five km were applied. However, the fare system incurred problems such as complaints about zoning and frequent fare changes whenever new lines opened.

As a part of bus reforms in 2004, Seoul City has introduced a unified, coordinated fare structure that integrates both bus and subway services to promote the transfer discount. As of 2011, the basic fare within 10km is 900 KRW, when paying with transit card. And additional 100 KRW is charged for every five km after exceeding the first 10km. Free transfers within five times are permitted between subway and buses. Meanwhile, urban railways running in local cities have more simple fare structures such as the zone rate system or the uniform rate system, because there is no intercity railway.

Under the current Urban Railway Act, in the event that a railway operator determines or changes the fare, it should be done within the scope prescribed by the head of municipality, following which the result should be reported to the head. In this case, the operator should determine or change the fare reasonably considering the cost and balance with other transport modes such as buses, and notify the changes in advance. It is because the urban railway is a daily mode of transport for citizens that political intervention is necessary in the light of the transport welfare and price management. Due to such intervention, the rate of railway fare as a portion of GDP per capita is on the decrease.

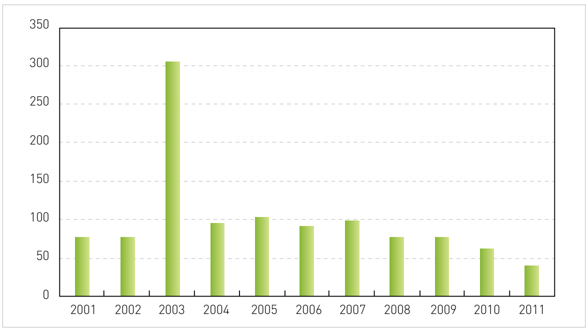
Safety Policy

Many negligence accidents occurred in the initial stage of the construction works for Seoul subway phase 1. As many as 133 workers died during the construction, and the causes of death were electrocution, cave-in, slope collapse, etc. The accident rate was high within two or three years of construction. Major accidents such as cave-in and slope collapse took place when the safety inspection and reinforcement works were not carried out sufficiently in the process of ground excavation and rock blasting. This caused cost increases and schedule delays as well as human and material damages. Such accidents happened again during the construction for Seoul subway phase 2. For example, while building subway line 5, there were 55 fatalities and among them, 35 were dead within three or four years of the construction. The main causes were fall from heights, objects falling and construction equipment accidents.

After the accidents took place, the construction companies took the responsibility for safety management, so they rearranged the safety management structure, enhanced the inspection activities, then promoted safe construction based on the principle of 'safety comes first.' Also they established standards for obstacle-passing areas, water and sewage, reinforcement works, and excavation and blasting based on block method, then carried out fault-free construction. And the safety education and tests for workers were implemented to raise safety awareness.

Meanwhile, in Daegu in year 2000 there was a huge fire disaster in subway line 1, causing 192 deaths and 148 injuries. An arsonist set fire to the train in operation. This accident highlighted the absence of a proper safety management system and the lack of the safety standards for rolling stock. Subsequently, the government strengthened the safety policies regarding equipment, rolling stock and

Figure 8.18. Trends of urban railway deaths



operation for urban railways. For example, the interiors of the train cas of urban and intercity railways have been replaced with non-combustible materials. These efforts have decreased the safety accident during the operation by a great margin.

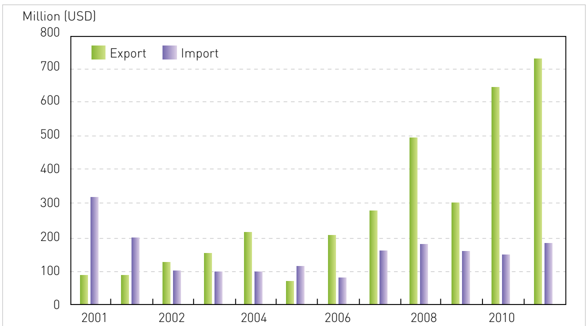
05
Evaluation and Conclusions

Evaluation

Since the 1970s, the government has continuously supplied the urban railways to cope with the transport problems incurred in the process of rapid industrialization and urbanization. As of the end of 2011, 19 lines were in operation and the length amounted to 571.6km. The urban railways in Seoul city are 316.9km long with nine lines, and current intercity railways in operation are 554.2km long with 12 lines. The operation of the urban railways helps to ease traffic congestion by shifting traffic demand from roads to railways. Also, as the railway operation is not subject to weather conditions, it plays an important role in substituting for cars in the event of unusual weather conditions such as cold waves in winter and heavy rains in summer.

After the first rolling stock was manufactured in Korea in 1976, the relevant technology level has continuously improved through the technology localization policy. And the government keeps sponsoring research development projects for the railway technologies. And private companies play a leading role in developing new technology, and apply it to the construction and operation of railway. In

Figure 8.19. Export trend of domestic railway products



the end, these efforts have raised the relevant technology level to world class. And based on these technologies the nation's railway-related exports have been rising steadily.

Conclusions

As the domestic and foreign cases show, most urban railway projects are developed by municipalities, because the railway runs within the city. However, railway construction costs an enormous amount of money, so the role of the central government is very important in promoting the projects in developing countries. In particular, financial support at a national level is essential.

For example, when the construction of Seoul subway line 1 suffered under the poor financial conditions, the government acquired foreign loans effectively. Also, it is worth considering that the central government supports the repayment of subway bonds issued by a municipality. However, as the LRT projects, which have been developed as PPP projects, suggest, if the government gives too much incentives to the project developers to attract foreign or private capital, it could have adverse effects. Therefore, it is necessary to thoroughly review the feasibility of projects and arrange relevant systems for the development of the railway projects with external capital more efficiently.

It would be better for the railway projects for new lines or line extension to be developed together with housing land development projects. As the success of the housing land development depends on the establishment of transport infrastructure, project developers on behalf of future beneficiaries (land or house owners in relevant areas) can bear some part of the project cost, thereby greatly reducing the financial burden of the central and local governments. However, the introduction of such a policy requires reviewing the aspects of the housing and urban development as well as transport aspects.

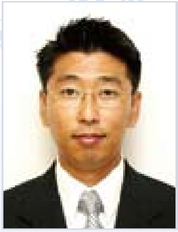
Urban railway projects can be seen not as a single process but as the combination of various technologies including the construction sector. If a nation continues to develop railway projects, it is essential to promote self-reliance in technology to cut down the construction and operation costs. Therefore, if a nation is lacking the relevant technology, it is advisable to come up with plans to receive technology transfer or training programs from other countries during the process of the project development.

Urban railway projects require the establishment of a competitive business plan to meet the users' needs. Unlike in the past, as private car ownership has become popularized, competition between road and railway has arisen. Therefore, it is necessary to strive to create ongoing demand for railway services. For instance, in the metropolitan areas, as most railway lines do not provide express service in reality, the longer travel distance tends to lower the competitiveness of railway. And in the local cities, lower than estimated passenger volume causes the operation deficits as well as low railway share. Of special note, in case of the LRT projects developed as PPP projects, there are cases where the government is supposed to make up for the deficits of the private developers. This means that the government planned railway lines with less competitiveness, or introduced a railway system inconsistent with selection criteria. Therefore, it is essential to set up a plan for the construction and operation of the railway project to maximize the effects of the railway system, taking into accounts the transport policies including transport connecting system, traffic demand management, etc.

Recently, as the environment and energy issues come to the fore in the world, the railway modes including urban railway have received increasing attention and importance. In this regard, for any developing nation seeking economic growth, it is worth reviewing the establishment of the urban railway infrastructure to address the traffic problems and realize the economic growth potential. It is a very unique case that Korea experienced a quick transition from developing to developed country in the urban railway sector as well as the economic sector. Therefore, the experiences Korea went through regarding the urban railway development would be good examples for developing countries to learn from.

CHAPTER 9

ITS (INTELLIGENT TRANSPORT SYSTEMS)



Jae-Joon LEE
Associate Research Fellow, The Korea Transport Institute

01

Introduction

Definition and Functions of ITS

Definition

The Intelligent Transport Systems (ITS) encompasses the application to the transport network of technology such as communication systems, control, and information processing technology.

According to Article 2 of the National Integrated Transportation System Efficiency Act (No.11020), the term ITS refers to “the transport system to improve the efficiency and safety through the automated and scientific methods of the operation and management of transport system by adding transport information and advanced technologies, such as electronics, control, and communications, to

Figure 9.1. Definition of ITS

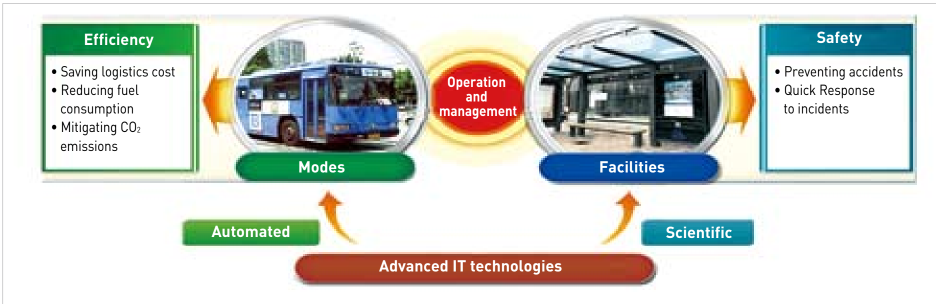
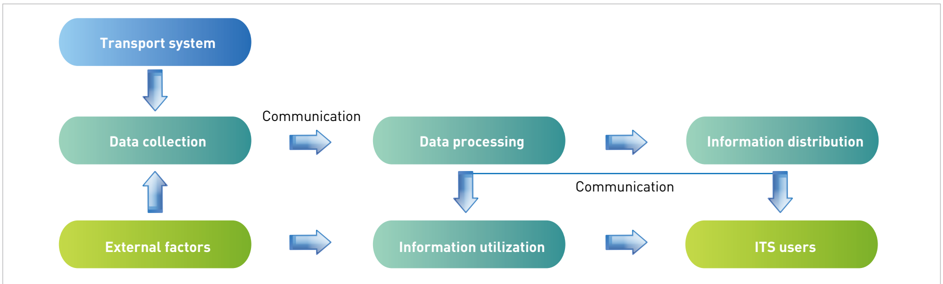


Figure 9.2. Structure of ITS



transport infrastructure and vehicles."

ITS is defined in the Act as the application of advanced technologies to transport facilities and modes, and consists of four factors and communication technologies connecting functioning factors.

Table 9.1. Functions and roles of ITS

Functions	Roles
Data collection	Collecting data about the operation status of transport facilities and modes, weather conditions, etc
Data processing	Analyzing collected data, and producing transport information and control information
Information distribution	Providing transport information and control information to travelers and operators
Information utilization	Controlling traffic management systems and vehicles by utilizing control information
Communication	Data exchange among ITS components

ITS helps users and operators to make more reasonable decisions about traffic conditions based on collected and distributed real-time information. And, through the public transport management it improves punctuality and offers operation information, and also facilitates the automatic payment for road charges and public transport fares. ITS, providing real-time information, scientific decision-making, and rapid and precise information processing, can help save time and money for travelers, reduce casualties from accidents, and decrease energy consumption and

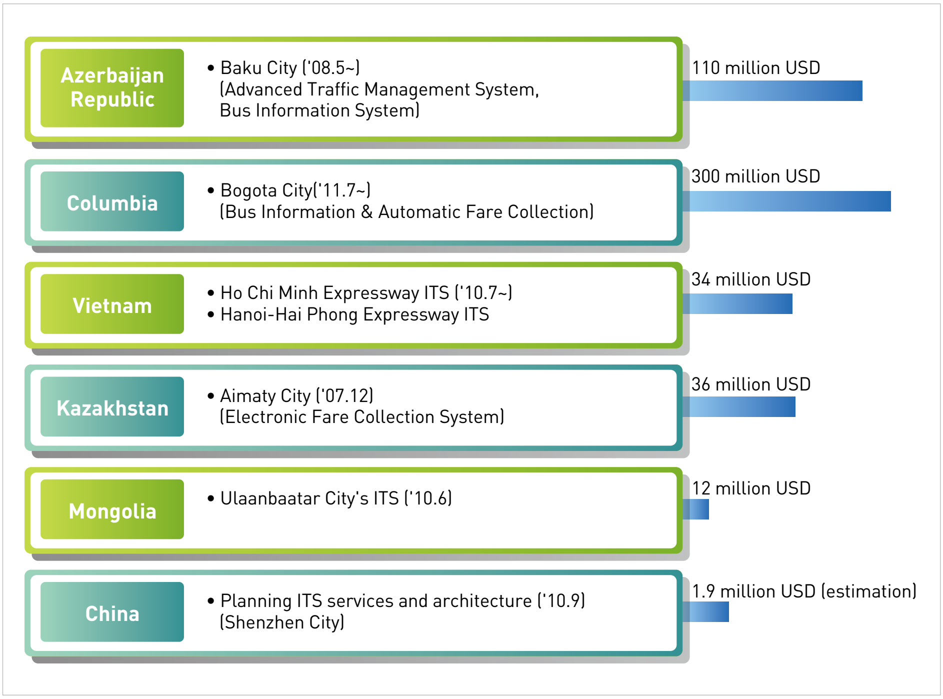
Figure 9.3. Roles of ITS

pollution caused by transport activities. Therefore, ITS is very important in that it can improve the efficiency of the existing transport systems and enhance traffic safety.

Roles of ITS in National Economy and Development

As all eyes of the world are fixed on the environment, ITS is drawing attention as a green technology to resolve transport problems. In this regard, the security of ITS technology has a close relationship with the improvement of national competitiveness. In the midst of rising interest in ITS, in 2001, Korea chose the establishment of ITS as one of the major agendas of "Advanced Green City", one of 17 new growth engines of the nation. Also, ITS makes great contributions to sharpening the nation's competitive edge by developing a variety of ITS based on advanced IT technology and providing ITS services.

Figure 9.4. International exchange through overseas ITS projects



02

Establishment and Development of ITS

Establishment of ITS

Background

After the 1988 Seoul Olympics, Korea has witnessed rapid economic growth and continuous increase of social, economic, and cultural activities, thereby resulting in rising traffic demand. Such increases in traffic demand and car ownership caused traffic congestion and also led to various social problems such as traffic accidents, air pollution, and energy consumption. Before the introduction of ITS, the methods to solve these problems were to provide or improve transport facilities or modes. In other words, the efforts were mainly to construct new roads or railways, to expand congested roads or bus routes, and to improve the geometry and alignment of roads with frequent accidents. However, the supply of facilities or transport modes was not enough to meet continuously increasing traffic demand and especially due to insufficient budget and road sites, reckless road expansion hit limitations.

At the time of the introduction of ITS, the traffic congestion costs showed the trend of increasing by 2 trillion KRW annually from 18.5 trillion KRW in 1997. In 1998, the logistics costs as a percentage of GDP were 16.5%, relatively higher than 10.1% of the United States and 9.5% of Japan, which reflected the severe traffic congestion. Traffic accident deaths per 10,000 cars in 1998 were 8.3 in Korea, relatively higher than 2 of the U.S. and 1.4 of Japan, and traffic accident costs amounted to 11 trillion KRW. This was caused by the lack of transport safety facilities and the accident management system, which resulted in the necessity for the establishment of a safety system based on advanced technologies. Also, in 1999, the construction cost accounted for 14.4% of the national budget. And as the nation developed, other sectors such as welfare also required more budgets. Therefore, the government sought to find ways to utilize the existing transport systems more efficiently rather than to build more new ones.

Figure 9.5. Trends in traffic congestion costs

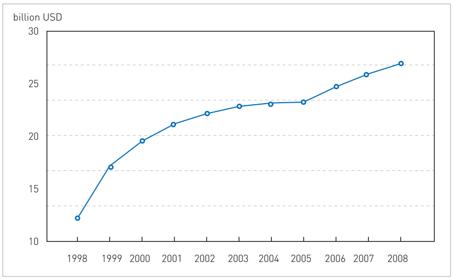
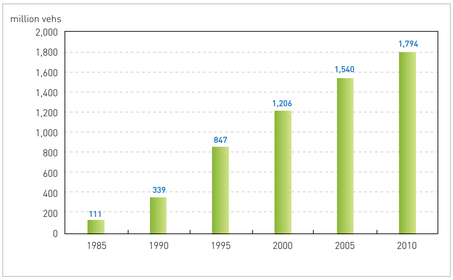


Figure 9.6. Trends of the number of cars



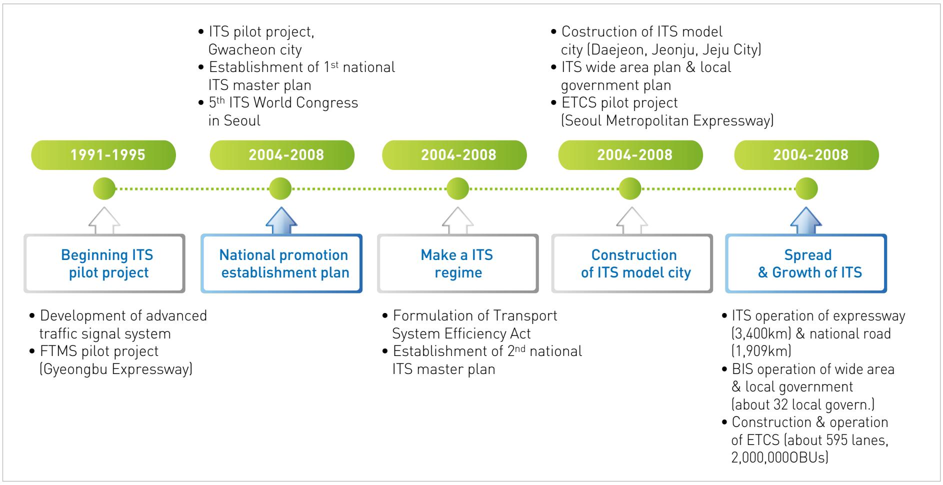
Along with this, the improved quality of life and developed state-of-art technology led to the diversification of people's needs. Therefore, it was necessary to draw up policies to satisfy new transport needs. In particular, the development of information and communication technologies facilitated the collection and distribution of traffic information, the real-time operation of transport systems corresponding to traffic conditions, and the provision of traffic information to help reasonable choices of modes and routes. And, as society sought a safer and more convenient transport system, ITS was introduced in the 1990s.

ITS Development

ITS Development Process

The ITS development process in Korea can be divided into two parts: before and after the Transportation System Efficiency Act. The Act, enacted in 1999, includes general articles about ITS. Before the Act was the time when ITS was first introduced and started to develop in technological and academic fields, and the pilot project was implemented in an area to evaluate the effects of easing traffic problems. On the other hand, after the Act, the government initiated the laying of the foundation for the introduction of ITS at a national level, and, as a part of these efforts, established a National ITS Master Plan. In this period of time, various systems were established. Also, local governments have earnestly adopted ITS, built traffic information centers, and offered a variety of ITS services for people's convenience.

Figure 9.7. ITS development process in Korea



Before the Transportation System Efficiency Act

In 1990, the Traffic Broadcasting System started to provide traffic information service at a basic level, and the introduction of ITS triggered research activities and technology development both in academic and private sectors. The Korean National Police Agency (KNPA) and the Korea Expressway Corporation (KEC) developed systems for the operation improvement and the traffic management of road transport, and promoted pilot projects.

From 1991 to 1994, the KNPA promoted ‘the development of an advanced traffic control system and pilot project,’ which controlled traffic signals at crossings based on current traffic conditions, rather than based on the TOD (time of day) operating mode with a pre-specified traffic signal timing plan and sequence. In 1997, the pilot project was implemented in 61 sites on 10 axes in the Gangnam area (southern part of Seoul) to check the validity of the system and real-time traffic control. Also, the KEC promoted a pilot project for ‘Freeway Traffic Management Systems (FTMS)’ from 1992 to 1994 to offer the electronic variable message sign (VMS) service on expressways to give travelers real-time information about traffic congestion, accidents, and incidents.

In 1993, the SOC Investment Planning Board reviewed the ITS introduction, following which the Ministry of Construction and Transport (MCT, now the Ministry of Land, Transport and Maritime Affairs) led the project. In 1997, the government set up the ITS master plan and applied its pilot program to Gwacheon city to evaluate relevant technologies. And the 5th ITS World Congress was held in 1998. In Korea, the central government played a key role in the ITS projects by supporting research and development for its establishment and operation. And in 1999, the government legislated the Transportation System Efficiency Act to secure an institutional framework for the project's promotion.

Figure 9.8. KEC's freeway traffic management systems (FTMS)

Figure 9.9. 5th ITS World Congress in Seoul

After Enactment of the Transportation System Efficiency Act

After the enanctment of the Transportation System Efficiency Act, the government exerted efforts to promote the ITS projects and established the 'ITS Master Plan 21' at a national level, and the 'ITS Plan for Five Major Cities' and other medium- and long-term plans for municipalities. Also, as a part of leading projects, the MCT designated Daejeon, Daegu, Jeonju and Jeju as ITS model cities. The purpose of this project was to present the basic framework for the ITS project and evaluate the effects of ITS in the city center, thereby encouraging local governments to introduce the ITS system. It sought to provide a model to promote

Figure 9.10. Daejeon, Daegu, Jeonju, Jeju ITS model cities

the ITS project by performing all-encompassing process that involved master plan planning, design, operation, evaluation, considering characteristics of local cities. Besides, the MCT has established and operated a national road traffic management system.

Since 1995, the KEC and the MCT had checked out the validity of automated toll collection system to reduce inconveniences such as stopping at the tollgates and cash payment. After three years of system development and tests, in 2000, they installed the system and operated the so-called 'Hi-pass' program at Cheonggye, Pangyo and Sungnam tollgates. And after fixing some problems regarding communications standards, they have expanded the operation the Hi-pass system nationwide since 2006.

Local governments introduced mainly the Bus Management System (BMS)/ Bus Information System (BIS) as a part of ITS. The MCT supported local governments to connect their own BIS one another, which enabled customers to receive information regardless of administrative units bus companies belong to.

Figure 9.11. Hi-pass system

And for the efficient implementation of the ITS projects, since 2004 the government has established technical standards and promoted the standardization of ITS, and published

Figure 9.12. History of ITS policy in Korea

1993	ITS was initiated by the Blue House
1997	Establishment of 1st national ITS master plan
1998	Establishment of "ITS Model Cities" – Gwacheon city (75 million USD)
1999	Enactment of "Transportation System Efficiency Act"
1999	Development of national ITS architecture 1.0
2000	Establishment of national ITS master plan for 21st Century
2009	Amendment of "National Integrated Transportation System Efficiency Act"
2010	Development of national ITS architecture 2.0
2011	Establishment of national ITS master plan for 2020

various guidelines and manuals, and set up national ITS architectures. Also the 'Transportation System Efficiency Act (1999)' was amended to the National Integrated Transportation System Efficiency Act (2009), which created a larger legal framework for ITS and, and the 'National ITS Master Plan 2020' was enacted.

ITS-Related Policies

In general, ITS-related policies can be categorized into three parts: ITS national master plan, Transportation System Efficiency Act, and National ITS architectures.

