Knowledge Sharing Program

2013 Modularization of Korea's Development Experience:

Establishment of Intelligent Transport Systems (ITS)

2014

MOLIT
Ministry of Land, Infrastructure and Transport

ITS KOREA
Intelligent Transport Society of Korea

2013 Modularization of Korea's Development Experience:

Establishment of Intelligent Transport Systems (ITS)

2013 Modularization of Korea's Development Experience

Establishment of Intelligent Transport Systems (ITS)

Title	Establishment of Intelligent Transport Systems (ITS)
Supervised by	Ministry of Land, Infrastructure and Transport, Republic of Korea
Prepared by	Intelligent Transport Society of Korea
Author	Seung-hwan Lee, Intelligent Transport Society of Korea, Head Dong-seob Oh, Intelligent Transport Society of Korea, General Manager Jeong-ho Seo, Intelligent Transport Society of Korea, Senior Manager Jun-young Yoon, Intelligent Transport Society of Korea, Assistant Manager Chan-hyun Choi, Intelligent Transport Society of Korea, Assistant Manager Seok-cheon Yoon, Intelligent Transport Society of Korea, Researcher
Advisory	Jung-wan Kim, Korea Agency for Infrastructure Technology Advancement, Senior Researcher Baek Jin Lee, Korea Research Institutes for Human Settlements (KRIHS), Research Fellow
Research Management	KDI School of Public Policy and Management
Supported by	Ministry of Strategy and Finance (MOSF), Republic of Korea

Government Publications Registration Number 11-1051000-000460-01

ISBN 979-11-5545-112-0 94320

ISBN 979-11-5545-095-6 [SET 18]

Knowledge Sharing Program

Government Publications Registration Number
11-1051000-000460-01

Knowledge Sharing Program

2013 Modularization of Korea's Development Experience

Establishment of Intelligent Transport Systems (ITS)

MOLIT
Ministry of Land, Infrastructure and Transport

ITS KOREA
Intelligent Transport Society of Korea

Preface

The study of Korea's economic and social transformation offers a unique window of opportunity to better understand the factors that drive development. Within one generation, Korea had transformed itself from a poor agrarian society to a modern industrial nation, a feat never seen before. What makes Korea's experience unique is that its rapid economic development was relatively broad-based, meaning that the fruits of Korea's rapid growth were shared by many. The challenge of course is unlocking the secrets behind Korea's rapid and broad-based development, which can offer invaluable insights, lessons and knowledge that can be shared with the rest of the international community.

Recognizing this, the Korean Ministry of Strategy and Finance (MOSF) and the Korea Development Institute (KDI) launched the Knowledge Sharing Program (KSP) in 2004 to share Korea's development experience and to assist its developing country partners. The body of work presented in this volume is part of a greater initiative launched in 2007 to systematically research and document Korea's development experience and to deliver standardized content as case studies. The goal of this undertaking is to offer a deeper and wider understanding of Korea's development experience in hopes that Korea's past can offer lessons for developing countries in search of sustainable and broad-based development. In furtherance of the plan to modularize 100 cases by 2012, this year's effort builds on the 20 case studies completed in 2010, 40 cases in 2011, and 41 cases in 2012. Building on the past three year's endeavor that saw publication of 101 reports, here we present 18 new studies that explore various development-oriented themes such as industrialization, energy, human capital development, government administration, Information and Communication Technology (ICT), agricultural development, and land development and environment.

In presenting these new studies, I would like to express my gratitude to all those involved in this great undertaking. It was their hard work and commitment that made this possible. Foremost, I would like to thank the Ministry of Strategy and Finance for their encouragement and full support of this project. I especially would like to thank KSP Executive Committee, composed of related ministries/departments, and the various Korean research institutes, for their involvement and the invaluable role they played in bringing this project together. I would also like to thank all the former public officials and senior practitioners for lending their time and keen insights and expertise in preparation of the case studies.

Indeed, the successful completion of the case studies was made possible by the dedicated efforts of the researchers from the public sector and academia involved in conducting the studies, which I believe will go a long way in advancing knowledge on not only Korea's own development but also development in general. Lastly, I would like to express my gratitude to Professors Kye Woo Lee, Jinsoo Lee, Taejong Kim and Changyong Choi for their stewardship of this enterprise, and to the Development Research Team for their hard work and dedication in successfully managing and completing this project.

As always, the views and opinions expressed by the authors in the body of work presented here do not necessary represent those of the KDI School of Public Policy and Management.

April 2014

Joon-Kyung Kim

President

KDI School of Public Policy and Management

Contents | LIST OF CHAPTERS

Chapter 3

Contents | LIST OF CHAPTERS

Chapter 4

Contents | LIST OF CHAPTERS

Contents | LIST OF TABLES

Chapter 1

Chapter 2

Contents | LIST OF TABLES

Chapter 3

Chapter 4

Chapter 5

Chapter 6

Contents | LIST OF FIGURES

Chapter 1

Chapter 2

Chapter 3

Contents | LIST OF FIGURES

Chapter 4

Chapter 5

Chapter 6

Abbreviation

ADB	Asian Development Bank
AFCS	Automatic Fare Collection System
ARS	Automatic Response System
ATES	Automatic Traffic Enforcement System
ATMS	Advanced Traffic Management System
AVI	Automatic Vehicle Identification
BIS	Bus Information System
BIT	Bus Information Terminal
BMS	Bus Management System
BOO	Build-Own-Operate
BOT	Build-Operate-Transfer
BRT	Bus Rapid Transit
BT	Bio Technology
B/C	Benefit/Cost
CCTV	Closed Circuit Television
CD/ATM	Cash Dispenser/Automated Teller Machine
C-ITS	Cooperative Intelligent Transport Systems
DAC	Development Assistance Committee
DB	Data Base
DMB TPEG	Digital Multimedia Broadcasting Transport Protocol Expert Group
DSRC	Dedicated Short Range Communications
EFCS	Electronic Fare Collection System
ET	Environment Technology
ETCS	Electronic Toll Collection System
EU	European Union
FTMS	Freeway Traffic Management System
GDP	Gross Domestic Product
GIS	Geographic Information System

GNI	Gross National Income
GPS	Global Positioning System
IBRD	International Bank for Reconstruction and Development
ICT	Information and Communication Technologies
IMF	International Monetary Fund
ISO/TC204	International Organization for Standardization/ Technical Committee 204
ISTEA	Intermodal Surface Transportation Efficiency Act
IT	Information Technology
ITIF	Information Technology and Innovation Foundation
ITS	Intelligent Transport Systems
IVHS	Intelligent Vehicle-Highway Systems
KAIA	Korea Agency for Infrastructure Technology Advancement
KATECH	Korea Automotive Technology Institute
KAST	The Korean Academy of Science and Technology
KEC	Korea Expressway Corporation
KEXIM	Korea Export-Import Bank
KICT	Korea Institute of Construction Technology
KOICA	Korea International Cooperation Agency
KOTI	Korea Transport Institute
KOTRA	Korea Trade-Investment Promotion Agency
KRIHS	Korea Research Institute for Human Settlements
KSA	Korean Standards Association
KSP	Knowledge Sharing Program
LED	Light Emitting Diode
LRT	Light Rail Transit
MDB	Multilateral Development Bank
MOE	Measure of Effectiveness
MOLIT	Ministry of Land, Infrastructure and Transport

Abbreviation

MOU	Memorandum of Understanding
MRT	Mass Rapid Transit
NIPA	National IT Industry Promotion Agency
NT	Nano Technology
OBE	On-Board Equipment
OBU	On-Board Unit
ODA	Official Development Assistance
OECD	Organization for Economic Co-operation and Development
O/D	Origin/Destination
PDA	Personal Digital Assistant
PMC	Project Management Consultancy
PPP	Public-Private Partnership
RFID	Radio Frequency Identification
RSE	Road Side Equipment
RTT	Road Transport Telematics
R&D	Research & Development
SI	System Integration
SMS	Short Message Service
SPATIC	Seoul Metropolitan Police Agency Comprehensive Traffic Information Center
TA	Technical Assistance
TBS	Seoul Traffic Broadcasting System
TF	Task Force
TICS	Traffic Information and Control System
TOPIS	Seoul Transport Operation & Information Service
TTA	Telecommunications Technology Association
UTIS	Urban Traffic Information System
VAN	Value Added Network
VDS	Vehicle Detection System

VICS	Vehicle Information and Communication System
VMS	Variable Message Sign
V2I	Vehicle to Infrastructure
V2V	Vehicle to Vehicle
WB	World Bank

Summary

The Korean government introduced the Intelligent Transport System (ITS) in the 1990s to deal with traffic-related problems caused by economic development, rapid population growth and vehicles, and ITS has reaped many benefits since it was established.

This report explains several policies the Korean government has adopted to implement the ITS from the 1990s, when the ITS was first employed, to the present. The objective of this report is to be quoted as a reference for public officials of our partner counties responsible for the ITS when they need to implement their own ITS successfully.

This report is composed of six chapters: Objectives and Achievements (Chapter 1), Background and Necessity of the ITS in Korea (Chapter 2), Strategies and Systems to Implement the ITS (Chapter 3), Details of ITS Projects (Chapter 4), Analysis of the Secrets of Successful ITS Projects (Chapter 5), and Implications for Developing Countries (Chapter 6).

1. Objectives and Achievements of the ITS

As of 2000 when the ITS was first introduced, road traffic congestion costs were 19 trillion and 448.2 billion KRW, 2 trillion KRW increase compared to the previous year, the number of injuries or deaths due to traffic-related accidents was 350,000, the social costs related to traffic accidents were 11 trillion KRW, and the social costs related to air pollution caused by vehicles were 1.6 trillion KRW (estimated). To deal with these issues, the Korean government began to consider the introduction of the Intelligent Transport System (ITS) with such objectives as improving traffic congestion, road safety, and traffic conditions. They estimated that the ITS would reduce road traffic congestion costs of 4.59 trillion KRW, 30% of traffic-related accidents, and 10% of air pollution caused by vehicles.

According to the "ITS Plan 2020 for Vehicles and Road Traffic", published 10 years after implementation of the ITS, the improvement in traffic congestion thanks to adoption of the ITS resulted in 11.8 trillion KRW worth of social benefits (on an annual basis) and to the increase in average traffic speed on roads of 15%~20%. As part of Korea's ITS, vehicle detectors and CCTVs were installed in major locations on roads and the traffic information system was established by the government. As a result, emergency situations on the road can be dealt with swiftly. The scale of the damage by the accidents reduced, and collateral accidents were prevented.

As you can see, introduction of the ITS increased the speed of vehicles, reduced delays, decreased energy consumption, increased the number of passengers of public transportation, and improved the stability of Korea's public transportation. In all, the ITS has greatly contributed to Korea's economic and social development.

2. Background and Necessity of the ITS in Korea

Economic development and overcrowding in the capital city lead to heavy traffic congestion and that became one of the most serious problems in the 1990s. From 1994 to 2012, the length of roads increased by 43% but the number of registered vehicles increased by 155%. As traffic congestion spread to other areas, the government realized that existing measures would not work and a new solution, the ITS, was necessary.