National ITS Master Plan

The government, which was fully aware of the necessity for the ITS introduction, devised a plan for the ITS introduction and implementation at a national level. It established the 'National ITS Master Plan' in 1997 to present

Figure 9.13. Step-by-step strategy in the 'National ITS Master Plan 21'

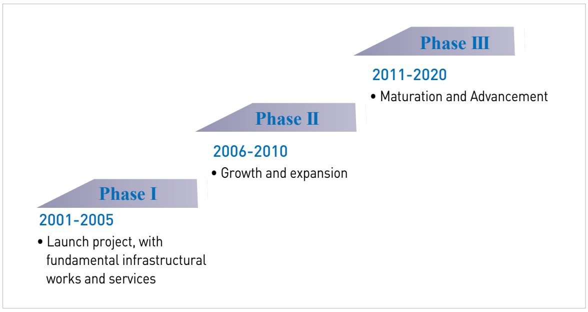
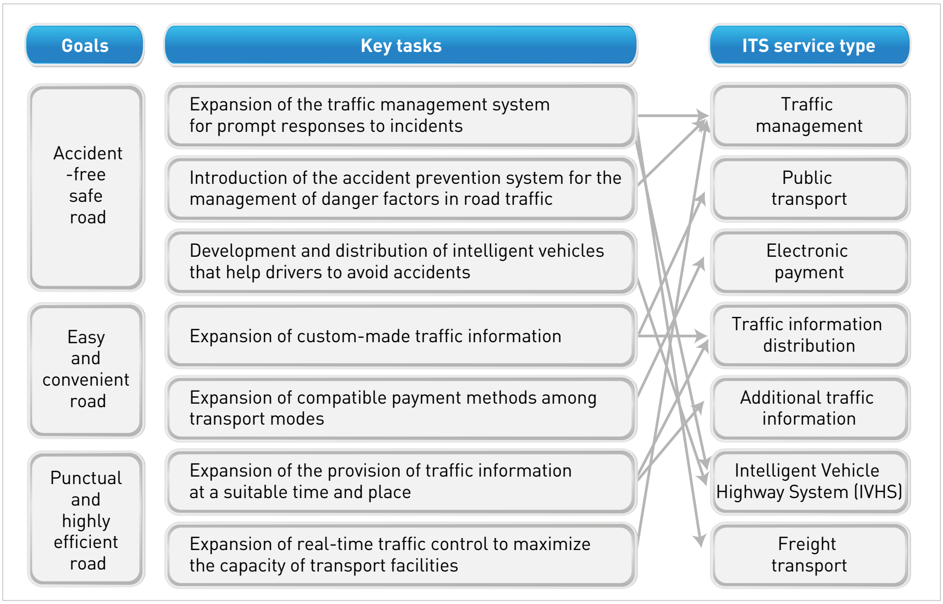


Figure 9.14. Car-road transport sector key tasks and service types (ITS Master Plan 2020)



basic directions for the efficient development of the ITS projects, and in 2000 set up the 'National ITS Master Plan 21' for 20 years from 2001 to 2020. The National ITS Master Plan presents basic strategies including goals, systems, procedures and directions of the project development, and also basic directions and financing plans to build up the foundation. The 'National ITS Master Plan 21' consists of seven ITS service sectors, 18 services, 62 unit services, and presents goals and strategies in three steps.

In 2011, the 'ITS Master Plan 2020,' which was updated from the previous master plan, embraced key tasks for the ITS establishment and operation by sector such as car-road, railway, marine and aviation transport. The car-road transport sector set up goals of 'accident-free safe roads,' 'easy and convenient roads,' and 'punctual and highly efficient roads,' and presented key tasks and the ITS service types to achieve these goals.

Transportation System Efficiency Act

The Transportation System Efficiency Act was enacted in 1999 to promote investment planning and assessment, intelligence for transport facilities to enhance the comprehensive coordination among transport policies, and to secure financial resources for the expansion and management of the transport facilities. Pursuant to the Transportation System Efficiency Act, the 'National ITS Master Plan 21' was established. And the Act prescribed the establishment of execution and implementation plans and ITS standardization. The Transportation System Efficiency Act has a significance in that it laid the legal and institutional foundations for the ITS development at a national level.

In 2009, the National Integrated Transportation System Efficiency Act was enacted to improve the efficiency, integration and connectivity of the transport system. The Act specifies the requirements for the comprehensive coordination of policies for road, marine and aviation transport systems, and for the efficient planning, operation and management of the national transport system. This Act aims to enhance people's convenience and boost the national economy through the amendment, providing more details. And according to the Act, the ITS Master Plan should be updated every 10 years and cover standard certification, quality certification, performance test, and establishment of national integrated ITS center.

National ITS Architecture

ITS is a new system connecting transport technology with information and communication technologies. As public and private participants in the ITS projects could have different understandings about the system to establish and operate for the service provision, it is hard to define the project scope. Therefore, when various developers establish the systems, suitable for their needs, it is difficult to share information because the systems are separated regionally and functionally, and also the level of equipment compatibility could be low. Therefore, it is necessary to secure the interoperability and compatibility of the system, which facilitates information sharing and the efficient use of the system components, regardless of who made or operates the system. In this regard, the national ITS architecture was established to secure the interoperability and compatibility of such systems. The architecture is a basic framework for the structures, functions and roles of ITS prescribed in the National Integrated Transportation System Efficiency Act.

The national ITS architecture is a kind of big picture showing the functions and components of the systems each developer wants to plan, design, establish and operate, and correlations with other systems. It offers the foundation to secure the interoperability and compatibility of the system at a national level, and supports planning and design, and prevents overlapped service areas and service blind spots.

The national ITS architecture divides ITS services from the user's point of view, chooses what ITS system a developer should establish and operate for service provision based on the analysis of divided services in technical and logical aspects, and covers the technical specifications of the chosen system.

Table 9.2. Components of the national ITS architecture

Classification	Contents
ITS service	• Classifies and describes ITS services from the viewpoint of a customer
Logical architecture	• Analyses services functionally • Provides functions and data flow for the service provision
Physical architecture	• Analyses services physically • Provides physical components and data flow for the service provision
Biz. architecture	• Sets up business units (systems) for the service provision

03
Current Status of ITS in Korea

ITS in Korea

Based on the National ITS Master Plan, a variety of the ITS services are operated in Korea, including traffic management, public transport service, electronic payment, traffic control center, traffic information, etc.

All expressways in Korea (total length 3,906km) are all equipped with ITS, currently providing basic information broadcasting service (BIBS), incident management service, and freeway traffic flow control service (FTCS). Also ITS is installed on 10% of national roads, comprising 2,552km out of 13,464km, and traffic information centers, established by the regional construction management offices, operate the system.

Figure 9.15. ITS services in Korea

Figure 9.16. ITS implementation in Korea

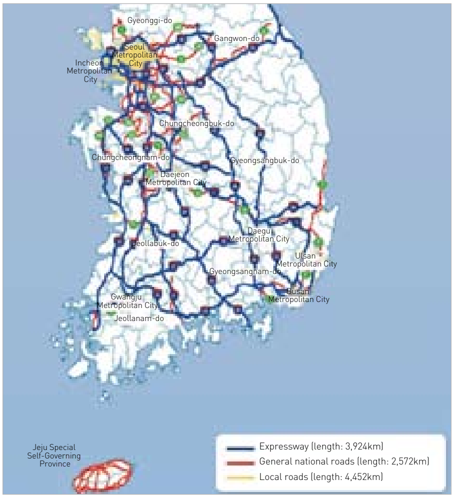


Figure 9.17. ITS operating cities

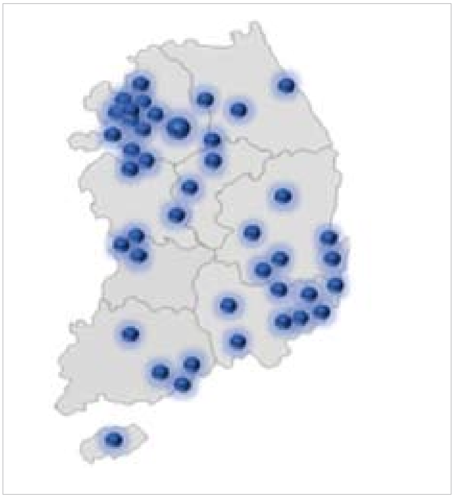
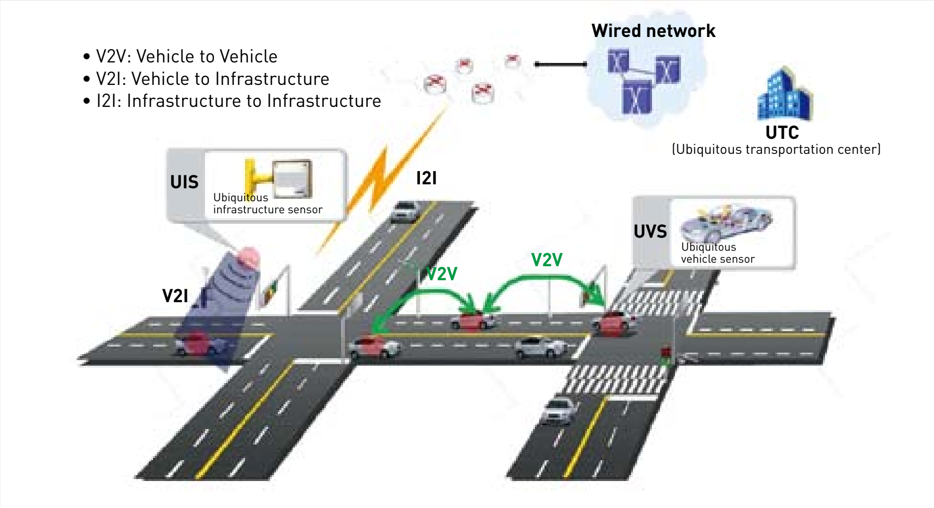


Table 9.3. ITS establishment by road type

Classification of roads	Total length (km)	Collection scope of traffic information (km)	Rate (%)
Expressways	3,906	3,906	100.0
General national roads	13,464	2,552	19.0
Local government roads	41,045	3,435	8.4
Total	58,415	9,893	16.9

Figure 9.18. Ubiquitous transport system



Except national roads managed by the central government, currently 44 local governments have established and operate ITS. They have constructed traffic information centers and provide services including traffic management, BIS, real-time traffic control, automatic traffic enforcement, etc.

From 2006 to 2012, KOTI has carried out a national R&D research on ubiquitous transport systems based on the advanced communication technology. The main purpose of the research was to develop base technology for realizing the ubiquitous transport system through collaborative work among industries, universities and research institutes. The research also deals with the development of on-board equipment (OBE) and roadside equipment (RSE) based on vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communications, real-time information service, and the development and evaluation of new services.

ITS Services and Advantages

Real-Time Traffic Information Service

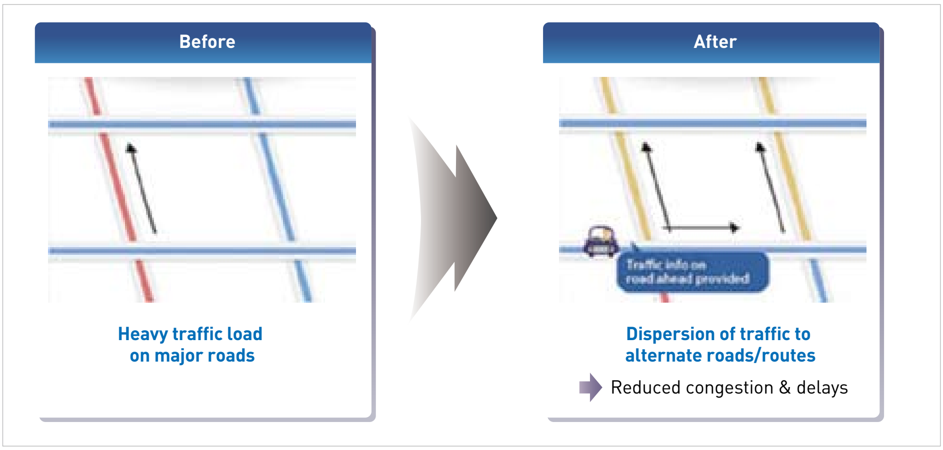
The traffic management collects data from roads and running vehicles, controls the traffic flow by using the roadside equipment for fast and safe movement, and

Figure 9.19. Process of the traffic information service (collection, processing, provision)

provides travelers with traffic information.

The traffic information service consists of three stages: collection, processing, and provision. Firstly, traffic information collection is a stage to collect traffic information such as traffic volume, speed, and occupancy through on-road vehicle detectors or CCTV. Secondly, the collected information is processed in a traffic information center to fit for operators and users. Lastly, the processed data is provided through VMS, the Internet or mobile. Based on such real-time information, road users can make a decision on the choice of route to their

Figure 9.20. Traffic dispersion by traffic information provision



destinations.

The biggest benefit of the real-time traffic information service is to disperse traffic volume, thereby reducing traffic congestion. As drivers obtain traffic information and change routes, high traffic volume on roads is dispersed into alternative ones, which results in alleviating traffic congestion and improving the efficiency of traffic flow.

Automatic Traffic Enforcement

The purpose of the automatic traffic enforcement service is to encourage lawful driving and improve the efficiency and safety of the transport system by controlling illegal driving and parking, which exert a bad influence on the transport system. The enforcement service aims at traffic light signal violation, speed limit violation,

Figure 9.21. Types of automatic traffic enforcement

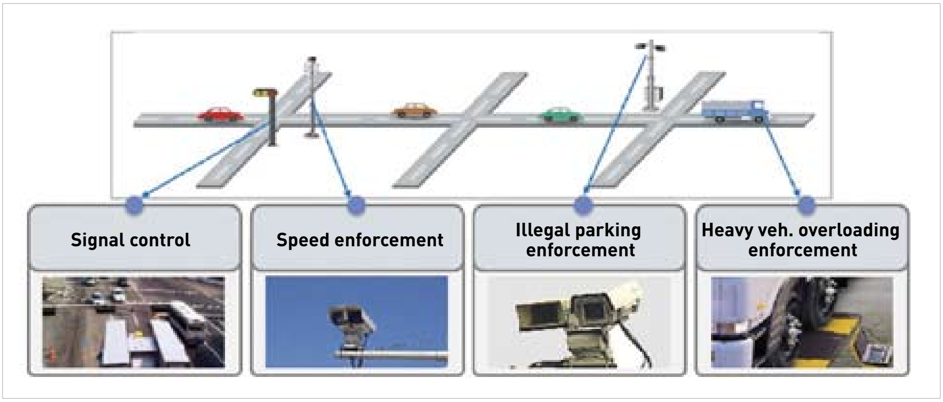


Figure 9.22. Process of the automatic traffic enforcement

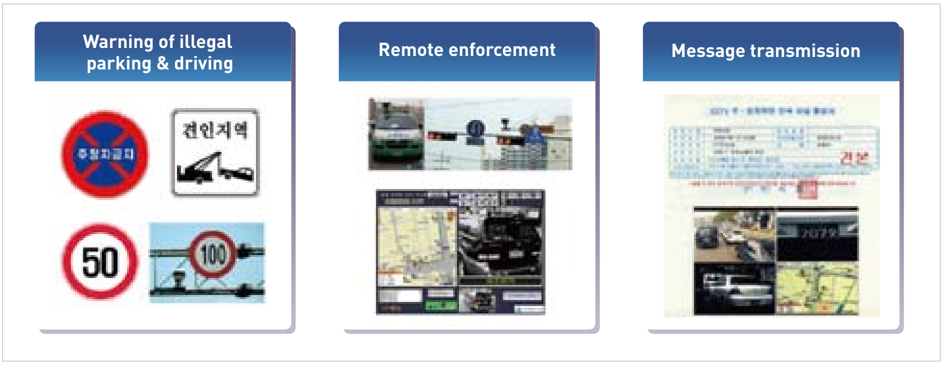
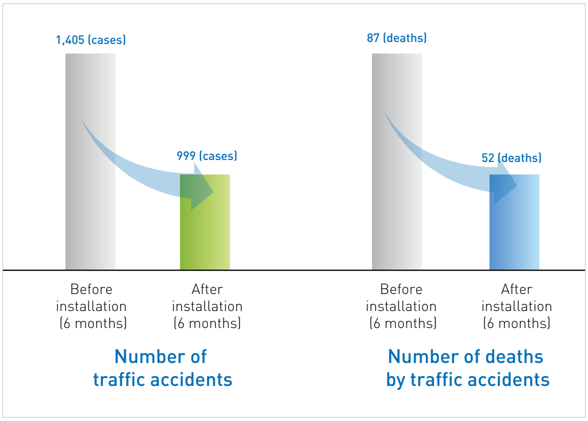


Figure 9.23. Effects of automatic traffic enforcement



illegal parking, overloading, and bus-only lane violation.

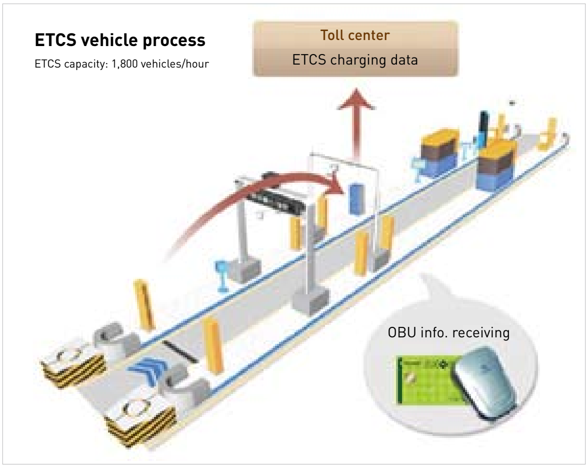
In an effort to encourage responsible driving behaviors, the automatic traffic enforcement service identifies, with the help of enforcement equipment, the number plates of running vehicles which violate speed limits or traffic safety facilities such as traffic lights, then issues tickets for fine payment.

Such a reinforcement leads to a decrease in the number of car accidents and deaths, and also the overall cost of traffic accidents. This enforcement service makes contributions to the improvement of overall traffic safety.

Electronic Toll Collection

Korea introduced the electronic toll collection system (ETCS), the so-called, Hi-Pass, which allows drivers to pay highway tolls without having to stop to pay. The electronic toll payment service saves delays and inconveniences to drivers and improves the efficiency of toll collection.

Figure 9.24. ETCS overview



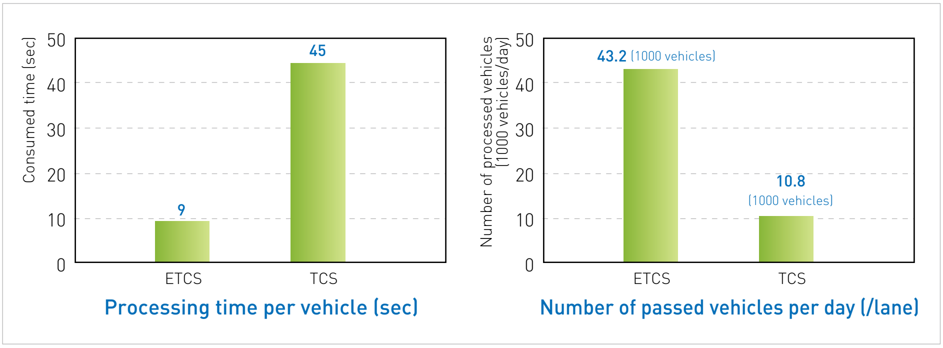
In Korea, the Hi-Pass system is installed at 344 tollgates. Currently, 5.6 million vehicles, 50.8% of the registered cars, use the non-stop toll payment system.

Table 9.4. Increasing trends of Hi-Pass use

Year	Total (Number of vehicles)	Use of Hi-pass (Number of vehicles)	Rate (%)
2007	4,649,682	730,000	15.7
2008	6,143,791	1,880,000	30.6
2009	8,076,010	3,400,000	42.1
2010	9,479,393	4,370,000	46.1
2011	11,023,622	5,600,000	50.8

Analyses showed that the introduction of the ETCS coped with traffic volume four-times higher than before, and led to an increase in travel speed and decrease in delays due to reduced stopping time at tollgates. Also the non-stop payment system reduced the environmental impact.

Figure 9.25. ETCS effects



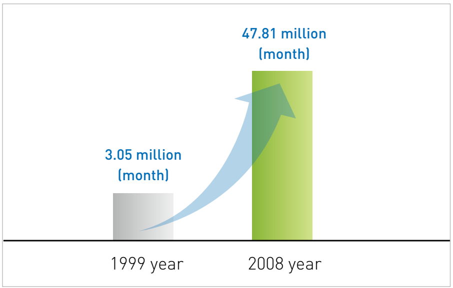
SMART Card (Electronic Fare Collection & Card)

Figure 9.26. Concept of SMART card

Korea has introduced the smart card system for the public transport to operate electronic payment of public transport fares. This smart card system enables users to pay public transport fares for bus, subway, taxi, etc. and other charges for the transport facilities like parking lots, thereby helping to improve the quality of public transport.

The smart card is being widely used by public transport users because it provides convenience and fare reductions as well. Also the card creates benefits such as the reduction in dwell time at bus stops and the transparent accounting of bus operations.

Figure 9.27. Increase of SMART card use



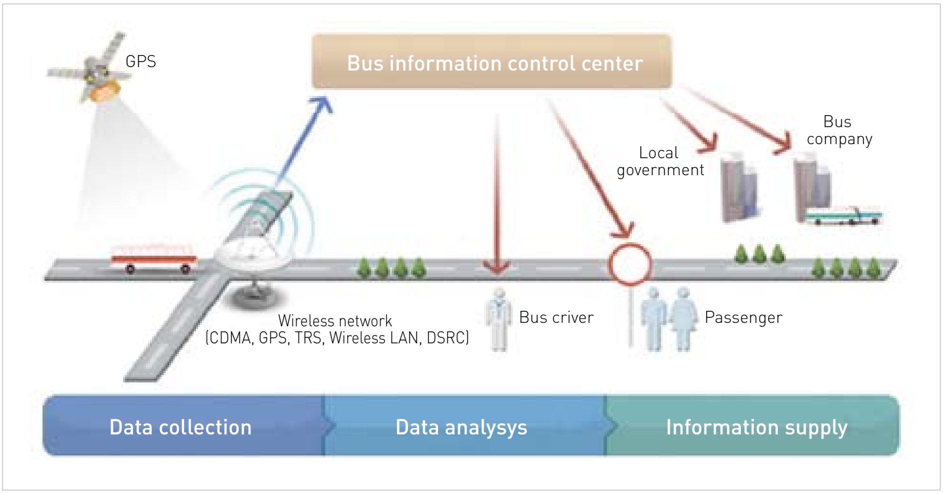
Bus Information System (BIS) and Bus Management System (BMS)

The BIS service collects, analyses and processes bus operation information, then provides the processed information to bus users for more convenience. And the BMS collects, analyses bus operation information to make buses run on schedule, and adjusts intervals in case of incidents or accidents, and performs the driver management, thereby improving the convenience and safety for bus passengers.

asted Graphic 28.bmp

Thanks to the improved convenience and safety due to the BIS and BMS

Figure 9.28. Overview of BIS and BMS



services, the number of bus passengers also increased. This implies that the upgraded public transport service leads to an increase in the share of its use by the public, which, in turn, decreases the traffic volume on roads.

Figure 9.29. Bus information terminal

04
ITS Policy Evaluation and Suggestions

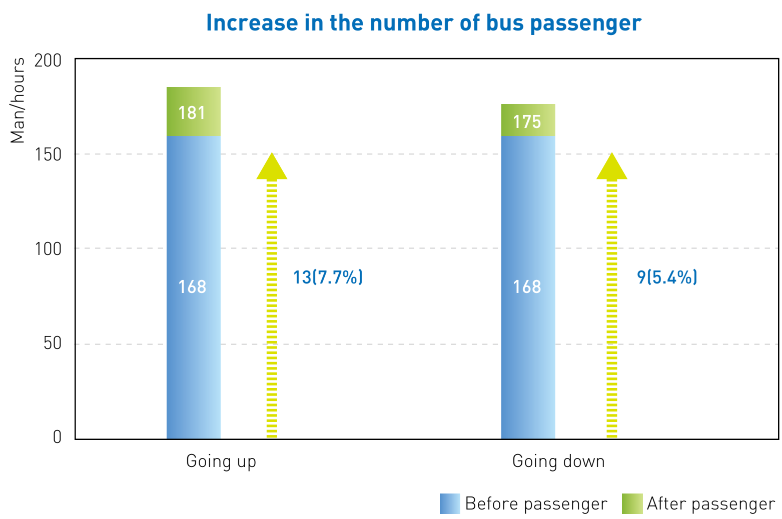
ITS Policy Evaluation

ITS Implementation Effects

In Korea, the central government's commitments and local governments' efforts were the main forces leading to the establishment of the foundation and framework for promoting the ITS projects. With legal and institutional support from the central government, the national-level ITS directions and targets have been established according to the National ITS Master Plan. And based on the abovementioned, local governments have implemented the projects consistently, maintaining connections with one another. Also, it is very important that the central government has developed the legal and institutional bases, from planning to technology standardization and to evaluation before/after the establishment, which facilitates the systematic development of the ITS projects at a national level. And, it is also notable that various public and private organizations with expertise have performed their roles in the ITS projects and maintained a complementary relationship.