In December 1999, the National Transport Board was launched to deliberate on various issues including the establishing modifications to the master plan for the ITS. In order to deal with the establishment and authorization of ITS plans, the Working Committee for the ITS and the Working Committee for Transportation Policies were officially formed. ITS Korea led the implementation of the ITS. In all, these organizations collaborated with one another for the implementation of the ITS.

The United States, Japan, and members of the European Union launched initial research into the ITS in the early 1970s and since then, they conducted research and development of each area of the ITS and performed test-runs of the ITS until the mid-1990s. After the 1990s they concentrated on the convergence and standardization of the technologies related to the ITS , which had been developed so far and since the 2000s they have put the ITS in practice.

The US planned and made public and private investments of 214.5 billion USD for the ITS after the establishment of the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991. Federal and State Departments of Transportation led the plan for the ITS and the Intelligent Transportation Society of America (ITS America) dealt with issues related to the ITS for the private and public sectors. The US sought the standardization of

the ITS through cooperation with the EU and concentrated on the electronic toll collection system and advanced vehicle systems.

The EU's ITS focused on Road Transport Telematics (RTT) and on the research and development of advanced road traffic and advanced cargo transportation. As each ITS project was allocated with relatively small budget, the scale of one project was small. In addition, as the EU's ITS covered all of the EU member states, conflict of interests existed among members.

As for Japan, at the initial stage, the Ministry of Construction, the Ministry of International Trade and Industry, National Police Agency, the Ministry of Transport had developed their own ITS. As the need for an integrated coordination agency was heightened, the Vehicle, Road and Traffic Intelligence Society (VERTIS) / TMC (Toyota Motor Corporation) – a coordinating body among the government, the academy, the industry, and research institutes – was established. Since the 1970s, the Japanese government has led research and development of the traffic sign system for urban areas, the automatic navigation system, and the expressway control system. During the 1980s, the government focused on the establishment of the integrated traffic control system based on the above systems. Since the mid-1990s, Japan has focused on addressing urban traffic problems and securing the global market share of relevant fields as the efficiency of road networks was improved by the development of information and communications technologies. Japan started the Vehicle Information and Communication System (VICS) in 1996. Japan provides traffic information to the public through the most advanced vehicle navigation technologies and traffic information technologies.

Though Korea was late in the adoption of the ITS compared to other advanced countries, Korea's ITS has expanded into overseas on the basis of its successful establishment and operation stories and as a result, it earned 100 million USD from overseas exports. In addition, a report submitted by the Information Technology & Innovation Foundation of the US to the Congress says that Korea, Japan, and Singapore are global leaders of ITS.

An analysis of the level of Korea's ITS-related technologies and services concluded that Korea ranked 9th for its technology level and 5th for its service level. In terms of the competitiveness of each ITS-related service, Korea's bus information system (BIS) and electronic toll collection system (ETCS) are the best in the world.

3. Strategies and Systems to Implement the ITS

In 1999, the Korean government established the Traffic System Efficiency Act to facilitate the coordination of traffic-related policies, to establish investment plans for transport facilities, to evaluate the investment, and to enable an intelligent transport system. The "Establishment of the Intelligent Transport Systems" prescribed in the Act is the legal foundation where the government could make and carry out ITS-related plans for the operation of new ITS businesses and the standardization of the ITS. And in 2009, the government revised the Traffic System Efficiency Act and it became the National Transport System Efficiency Act. The National Transport System Efficiency Act prescribes the establishment of the master plan for the ITS, guidelines for the implementation and standardization of ITS projects, and the establishment of ITS Korea.

The master plan for the ITS is located at the top layer of ITS-related plans and aims to provide a basic direction for effective ITS implementation. The master plan was initially drafted in 1997 and, after much research to supplement the relevant plans and revisions, it was finalized in 2001 and named "the Master Plan 21 for the ITS." "The Master Plan 2020 for the ITS" was formulated in December 2011, and prescribed current traffic conditions and future prospects, plans to lay the groundwork for ITS implementation, including research and development and standardization, and plans for the establishment of the system to promote the ITS and for division of labor in financing.

The Standardization Plan for the ITS was established in 2002 in accordance with the basic direction for the standardization of the ITS prescribed in the Master Plan 21 for the ITS. This plan guaranteed compatibility and interoperability between different devices and prevented overlapping investment among individual businesses while considering the fact that the ITS will be operated individually or inter-connectedly in a wide range of areas.

The government drew up ITS guidelines on the specific roles of each area and interested parties related to the project for the establishment of the ITS. The areas whose roles were prescribed in the guideline were as follows: planning, construction, standardization, operation and management, performance evaluation, and effectiveness analysis.

In addition to these institutional activities, the government established a government body to be in charge of the ITS and conducted reorganization for the successful implementation of the ITS. In 1995, a division in the Ministry of Construction and Transportation was responsible for the ITS and after several government reorganizations. As of 2013, the ITS and Road Environment Division at Road Bureau of the Ministry of Land, Infrastructure and Transport is responsible for the ITS. The Division currently deals with the overall management and coordination of ITS policies, the establishment and operation of ITS plans including the master plan, research and development, and training and education of experts.

While various relevant government agencies shared the required activities for the establishment of the ITS, in 1999, ITS Korea was established as the control tower to establish cooperation between government agencies and the industrial sectors, academia, and research institutions related to the ITS.

Since the launch of the test run of the ITS in Gwacheon in 1995, the government has facilitated the establishment of the ITS by local governments through various activities such as the Advanced Transportation Model City Projects, local governments' adoption of the BIS and ATMS. In addition, the government has encouraged more people to use public transportation by establishing the standards of public transportation cards which guarantee nationwide compatibility.