Local governments have drawn up the ITS plans considering their own particular needs and characteristics, and implemented the ITS services systematically to address traffic problems, and kept developing the systems. Also in case of developing an ITS project over a wide area, the central government offered the financial support, thus making connections among local governments.

Figure 9.30. BIS effects

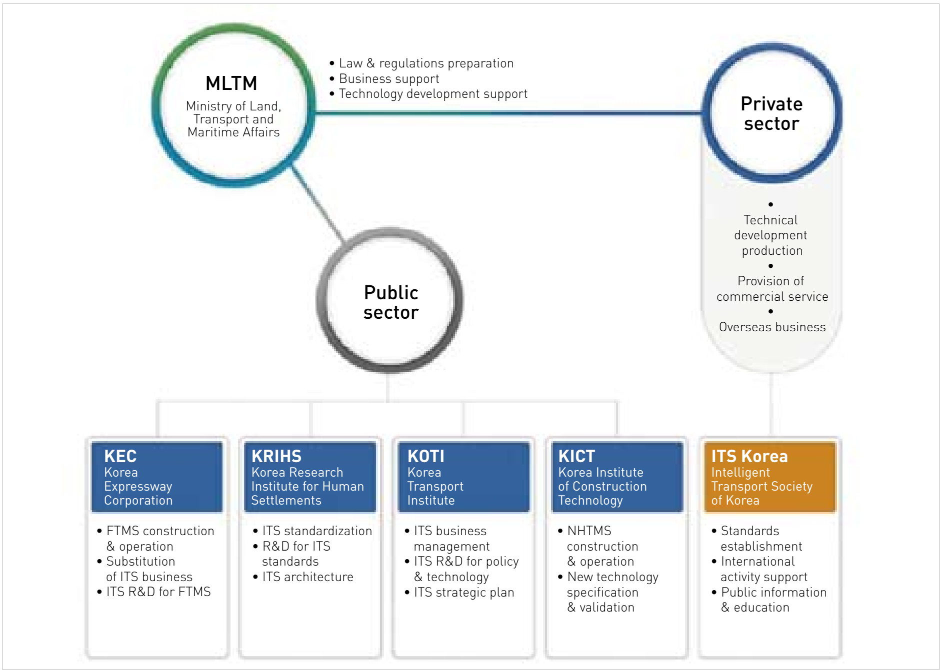


ITS in Korea, based on the advanced IT technology, has a technical edge through smart card, Hi-Pass, BIS, etc, and as the experts are booming, it makes a great contribution to the improvement of the national economy and competitiveness. Also the government has acknowledged the importance of expanding ITS at a national level, and announced the financial investment plan for it. Therefore the continuous expansion of ITS will progress seamlessly in the future.

Future Policy Improvements

In Korea, the establishment of the ITS project requires evaluation through a before-after comparison analysis. The effect evaluation is an important step, but because it is difficult to carry out an objective evaluation of each system, the comparison analysis as well as comprehensive evaluation are not easily performed. It is thus necessary to perform an objective evaluation of improvements after the ITS establishment, then encourage local governments to adopt the ITS programs by promoting policies including financial support. Also, it is necessary to create a database of the ITS projects, which are individually operated by local governments, to understand the ITS implementation status, and to utilize the relevant information

Figure 9.31. ITS related organizations



for system connection. Lastly, it is necessary to provide support for the creation of jobs through training programs or qualification license. for improving expertise and professionalism about ITS.

Suggestions

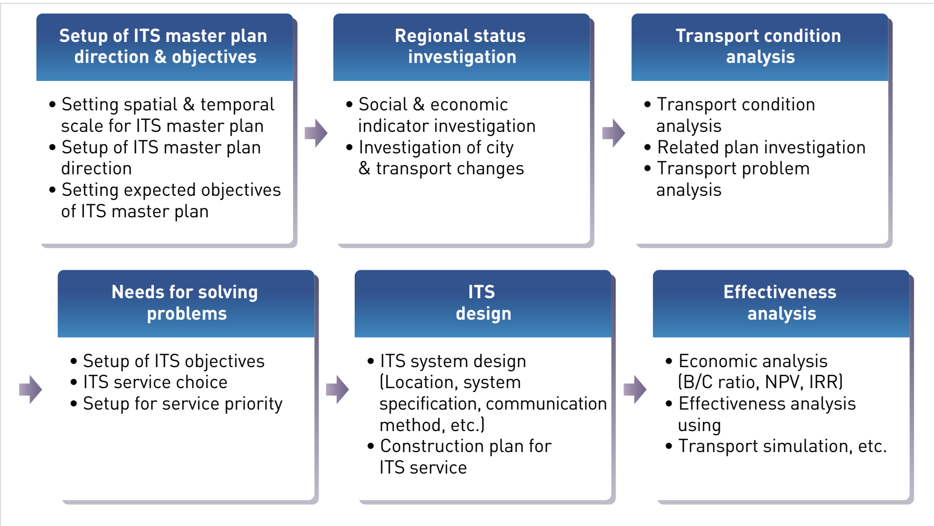
ITS is an essential means to address transport problems in many countries where reckless road expansion has often reached its limits and road transport is regarded as a red mode. ITS needs to be promoted nationally as a way to create a green road system, and systematically to reap the successful results. Also, governments that recognize the transport problems such as traffic congestion and transport safety as a social problem, should exert efforts to continuously introduce and expand ITS nationwide.

Korea introduced ITS in a way to solve transport problems caused by the

Figure 9.32. ITS Master plan hierarchy

economic development, and at the initial stage when the national framework was not established yet, FTMS (Freeway Traffic Management System) for expressways, and ATMS (Advanced Traffic Management System) for urban expressways, advanced signal system, etc. were implemented gradually to resolve the problems. However, if the individual systems are introduced indiscriminately before the establishment of directions and systems at a national level, problems could result such as overlapped investments and insufficient connection among systems.

Figure 9.33. Process of establishing the ITS master plan

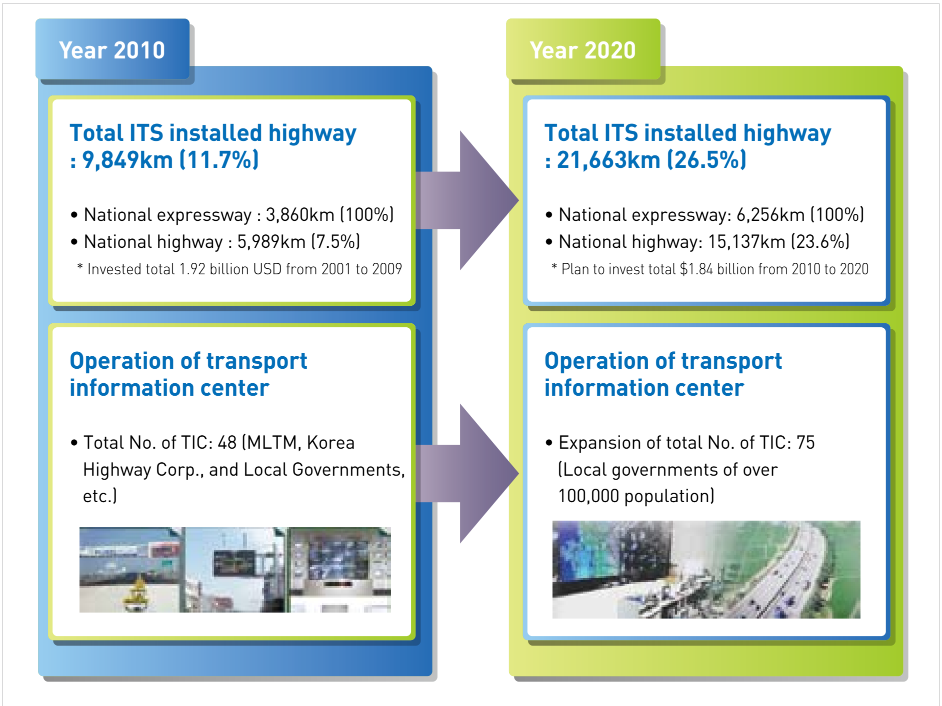


Therefore, it is essential to set up an ITS master plan suitable for the nation and regions. The ITS master plan should be established step-by-step by the hierarchy of plans: national plan, regional plan and city plan.

ITS is not just one unified system but a customized system installed where necessary. The establishment of the ITS master plan needs to reflect the regional transport problems, and set up targets and directions to solve the problems, then prioritize the ITS services to be introduced in the relevant regions. It is assessed that the requirements of successful ITS establishment are the legal and institutional supports based on the master plan suitable for the region. And the establishment of an ITS master plan at a national level is an essential prerequisite for the ITS introduction.

In the end, it is necessary to put efforts for the application of new technologies and the changing transport environment through technology sharing among the government and ITS-related organizations. In the future when more rapid and

Figure 9.34. Process of establishing the ITS master plan



precise information is required, the ITS development will make great contributions to the national competitiveness.

Future ITS Technology

The ITS installation rate on the arterial roads will be increased from the currently 14% to 30% by 2020, and the installation of road side equipment (RSE) for vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communications will be increased from 2,000 to 15,000 sites by a great margin. The analysis shows that the ITS operation would result in an increase of average travel speed by 15-20%, and a decrease of traffic congestion by 20%. And the ITS installation over 1,000km of road is expected to decrease 19,000 tons of CO_2. Also, in an effort to support such policies, the Ministry of Land, Transport and Maritime Affairs (MLTM) announced a plan to expand the investment for ITS to 2% of road budget by 2015.

Also, according to the MLTM, the traffic information centers, run by the MLTM, the KEC, and local governments, will be expanded to the local cities with a population of over 100,000, expecting an increase of centers from 48 to 75 sites.

In a ubiquitous society in the future, there will be an information communication

Figure 9.33. Process of establishing the ITS master plan

environment where information exchange and processing can be possible anytime and anywhere. ITS in a ubiquitous society will help operators and users of transport systems go beyond recognition, decision and behavior. In other words, through the ample and precise information, the rational decision-making process, and the automatic control of transport modes and facilities, future ITS will facilitate the rapid, safe and convenient use of the transport system. Also, all the components of the transport system such as public transport passengers, private car users, vehicles, roads, etc, will be equipped with intelligence and connected with communication networks, then perform optimum activities within the system. If the technology of vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communications to be developed in the R&D of the "Development of Base Technology for u-Transportation Systems" can be commercialized, more efficient and safer transport service than ever will be realized.

CHAPTER 10

ROAD SAFETY

Lyoong OH
Associate Research Fellow, The Korea Transport Institute

01
Introduction

In parallel with rapid industrialization and economic growth of recent decades in Korea, the volume increase of the motorization process has been equally significant and rapid: the current total number of motor vehicles is approximately 21.4 million (2010) which is about 40 times that of 1980. The inevitable consequence of such a rapid increase of the motor vehicles was the road accident statistics which reflect the road safety records of the past 3 decades.

The total number of the road accident fatalities in 1980 was 5,608 and it peaked to 13,429 in 1991 in just 10 years of rapid motorization. Since its peak in 1991, a rapid reduction in road fatalities has brought it down to 5,505 in 2010 by rigorous safety policy measures. Considering that the safety record improved in such a short period of time, especially despite the fact that the number of motor vehicles was still increasing at a fast rate, the Korean safety policy measures are exemplary to the developing countries who are experiencing similarly rapid industrialization and motorization processes.

Moreover, considering the significance of the economic cost of the road accidents (total cost of road accidents in 2010 is 1.11% of GDP) and safety-related investment budget (0.6% of the total national budget in 2010), formulating effective road safety policies is an important part of the larger picture of the transportation policy framework.

The early part of this brief summary report includes some road accident statistics, trends and characteristics. The second part of the report consists of the transportation safety management system and the government organization for safety planning. And the concluding part includes various policies and the road accident reduction targets and the likely issues of the future safety concerns.

02
Road Accident Statistics

Number of Accidents

The total number of road accidents reached the peak of 290,481 in 2000, then it decreased to 226,878 in 2010. The reduction of road accidents after 2000 mainly resulted from the following three factors: (1) the rigorous application of the seat-belt laws, (2) nation-wide installations of speed enforcement cameras and (3) the installations of median barriers on the national roads.

Table 10.1. Time-series of crash statistics

Year	Accidents	Fatalities	Injuries	Remarks
1970	37,243	3,069	42,830	Max. Fatalities Max. Accidents
1980	120,182	5,608	111,641	
1990	255,503	12,325	324,229	
1991	265,964	13,429	331,610	
2000	290,481	10,236	426,984	
2005	214,171	6,376	342,233	
2006	213,745	6,327	340,229	
2007	211,662	6,166	335,906	
2008	215,822	5,870	338,962	
2009	213,990	5,838	361,875	
2010	226,878	5,505	352,458	

Number of Fatalities

The number of fatalities reached the peak of 13,429 in 1991, then it decreased to 5,505 in 2010. These figures suggest that the number of fatalities reduced to 41% of the maximum between 1991 and 2010.

The reduction of fatalities after 1992 mainly resulted from the seat belt legislation and the strong government road safety campaigns.

Figure 10.1. Variation of fatalities over time

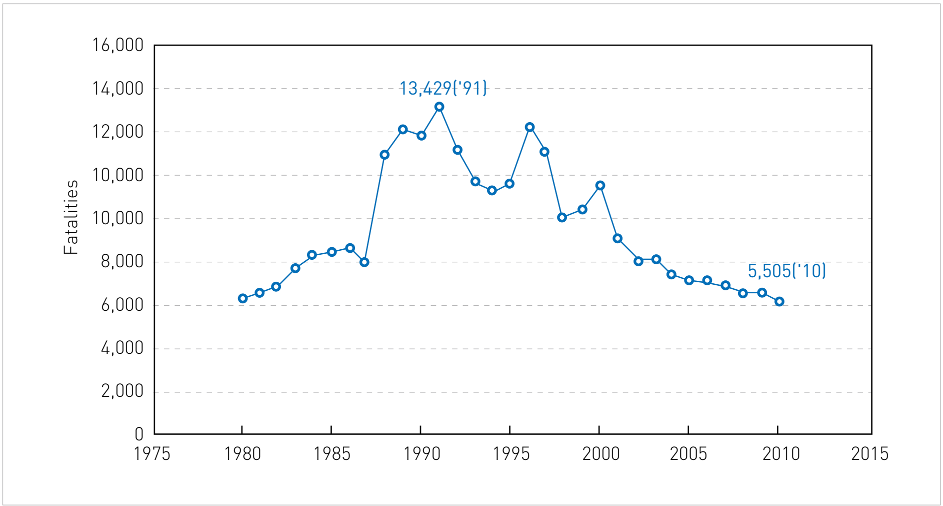
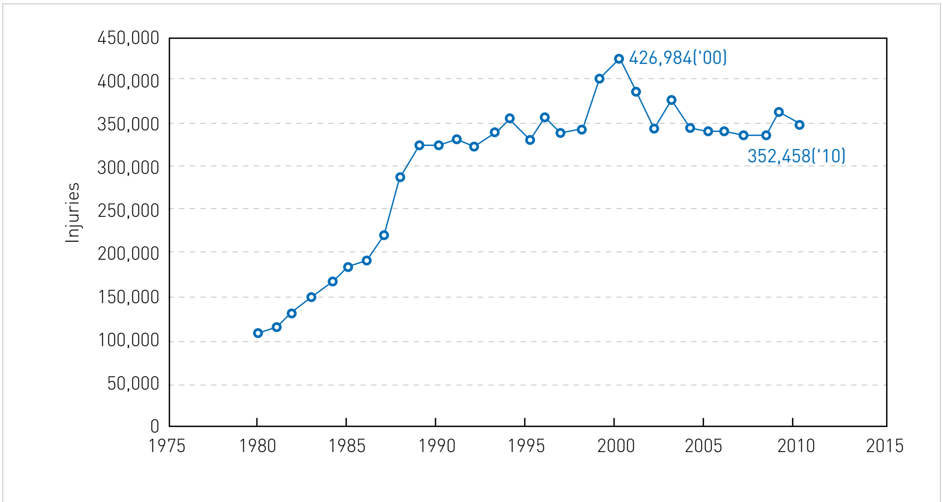


Figure 10.2. Variation of injuries over time



Number of Injuries

The number of injuries reached the peak of 426,984 in 2000, then it decreased to 352,458 in 2010.

For the similar reasons as the above accident and fatality statistics, the total number of injuries was reduced by 17% for the 10-year period. It is clear from the graph that the rate of decrease in injuries is not as fast as that of the fatalities. The decrease of fatalities means that the accident severity has reduced, but the total injury-resulting accident is not reducing as rapidly. It should also be noted that the peak accident rate is in 2000, 10 years after the peak fatalities rate. This means that the rigorous safety measures had an impact on the severity, but the rate of increase in vehicle numbers cause a time lag in total accidents.

03

Road Accident Rates by Population and Vehicle

Population and Motor Vehicles

The population of Korea reached 48,875 thousand at the end of 2010. The number of motor vehicles reached 21,449,302 at the end of 2010. The vehicle statistics denote all vehicles including two wheel motor vehicles, construction vehicles and agricultural vehicles (farm tractors). These figures suggest that the number of any type of vehicle per capita is approximately 0.44 in 2010.

Table 10.2. Time-series of population and vehicle growth

Year	Population (thousands)	Motor vehicles	Fatalities per 100,000 population	Fatalities per 10,000 motor vehicles
1970	32,241	128,298	9.5	237.0
1980	38,124	527,729	14.7	106.3
1990	42,793	3,394,803	28.8	36.3
1991	43,206	4,247,816	31.1	31.6
2000	47,008	13,887,805	21.8	7.4
2005	48,294	18,964,061	13.2	3.4
2008	48,607	20,382,352	12.1	2.9
2009	48,747	20,831,653	12.0	2.8
2010	48,875	21,449,302	12.1	2.6

Figure 10.3. Variation of fatalities per 100,000 population over time

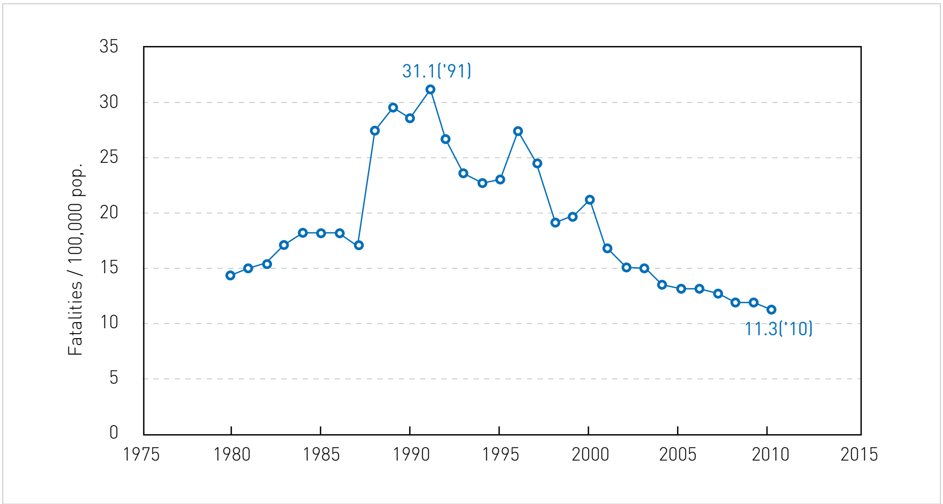
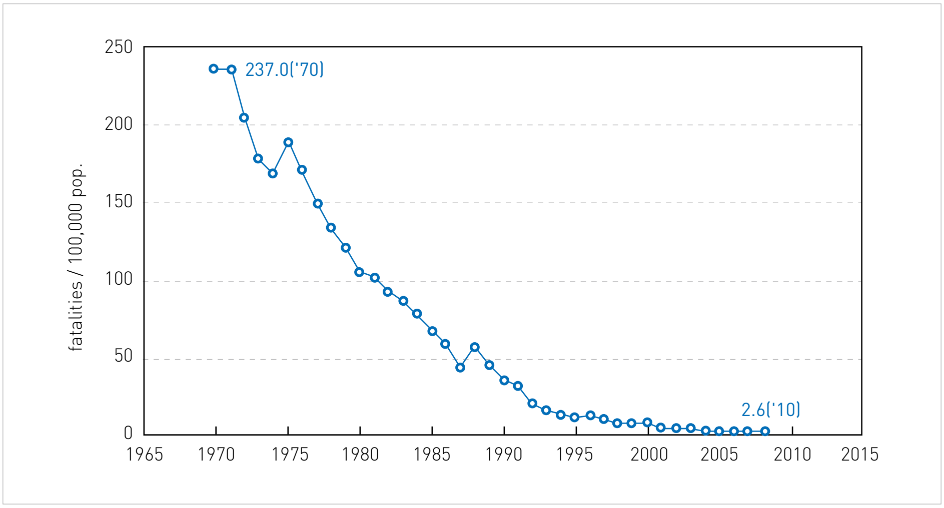


Figure 10.4. Variation of fatalities per 10,000 vehicles over time



Fatalities per 100,000 Population

The peak number of fatalities per 100,000 population was 31.1 in 1991, and the number is significantly reduced to 11.3 in 2010. These figures suggest that the number of fatalities per 100,000 population was significantly reduced by 72.7% for

20 years between 1991 and 2010. The turning point at the peak is marked by the introduction of compulsory seat-belt, which is one of the critical factors in reducing the severity of injuries to the front seat passengers.

Fatalities per 10,000 Motor Vehicles

The number of fatalities per 10,000 motor vehicles has steadily decreased to 2.6 in 2010. Considering that of 237 in 1970, the prevention measures such as seat-belts and other infrastructural improvement efforts have significantly reduced the figure by over 99% during 40 years between 1970 and 2010. In statistical perspective, such a reduction in fatalities is particularly a significant achievement considering that the total number of vehicles increased by 40 times during the same period. It is reflective of the intensity of efforts that the government exerted to cope with an unprecedented growth in vehicle numbers.

04
Road Accident Trends

Fatalities by Age Groups

The proportion of fatalities of age group 'under 14' was 23.3% of all age groups in 1980, but it reduced to 2.3% in 2010. Such a reduction in fatalities among children is thought to be due to both the road safety education at school and improvement of safety infrastructure.

The proportion of fatalities of age group 'over 61' was 6.5% in 1980, but it increased to 37.6% in 2010. This increase in figure does not necessarily suggest that the old age group became a particularly vulnerable group, but rather, such statistics result mainly from the general increase of old population and old drivers over the period of 30 years as the life expectancy increased significantly. And of

Figure 10.5. Variation of fatalities by age groups over time

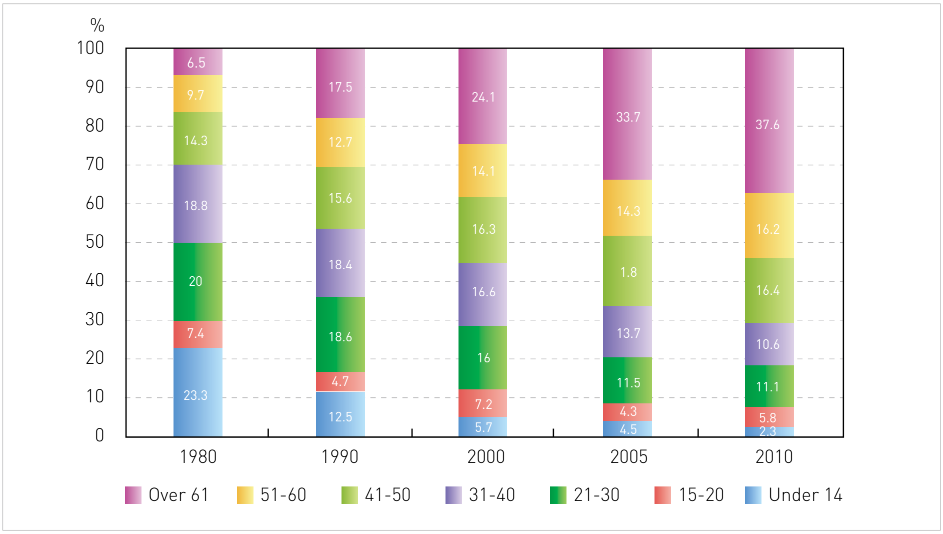
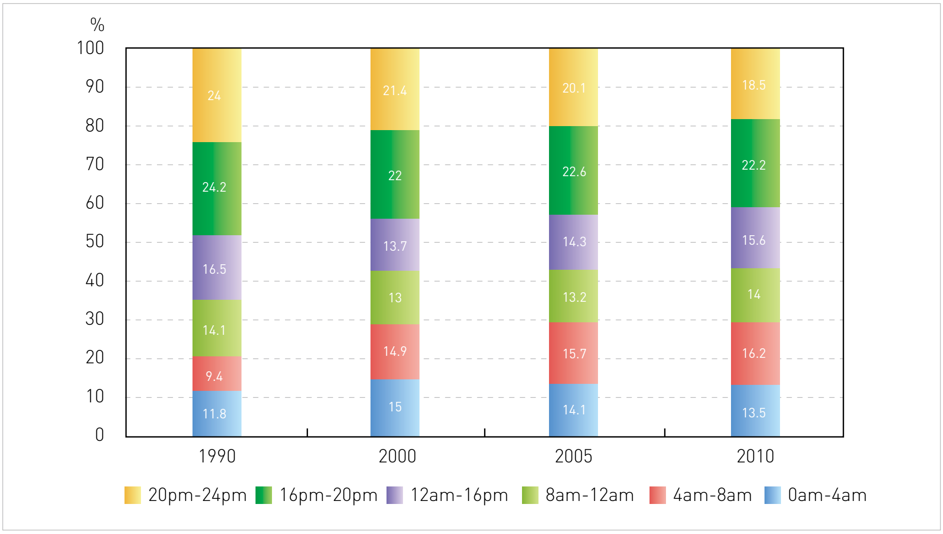
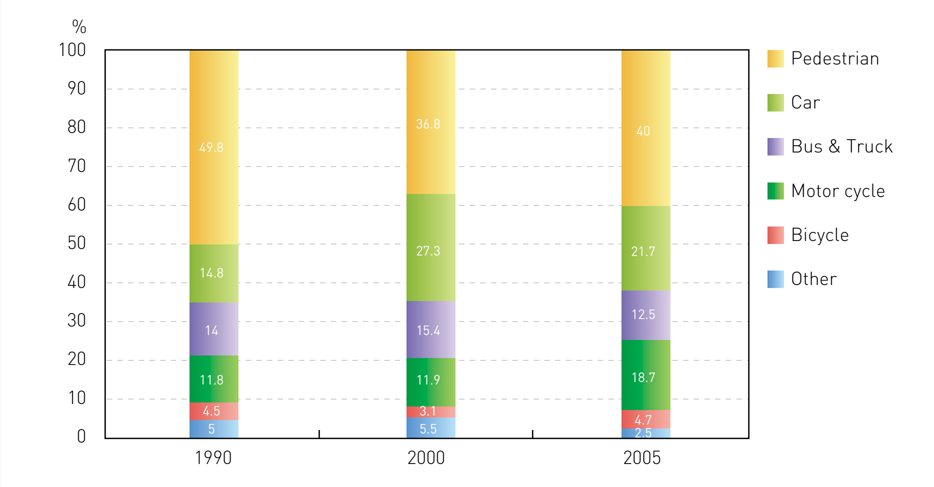


Figure 10.6. Variation of fatalities by time of day over time



course to reduce the fatalities figure among the old age group is hence very high on the agenda.

Figure 10.7. Variation of fatalities by travel types over time



Fatalities by Hours

The proportion of fatalities between '0-4 hours' was 11.8% in 1990, but it increased to 13.5% in 2010. The increase of night activities is thought to be its main cause. The proportion of fatalities between '4-8 hours' was 9.4% in 1990, but it increased to 16.2% in 2010, which reflects an increase in early morning activities. It is clear that one of the factors is travelers' daily life cycle and activities.

Fatalities by Travel Types (1980-2005)

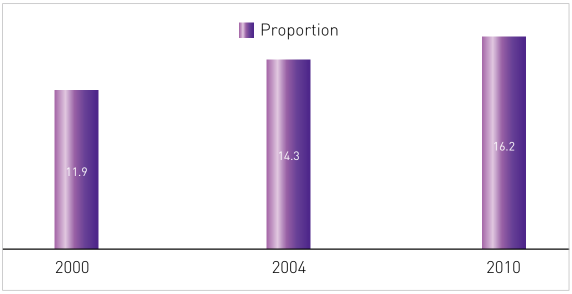
The proportion of the 'pedestrian' fatalities was 9.8% in 1990, but it reduced to 40% in 2005. A considerable part of the change is due to the decrease in children casualties. The proportion of the 'car passengers' fatalities was 14.8% in 1990, and increased to 21.7% in 2005. This is reflective of the general increase in passenger cars over the course of 25 years.

05
Road Accident Characteristics

Drink-Driving Accidents

The proportion of the road accident fatalities by drink-driving was 16.2% in 2010. The proportion of the fatalities by drink-driving is increasing continuously from 11.9% in 2000 to 14.3% in 2005.

Figure 10.8. Variation of fatalities by drink-driving over time

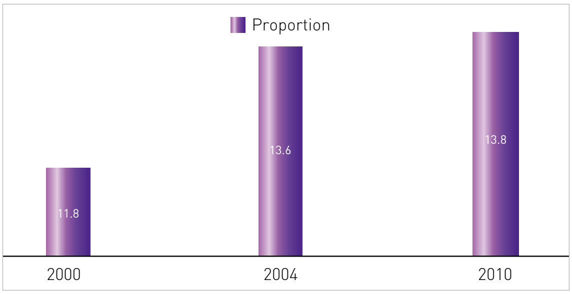


The present enforcement criteria of blood alcohol concentration (BAC) is 0.05% in Korea. This is one of the offences that needs constant education and campaigning to deter drivers from driving when they are impaired. In response to such an increase and as a firm measure, the government adjusted the penalty charge criteria by a significant increase in fine and penalty points on the licence.

Motor Cycle Accidents

The proportion of the fatalities by the motor cycle accidents was 15.8% in 2010. The proportion of the fatalities by the motor cycle accidents is increasing continuously from 11.8% in 2000 to 15.8% in 2010.

Figure 10.9. Variation of motor cycle fatalities over time



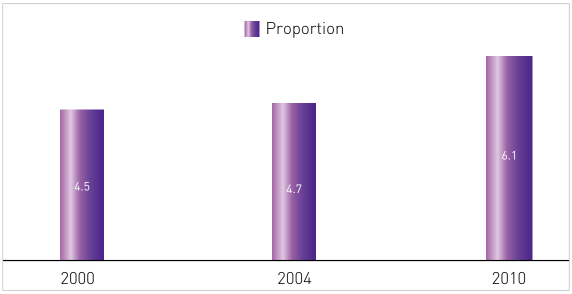
One of the main reasons of the increase of motor cycle accidents seems to be the significant increase of the small freight delivery industry (courier industry) using the motor cycles.

Bicycle Accidents

The proportion of the fatalities by the bicycle accidents is increasing continuously from 4.5% in 2005 to 6.1% in 2010.

One of the main reasons for the increase of bicycle accidents seems to be due to the increase of the bicycle use in response to the recent green transport policies. This is one of the critical road safety issues due to recent nation-wide extension of bicycle routes along the four national rivers. It is expected to increase the number of cyclists significantly.

Figure 10.10. Variation of bicycle fatalities over time



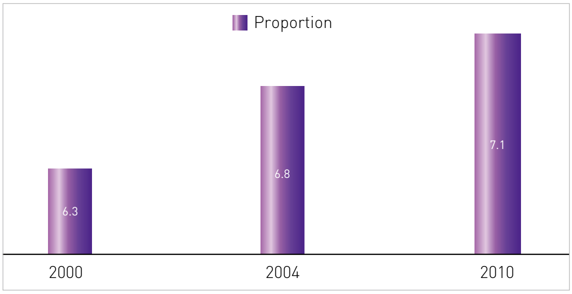
Motorway Accidents

The proportion of the fatalities on the motorway is slightly increasing from 6.8% in 2005 to 7.1% in 2010.

One of the main reasons of the increase of motorway accidents seems to be to due to the continuous expansion of the motorway length and traffic volumes.

The total length of motorway in 2010 is 3,859km.

Figure 10.11. Variation of motorway fatalities over time



CHAPTER 10

Business Vehicle Accidents

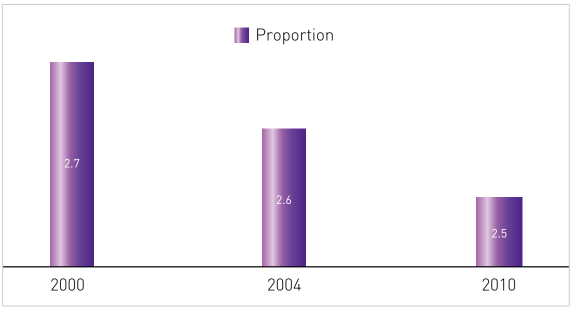
The number of fatalities of the business vehicle accidents was 979 persons in 2010, and the proportion was 17.8% of the total. The fatality ratio of the business vehicles including buses, taxis and goods vehicles is 10.5 persons per 10,000 vehicles, and this figure is about 4 times higher than that of the private vehicles. One of the main reasons of the high accident ratio of the business vehicles seems to be the competitive environment of the transportation businesses as a result of large scale urbanization, and longer hours of daily exposure.

Table 10.3. Crash statistics by vehicle use

Desc.	Fatalities (2010)	Proportion of total fatalities (2010)	Number of vehicles (2010)	Fatalities per 10,000 vehicles (2010)
Business vehicle	979	17.8%	930,316	10.5
Private vehicle	3,675	66.8%	16,330,410	2.3

Speeding Accidents

Figure 10.12. Variation of fatalities by speeding over time



The number of fatalities by the speeding accidents was 138 persons in 2010, and the proportion was 2.5% of the total fatalities.

The proportion of the fatalities by speeding accidents is counter-intuitively low because determining the speed when an accident occurs is not straightforward. However, the recorded speed-related fatalities are on the decreases due to increasing installation of enforcement speed cameras in the pas decade.

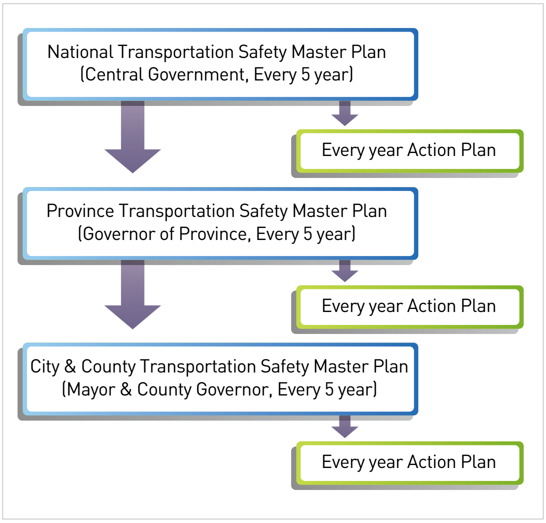
The speed limit is 100km/h on the motorway, 80km/h on the national road, and 60km/h on the urban road.

06
Transportation Safety Management System

Figure 10.13. Hierarchy of safety committees

Transportation Safety Committees

Figure 10.14. Hierarchy of safety planning



The National Transportation Safety Policy Committee chaired by the Minister of Land, Transport and Maritime is the highest level in the hierarchy of organizations for the road safety in Korea.

The Provincial Transportation Safety Policy Committee chaired by the Governor of Province is the practical level organization.

The City & County Transportation Safety Policy Committee chaired by the Mayor & the Governor of the County is the local level organization of the region.

Transportation Safety Planning Hierarchy

The central government sets out the National Transportation Safety Master Plan once every five years, and this is approved by the National Transportation Safety Policy Committee.

The National Transportation Safety Action Plan is made every year by the designated ministries, and this is approved by the National Transportation Safety Policy Action Committee.

The local government makes the Local Transportation Safety Master Plan once every five years according to the National Plan, and makes the Local Transportation Safety Action Plan every year according to the National Action Plan.

The Local Plan is submitted and confirmed by the National Transportation Safety Policy Action Committee.

07

Government Organizations Related To Transportation Safety

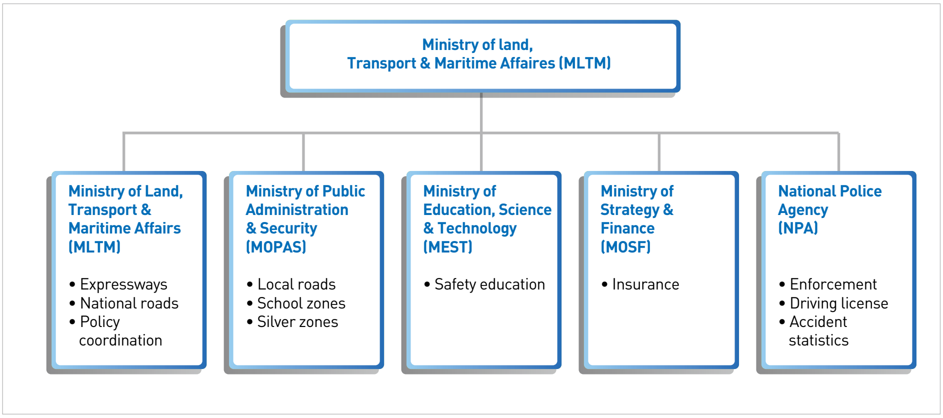
Government Ministries

The Ministry of Land, Transport & Maritime Affairs (MLTM) is one of 6 ministries designated by the Transport Safety Law for the transportation safety. It is in charge of the expressways and national roads, and takes the policy coordination role between other designated ministries.

The Ministry of Public Administration & Security (MOPAS) deals with the city roads and county roads, and manages the school zones together with local governments.

The Ministry of Education, Science & Technology (MEST) deals with the transportation safety education, and the Ministry of Strategy & Finance (MOSF)

Figure 10.15. Organisation of government ministries on safety



deals with the automobile insurance systems.

The National Police Agency(NPA) is responsible for the traffic law enforcement, the driving licenses and the road accident investigation and data management.

Authorities and Institutes

Listed below are some of the authorities and institutes related to the transportation safety in Korea.

- Korea Transportation Safety Authority (KOTSA) : KOTSA is a public authority under the MLTM. KOTSA is in charge of the mechanical examination of motor vehicles, and transportation safety activities of road, rail and air. Under KOTSA were established the KATRI and the TSRI.
  - Korea Automobile Testing & Research Institute (KATRI) : KATRI deals with the New Car Assessment Program(NCAP) and the automobile safety standards and testing.
  - Transportation Safety Research Institute (TSRI) : TSRI deals with various researches about transportation safety of road, rail and aviation.
- Korea Highway Corporation (KHC) : KHC deals with the construction, operation and maintenance of expressways under the MLTM. Under KHC is established the HTTI.

CHAPTER 10

- Highway and Transportation Technology Institute (HTTI) : HTTI deals with the technology researches on roads including pavement, bridge, tunnel and traffic management.

• Road Traffic Authority (ROTA) : ROTA is a public authority under the NPA. ROTA deals only with the road safety. Under ROTA were established the TSI and TAAC.
  - Traffic Science Institute (TSI) : TSI deals with researches on traffic enforcement, driving licence, traffic safety facilities and other police activities.
  - Traffic Accident Analysis Center (TAAC) : TAAC analyses road accident data obtained from the police and does the re-investigation of big and critical accidents.

• Korea Transport Institute (KOTI) : KOTI is a research institute under the MLTM. KOTI deals with researches on transportation policy of road, rail, air and logistics.

• Korea Institute of Construction Technology (KICT) : KICT is a research institute under the MLTM. KICT deals with construction technology researches including road construction and road safety.

• Korea Automotive Technology Institute (KATECH) : KATECH is a research institute under the Ministry of Knowledge Economy. ATECH deals with researches on automotive technology.

• General Insurance Association of Korea (GIAK) : GIAK is an association of automobile insurance companies under the Ministry of Strategy and Finance. GIAK supports many road safety campaigns in order to reduce road accidents.

08
Road Safety Policies

Road Safety Policies Before 1991 (Accident Increasing Period)

In 1979, the Transportation Safety Law was enacted, and the National Transportation Safety Policy Committee was organized according to the law.

In 1981, the Traffic Accident Management Exemption Law was enacted, and the drivers who caused injury accidents without serious offences began to be exempted from the criminal prosecution.

In 1984, the property-damage only accidents were excluded from the road accident statistics.

In 1988, the computer-based accident data processing system was introduced.

In 1990, the wearing of front seat belt and the installation of children's safety seat became compulsory.

Road Safety Policies After 1992 (Accident Decreasing Period)

After reaching the peak fatalities of 13,429 in 1991, the Prime Minister’s Office launched a strong accident reduction campaign in 1992.

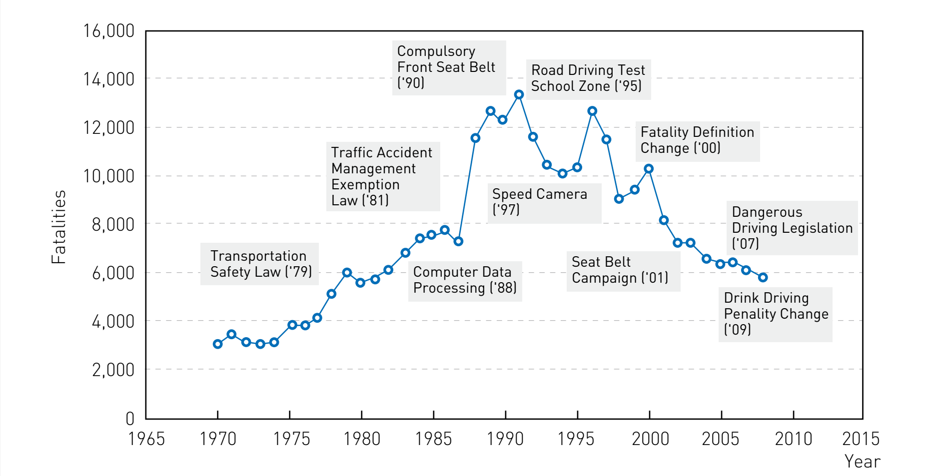
In 1995, the school zone scheme was introduced, and the learner’s driving licence system and the road driving test were introduced.

In 2000, the definition of the fatal accident was changed from ‘3 days after accident’ to ‘30 days after accident.’

In 2001, the strong seat belt campaign began and the wearing ratio reached 90%, and the number of fatalities dropped rapidly.

In 2009, the penalties for drink drivers were strengthened to max. 5-years imprisonment and 10 million KRW fine (about 9,000 USD).

Figure 10.16. Variation of fatalities over time and various policies



Accident Black-Spot Improvement Initiative

The objective is to identify a specific location of frequent accident spots of certain regularity and establish the causes in human, vehicle and road infrastructure elements.

The 4th Accident Black-Spot Improvement Initiative' is consisted of the following 6 procedural stages : (1) Accident data analysis, (2) Identifying locations of Black-Spots and examining the site, (3) Identifying the causal factors and establish the criteria of improvement, (4) Writing the improvement plans and reporting to relevant authorities, (5) Execution of improvement construction (6) Evaluation of the effects of improvement.

The effects of improvement were evaluation at 12,496 Black-Spots between the periods, 1991 – 2010. The total number of accidents and fatalities decreased by 27.6% and 43.1% respectively.

School Zone Improvement Project

The School Zone is designated within 300m-radius of the main entrance to nurseries, elementary schools, special schools or other academies of more than 100 attending children.

The School Zone Project is about installing safety enhancing infrastructures such as the speed bump, facilities that separate the pedestrian and traffic roads, protective fence, traffic lights and road signs.

In 2010 alone 900 locations have been designated as School Zone with an estimated cost over 968 million USD.

Over the periods, 2003 - 2010, the total number of designated School Zones is 7,351 at an estimated cost of over 9.9 billion USD.

Police Enforcement & Penalties

In 2010, the total number of traffic violations recorded by the police enforcement was 13,482,309, which is a slight decrease (-2.6%) on the previous year. The decrease on the previous year is made up of middle line violation (-12.4%), drink-driving (-7.6%), no license (-30.9%), speeding (-6.7%) and traffic light violation (-9.1%).

The police carry out constant enforcement activities throughout the year, However, the police set a specific seasonal or topical enforcement periods during which a specific violation is enforced more rigorously than other periods. For example, the School Zone violation was rigorously enforced for 2 weeks of the school start period in the beginning of March 2010. The violation criteria included pedestrian protection violation, observing the stop line, speeding, traffic light violation and illegal parking.

Similarly for example, such rigorous periods are applied to the motor cycle enforcement or the freight vehicle enforcement with specific reference to certain topical violations frequently associated with respective vehicles.

Drink-Driving

The existing practice of enforcing the drink-drivers up to 2010 has been by stopping every vehicle at certain point and carrying out mechanical testing with alcohol detector (breathalyzer), which is a very meticulous method but time-consuming with an inevitable consequence of long congestion.

A selective approach has been taken in 2010 in which both the enforcement locations and the vehicles to enforce are selected appropriately. This has reduced the congestions significantly and the inconveniences to the innocent drivers.

In comparison to 2009, drink-driving violation reported by the police enforcement has decreased by 7.6% due to the selective approach. However it did not compromise the efficiency as the total number of fatalities has also reduced by 13% relative to the previous year 2009.

Emergency Rescue

Rapid industrialization and urbanization in Korea brought a rapid increase in both various accident rates and early deaths among the economically active age group workers. Moreover, aging society and westernization of food consumption have increased such diseases as cerebrovascular disease, which requires rapid treatment on patient's demand. Such urgent treatment is of course required mostly for traffic accidents.

The emergency medical services are regarded as one of the basic rights of the public. For the following characteristics of the emergency patients due to various accidents, it particularly requires the government involvement: (1) Unpredictability, (2) Constant possibility of medical demand, (3) Specialty and readiness of the supply of medical services and (4) The scale of investment.

In 2005 a national scale Comprehensive Emergency Medical Plan (2006 - 2010) was established to promote advanced and efficient management system. It addresses: (1) Improving the standard of services, (2) Improving the accessibility and convenience, (3) Enforcing the response rate, (4) Monitoring and evaluation system of the medical centers, (5) Support and training of emergency response personnel, (6) Efficiency of emergency patient transportation system, (7) Telecommunication system.

Education

To realize an advanced public awareness of transport safety, a constant education from childhood to adulthood is important.

Nursery school carries out repetitive safety education through experience based practices at premises such as transport theme parks. Also by means of the safety guideline letters to the parents, the children are better educated at home and the parents become more aware of the safety issues that need to be addressed.

A more systematic safety education is introduced at school (primary and secondary) level. On average officially designated transport safety education classes are 21-23 hours annually. The classes include on-site education, safety while on extra-curricular activities, safety lessons on various rides such as kickboard or Rollerblading, railway crossing, bicycle riders and their safety equipments and safe route choice. Such education is designed for the students to routinize the safety awareness as part of their daily life.

Such education is extended to the teachers and parents, and is designed to show them what the model safety behaviors are with examples of accidents. These knowledge are used as precautionary guidelines to the students.

Publicity

Traffic accidents occur due to combinations of travelers, vehicles and transport infrastructure, but are not absolute inevitabilities but preventable by reducing the human factors.

Given the time scale and the scale of investment required for infrastructure improvement, individual awareness and behavioral changes are important to enhance safe transport system. This is achieved through publicity of safe practices. Considering that more than 90% of the total accidents are due to driver's violation of the traffic laws, individual awareness and safe practices improve the safety record significantly.

May is set as the Month of Transport Safety and a variety of transport safety campaign events such as Children's safety quiz competition take place.

09
Road Accident Reduction Target and Conclusions

Accident Reduction Target

The accident reduction target of Korea is to reduce the number of fatalities per 100,000 population down to 8.8, and the fatalities per 10,000 motor vehicles down to 1.9 until 2011 according to the 6th Transportation Safety Master Plan (2007-2011).