The government divided national policies for the successful implementation of the ITS into five groups and then focused its efforts in a more systematic way. It had spent 2.9 trillion KRW to implement the ITS from 2001 to 2012. By 2020, it plans to spend 2.5 trillion KRW more. In accordance with the master plan for the ITS, the government provides subsidies for the implementation of the ITS as initial costs for the implementation are substantial, but the private sector is encouraged to invest in projects with profitability in order to reduce the financial burden and improve the quality of services.

4. Details of ITS Projects

Most of the ITS were established in cities. To improve the understanding of our prospect partners who would cooperate in the ITS, we would like to present two successful ITS cases: one is a city with the population more than one million and the other is a city with the population less than one million.

The government has three stages of ITS implementation. Before the 2000s (stage one), the government formed the foundation for the establishment of the ITS. During the 2000s (stage two), the government focused on laying the foundation for the promotion of ITS projects and provision of entry level ITS services. And during the 2010s (stage three), ITS projects are focusing on the provision of fully developed and sophisticated technologies.

This report presents two cities as examples: Seoul and Anyang. Seoul operates the ITS through TOPIS, the Urban Expressway Traffic Management Center, SPATIC, and TBS. Anyang operates the ITS via Anyang Traffic Information Center.

Seoul is the largest city in Korea and has a population of over 10 million. Seoul's traffic volume is very heavy and various transportation systems are intricately interconnected. To secure efficiency, convenience, and safety of different means of transportation, Seoul started ITS implementation and launched 16 ITS projects categorized into five areas:

traffic information, public transportation, maintenance of roads and traffic facilities, traffic management, and the pedestrian safety system. The policies to implement the ITS (the semi-public bus system and electronic fare collection) caused conflicts of interest among interested parties, left heavy burdens on Seoul's budget, and inconvenienced Seoul citizens. Seoul strived to deal with such problems by persuading interested parties and conducting promotional activities to the public.

Anyang is located near Seoul and has the population of 610,000. Since 2003, Anyang has introduced advanced traffic systems including the ITS, the BIT, and the Bus Rapid Transit (BRT) and now Anyang citizens can enjoy Anyang's advanced traffic system conveniently. To deal with mounting problems of air pollution, traffic congestion, and crime, Anyang decided to establish the efficient and scientific traffic information system and crime prevention system by adopting advanced IT technologies and opened the Anyang Traffic Information Center in March 2009. As the Center integrated traffic-related systems (such as the ITS, the BIS, and the BRT) with the crime prevention system it could save office and equipment space and reduce personnel expenses and operational costs. The Anyang Traffic Information Center may be one of Korea's biggest achievements in ITS projects. KOTRA and ITS Korea always include the Center as one of its destinations for foreign visitors who visit Korea for ITS-related matters. Initially, there was no one who had expertise in such an integrated ITS and therefore difficulties arose during the operation of the Center, but the city government clearly defined the role of each group at the Center and successfully maximized the effectiveness of the Center.

5. Analysis of the Secret of Successful ITS Projects

This report selects Seoul's public transportation card system (T-Money) and Anyang's Anyang Traffic Information Center as the examples of Korea's successful ITS projects and analyzes the secrets of success and what still needs to done. Also, the report will introduce similar success stories of foreign nations and compare them with Korea's.

The secrets of Seoul's success are, first, Seoul adopted the public transportation card system and formulated appropriate policies to be in line with the adoption. Cardholders can enjoy fare and transfer discounts and can take other modes of public transportation, which led to an increase in the number of passengers.

Second, Seoul established a system to collect and process the information gathered via the public transportation cards system. This meant that public transportation cards could be another means to collect information for better management of the public transportation system.

Third, Seoul did not cease to invest; it continued to invest in the infrastructure for the public transportation system to facilitate the usage of T-Money and as a result, T-Money had an early adoption rate faster than expected. Seoul allocated a large budget to the construction of more infrastructure even after the adoption of the revised public transportation cards system and that resulted in more services and benefits for citizens.

Fourth, Seoul was open to reforms against strong opposition from interested parties especially when it changed the location of bus-only lanes and introduced the semi-public bus system. The government of Seoul never ceased to persuade bus operators who opposed the semi-public bus system and street vendors who were against the median bus-only lanes through a series of talks and discussions.

Lastly, Seoul's public transportation cards system enables micropayments as well as paying fares.

There was an issue with traffic information provided by Seoul's ITS because it was mainly supplier-oriented, not receiver-oriented. Each mode of public transportation (buses and subway) has its own traffic information collection and provision system, which means passengers had to use two different information services and as a result the effectiveness of traffic information was reduced. To deal with this, Seoul planned to establish the integrated traffic information system for public transportation which encompasses traffic information for all modes of public transportation in Seoul and therefore to increase the consistency and effectiveness of traffic information.

Anyang Traffic Information Center is considered a successful ITS project, and since it opened, about 5,000 people in Korea and approximately 150 people from 28 different countries have visited the Center and there has been positive media coverage about the Center as an exemplary case. Here are the factors which contributed to the success of Anyang Traffic Information Center.

First, the government of Anyang concentrated on qualitative factors rather than quantitative ones during the development of this Center. Anyang installed many CCTVs for crime prevention and, from the initial stage of the establishment of the Center, focused on developing software customized for the existing CCTVs and of safeguards against possible trouble in solutions. Anyang was proactive and wanted to make various functions and systems integrated in the Center.

Second, Anyang established the system which guaranteed stable operation and management of the Center after its launch by establishing agreements and forming collaborative relationships between interested parties. In addition, Anyang established a more stable and successful system based on mutual trust and on collaboration between the public and private sectors, the police, and the military.

Third, Anyang had professionals who could produce the best achievements at the Center. As a result, monitoring personnel in the Center dealt with emergency situations, 7 days a week, 24 hours a day and greatly contributed to the maintenance of public order in Anyang.

But Anyang's system isn't immune to ethical controversy over people's privacy and therefore policies to address this should ensue. Anyang has CCTVs at about 100 locations and they are used for various purposes but negative impacts such as infringement of citizens' basic rights including privacy and photo rights exist. Anyang needs to strengthen its efforts to deal with security issues and to modify relevant provisions.

6. Implications for Developing Countries

The Korean government was late in ITS introduction compared to other developed nations. But the development of Korea's ITS has been significant as the government has invested substantial amounts of capital and the private sector has made significant achievements in the research and development of ITS technologies. The Korean government laid the foundation for a nationwide introduction of the ITS by setting the standards of the ITS, formulating guidelines for ITS construction, and revising relevant laws. Private businesses could secure advanced technologies through the support from the government or for themselves. Due to the government's swift actions for support, the ITS market has grown every year.

But Korea's ITS businesses did not pay much attention to the investment in making new products, providing new services, and developing new technologies and as a result the market share of Korean ITS companies in the global market is small. Large ITS corporations in Korea focus on system integration and small and mid-sized corporations focus on manufacturing. Large corporations fail to obtain fundamental technologies. Although small and mid-sized corporations concentrate on fundamental technologies and product development, but they are not popular in the market and have no brand awareness, and lack the funds for investment.

In addition, though many local governments adopt the ITS to meet the demands of citizens, the people in charge of traffic issues and the operators of traffic centers often do not have enough expertise to operate the ITS and therefore expansion of the ITS has to stop. Moreover, ITS information was not shared smoothly among interested parties and heavy congestion of information flow occurred. As a result, the quality of information decreased and that hindered the development of additional services.

The establishment of the ITS requires a clear division of labor between the government and private businesses as ITS projects are for the benefit of the public. The Korean government laid the foundation for the nationwide establishment of the ITS in a short period time and

successfully prevented possible issues and difficulties in advance. In developing countries, the introduction of the ITS is often done unsystematically and sporadically as the central government doesn't establish or designate a government agency to be responsible for ITS-related matters and therefore, even after the establishment of the ITS, coordination between different ITS and expansion of the scope of the ITS could face limitations.

Therefore, when the government introduces the ITS, the establishment of the ITS should be done gradually after the government formulates systematic implementation plans and sets the standards for the ITS. In addition, the government should develop strategies for helping the domestic private businesses to build the capacity for the ITS. The government should also form a long-term master plan for the establishment of the ITS, adopt foreign businesses' ITS technologies, and transfer domestic businesses' ITS technologies to foreign companies. This is especially required when the nation wants to improve the quality of ITS technologies owned by domestic private businesses.

The government also nurtures ITS professionals by educating ITS operators while the system is under construction to make sure the ITS is operated efficiently after it has been established.

Given Korea's successful experience, developing nations need to conduct the implementation of the ITS step by step while considering each nation's traffic and economic conditions.

This report recommends developing nations to seek assistance from or PPPs funded by the Asian Development Bank and the World Bank to finance ITS projects. Also, as a prerequisite for the establishment of the ITS, this report recommends developing nations to conduct the revisions to its bus routes and systems as well as the unification of the form of vehicles' license name plates. They will be essential for developing nations to adopt the ITS successfully.

In conclusion, ITS projects require the participation of the public sector and its large investment. But the problem is that regime change or replacement of the people in charge of ITS projects in developing counties often lead to interruptions of projects as the continuity of policies are damaged. This will greatly harm the effectiveness of ITS implementation. Therefore, this report suggests that at first the government invest money to lay the foundation for the establishment of the ITS and then ITS projects are led by private businesses. The government should support private business until they achieve successful results.

2013 Modularization of Korea's Development Experience
Establishment of Intelligent Transport Systems (ITS)

Chapter 1

Objectives and Achievements

1. Assessment of Achievements in Comparison with the Objectives Established when the ITS was First Introduced
2. Review of the Contribution to Korea's Economic and Social Development by the ITS

Objectives and Achievements

1. Assessment of Achievements in Comparison with the Objectives Established when the ITS was First Introduced

1.1. Objectives Established when the ITS was First Introduced

As of 2000 when the ITS was first introduced, road traffic congestion costs were 19 trillion and 448.2 billion KRW, 2 trillion KRW rise compared to those of the previous year, the number of injuries or deaths due to traffic-related accidents was 350,000, the social costs related to traffic accidents were 11 trillion KRW, and the social costs related to air pollution caused by vehicles were 1.6 trillion KRW (estimated).

To deal with these issues, the Korean government began to consider the introduction of the Intelligent Transport System (ITS) and estimated that the System would reduce road traffic congestion costs of 4.59 trillion KRW, 30% of traffic-related accidents, and 10% of air pollution caused by vehicles.

1.1.1. Improvement in Traffic Congestion

In 2000 when the introduction of the ITS was in progress, an increasing number of vehicles caused heavy traffic congestions in major urban areas. To address such traffic congestion, the government started to consider various methods through the ITS. To minimize delay in the movement of vehicles and improve traffic flow on crossroads, the government adopted a system that allowed traffic signs to change according to traffic conditions. To help drivers take detours to avoid congestion, the government provided drivers with traffic information through variable-message signs and the Internet.