The long-term accident reduction target is to reduce the number of fatalities per 100,000 population down to 7.1, and the fatalities per 10,000 motor vehicles down to 1.4 until 2016.

The present government has set an ambitious target to reduce the number of fatalities by half during the 5-years reign (2008-2012).

Table 10.5. Crash reduction target

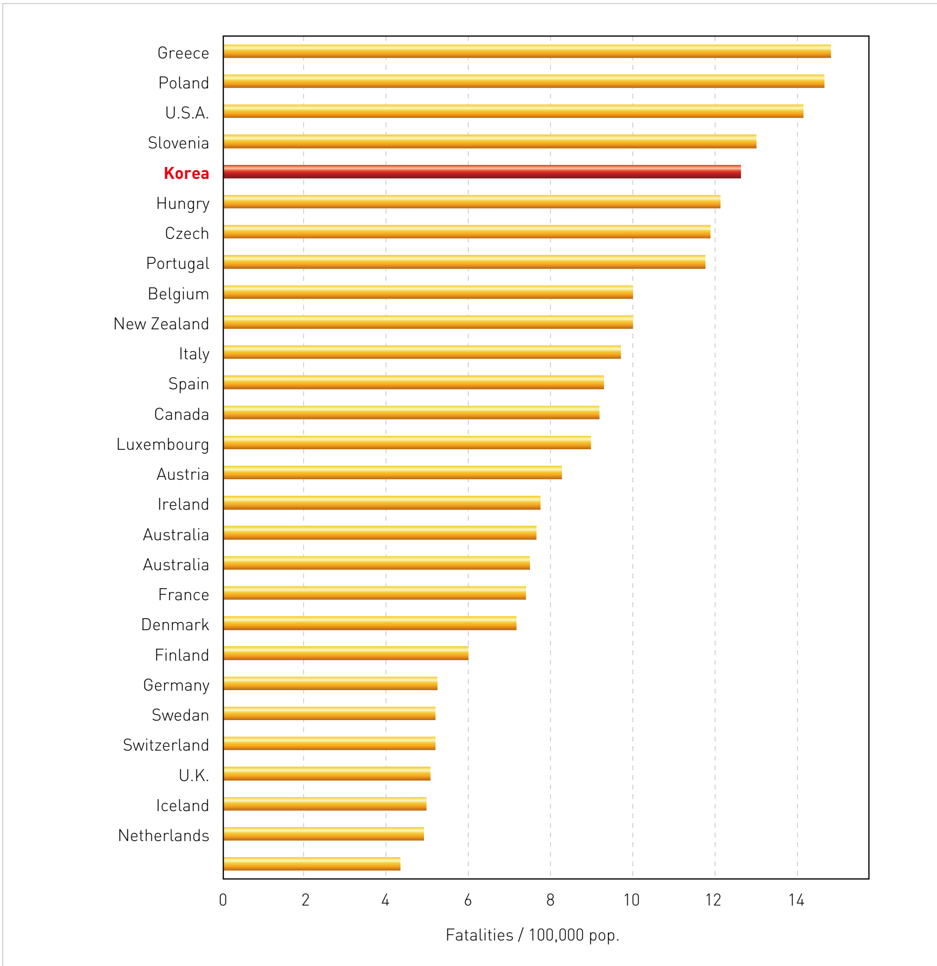
Target year	No. of fatalities	Motor vehicles (Thou.)	Population (Thou.)	Fatalities per 100,000 population	Fatalities per 10,000 motor vehicles
2008	5,870	20,382	48,607	12.1	2.9
2011	4,350	22,480	48,989	8.8	1.9
2016	3,500	25,410	49,312	7.1	1.4

International Comparison

In 2007, the number of fatalities per 100,000 population in Korea was ranked at 24th position among the 28 OECD member countries, and the number of fatalities per 10,000 motor vehicles at 27th position.

Korea is targeting to reduce the fatalities per capita to 6.1 by 2016, and this ranks at the middle level among the OECD member countries as marked in the graph below.

Figure 10.17. **Fatalities per 100,000 population of OECD countries (2007)**



CHAPTER 10

Recent Issues and Future Road Safety Concerns

One of the most immediate issues to address is the use of in-vehicle digital devices such as mobile phones, satellite navigation systems, and digital multimedia broadcasting devices while driving. This is relatively a recent issue with the advancement of the digital technologies. Despite its wide-held and strong view that distraction by them while driving can be extremely dangerous and even more so than drink-driving, systematic research and the level of regulations that guide the enforcement have not been well established.

It is clear both in developing and developed countries that aging society means high accident rates for the old age drivers and pedestrians. Aging society is one of the dictating issues of future safety concerns, together with the rising bicycle population associated with green policy and drink-driving which is on the decrease but still a significant contributor to road accidents.

Proposal for Developing Countries

Korea's motorization process was a remarkably fast one, whereby the total number of vehicles increased by 40 times in 30 years from 1980 to 2010. Consequently, the biggest casuality during the course of such a rapid process was the road safety. To counter such a phenomenon, significant funding and efforts have been invested to control the road accident rate. The total fatalities peaked at 13,429 in 1991 and the figure reduced to 5,505 in 2010, which is a 60% reduction. In comparison to the European and American cases where the history of motorization is over a significantly longer period of time, the Korean case exhibits a concentrated trials and errors in a short period, hence is an exemplary case study for the developing countries that are undergoing a similar process of fast motorization. There are many benefits of Korean knowledge and experiences to the developing countries, and one of them is time-efficiency in achieving a desired level of road safety in a process of rapid motorization.

During the course of bringing the accident rate down to the current level, the most effective means of preventative measures were the automated speed camera enforcement and the compulsory seat-belt regulations. In the experience of Korea, these measures were practiced well after the accident rate reached an acceptable level. The lesson to take for the developing countries here is to initiate such preventative measure prior to the full motorization, so that the road users get used to the safety measures at earlier stage of the motorization process. Installation of speed cameras requires investment but from the Korean experience, it is economically viable in the long term perspective with respect to the social cost. Early introduction of such measures also means passing over a significant part of the trial and error process of inevitable road safety issues during a motorization process.

CHAPTER 11

KTDB

Ji Youn YEON
Associate Research Fellow, The Korea Transport Institute

01
Introduction

Background

Since the launch of the first five-year economic plan in 1962, systematic investment in SOC started to back up the rapidly growing industrial production. The medium- and long-term plans such as the comprehensive national development plan and the plan for national transportation network were implemented from 1972 to support the SOC investment. And in 1994 the special account for the transport infrastructure was introduced to secure financially more stable investment and better management. Against this backdrop, the SOC investment increased greatly since the 1990s. Then, in 1998 due to the financial crisis, Korea was under control of the IMF and faced severe unemployment. So the government came up with financial countermeasures to overcome such difficult economic situations causing the decreases in income and employment. One of the government's solutions was the project for the national informatization, a foundation of this project. It is in accordance with the Framework Act on Informatization Promotion (enacted in 1995, enforced in 1996), implemented in every ministry. And the project for the National Transport Survey and DB Establishment (KTDB) was part of the technetronic project that the Ministry of Land, Transport and Maritime Affairs (MLTM, formerly the Ministry of Construction and Transportation) carried out as a public works program for the unemployment.

In line with the government's investment in transport, the private sectors actively got involved in the SOC investment. These efforts improved national competitiveness through the secured government's financial integrity after the IMF crisis and the increased investment in infrastructure, and provided greater convenience to people and productive investments, and also made contributions to financial markets. However, it was pointed out that the government was keen on performing a number of projects without a thorough review of their feasibility. In other words, it gained a negative image, while having shouldered the financial burden and failed to reach social agreement. In particular, before 2000 the evaluation of the feasibility for infrastructure investing lacked creditability, because there were no systematic transport surveys nor database based on the research and analysis. Accordingly, there was recognition of the need for the survey for basic data and the database establishment at a national level.

On the other hand, some foreign countries already carried out transport surveys on a regular basis for the investment evaluation, then produced and distributed statistical data, calibrated transport demand models, and produced manuals to verify the results of traffic demand analysis.

Problems before the KTDB

Uncontrolled Individual Transport Surveys

The transport survey has a short history in Korea, compared to advanced countries, which is an indication of inefficiency in surveying because of the lack of an established system. The most inefficient part was overlapping surveys, which were performed, individually and duplicately, by plan or project of the central government or local governments. This led to the lack of specialty and consistency, and also the waste of budget. Another problem was the non-existence of the standardized methods to survey and analyze, which raised an issue with the objectivity of survey results. Because each project carried out different surveys and methods, it was difficult to secure compatibility and objectivity. Lastly, the government had no master plan for the national transport survey, which was not reflected in budget nor sub-plan of relevant bodies. This suggested the survey was not efficiently well managed.

Inefficient SOC Investment Evaluation

Since the 1990s, the government has kept on investing in transport facilities under the target of sharpening the competitive edge, as a result the SOC stock has greatly increased. However, in spite of continuously investing in the transport infrastructure, logistics costs and congestion costs were still high (see table 1).

One reason for this was the lack of the transport statistics and standard units. At the time when the SOC projects were being promoted, there was no basic statistic data available to evaluate the investment in transport facilities, nor standardized surveying techniques. And a survey was carried out by each project, frequently, when necessary, with its own standard applied, therefore, it was evident that there was poor basic data for transport statistics. Another reason was that without consistent standard and methods, different analysis agents presented different estimates of traffic demand.

Table 11.1. Trends of the national logistics costs and congestion costs (Unit : Trillion KRW, %)

Category	GDP (current price)	National logistics costs		Congestion costs	
		Costs	% of GDP	Costs	% of GDP
1993	290.7	41.2	14.2	8.6	3.0
1998	484.1	74.2	15.3	12.2	2.5
2000	603.2	94.1	15.6	19.4	3.2
2008	1,026.4	178.5	17.4	26.9	2.6

• Source: KOTI, 2010 Korea Transportation Statistics, 2011

Insufficient DB for the Transport Policy and Plan

When it comes to the medium- and long-term transport policy and investment, many countries establish and evaluate a long-term master plan. Also Korea has established and evaluated various transport plans such as a 20-year national intermodal transport plan, a 20-year national rail network plan, a 5-year feasibility assessment for transport facilities, etc. However, the government experienced the loss of policy credibility due to the nonexistent or insufficient basic data for policymaking, and then recognized the importance of the countermeasures. That is to say without data collection and handling fit for purpose, it is difficult to have readily available data for the establishment of policies and plans, demand forecast, and feasibility studies. In particular, it was understood that the basic data was essential to prevent overlapping investment among modes of transport, develop an intermodalism policy, and promote the sustainable transport and logistics policy, etc.

Advent of the KTDB

The Korean government had made massive investments in expanding transport infrastructures, but came to the conclusion that the lack of basic data, necessary for the feasibility assessment and impact analysis for transport policy and projects, caused inefficient investment. In particular, most of the transport surveys, as one-off measures, had no continuity, and also no consistency at a national level. So the government felt the need for laying the foundation for the management of the national transport database by the government. In this regard, the project to establish a national transport database started from 1998 by performing the nationwide transport survey, then collecting the basic data. At the same time, the Transportation System Efficiency Act (enacted in Feb. 1992, enforced in Aug. 1992), currently, the National Integration Transportation System Efficiency Act, was prepared to continuously implement the transport survey, and establish a database for the use of investment assessments.

02
Project Contents

Project Development and Promotion

History

The KTDB project started as public works for unemployment in a government effort to recover the economic situation during the IMF financial crisis. In 1998 the government picked up the tab, as much as 3.139 billion KRW, for the project to obtain the basic data for the transport field, which included the surveys for nationwide passenger and freight traffic. Thereafter, in 1999 the project was expanded with more budget of 10.908 billion KRW to carry out a variety of surveys for the transport facilities, traffic patterns in five metropolitan cities, trip generation unit, etc.

In February 1999, the government reorganized the legal grounds to support the KTDB project. The Transportation System Efficiency Act (now, the National Integration Transportation System Efficiency) has a goal to provide more convenience to people and contribute to the national economy by ensuring comprehensive coordination among policies and an efficient transport system. Also it stipulates standardization of the surveying techniques and criteria, and development of the guidelines for objectivity and consistency of the national transport survey, then establishment of a database based on the obtained results, and preparation of the ground for common use. Thereafter, social changes have led to modification of the Transportation System Efficiency Act several times, followed by changes in the contents and extent of the KTDB project. And KOTI and the Korea Maritime Institute were designated to implement the KTDB project to ensure professionalism and efficiency of the survey and analyses. The details will follow in the next part.

Project Promotion

• Legal Grounds

The Transportation System Efficiency Act, enacted in 1999, has been revised four times and had its name changed to the National Integration Transportation System Efficiency Act in January 2010, which included the establishment of the special transport plan, the enhancement of the intermodal transport system, council formation, surveys to prepare for the climate changes, etc.

•Institutional Grounds

The KTDB project is based on the 'National Transport Survey Plan' according to Article 12(2) of the National Integration Transportation System Efficiency Act. The plan is established every five years to prevent overlapping surveys, to implement the survey efficiently and to promote the public use of the results. And before the establishment, the national transport council reviews its targets, strategies, contents and methods of the detailed surveys, etc. The first National Transport Survey Plan (2009-2013) was set up in 2009.

Development Phase and Structure

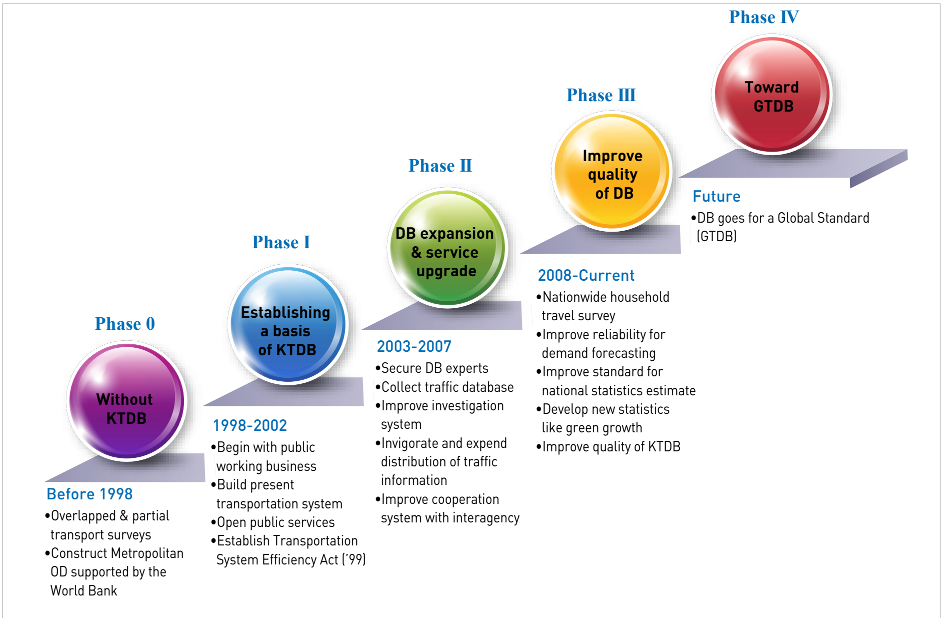
Development Phase

In Phase 0, before the introduction of the KTDB system, the problems caused by its non-existence, overlapping and separate surveys by project occurred at the time of transport investment and feasibility assessments as already mentioned. And there was an attempt to establish an O/D matrix for the Seoul Metropolitan Area for the first time with the support of international organizations such as the World Bank.

Phase 1, starting from 1998 to 2002, completed with a target of building up the foundation for the KTDB, which included passenger and freight O/D volumes, network establishment and transport statistics, and commenced Internet-based information delivery.

Phase 2, starting from 2003 to 2007, promoted the expansion of the KTDB project and upgrading of its services annually by improving the data collection system, creating a user-friendly Internet service, extending the traffic information distribution, enhancing the analysis of the transport database, and cementing the

Figure 11.1. Development phase of the KTDB project



CHAPTER 11

cooperation among organizations concerned for the transport surveys and data.

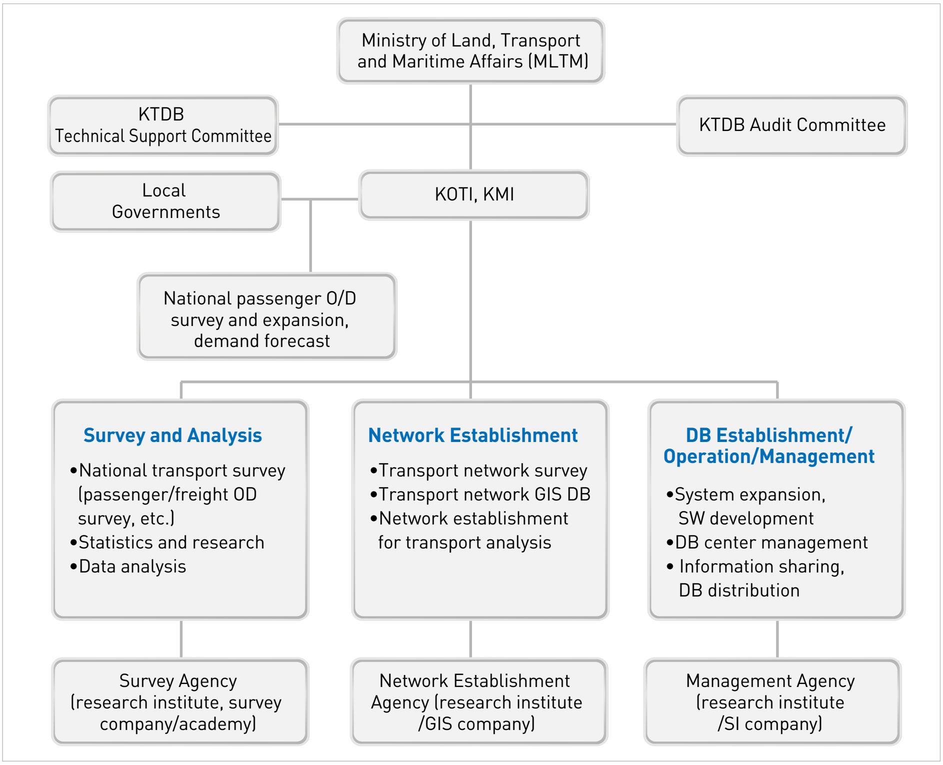
After Phase 2, the KTDB project got on the track and has been proceeding on a yearly basis. It has sought to increase the reliability and applications of survey results by performing the regular nationwide transport survey, related research and analysis, finding ways to raise the credibility, collecting users' opinion, and expanding the database.

Phase 4 will establish a system to produce statistics at the level of developed countries and internationally standardize the KTDB to prepare for the GTDB (Global Transport Database).

Development Structure

The project to establish the KTDB was led by the central government (MLTM), and commissioned to KOTI, a governmental research body, for the specialty and efficiency.

Figure 11.2. KTDB project development structure



And as the surveys and database establishment are implemented nationwide, the cooperation of local governments is also essential. The MLTM establishes a medium- and long-term plan, secures budget, manages and supervises the KTDB Council and the KTDB Technical Support Committee. The local governments cooperate with the MLTM to review the transport survey from planning to results, utilize jointly the KTDB, and maintain a cooperative relationship with the central government while the survey is under way. KOTI and the KMI have responsibility to plan and develop the project with the central and local governments, to set up a detailed survey plan, to analyze the results, and to establish a database, then to provide the foundation for common use (see Figure 11.2).

Project Contents

Major Contents

The KTDB project consists of the database establishment for the national transport survey, the database establishment for the SOC investment assessment, the production of national transport statistics, the publication of PR materials for policy support, and the operation and management of the database system. <Table 11.2> shows the major contents in details.

Table 11.2. The major contents of the KTDB project

Major contents	Details	Remarks
DB establishment for national transport survey	Survey for the movement patterns of people and freight	including marine transport
DB establishment for SOC investment assessment	Establishment of the national transport network and the O/D estimation by using the survey results	including marine transport
Issue of national transport statistics	Calculation of the modal share and the transport volume of passenger and freight by city	-
Issue of PR materials for policy support	Support for the decision making of short-term policy (special transport plan) and distribution of PR materials such as reports, Pocket books, etc.	-
DB system establishment and Web site operation	Operation of DB system and website	-

CHAPTER 11

National Transport Survey

The national transport survey is performed, regularly one every five years, to analyze the movement of people and freight including how (mode of transport), why (trip purpose), when (time slot) and where (from/to), then collected statistically. The following <Figure 11.3> shows the types of surveys to estimate O/D matrices for passenger and freight.

Figure 11.3. National transport survey (passenger and freight)

Classification	Scope	Survey year	Survey type	Sample size
Passenger	Nationwide	1998 2005 2010	1) Weekday trip diary survey 2) Weekend trip diary survey 3) Traffic counting & occupancy 4) Station & terminal survey 5) Toll booth	1) 460,000 households 2) roads, passenger transport facilities : 2,086 sites
Freight	Nationwide	1996 2001 2005 2011	1) Freight survey for companies 2) Truck diary survey for drivers 3) Inter-modal terminal survey 4) Traffic counting around industry parks 5) Toll booth	1) 25,000 companies (7%) 2) 51,000 vehicles (1.6%) 3) 750 sites 4) 134 logistics hubs 5) all the tollgates

• Note: The survey type and sample size were based on 2010 (passenger) and 2011 (freight)

• Passenger Traffic Survey

The passenger traffic survey is intended to keep the passenger O/D matrices up to date. The survey results will update the present and future traffic volumes every year reflecting the changes in socio-economic indices and transport facility investments. The traffic volumes are classified by trip purpose and transport mode. And the survey results are used to carry out modal share analysis, traffic pattern analysis, time series analysis, etc. The passenger O/D matrices by trip purpose and by mode are based on the various surveys such as traffic volume survey, interview survey, household travel survey, etc. as shown below in <Figure 11.4>.

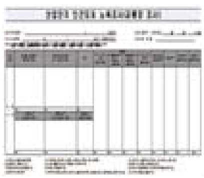
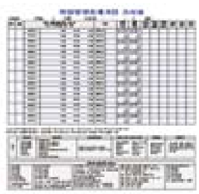
• Freight Traffic Survey

The aim of the ‘Freight O/D Survey’ is to survey the movement pattern of the national freight and establish freight O/D matrices applicable for transport policy and project analysis. This survey is to understand the origin and destination of freight by item and mode, and includes logistics status survey of businesses, freight vehicle travel characteristics survey, logistics facility survey, survey of freight generation and transfer points, etc.

Figure 11.4. Survey types and methods for the estimation of passenger O/D matrix

Passenger survey types			
Survey methods	Target	Survey items	Questionnaire form
 Roadside interview survey	Car drivers passing through the cordon lines (except highways)	• Mode of transport • Trip distance • Trip purpose • Residence • Origin • Destination	
 Mail survey	Car drivers passing through the toll gates on highways		
 Traffic volume survey	Cars passing through the cordon lines (on all roads)		
 Terminal survey	Passengers on express/ inter-regional buses, trains, airplanes, and ferries		

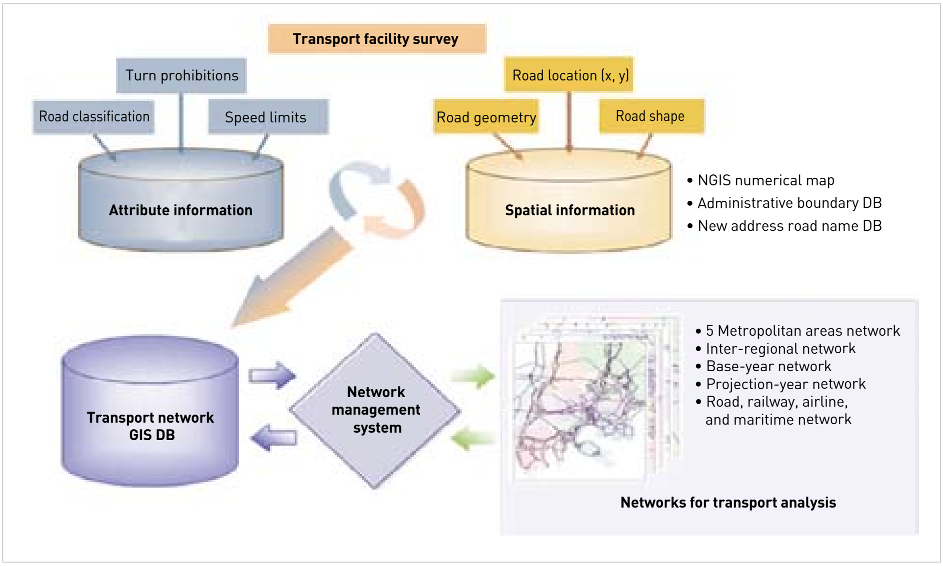
Figure 11.5. Survey types for the estimation of freight O/D matrix

			
Freight survey for companies	Truck diary survey for drivers	Traffic counting around industry parks	Multimodal terminal survey

• Network Establishment for Transport Analysis

The network establishment for the purpose of the transport analysis is to make a transport digital map based on the surveys for the transport facilities such as roads, railways, etc., and to establish basic data available for use in various sectors. As shown in the <Figure 11.6>, it establishes and updates the transport network

Figure 11.6. Process of network establishment for transport analysis



by combining the attribute information and spatial information obtained by the surveys.

• Transport Statistics

The transport DB, made based on the transport statistics, including individual statistics and references, is used to calculate the transport performance and modal share. The government has collected data from relevant references and major transport statistics produced in various sectors, upgraded and updated the contents to meet the customers' needs, and published Korea Transport Statistics. As of 2010, 158 survey items were presented including data from overseas and North Korea.

Figure 11.7. Items in the national transport statistics

General statistics	Transport system	Transport safety	Transport economy	Energy and environment
Area	Facility size by mode	Accidents by mode	Transport cost	Energy consumption
Population and population density	Transport volume by mode (passenger/freight)	Motor vehicle fatality rate	Transport budget	Greenhouse gas emission
GDP	Mode ownership		Fares by mode	

Figure 11.8. PR materials and website operation

• **DB System**

The DB system is not related to the transport survey directly, but involved to establish, provide, and manage the KTDB. For instance, it makes and operates the homepage for the KTDB project, and performs the system maintenance and management including the stable service and operation of the KTDB system, the reinforcement of the security of web server, hardware monitoring, network management, data backup, etc.

03 Achievements

Project Achievements

Achievements

The achievement of the KTDB project can be summarized into three parts: Firstly, the KTDB established the system for the collection of the basic transport data. This brought the benefits of the budget reduction by avoiding the overlapping surveys, compared the previous individual survey for the traffic demand analysis and the investment assessment, and also the system establishment of the national transport survey, which facilitated the regular and frequent surveys for passenger and freight.

Also, surveys in response to the domestic and international changes such as green growth were carried out, and the national transport statistics have been regularly published through the systematization and standardization. For example, DB for policy support purpose was established to present the criteria for calculating the traffic congestion fee through the traffic generation unit survey. The following <Table 11.3> shows the yearly achievements and budget of the KTDB project.

Table 11.3. Major achievements and budget by year

Year	Major Survey	Budget (100 million KRW)	Personnel*	
			Doctoral degree	Master degree
1998	Nationwide inter-regional traffic volume survey	32.0	3	3
1999	Traffic volume survey for the five metropolitan cities	109.0	9	15
2000	Transport survey for the Seoul metropolitan area	70.0	11	30
2001	Land/Maritime transport survey	70.0	16	39
2002	Transport facility survey	38.0	16	31
2003	Actualization of inter-regional passenger/freight O/D survey	40.0	17	19
2004	Transport facility survey and preliminary O/D survey	35.0	16	25
2005	Nationwide inter-regional passenger/freight O/D survey	65.0	15	31
2006	Passenger traffic survey in the metropolitan area	67.0	16	23
2007	Nationwide transport facility survey	57.0	18	38
2008	Nationwide inter-regional passenger/freight O/D survey(supplementary)	58.5	15	22
2009	Nationwide passenger traffic volume survey(supplementary)	53.4	16	26
2010	Nationwide passenger traffic volume survey	77.5	18	28
2011	Nation-wide freight/passenger O/D survey	77.5	16	29
2012	Trip generation unit survey	64.9	16	29
Average		60.73	14.5	25.9

* External personnel for site surveys and evaluation is excluded.

And, the KTDB project laid the foundation for the rational analysis of the transport policies. This can be seen in the following <Figure 11.9>, which shows that the use of the KTDB has increased continuously since 2001 in the process of evaluating the SOC investment in

Figure 11.9. KTDB use frequency

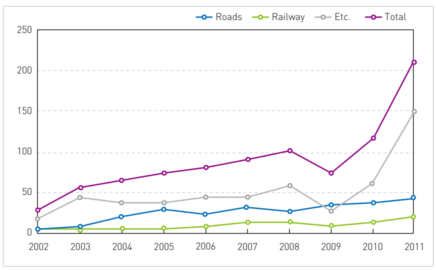
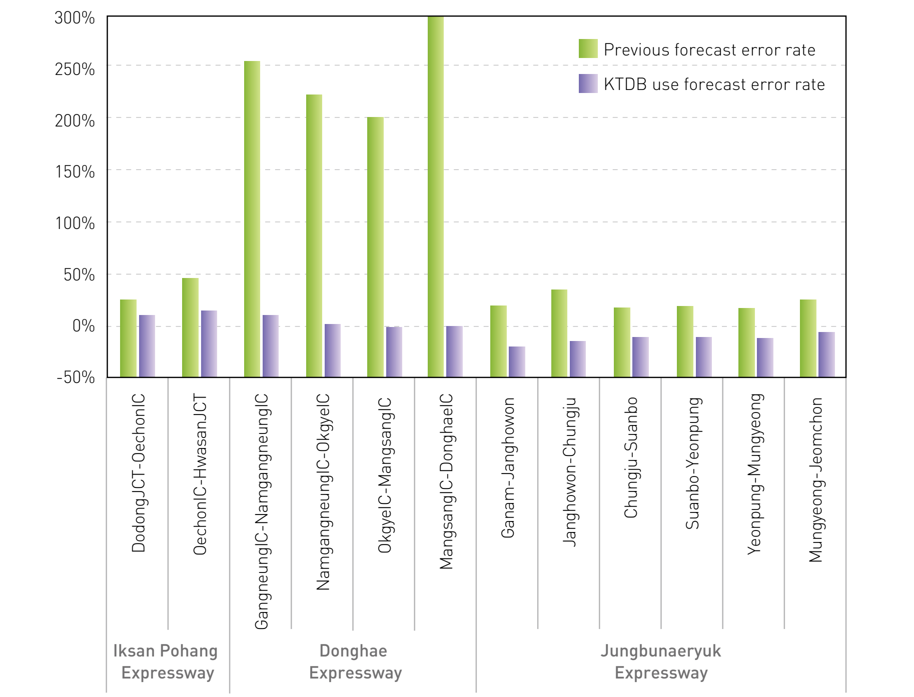


Figure 11.10. KTDB Use error rate comparison



• Note: For Jungbunaeryuk Expressway, Ganam-Chingju section completed in 2002, and the other sections completed in 2004.

transport facilities.

Also, <Figure 11.10> shows that the use of the KTDB in the estimation process brought a decrease in the error rate to less than 17%, thus increasing the credibility of the demand forecast.

Lastly, it has received the national support through the media PR activities based on a variety of analyses, in 2011 more than 10 articles about transport issues were published.

KTDB Use

Application Areas

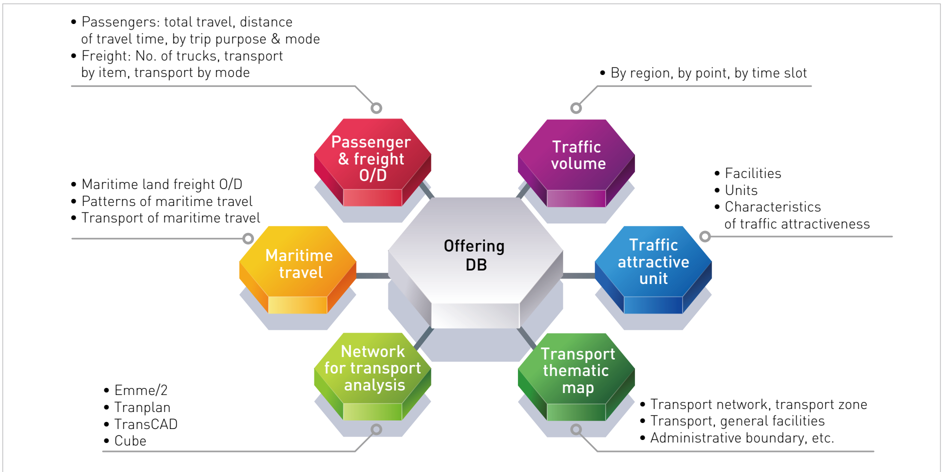
The KTDB is used as basic data for the establishment and implementation of the transport plans and policies of the central and local governments. In April 2001, the KTDB started to provide the service for external use, and industrial and academic sectors as well as governmental bodies have used this data for various analysis. And a range of transport statistics, including spatial information, are provided through the Internet to the public.

Also, in the past the KTDB was provided in two ways, the on-line provision through the Internet and the direct provision through a paper application for the detailed data. However, the processes of the paper application and the receipt of the applied data were complicated. Therefore, the KTDB provision system has been changed to enable people to apply and receive data at the KTBD's homepage for settling complaints and expanding the use of the KTDB. The homepage includes the achievements of the projects such as transport statistics, reference data, the analysis of the survey results, etc. And it provides a function that people can use to perform on-line basic analyses for their convenience.

The KTDB is used the most in the evaluation process for the transport investment. It has been used in the investment assessment of the transport facilities and the feasibility studies, and expanded its usage to other sectors including the public transport management plan, the accident management system, the study on the habitat selection of wild animals, etc.

Also, the established KTDB has provided a variety of data based on users'

Figure 11.11. Available DBs



needs and demand such as passenger and freight O/D volumes, marine traffic DB, the network for transport analysis, various thematic maps, traffic volume, and trip generation units, as shown in the following <Figure 11.11>.

04

Evaluation and Future Plans

Evaluation

Self-Evaluation

So far, the KTDB project is said to lay the foundation for the establishment of the national transport DB and its continuous promotion by the central government's strong commitment and cooperation with the local governments. In other words, the KTDB project has established the national transport survey system through the regular and frequent surveys for passengers and freight, and also set up a system for the establishment of the basic transport statistics through the standardization and systematization of the national transport surveys. Also, the KTDB has been used as basic data in the process of evaluating the investment and assessment of transport facilities, and the effects before/after the establishment of transport policy. It has expanded its usage for the transport survey and research to improve its credibility. At last, the information sharing system has increased its use to the public and private sectors, thereby facilitating the reasonable establishment and evaluation of the transport policy.

Good and Bad Points

The strongest point of the KTDB project is that it is suitable to a nation that promotes the SOC projects initiated by the central government. It prevents the overlapping surveys by minimizing the necessary ones, enables the analysis with credible data when evaluating the various transport investment projects, and facilitates the management of SOC projects through the establishment of the transport investment evaluation system and the guidelines on investment evaluation.

However, the KTDB has problems also. Recently, as the overestimated demand of PPP projects has emerged as a problem, people have raised an issue with the credibility of the established O/D matrices. So, in an effort to dispel concerns, the government has established the 'KTDB Technical Support Committee' to carry out the monitoring to collect opinions, and sought to improve the KTDB's credibility through the foreign benchmarking and the research cooperation among industry, academy and research sectors. Also, the government has tried to improve the quality of DB creation by giving continuous education to the research personnel.

There is another problem. So far, the one of the main outcomes of the KTDB project has been the O/D matrices for passenger and freight, but there is a widespread recognition of 'DB is equivalent to O/D', which makes it difficult to establish new DB related to transport. So, the KTDB project has attempted to create new statistics by collecting various transport data through small-scale surveys and using statistical methods. Lastly, because the project includes large-scale surveys, it is required to secure huge amount of budget and personnel to maintain the project. So, the KTDB project has secured its continuity by setting up a five-year plan.

Future Plan

From the initial stage of the KTDB project to the present, the KOTI DB center has laid the foundation for the national transport survey and DB establishment, and exerted its efforts to establish a more diverse and credible DB system. However, now is the time to make preparations for the incoming changes in the future in order to maintain and also improve the KTDB project. The first challenges are globalization and advancement due to the development of communication technology. As the communication technology with the help of the Internet and personal mobile communication equipment such as the smartphone has stimulated the exchange and diversification of information, the world is being recognized as one community. Therefore, the transport DB establishment requires preparation for international standardization and the creation of the transport statistics, which can be compared among nations, to respond to such social changes. Also, it is necessary to build up the foundation for the advancement of the survey and analysis methods to replace the current methods incurring huge costs and time commitment by utilizing various types of high-tech equipment. Lastly, the close relationship with other organizations that provide information such as transport volume by mode, traffic volume, and various socio-economic indices, is necessary to produce more varied and practical transport DB to satisfy the people's right to know.

Lessons

The transport DB in Korea, as explained in the previous sections, started as a public works, and experienced both small and large trials and errors. The DB has been diversified and advanced recently in 15 years after the project started. From the perspective of the developing countries, the systematic establishment of the transport DB seems far beyond the reality, while they give priority to infrastructure construction. However, the establishment of the transport infrastructure without the transport DB, which is used as an input data for it, is highly likely to be made based on inaccurate demand forecasts. The establishment of the transport DB does not cost much at the initial stage, and if necessary, it could kick off anytime with the help of the Asian Development Bank (ADB) or the World Bank. Also, because it is very important but difficult to perform the demand forecast through the objective and standardized DB, it is desirable to learn the relevant techniques and know-how of the experienced organizations such as the KOTI DB center for the system establishment at the beginning stage. Now, many countries are seeking to improve their national competitiveness through objective comparisons based on various transport statistics published in their nations. In an effort to keep up with this trend, Korea plans to make the transport DB compliant with global standards, and also it is advisable for developing countries to establish the transport DB system to develop into the GTDB (Global Transport Data Base) before it is not too late.

CHAPTER 12

SUSTAINABLE TRANSPORT

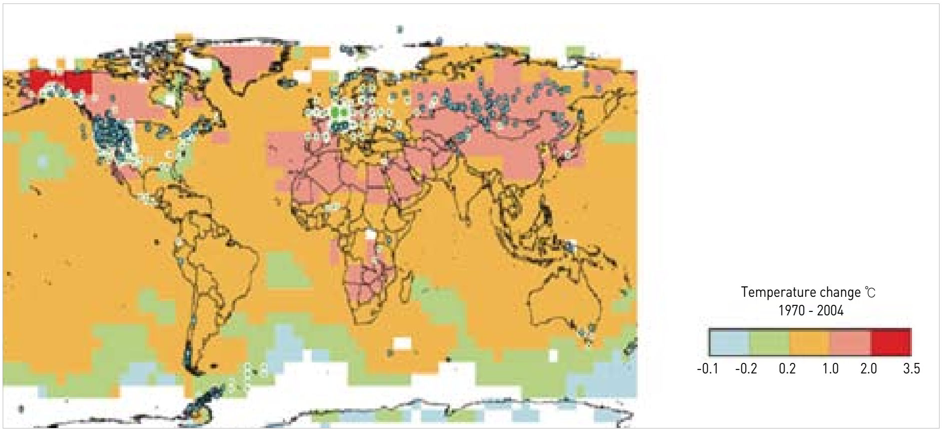
Seung Kook WU
Associate Research Fellow, The Korea Transport Institute

01
Background

Global Warming Prospects

According to the IPCC[1] Climate Change 2007: Synthesis Report, global warming in the past 100 years has been caused by the artificial increase of carbon dioxide from fossil fuel use. In the past 100 years, the global average temperature has increased by about 0.74°C, while sea levels have risen 1.8 mm every year, and the concentration of carbon dioxide, responsible for 77% of the greenhouse gas (GHG) emissions have increased. Also, carbon dioxide emissions between 2000 and 2030 are projected to grow to 110% over that period, global average temperature will increase 4°C by the end of this century and sea-levels will rise by 48cm. Also global warming and sea level rises are expected to bring change to the eco-system, and increased frequency and intensity of drought and heavy rain.

Figure 12.1. Global temperature change (1970-2004)



• Source: IPCC, Climate Change 2007: Synthesis Report, 2008

1) IPCC: Intergovernmental Panel on Climate Change

United Nations Framework Convention on Climate Change (UNFCCC)

The United Nations Framework Convention on Climate Change (UNFCCC[2)]) is an international environmental treaty produced at the Rio Environment Summit, held in June 1992 to combat abnormal climate conditions. The ultimate goal of the treaty is to stabilize GHG concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. A total of 154 nations out of 178 participants signed the UNFCCC, which entered into force in March 1994. As of 2010, the UNFCCC has 194 parties. In 2009, the Copenhagen meeting set a long-term target of limiting the global temperature rise to 2°C above pre-industrial level.

After the Rio environment summit, the ‘Kyoto Protocol’ has established and promoted global measures to reduce GHG emissions. The ‘Kyoto Protocol’ prescribed legally binding obligations for AnnexI countries to reduce their GHG emissions, and through the continuous meetings, it be came inevitable for developing countries also to fulfill the GHG reduction commitments. Under the ‘Kyoto Protocol’, AnnexI countries committed themselves to binding targets for GHG emissions for the period 2008-2012, and 39 parties reduced GHG emissions by 5.2% below the benchmark 1990 emissions levels during that period.

Recently, at the 2011 climate change conference in Durban, South Africa, parties finally agreed on a platform, in which developing and developed countries agreed to enter into a 2020 legal frame work to cut GHG emissions.

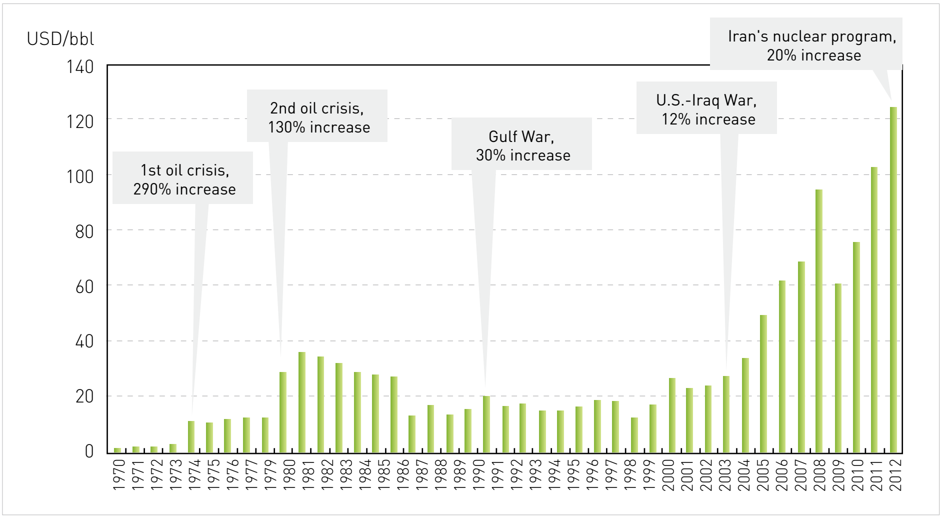
Energy Crisis due to Oil Price Hikes

The price of oil as the main transport energy source has increased gradually over the past 40 years.

Korea has to import almost all of its energy requirements. The energy use of

2) UNFCCC: United National Framework Convention on Climate Change

Figure 12.2. Dubai oil prices



- Note: In 2003, oil prices increased by 12% over the previous year. The Iraq War was certainly a factor in the climbing oil prices.
- Source: www.opinet.co.kr

the transport sector is proportionate to GHG emissions, so GHG reduction in the transport sector raises significantly the cost of energy imports.

Problems with the Current Transport System

Increase of GHG Emissions in the Road Sector

Total GHG emissions in 2009 amounted to 607.6 million ton CO_{2eq}, and the energy sector accounted for 84.9%. The trend shows that total GHG emissions have increased continuously, but yearly average increase rate has slowed down.

The 2009 GHG emission, excluding international bunkers, in the transport sector formed 13.6% of total emissions, or 16% of the energy sector. Like the national GHG emissions, its yearly increase rate has showed a downward trend.

In 2009 road sector GHG emissions by transport mode, excluding international bunkers, road recorded the highest level of 94.9%, followed by shipping, aviation and railways. Road sector emissions have continued to increase every year, but its yearly increase rate has slowed down, and emissions in other sectors have maintained the current status or showed a decreasing trend.

Table 12.1. GHG Emissions in Korea

(Unit: million ton CO_{2eq}, %)

Classification	1990	1995	2000	2005	2006	2007	2008	2009	Increase rate (2009 over 1990)
Energy Total	243.1	357.7	414.4	469.6	476.6	495.8	509.6	516.0	112.3%
Energy	48.8	95.8	137.0	177.5	187.2	198.2	211.1	228.7	368.7%
Manufacturing & construction	77.0	115.2	129.6	134.6	136.0	144.6	150.0	140.8	82.9%
Transport	35.4	64.9	70.1	81.9	82.7	84.0	81.8	82.6	133.4%
Others	76.5	78.6	73.4	69.6	64.4	62.3	59.9	57.6	-24.7%
Fugitive emissions	5.4	3.2	4.4	5.9	6.2	6.7	6.8	6.4	18.0%
Industrial process	20.2	51.3	58.4	64.1	62.8	58.6	58.3	56.7	180.6%
Agriculture	22.7	23.5	22.4	20.3	19.7	19.3	19.4	19.8	-12.6%
Waste	10.4	15.5	18.5	16.3	16.6	15.2	15.1	15.1	44.8%
Total emissions	296.4	448.1	513.7	570.3	575.7	588.8	602.3	607.6	105.0%

• Note : Excluding carbon absorption by Land-Use Change and Forestry
• Source: Third National Communication of the RepublicofKoreaUndertheUNFCC,RepublicofKorea,2011.12

Table 12.2. 2009 GHG emissions by sector

(Unit: million ton CO_{2eq}, %)

Classification	Total	Energy consumption					Industrial process	Agriculture & livestock	Waste
		Energy	Manufacturing &construction	Transport	Others	Fugitive emissions			
Emissions	607.6	228.7	140.8	82.6	57.6	6.4	56.7	19.8	15.1
Rate	100%	37.6%	23.2%	13.6%	9.5%	1.1%	9.3%	3.3%	2.5%

• Notes: 1) In the transport sector, international bunker emissions excluded and net calorific value applied
2) Except carbon absorption by Land-Use Change and Forestry
• Source: The Ministry of Environment, 'National GHG Inventory Report', 2011

Table 12.3. GHG emissions by transport mode

(Unit: million ton CO_{2eq}, %)

Classification	1990	1995	2000	2007	2008	2009	Yearly increase rate		
							1990-2000	2000-2009	1990-2009
Total	32.94	60.88	65.88	83.78	81.67	82.14	7.2%	2.5%	3.2%
Road	28.95 (87.9%)	55.15 (90.6%)	60.96 (92.5%)	79.6 (95.0%)	77.31 (94.7%)	77.94 (94.9)	7.7%	2.8%	3.5%
Railway	0.78 (2.4%)	0.84 (1.4%)	0.87 (1.3%)	0.67 (0.8%)	0.66 (0.8%)	0.58 (0.7)	0.5%	-4.4%	-1.0%
Aviation	0.83 (2.5%)	1.34 (2.2%)	1.43 (2.2%)	0.9 (1.1%)	1.05 (1.3%)	1.17 (1.4)	1.1%	-2.2%	-1.2%
Shipping	2.37 (7.2%)	3.55 (5.8%)	2.64 (4.0%)	2.62 (3.1%)	2.65 (3.2%)	2.45 (3.0)	-5.9%	-0.8%	-0.1%

• Note: International bunker emissions excluded and net calorific value applied.
• Source: Korea Transportation Safety Authority,2009 Transport Sector GHG Emissions, 2011

Road-Centered Inefficient Transport System

According to the transport statistics of 2009, road transport was responsible for

81.7% of passenger volume, and 75.1% of freight volume, showing the road-centered and inefficient transport structure. [passenger (2009): road 81.7%, railway 15.4%, aviation 2.7%, shipping 0.2%, freight (2009): road 74.1%, railway 6.93%, aviation 0.08%, shipping 18.88%]

Increased Traffic Congestion and Road-Centered SOC Investment

The number of registered vehicles in Korea showed a rapid increase from 11.1 million in 1985 to 18.4 million in 2011, and it is expected to increase to 20 million by 2020. Therefore, SOC investment in the transport sector has been made mainly on roads. For he past five years from 2005 to 2009, the rate of investment in the transport infrastructures was 48% for roads, and 23% for railways.