1.1.2. Improvement in Road Safety

The number of traffic accidents in Korea has steadily increased in line with the growing number of privately owned vehicles. As a result, the Korean government established a system that effectively detected vehicles that broke traffic regulations as a means to guarantee safe driving, to swiftly respond to emergency situations for the prevention of collateral accidents, and to lower social costs related to traffic accidents such as medical costs and health insurance costs covered by the government.

1.1.3. Improvement in Traffic Conditions

Escalating numbers of privately owned vehicles and heavy traffic congestions resulted in environmental pollution, a very serious social issue that had be dealt with immediately by the Korean government. Adopting the ITS was a choice of the Korean government; the Systems were to improve traffic flow and prevent speeding, which led to reductions in energy consumption and exhaust gases, and lead to increased public transportation usage, which decreased the use of privately owned vehicles.

1.2. Rate of Achievements in Comparison with the Objectives[1]

1.2.1. Improvement in Traffic Congestion

By establishing the ITS to provide the most appropriate traffic information to drivers, the government could reduce each driver's driving time and cost, which led to nationwide reduction in traffic congestion costs. The ITS could also quickly respond to emergency situations as well as chronic traffic congestion, which led to minimization of non-repetitive traffic congestion. Improvement in traffic congestion due to adopting the ITS resulted in 11.8 trillion KRW worth of social benefits (on a yearly basis) and to the increase in average traffic speed on roads of 15%~20%.

In conclusion, the cost to adopt the ITS was only 1% of the expense to build a four-lane national highway (worth 29.6 billion KRW per one kilometer) but it resulted in 20% reduction of traffic congestion.

1.2.2. Improvement in Road Safety

By warning drivers in advance about risk elements and using automatic avoidance of possible accidents, the ITS could prevent traffic accidents, minimize injuries and deaths caused by traffic accidents. By dealing with emergency situations quickly, the Systems

1. See the following for your reference: the Ministry of Land, Transport and Maritime Affairs, the ITS Plan 2020 for Vehicles and Road Traffic, June 2012.

could reduce the scale of the damage of accidents and prevent collateral accidents. As part of Korea's ITS, vehicle detectors and CCTVs were installed in major locations on roads; they monitor traffic conditions in real-time and conduct other road safety-related activities such as warning drivers of possible risk elements in advance, dealing with emergency situations, and measuring the speed of vehicles. The traffic information system, based on the ITS, was established by government agencies such as the Ministry of Land, Infrastructure, and Transport, Korea Expressway Corporation, and National Police Agency and local governments of 33 cities. The system analyzes traffic information, selects accident-prone areas, and manages these areas.

1.2.3. Improvement in Traffic Conditions

The ITS enabled vehicles reduced energy consumption caused by traffic congestion, idling and greenhouse gas emission, which led to greener traffic systems. Korea's improvement of public transportation systems increased public transportation usage and lowered the use of privately owned vehicles, which led to reductions in travel costs and enhancements of greener modes of transport.

The ITS installed on a national highway of 1,000km cut 19,000 tons of carbon dioxide (on a yearly basis) and those on a national expressway of 1,000km cut 23,000 tons of carbon dioxide (on a yearly basis).

Table 1-1 | Benefit-Cost Analysis of each Project of the ITS

Type	Project Name	Period	Cost	B/C
ATMS	Advanced Transportation Model City project for Jeonju	2001.11 ~ 2002.05	9.8 billon KRW	2.9
ATMS	Advanced Transportation Model City project for Daejeon	2001.10 ~ 2002.09	30 billon KRW	5.2
ATMS	Advanced Transportation Model City project for Jeju	2001.09 ~ 2002.07	13.9 billon KRW	6.2
BIS and Others	ITS establishment project in Suwon	2004.03 ~ 2005.10	24.6 billon KRW	5.12
BIS and Others	ITS establishment project in Cheonan	2005.07 ~ 2007.08	16 billon KRW	3.6
BIS and Others	ITS establishment project in Busan	2009.01 ~ 2010.08	23.8 billon KRW	3.01
UTIS and Others	ITS establishment project in Yongin	2008.12 ~ 2010.07	24 billon KRW	2.97

Type	Project Name	Period	Cost	B/C
ATMS	ATMS establishment project in Namyangju	2010.01 ~ 2011.01	4 billon KRW	2.16
BIS and Others	ITS establishment project in Ulsan	2002.11 ~ 2005.02	20.3 billon KRW	5.46
BIS	BIS establishment project covering Namyangju, Gapyeong, and Chuncheon	2012.06 ~ 2013.03	3.8 billon KRW	1.27

Source: Reports on preliminary and post assessment of each ITS project.

2. Review of the Contribution to Korea's Economic and Social Development by the ITS

2.1. Quantitative Achievements

2.1.1. Reduction in Energy Consumption at Trial Cities (Improvement on Economic Efficiency)

The Korean government selected several local cities to carry out a trial run of the ITS before adopting and implementing the Systems and discovered that the ITS helped the cities to cut energy consumption by reducing traffic delay and increasing the speed of vehicles.

Table 1-2 | Increase in the Speed of Vehicles at Trial Cities

City	Increase in Speed (Km/h)	Mileage Improvement (Km/l)	Mileage Improvement (Km/l)	Mileage Improvement Rate (%)
Daejeon	28.5 → 34.0	20.5 → 23.9	3.4	16.6
Jeonju	22.8 → 31.4	20.4 → 23.8	3.4	16.7
Jeju	29.8 → 31.6	-	0.9	-
Gwacheon	28.5 → 35.8	-	3.5	-
Average	21.2% increase in speed	-	-	16.6

Source: Korea Automotive Parts Testing Institute, Analysis on Reduction in Energy Consumption through the Intelligent Transport Systems (ITS), 2005, p27~32.

Note: Mileage Improvement in this table is based on compact cars.

Table 1-3 | Reduction in Traffic Delay at Trial Cities (per one vehicle)

City	Reduction in Traffic Delay (second)	Reduced Time (second)	Reduction Rate (%)	Reduction in Energy Consumption (%)
Daejeon	70 → 33	37	52.9	8.2
Jeonju	176 → 104	72	41.1	16.0
Jeju	596 → 406	190	31.9	42.4
Gwacheon	94 → 41	53	56.4	11.8

Source: Korea Automotive Parts Testing Institute, Analysis on Reduction in Energy Consumption through the Intelligent Transport Systems (ITS), 2005, p27~32.

Table 1-4 | Reduction in Energy Consumption at Trial Cities

		Daejeon	Jeonju	Jeju	Gwacheon	Total
Reduction in Traffic Delay	Reduction in Energy Consumption (km/l)	4,883	6,535	7,587	5,216	24,221
	Saved Money (one million KRW)	6,185	8,262	9,587	6,592	30,626
Increase in Speed	Reduction in Energy Consumption (km/l)	2,479	4,339	927	3,552	11,297
	Saved Money (one million KRW)	3,095	5,488	1,173	4,488	14,244
Total	Reduction in Energy Consumption (km/l)	7,362	10,874	8,514	8,768	35,518
	Saved Money (one million KRW)	9,280	13,750	10,760	11,080	44,870

Source: Korea Automotive Parts Testing Institute, Analysis on Reduction in Energy.

2.1.2. Increase in Use of Buses in Seoul (Improvement on Convenience)

The number of bus passengers in Seoul has steadily decreased due to deteriorated buses and their associated facilities and inconvenience. The Seoul government planned and implemented measures to undergo a complete overhaul of Seoul's public transportation system (including median bus-only lanes, public transportation cards, and the upgraded bus information system) and as a result, use of public transportation including buses in Seoul increased.

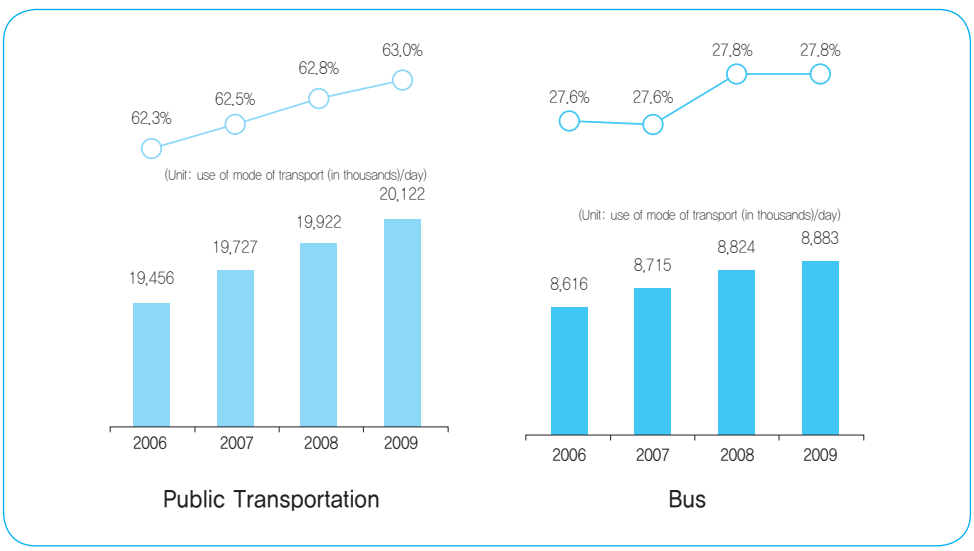
Table 1-5 | Changes in Modal Share in Seoul

(Unit: use of mode of transport (in thousands)/day)

	2002	2003	2004	2005	2006	2007	2008	2009
Total	29,680	29,375	30,344	31,004	31,196	31,509	31,705	31,948
Privately Owned Vehicle	(26.9%)	(26.4%)	(26.4%)	(26.3%)	8,189 (26.3%)	8,243 (26.3%)	8,235 (26.0%)	8,262 (25.9%)
Public Transportation	(60.6%)	(61.2%)	(62.0%)	(62.3%)	19,456 (62.3%)	19,727 (62.5%)	19,922 (62.8%)	20,122 (63.0%)
Bus	(26.0%)	(25.6%)	(26.2%)	(27.5%)	8,616 (27.6%)	8,715 (27.6%)	8,824 (27.8%)	8,884 (27.8%)
Subway	(34.6%)	(35.6%)	(35.8%)	(34.8%)	10,839 (34.7%)	11,012 (34.9%)	11,097 (35.0%)	11,239 (35.2%)
Taxi	(7.4%)	(7.1%)	(6.6%)	(6.5%)	1,960 (6.3%)	1,958 (6.2%)	1,961 (6.2%)	1,981 (6.2%)
Others	(5.1%)	(5.3%)	(5.0%)	(4.9%)	1,592 (5.1%)	1,582 (5.0%)	1,587 (5.0%)	1,583 (4.9%)

Source: the Government of Seoul, Seoul's 2nd Public Transportation Development Plan (2012~2016), 2012, p32.

Figure 1-1 | Changes in Modal Share of Bus and Public Transportation in Seoul



Source: the Government of Seoul, Seoul's 2nd Public Transportation Development Plan (2012~2016), 2012, p32.