Table 12.4. SOC investments in the transport sector (Unit : million USD, %)

Classification	Road	Railway	Urban railway	Airport	Port	Logistics, etc.	Total
2005	66,642 (49.3)	31,824 (23.6)	10,753 (8.0)	3,530 (2.6)	16,135 (11.9)	6,243 (4.6)	135,127
2006	63,971 (48.1)	28,644 (21.5)	11,263 (8.5)	3,407 (2.6)	16,871 (12.7)	8,766 (6.6)	132,923
2007	65,504 (47.8)	30,109 (22.0)	11,170 (8.2)	2,899 (2.1)	17,932 (13.1)	9,344 (6.8)	136,958
2008	68,921 (46.7)	35,083 (23.8	12,268 (8.3)	1,834 (1.2)	17,917 (12.1)	11,545 (7.8)	147,568
2009	80,640 (46.5)	45,077 (26)	14,037 (8.1)	515 (0.3)	18,490 (10.7)	14,840 (8.5)	173,598

- Note: Exchange rate 1,150 KRW/USD applied, ( ) rate
- Source: The Ministry of Land, Transport and Marine Affaires, 'National Transport Network Plan, 2nd Amendment', 2011

Also supply-centered transport policies resulted in the increase of the number of vehicles, creating a vicious cycle of traffic congestion and road expansion. From 2002 to 2009, the number of daily auto trips in the metropolitan area increased from 15.7 million to 19.5 million, and in local major cities, the trips were increased by 20% on average. Average travel speed in Seoul was 16km/h, and also other cities faced traffic congestion.

Therefore, it is required to adjust investment rates among transport infrastructures to realize a sustainable transport system.

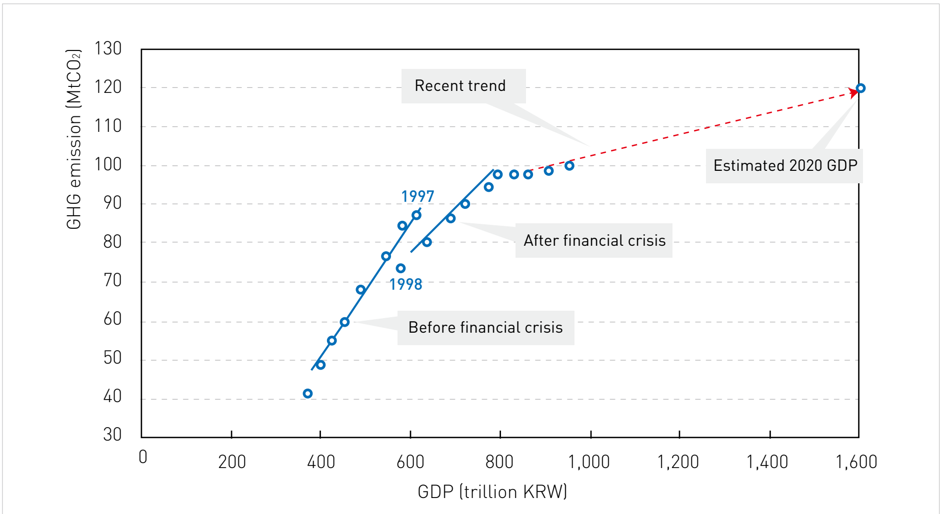
Increase of Socio-Economic Costs Incurred by Traffic Congestion

In 2008, traffic congestion costs reached 26.5 trillion KRW, with a yearly increase rate of 3.9%. It amounted to 2.8% as percentage of GDP, which was a relatively high level compared to those of developed countries such as 0.63% of the U.S. and 2.3% as of 2005.

GHG Emissions Outlook to 2020 in the Transport Sector

Based on GDP and GHG emissions, 2020 GHG emissions in the transport sector including international bunkers is estimated at 120 billion CO_{2eq}, which is similar to 121 billion CO_{2eq}, the estimates of the Green Growth Korea, and 157 billion CO_{2eq} when international bunkers are excluded.

Figure 12.3. GHG emissions projections in the transport sector



• Source: Korea Energy Economics Institute (http://keei.re.kr/) IMF, World Economic Outlook, 2010

02
Korea's Transport Master Plan for Climate Change

Korea's Response to Climate Change

Since 1990 Korean GHG emissions have been growing fast due to the economic development of the manufacturing industry. Korea is a non-AnnexI party to the 'Kyoto Protocol' to the UNFCC, but the 10th largest energy consuming country in the world as of 2008. It is be cause Korea has an energy matrix which is largely dominated by fossil fuels, but lacking a green industry and technology for GHG reduction.

On August 15, 2008, at a national address the President announced a low-carbon, green growth as a new vision, and relevant policies have been promoted government-wide.

Framework Act on Low Carbon, Green Growth

The 'Framework Act on Low Carbon, Green Growth,' enacted in 1999, is to systematically connect and integrate the policies of climate change, global warming, new and renewable energy, etc, which are implemented individually and collectively in various governmental bodies.

- Main contents of the 'Framework Act on Low Carbon, Green Growth'
  - The government shall establish and implement the 'Basic plan for coping with climate change' concerning medium- and long-term targets for the GHG reduction and countermeasures for each sector by phase, and the 'Basic plan for energy' concerning the energy demand management and the safety control of energy.
  - The government shall set up medium- and long-term targets by phase for GHG reduction, energy conservation, energy efficiency improvement, and new and renewable energy use promotion, and make entities which

emit GHG and consume energy over a certain degree forced to report their performance to the government, and establish an integrated information management system for GHG.

- The government shall operate a system for setting limits on GHG emissions and for trading emissions by utilizing market functions in order to accomplish its target of GHG reduction, and to prepare for the international emissions trading market. And GHG emissions allowances under the cap, registration, management methods will be regulated.
- Target for GHG reduction is specified in the enforcement decree of the ‘Framework act on low carbon, green growth’ (2010. 01): GHG emissions reduction target of 30% BAU by 2020.

Sustainable Transport and Logistics Development Act

In 2009, the ‘Sustainable Transport and Logistics Development Act’ was enacted to specify basic directions, establishment and promotion for sustainable transport and logistics policies in response to changing circumstances such as climate change, energy crisis, and call for environment protection, etc. The purpose of this Act is to make a contribution to establishing the foundation for sustainable transport and logistics for the present and future generation, and improving the national economy and people’s welfare.

• Main contents of the ‘Sustainable Transport and Logistics Development Act’

- The government shall designate and manage a sustainable transport and logistics zone and establish management indices and standards.
- The government shall arrange various means to promote the shift to a sustainable transport and logistics system, and establish relevant regulations to efficiently promote policies of GHG emissions.
- The government shall promote non-motorized carbon free modes of transport, and regulate the designation and management of special zones.
- The government shall establish and implement a ten-year master plan for sustainable transport and logistics to shift the current transport and logistics system to eco-friendly, energy saving, low-carbon system.

- Shift of transport and logistics system to energy saving low carbon mode
- Security of mobility and accessibility
- Designation and management of transport and logistics zone suitable for the regional characteristics (by region)
- Set up sustainable management indices and standards
- Promotion of nom-motorized, carbon free modes of transport

Master Plan for the Development of Sustainable Transport and Logistics

As prescribed in the "Sustainable Transport and Logistics Development Act," the "Master plan for the development of sustainable transport and logistics," as a ten-year national plan to facilitate the development of sustainable transport and logistics system, presented policy directions and promotion strategies to establish green transport system for the next ten years.

- Main contents of the "Master plan for the development of sustainable transport and logistics"
  - Traffic demand management (TDM) reinforcement and improvement of operational efficiency of transport facilities
  - Promotion of walking/cycling as daily modes of transport
  - Public transport infrastructure expansion and service improvement
  - Establishment of low carbon green logistics system
  - Development of eco-friendly transport and logistics technology
  - GHG emissions reduction target of 34.3% BAU by 2020

GHG/Energy Target Management System

"GHG/Energy Target Management System" laid the groundwork to achieve the national interim target of GHG emissions reduction. The government has sought to establish GHG inventory through the system as soon as possible, and put it into force.

- Main contents of the "GHG/Energy Target Management System"
  - The Ministry of Environment, in charge of 'GHG/Energy Target Management

System,' and other competent organizations such as the Ministry for Food, Agriculture, Forestry and Fisheries, the Ministry of Knowledge Economy, and The Ministry of Land, Transport and Marine Affaires, announced the 'Guidelines on the operation of GHG/Energy target management' (Ministry of Environment, Notice No. 2011-29) on 16 March.

- According to the guidelines, 468 entities, designated in September 2010, started to perform the GHG/Energy target management.
- When the companies set GHG reduction target and energy saving targets in September 2011, and submit the action plans by December 2011, the year 2012 will be a starting point.

GHG/Energy Emissions Trading System

The "GHG/Energy emissions trading system" is a cost-effective measure to cut the cost for GHG reduction at a national level based on market principles, which allow companies to cut emissions or buy credits by comparing the reduction costs and the cost of such credits. After the system draft was submitted to the parliament in April 2011, the "Special committee on response to climate change and green growth" made amendments by collecting opinions from industries, environmental groups, and other sectors. And through consultation among parties, finally, the National Assembly approved it. It will go into effect in 2015.

• Main contents of the "GHG/Energy Emissions Trading System"

- The government shall establish a national allocation plan every five years including total allowed emissions, industry sector, and business type.
- As part of the "Framework Act on Low Carbon, Green Growth", the government will designate companies that discharge 125,000 tons more of carbon dioxide annually or work places that emit at least 25,000 tons a year, or voluntary companies.
- The system will be applied to the all parts of the designated sector, and allocation plan will be decided considering application circumstances, impact on international competitiveness, etc by sector and business type.
- Companies can sell off or buy the emissions right, and for the transaction

they should hold emissions trading accounts in the registry.

- The government will offer tax benefit or financial support for the installation of equipments for GHG emissions reduction to prevent competitive disadvantages for the industries under an emissions cap.

Scope of Master Plan

- Time scope
  - Period: 2011-2020
  - Interim target year: 2015
- Spatial scope
  - Nationwide
- Work scope
  - The plan puts focus on realizing the substantiality of transport and logistics system through the low energy and low carbon activities, taking into consideration international GHG reduction efforts and "Framework Act on Low Carbon, Green Growth."
  - Travel modes encompass road transport including walking/cycling, railway transport, aviation transport, and marine transport.

Target and Strategy

Target

Promotion of Environmentally-Friendly and Human-Centered Green Transport

So far, the operation of community roads have put more focus on 'cars' rather than 'people', causing problems of prevalent parking on the community roads and sidewalks. And the length of bicycle lane per person in Korea is 0.19m, which is lower than other advanced countries, like 0.62m in Japan and 1.16m in the

Netherlands. These facts show the poor walking/cycling environment in Korea. And pedestrian road accident deaths in Korea marked the highest among the OECD countries, recording 4.4 deaths per 100,000 people, compared with 0.96 in U.K. and 1.55 in Japan.

Also, the public transport is analyzed as a slower mode than private passenger car. Compared to the travel time (subway/car, min.) from new towns to Seoul, The results shows Bundang Seohyun (92/48), Ilsan Juyeop (85/67), and Pyungchon Bumgae (72/59). And the average waiting/transfer/access time of public transport is 26 min., accounting for 50% of the total travel time. Mass transit such as bus and railway needs to be developed as an eco-friendly mode of transport which consumes less energy per transport volume. And the competitive public transport modes should be equipped with speed, convenience and comfort.

It is necessary to develop the public transport and improve the environment for the carbon-free modes of transport to promote human-centered green transport.

Establishment of Low-Carbon and High-Efficiency Transport and Logistics System

The number of registered vehicles in Korea skyrocketed from 11.1 million in 1985 to 18.4 million in 2011. Also from a supply side, the investment in transport infrastructure has focused on road transport.

The total road length is 104,236km (3,368km of expressway, 13,832km of national road), intercity railway length is 3,381km (40% double track), and road investments exceeds over 50% of transport SOC budget, which were 54% in 2004, and 47% in 2009.

The transport sector forms a large part of national GHG emissions. And in terms of the energy consumption and GHG emissions per unit of transport volume, road transport, which is less efficient than other modes, accounts for the most part.

It is necessary to control and make efficient the movement of people and freight by car to establish the low carbon, high efficiency transport and logistics system.

Creation of New Growth Engines in the Green Transport Sector

2010 Budget for transport technology[3)] amounted to 203.2 billion KRW, accounting for 1.5% of total R&D budget of 13.6 trillion KRW. Compared to advanced countries which put importance on transport technology as well we information technology (IT), bio technology (BT), and environment technology (ET), research and development for improving transport system are not satisfactory.

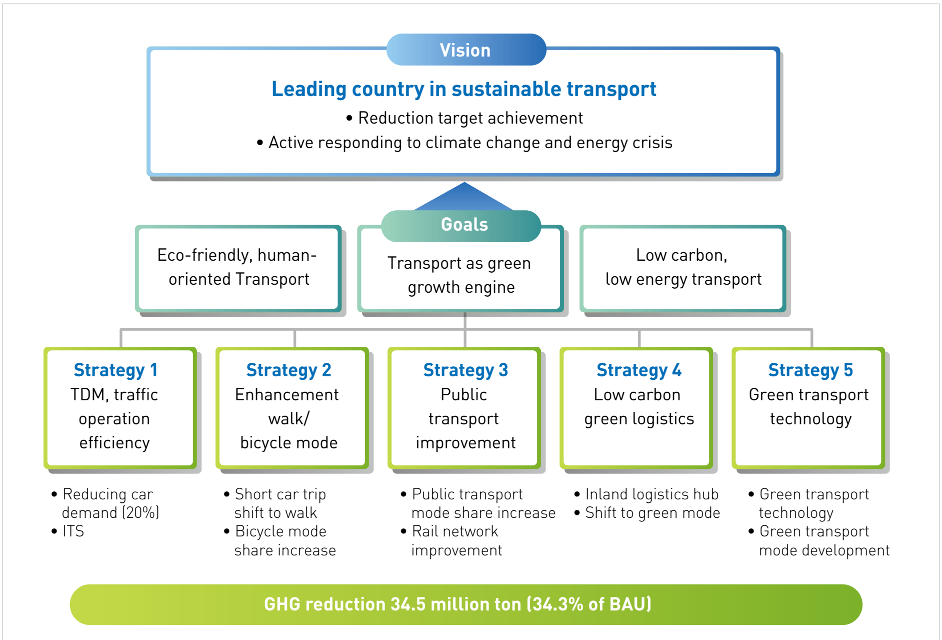
As battery technology for electric vehicles has rapidly improved, the production and distribution of electric cars is likely to increase beyond hybrid cars, but still there is a lack of charging stations and distribution bases for them.

It is essential to enhance sustainable transport and logistics system and explore new business area, through the development and distribution of eco-friendly technology, to create new growth engine in the green transport sector.

Five Promotion Strategies

Based on the abovementioned basic framework, five strategies for fulfilling targets

Figure 12.4. Strategy map sustainable transport



3) Research and development projects for transport technology include transport system efficiency, future railway technology development, air transport advancement, air and space center construction.

are established as follows:

- TDM reinforcement and improvement of operational efficiency of transport facilities
- Walking/cycling modes promotion
- Public transport infrastructure expansion and service improvement
- Low carbon green logistics
- Development of green transport and logistics technologies

03 Strategies and Estimated GHG Emissions Reduction

(Strategy 1) TDM Enhancement and Traffic Operation Efficiency

Car Sharing

According to the 2006 national household travel survey performed by the metropolitan transport authority, the total number of commuting trips from the metropolitan area including Seoul, Gyeonggi province, and Incheon city to Seoul amounted to 4.5 million, and daily commuting trips with in Seoul reached 9 million. The introduction of a car sharing program is expected to reduce 5.2%, or 460,000 out of the total trips, equivalent of 58 million km in travel distance, when 12.5km of average commuting distance applied.

Table 12.5. Trip reduction effects by the decrease of commuting trips by car (2006)

Commuting destination	Period	Total trips (ten thousand trips)	Trip reduction effects (ten thousand trips)	Travel distance reduction effects (million trips-km)	Rate (%)
Seoul	day	902.2	46.1	5.8	5.11
	year	238,172.9	12,181	1,528	
Metropolitan area	day	1,811.7	92.7	11.6	
	year	478,300.5	24,463	3,058	

• Note: 12 months per year and 22 working days per month

ITS Establishment

ITS (Intelligent Transport Systems) is a low cost, high efficiency smart transport system which, through the integrated application of advanced IT technology and transport information to the transport facilities, improves the efficiency and safety, and facilitates the automation and systematization of the transport operation and management. According to a 2009 report of SERI (Samsung Economic Research Institute), the nationwide ITS establishment was expected to decrease traffic congestion/accident costs and logistics costs, thereby bringing about social benefits of more than 11.8 trillion KRW. And in 2009 KOTI expected that ITS would contribute to about 12% of potential GHG emissions reduction in the transport sector. The government has expanded the installation of ITS on major arterial roads across the country with a target of 25% of nationwide paved road, or 2,065km by 2020, from 12%, or 9,763km in 2010.

Table 12.5. ITS establishment plan for paved roads across the country

Classification		2010	2020
Paved road across the country		11%	25%
Expressway(new · expansion)		100%	100%
National road		18%	45%
Road in the urban areas	Seoul · metropolitan city road	8%	20%
	city road	9%	27%
	provincial road	1%	7%

Eco-Driving Promotion

Eco-driving is an economical and environmentally friendly driving practice, which avoids sudden acceleration/deceleration/start/braking. It leads to energy-saving and reduction of GHG emissions from cars.

Eco-driving practice, along with maintaining economical speed and distance between cars while driving, is expected to result in the decrease in fuel and maintenance costs, the capacity to proactively cope with high oil price and energy crisis, and the decline of traffic accident by 30-40%.

Recently, the Korea Transportation Safety Authority was designated and notified as an eco-driving training center through the contest and review on 5 April 2001.

IT-Based Smart Mobile Office Promotion

Smart mobile office, such as IT-based telecommuting and working center, restrains traffic demand. In order to promote the smart mobile office, it is required to create an environment where people can work anytime anywhere on the Internet, prepare support measures for its promotion, and connect communication technology and transport to ease the incoming traffic. Also, it is necessary to provide an Internet-based mobile office environment in the public transport modes (KTX, express bus, etc) and install teleworking facilities (meeting rooms, etc) at the major transport nodes (terminal, transit centers, etc). When this system actively operates and 10% of workers become teleworkers, auto demand is expected to decrease by 4.2%.

(Strategy 2) Promotion of Walking/Cycling as a Daily Mode of Transport

Walking Environment Improvement

Pilot Program of Pedestrian Preference Zone

The purpose of implementing the pilot program of pedestrian preference zone is to arrange roads in residential/commercial area with poor walking conditions or high risk of accidents, and to create convenient walking environment, by applying traffic calming measures. Since 2007, the government has designated the zone every year and offered support for detailed design plan, and currently the total number of pilot zones is 18 including 9 in the 1st phase, 6 in the 2nd, 3 in the 3rd. At present, the pedestrian preference zone project is being promoted, coupled with the '2nd plan for the promotion of the transport convenience of the mobility disadvantaged (2012-2016).'

Urban Olle, Walking Tail, Establishment and Operation

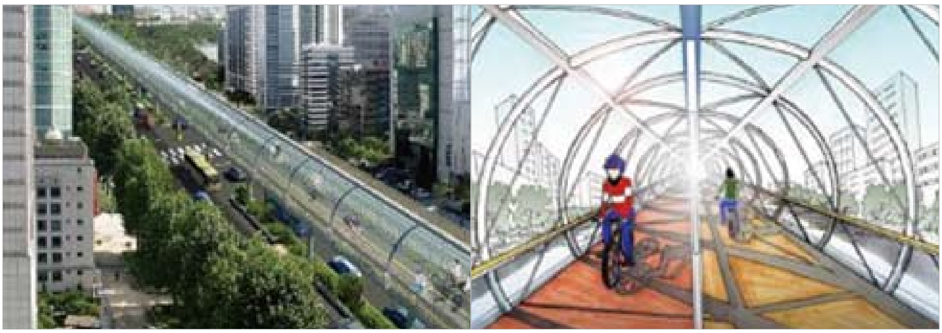
Environmentally friendly walking trail, like Jeju Olle, in the city aims to shift medium- and long-distance leisure trips to walk trips by building urban walking trails, Olle, around the residential areas and to diversify leisure areas. Also, walking trail, which connects public transport nodes (station, bus stops) and residential/ commercial area, can make a contribution to the increase of public transport use, and improve people's convenience by making spaces for a range of leisure activities through the route development in connection with riverside, historic buildings, theaters, etc.

Bicycle Use Promotion

Introduction of Bike Rapid Transit

Bike Rapid Transit (BIRT) is a tube-shaped light structure, which requires relatively low costs of construction and maintenance. This bridge can be used all the time regardless of weather conditions such as heatwave, coldwave, rain, snow, and icing. And because it can be constructed on the median barrier of roads or green areas, there is no separate land acquisition. Also, bicycle riders go faster on this transit system than on the existing bicycle road, and can save more travel time in commuting compared to bus rides. The height of the BIRT structure can be adjusted, regardless of slope steepness, to maintain hi-speed of bicycle with less energy.

Figure 12.5. Bike rapid transit overview



Expansion of Public Bike System

Public bike system needs to be expanded for the various types of connection with bicycle and other modes of transport including walking. Like other cases in advanced countries such as BiXi in Montreal, Canada, and Velib in Paris, France,

Figure 12.6. Public bike service operation cases (Changwon, Daejeon)

Changwon city	Daejeon city
• Service name is Nubija, 'let's ride' in Korean • Started in 2008 with 20 stations and 430 bicycles • Now, 224 stations and 2,195 bicycles in operation • About 8,500 daily use on average (as of 2010)	• Service name is Tashu, regional dialect for 'get on' • Now, 20 stations and 200 bicycles in operation • Scheduled to expand service

public bike rental service, as a transport mode for short distance, is expected to address severe social problems such as traffic congestion, air pollution, oil price hikes, etc. Currently, Changwon city and Daejeon city run the service as described in the following <Figure 12.6>.

(Strategy 3) Expansion of Public Transport Infrastructure and Service

Expansion of BRT (Bus Rapid Transit) Operation

Currently, it is said not to be a cost effective to put investment in the road and railway facilities to perform traffic demand management and alleviate traffic congestion. It is essential to actively expand the BRT system as a low cost, high efficiency public transport mode to ease traffic difficulties. The BRT system in Seoul improved bus speed by 2.0-9.0km/h, and punctuality with 1 or 2 minute variation.

Enhancement of the Connection of Transport Modes (Establishment of Multimodal Transit Center)

The multimodal transit center requires the construction at major transport nodes such as railway stations, bus terminals, transfer stations, etc, to nurture green transport as a new growth engine for the regional economy, and high-density compact development to provide a variety of services to residence. The center is expected to reduce transfer distance and waiting time by 30%, and create 110,000 jobs for ten years.

The construction of multimodal transit center, which has transport facilities in one place, creates ripple effects such as the reduction of travel time, the decrease of transfer impedance, the promotion of public transport use. In particular, the restraint of car use is expected to decrease energy consumption and GHG emissions. The analysis of 21 transfer parking lots showed that such park-and-ride facilities could bring the decrease of 500 million vehicles-km in travel distance, 3,881,000 TOE in energy consumption, and 1,154 CO_{2eq} in GHG emissions.

Expansion of Urban/Intercity Railway Service

It is necessary to expand the urban and intercity railways to reduce the transport difficulties of new town residents and to control the private car use. The expansion would improve the railway modal share and ease the congestion on major transport axes between the metropolitan city and its neighboring areas. The urban and intercity railway networks will be expanded from the current 831km to 1,054km by 2012, or a 1.3-fold increase.

It is advisable to change the train operation methods to express mode to increase its modal share by improving train speed. Express train service in pilot operation has less stops than rapid train, thereby reducing the travel time entering into the city center by more than 30%. For example, the Gyeongui line has 20 stations of normal service, 11 stations (60 minutes) of rapid service, and 8 stations (48 minutes) of express service.

Establishment of National High-Speed Railway Network

The Honam high-speed railway construction will make a contribution to the nation's balanced development through the establishment of the national transport network, and prepare for the increase of the traffic demand in Honam region, a southwestern part of the Korean peninsula. This Honam line is expected to reduce logistics costs by increasing transport capacity dramatically, enable a half-day living zone by reducing travel time from Seoul to Mokpo from 185 minutes to 106 minutes by 79 minutes, and help establish the transport network connected with the continental train.

It is necessary to set up detailed action plans for the ongoing projects of high-speed rail construction on the major arterial lines to promote regional balanced development and improve railway modal share.

Development of New Generation High-Speed Railway

The world high-speed train market is fiercely competing to develop the Electric Multiple Unit (EMU). Korea has been developing the next generation high-speed railway with the top speed of 400km/h and the maximum operating speed of 370km/h, to keep up with the world trends in railway technology and the technical demand. Also, after the completion of Gyeongbu high-speed railway line, it is necessary to cope with foreign demand as well as domestic demand such as Honam high-speed railway line construction.

- High speed train development by nation
  - Japan: 360km/h 'FASTECH 360,' EMU, opened in March 2011
  - France: 360km/h, 'AGV,' EMU, commissioning
  - Germany: 350km/h, 'VELARO,' EMU, opened in 2007
  - Korea: 350km/h, 'HSR-350X,' 'KTX-II,' currently, 400km/h HEMU-400x under development

(Strategy 4) Establishment of the Low Carbon Green Logistics System

Modal Shift to Railway/Marine Transport

The freight transport system is necessary to shift its focus from road transport to railway/marine transport to reduce GHG emissions in the transport sector. However, railway/marine transport has weak competitiveness in terms of time and cost. Therefore, without any special support, the road-centered freight system will be likely to set in. Therefore, until the railway/marine transport has enough competitiveness, the government should financially support some part of costs, to encourage the modal sift by concluding an agreement with a consignor/transport business and giving subsidies based on performance.

Promotion of a Third Party Logistics (3PL)

It is necessary to promote the change of 1PL and 2PL to 3PL to reduce a company's logistics costs by transferring the shipper's logistics activities to a 3PL provider. To this end, the government should reinforce 3PL parts in the standards for the certification of integrated logistics company, thus encouraging companies to actively pioneer the 3PL market. As of 2010, 52.1% of companies work with 3PL providers (Europe 80%, U.S. 79%, Japan 70%), and 3PL market size in 2009 is estimated to have been about 8 trillion KRW, accounting for 7.9% of total logistics market.

Also, in an effort to minimize the 2PL activities of large-sized shippers, it is necessary to check the performance of the publication of large-scale internal trading prescribed in the Fair Trade Act, and investigate the undue internal trading between a large-sized shipper and a logistics subsidiary, and keep providing 3% reduction of corporate tax on logistics costs to the companies using 3PL providers and counseling works about 3PL. The promotion of using 3PL providers by

Figure 12.7. Number of companies using 3PL providers

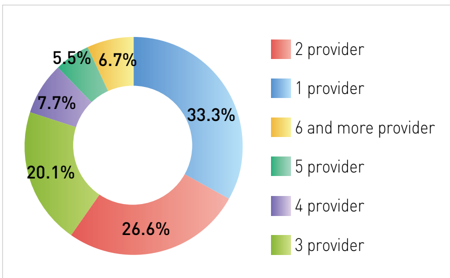
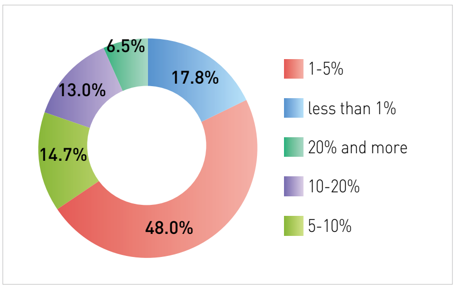


Figure 12.8. 3PL costs as a percentage of revenue



• Source: The Korean International Trade Association, 'Results of Survey on the Use of 3PL Providers', 2009
KOTI, 'National Logistics Master Plan (2011Ð2020)', 2010

manufacturing industry will make a contribution to the national economy.

Conversion of Freight Vehicles from Diesel to LNG

Freight vehicles need to be converted from diesel to LNG as a part of efforts to introduce the use of eco-friendly alternative fuel because of oil price hikes. Diesel powered freight vehicles of more than ten tonnes will be equipped with LNG fuel system and use the dual-fuel of diesel and LNG. Also the government promotes the development of additional engines to be converted and the expansion of the types of vehicles for the conversion. The introduction of LNG freight vehicles is expected to ease the financial burden of the freight transport business, and reduce GHG and air pollutants.

(Strategy 5) Development of Eco-Friendly Transport Logistics Technology

Development and Promotion of Green Cars

So far, the shortcomings of electric vehicle (EV) such as frequent charging or short driving distance. have obstructed its commercialization. Therefore, as oil price rise and environmental issues have received attention and relevant technology has been developed, it is necessary to promote the use of EV.

To that end, it is required to set up separate standards about low-speed EV, give the permission to run in designated areas, and establish the qualification criteria for a maintenance company and the conversion standards for the safe conversion of internal combustion engine vehicle to EV. And it is also required to improve the safety standards for EV through the monitoring of on-road driving performance.

The government will revise laws related to parking lots and housing to establish the legal grounds for the charging infrastructure installation in public parking lots and public housing at the initial stage of its commercialization. Considering the trends of EV distribution, the infrastructure for hi-speed charging will be installed at gas stations, and express rest areas. as separately as possible.

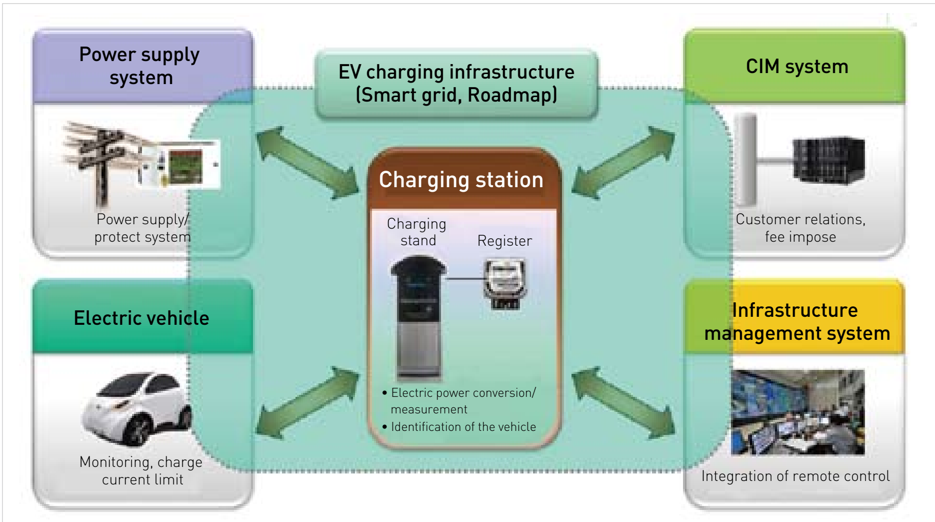
Table 12.7. Distribution target of the charging infrastructure (Unit : 1,000 units, accumulated value)

Classification			2011	2013	2015	2020
Electric charging station	Public charging station	Low-speed	0.17	3.1	4.5	8
		Hi-speed	0.07	0.5	1.1	2.6
	Commercial charging station	Low-speed	-	2.5	11.4	1,321.1
		Hi-speed	-	1.0	3.0	19.6
	Total		0.24	7.1	20	1,351.3
Hydrogen station (unit)			-	18	43	168

• Source : Ministry of Knowledge Economy, Ministry of Environment, Ministry of Land, Transport and Maritime Affaires, 'Strategy and Challenge for being a Top 4 in the Green Car Market,' 2010

In preparation for the full-fledged EV production, it is required to expand charging facilities and establish the standardization. Hyundai Motor launched a pilot program in 2011 and plans to produce in 2013. Standard charging models available in Korea should be found through the empirical investigation of various charging methods. Currently, the Ministry of Knowledge Economy has promoted the development of the operation (payment) system for charging infrastructure, and performed an empirical program of Jeju Smart Grid Test Bed/Smart Transport from December 2009 to May 2013.

Figure 12.9. Green car charge infrastructure [pilot project in Jeju (2009-2013)]



Improvement of Aircraft Fuel Efficiency

Voluntary agreement on reducing GHG emissions with airlines encourages them to put effort into improving the aircraft efficiency. Korean Air, Asiana Airlines, Jeju Air, which concluded the agreement in July 2010, and three low-cost carriers should submit action plans about the application of economical speed and procedure, improvement of aircraft and engine, establishment of optimum flight plan and reduction of payload, then the Ministry of Land, Transport and Maritime Affairs verifies the results. As the low-cost carriers have been growing in the air transport market, it is necessary to promote the voluntary agreement with them. The government set up the “Guidelines on the operation of the voluntary agreement on GHG reduction” in January 2010 to proactively respond to global climate change regulations such as ICAO. Therefore, it is required to form a council, which is composed of the private, public and institutes to set targets and check the performance of the voluntary agreement, thereby improving the competitiveness of national flagship carriers through the preemptive response to the global climate change regulations and GHG emissions target management system. Active reduction of GHG emissions is expected to improve more than 2% of aircraft fuel efficiency and maintain the world’s top fuel efficiency performance.

GHG Emissions Reduction by Strategy

Table 12.8. GHG emissions reduction by strategy

Strategy	Action plans	CO_2 1,000ton	
1 TDM Enhancement Traffic operation efficiency	Car-sharing program	460	3,940
	ITS establishment	1,430	
	IT-based smart mobile office promotion	1,950	
	Eco-driving promotion	150	
2 Promotion of walk/bicycle as a daily mode of transport	Walking environment improvement	3	820
	Bicycle use promotion	817	
3 Expansion of public transport infrastructure and service	BRT operation expansion and public transport connection system enforcement	20	2,430
	Urban/intercity railway service expansion	2,410	

4 Establishment of low carbon green logistics system	Conversion to railway and marine transport	4,810	6,900
	Promotion of 3PL and joint logistics	2,080	
	LNG freight vehicles	10	
5 Development of eco-friendly transport logistics technology	Green car development and distribution	2,240	20,410
	Improvement of aircraft fuel efficiency	170	
Total		34,500	

04

Application of GHG Mitigation Strategies

Policy Priority

The priority assessment of GHG reduction policy considers cost, time, acceptability, potential reduction, co-benefits, rebound effects, etc. However, it is subject to change due to each nation's circumstances.

As shown in <Table 12.9>, the public transport is classified as a high cost, low effect policy in the United States, which has large land area and low household density. However, in general, as shown in <Table 12.10> of German cases, the public transport is regarded as highly effective policy.

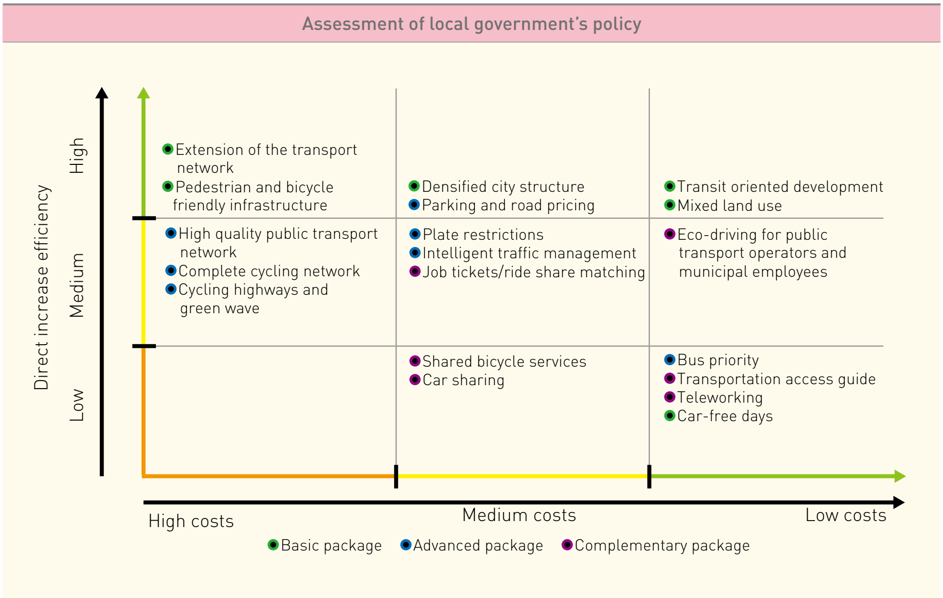
In both the U.S. and German cases, eco-driving and the distribution of fuel-efficient cars are evaluated as highly effective policy.

Table 12.9. Assessment of GHG emissions reduction policies in the U.S.

Classification		Low cost, High effect	Low cost, Low effect	High cost, High effect	High cost, Low effect
Acceptability	High	Eco-driving	ITS	Fuel-efficient green car	Bio-fuel
	Medium	Mileage-based insurance	Modal shift to walk/ bicycle Car sharing	High speed railway	Flexible work, Smart mobile office, Public transport
	Low	Congestion fee			

• Source: U.S. Department of Transportation, Transportation's Role in Reducing U.S. Greenhouse Gas Emissions Volume 2: Technical Report, 2010.

Table 12.10. GIZ's assessment of GHG emissions reduction policy in Germany



- Note: GIZ supports the German Government in achieving its objectives in the field of international cooperation for sustainable development.
- Source: GIZ, Public Transport and Energy Efficiency, 2012

Development of Public Transport in Korea

Investment in Transport Infrastructure

After the liberation of Korea from the Japanese colonial rule, Korea has invested in mainly road transport. This can be noticed in the SOC investment records of the central government-led five-year economic development plans, and the trend has continued until now as shown in <Table 12.4>.

This investment trend has resulted in a 540% increase in road length from 16,241km in 1945, the year of liberation, to 104,236km in 2008, while railway length increased from 2,642 in 1045 to 4,182km in 2008 by 60%.

The Gyeongbu expressway, the first one in Korea, was built in 1970 when the number of registered cars in Korea was only 100,000. As this case shows, Korea has put more financial resources into roadt ransport than railway transport because of relatively low costs in initial investment and maintenance costs.

Road-centered investment has made a great contribution to the automobile industry, which has exerted great economic ripple effects on all the industrial sectors. Its yearly production capacity increased from 6,000 cars in the 1960s to 4,000,000 cars in 2011.

Table 12.11. Trends of transport investment during the periods of the five-year economic development plans

(Unit : billion USD, %)

Classification	Road	Railway	Subway	Airport	Port	Total
1th (1962-1966)	53 (17.2)	187 (60.6)	- (0)	23 (7.3)	46 (14.9)	209 (100)
2th (1967-1971)	997 (52.0)	551 (28.7)	72 (3.8)	66 (3.4)	232 (12.1)	1,919 (100)
3th (1972-1976)	4,064 (51.6)	2,321 (29.4)	216 (2.7)	164 (2.1)	1,117 (14.2)	7,882 (100)
4th (1977-1981)	14,176 (47.7)	6,464 (21.7)	4,810 (16.2)	1,277 (4.3)	3,001 (10.1)	29,729 (100)
5th (1982-1986)	32,340 (46.7)	8,389 (12.1)	21,199 (30.6)	1,933 (2.8)	5,379 (7.8)	69,240 (100)
6th (1987-1991)	100,196 (79.6)	12,713 (10.1)	686 (0.5)	2,207 (1.8)	10,033 (8.0)	125,835 (100)

- Note: ( ) percentage
- Source: Yong Sang LEE, Study on the railway history in Korean Rail, 2005

Trends of Transport Volume by Mode

Before the Seoul subway line 1 started its service in 1974, the government had developed road transport as a priority, focusing on bus service. With the opening of Seoul subway line 1 in the metropolitan area, the transport volume of railways increased, but still road transport, mainly bus service, accounts for 74% of the public transport. The bus service showed high records in transport volume even in the metropolitan areas where urban railways have been developed. See <Table 12.12>.

Korea has developed the road-centered public transport system, because it costs less than railway system, allows flexible route design, and offers great accessibility.

With the expansion of the BRT system, buses have improved the quality of service. The length of the BRT system in Korea was 195km in 2010 and will increase to 516km by 2020. And diesel bus-centered public transport produces various air pollutants such as nitrogen oxides, sulfur oxides, particulate matter (PM), carbon monoxide, etc, but recently the government is dealing with this environmental problem by introducing CNG buses, etc.

Table 12.12. Nationwide public transport volume

(Unit : 1,000 people/year)

Year	Total	Railways		Subway		Road (Bus+Taxi)	
		Volume	Share	Volume	Share	Volume	Share
1975	4,797,979	220,952	4.61%	34,288	0.71%	4,542,739	94.68%
1980	8,534,855	430,773	5.05%	65,076	0.76%	8,039,006	94.19%
1985	11,429,407	503,122	4.40%	325,238	2.85%	10,601,047	92.75%
1990	14,468,368	644,814	4.46%	1,101,677	7.61%	12,721,877	87.93%
1995	13,772,891	790,381	5.74%	1,693,003	12.29%	11,289,507	81.97%
2000	13,483,066	837,268	6.21%	2,235,221	16.58%	10,410,577	77.21%
2005	11,773,195	950,995	8.08%	2,020,360	17.16%	8,801,840	74.76%
2007	12,598,344	989,294	7.85%	2,090,290	16.59%	9,518,760	75.56%
2008	12,959,259	1,018,977	7.86%	2,141,872	16.53%	9,798,410	75.61%
2009	12,790,798	1,020,319	7.98%	2,182,346	17.06%	9,588,133	74.96%
2010	12,980,416	1,060,926	8.17%	2,273,086	17.51%	9,646,404	74.32%
Increase rate	-1.29%	0.13%		1.84%		-2.15%	

- Notes: 1) Subway, counting method changed in 2002
  2) Road transport included transport volume of buses and taxies only (except private cars)
- Source: The Ministry of Land, Transport and Marine Affairs, Statistical Yearbook, 2011

Table 12.13. Modal share in the metropolitan cities (2008)

(Unit : trips/day, %)

Area	Walking/ Cycling	Car	Bus	Subway /Railway	Taxi	Others	Total
Seoul Metropolitan	12,853,325	12,710,720	10,520,736	5,634,369	468,340	670,561	42,858,051
	29.99%	29.66%	24.55%	13.15%	1.09%	1.56%	100.00%
Busan, Ulsan	6,045,172	4,985,163	4,305,746	905,718	383,545	676,065	17,301,409
	34.94%	28.81%	24.89%	5.23%	2.22%	3.91%	100.00%
Daegu	3,301,843	3,027,413	1,695,389	341,091	102,100.99	286,544	8,754,381
	37.72%	34.58%	19.37%	3.90%	1.17%	3.27%	100.00%
Gwangju	3,159,516	2,785,316	1,636,366	43,865	136,139	260,081	8,021,283
	39.39%	34.72%	20.40%	0.55%	1.70%	3.24%	100.00%
Daejeon	2,800,459	2,636,312	1,342,098	47,822	110,172	220,143	7,157,006
	39.13%	36.84%	18.75%	0.67%	1.54%	3.08%	100.00%
Total	28,160,315	26,144,924	19,500,335	6,972,865	1,200,297	2,113,394	84,092,130
	33.49%	31.09%	23.19%	8.29%	1.43%	2.51%	100.00%

- Source: Korean Transport DB Center, 'National Transport DB Establishment, 2009: Vol. 5 Survey on Transport Volume and Modal Share,' 2010

Table 12.14. BRT lines in operation in Korea (as of 2010)

(Unit : km)

Classification	Seoul	Gyeonggi	Busan	Gwangju	Total
Length	100.4	90.4	1.08	2.7	194.6

Efforts to Reduce Bus Air pollution - CNG Bus Introduction

Compared to diesel buses, CNG buses emit very low levels of sulfur oxides and dust. Since 2000 the Ministry of Environment has obliged seven major cities including Seoul to introduce CNG buses only, and as of 2010, more than 95% of buses in Seoul are running on CNG. In Seoul, the introduction of CNG buses reduced 23% of nitrogen oxides, 80% of PM, and 44% of carbon monoxide as of 2008. Low sulfur diesel made a great contribution to a 67% decrease in sulfur oxides emission.

Table 12.15. Changes in air pollutant volume after the introduction of CNG bus (Unit : ton)

	SOx	NOx	PM	CO
1999, before the introduction	1,878	65,337	8,820	177,590
2008	627	50,404	1,785	99,458
Decrease rate (%)	66.6	22.9	79.8	44.0

• Source: The Ministry of Environment, Environment statistics, http://stat.me.go.kr/nesis/index.jsp

05
Lessons from Korean GHG Reduction Efforts

On August15, 2008, in a national address the President announced low-carbon, green growth as a new vision, and relevant policies have been promoted government-wide.

In 2011, the government established the “Master plan for the development of sustainable transport and logistics”, as a ten-year national plan to facilitate the development of a sustainable transport and logistics system, and presented policy directions and promotion strategies to establish a green transport system for the next ten years. The main contents of the Plan include TMD reinforcement and improvement of operational efficiency of transport facilities, promotion of walking/cyclingas daily modes of transport, the expansion of public transport infrastructure and service improvement, etc.

Korea has developed the road-centered public transport system, mainly bus service, because it costs less than railway system, allows flexible route design, and offers great accessibility.

CNG buses are fuel efficient and produce GHG emissions lower then diesel buses. Also natural gas, the main source of CNG, is imported from the East Asia, therefore, it could reduce the dependence of oil imports from the Middle East. Recently, the Ministry of Environment announced the introduction of hybrid CNG buses which are more fuel efficient than CNG.

And diesel bus-centered public transport produces various air pollutants such as nitrogen oxides, sulfur oxides, particulate matter (PM), carbon monoxide, etc, but recently the government has been dealing with this environmental problem by introducing CNG buses, etc.

Table 12.16. Comparison of CNG bus and diesel bus (100,000km driving)

Vehicle type	Field mileage	Fuel consumption	Annual fuel costs	GHG emissions
	Diesel: km/l CNG: km/Nm^3	Diesel (l) CNG (Nm^3)	(1,000 KRW)	CO_2 (ton)
Diesel bus	1.7	58,824	94,236	160
CNG bus	1.6	62,500	53,094	137
CNG hybrid bus	2.1	47,619	40,452	104

Recently, major developed countries have pushed ahead with policies to promote the use of bicycles as a non-motorized and zero-carbon mode in an effort to reduce GHG emissions. However, in China, the number of cars has surged due to increased income levels and improved standard of living, while the use of bicycles, previously the main mode of transport, has gradually dropped. Therefore, in order to solve this problem, developing countries like China, first of all, should come up with measures to prevent the bicycle users from shifting their mode of transport to private cars.

Economic Growth and Transport Models in Korea

In response to such demand, the Korea Transport Institute (KOTI) has launched a research and publication project titled "Knowledge Sharing Report: Korea's Best Practices in the Transport Sector." The project is designed to share lessons and implications experienced by Korea in implementing its transport policies with developing countries. This book is the second output of the project and deals with the theme of "Economic Growth and Transport Models in Korea." ... In this book, you will see how the four key success factors work in twelve different transport sectors. Twelve of KOTI's researchers have devoted themselves to writing about the relationship between Korea's economic growth and transport models. We hope that this publication will help facilitate the process of establishing transport policies in developing countries.

- Excerpted from the preface -

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