2.1.3. Reduction in Pollutants after the Introduction of Hi-Pass (an Electronic Fare Collection System) (Improvement on Eco-Friendliness)

After installing a device to measure exhaust gases in one-ton cargo trucks, the government found that a one-ton cargo truck with a Hi-Pass device could cut the time to pass a tollgate by 20 to 42 seconds, carbon dioxide emission by 38 to 99 grams, and fuel costs by 25 to 66 KRW when it drove on a Hi-Pass only lane. Taking these figures into account and given that the usage rate of Hi-Pass was 50%, it was estimated that vehicles run by gasoline and one-ton trucks, which account for 60% of all registered vehicles in Korea, could lower carbon dioxide emissions by 15,300 tons and fuel cost by 12.3 billion KRW annually.[2]

Table 1-6 | Reduction in Fuel Costs and Pollutants for One Vehicle with a Hi-Pass Device when it Passes a Tollgate

		Fuel Consumption (mL)	CO_2 (g)	NO (g)	Fuel Costs (KRW)
One-ton Cargo Truck	Using a Hi-Pass Only Lane (A)	70.2	188.8	1.636	126
	Using an Ordinary Lane (B)	94.7	254.6	2.369	170
	Reduction (B-A)	24.5	65.8	0.733	44
One Vehicle Run by Gasoline	Using a Hi-Pass Only Lane (A)	62	145.4	0.017	124
	Using an Ordinary Lane (B)	76.8	180.0	0.029	154
	Reduction (B-A)	14.8	34.6	0.012	30

Source: a press release by National Institute of Environmental Research, "If you use Hi-Pass, you can cut carbon dioxide emissions and lower fuel costs", 2011.

2. See the following for your reference: a press release by National Institute of Environmental Research, "If you use Hi-Pass, you can cut carbon dioxide emission and lower fuel costs", 2011.

Table 1-7 | Annual Reduction in Fuel Costs and Pollutants for One Vehicle with a Hi-Pass Device when it Passes a Tollgate (Reduction of One Vehicle X the Number of Vehicles with Hi-Pass Devices which Pass a Tollgate in One Day X 365 Days)

	Fuel Consumption (KL)	CO_2 (ton)	NO (ton)	Fuel Costs (KRW in Billions)
One-ton Cargo Truck	1,485	3,994	44.5	27
One Vehicle Run by Gasoline	4,825	11,305	3.9	96
Total	6,310	15,299	48.4	123

Source: a press release by National Institute of Environmental Research, "If you use Hi-Pass, you can cut carbon dioxide emissions and lower fuel costs", 2011.

2.1.4. Effectiveness of Automatic Traffic Enforcement Systems (Improvement on Safety)

Korea has several automatic traffic enforcement systems such as those to check speeding, bus-only lane violations, illegal parking and stopping, and traffic sign violations. The effectiveness of automatic traffic enforcement systems was measured by comparing the number of traffic accidents and their mortality rate in a 2km section (which covers 1km ahead and 1km behind of a location where an automatic traffic enforcement system is installed) with those in the same section before the installation of the system.[3]

Table 1-8 | Reduction in the Number of Traffic Accidents and Deaths Before/After the Installation of Automatic Traffic Enforcement Devices

Year	Number of Installed Devices	One Year before the Installation		One Year after the Installation		Comparison		Note (Period for Analysis)
		Accidents	Deaths	Accidents	Deaths	Accidents	Deaths	
Systems Installed in 2002	280	2,796	146	1,889	59	-907 (↓ 32.5%)	-87 (↓ 59.5%)	12 Months
Systems Installed in 2003	521	4,934	237	3,494	114	-1,440 (↓ 29.1%)	-123 (↓ 51.8%)	12 Months

Source: Korea Transportation Safety Authority, Evaluation of Automatic Traffic Enforcement Systems (focusing on speeding violations), 2005, p34.

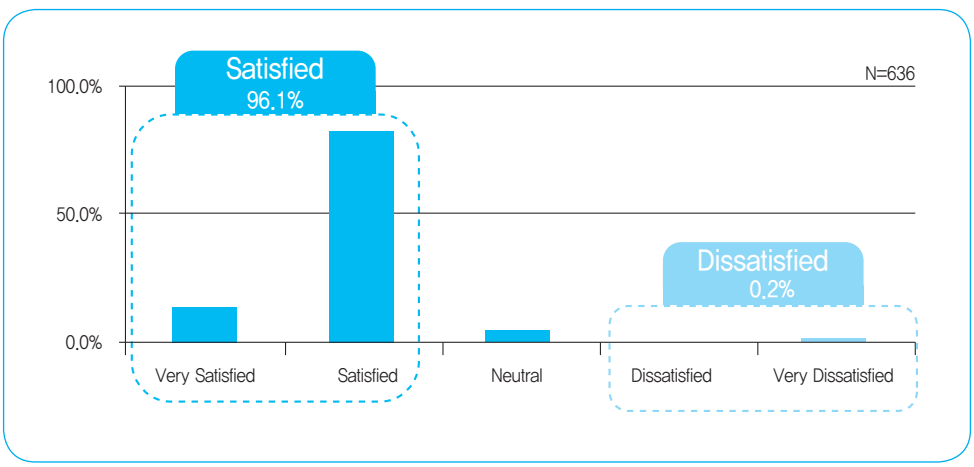
3. See the following for your reference: Korea Transportation Safety Authority, Evaluation of Automatic Traffic Enforcement Systems (focusing on speeding violations), 2005.

2.2. Qualitative Assessment

2.2.1. Satisfaction of Seoul Residents with the Information Provided by Seoul's Bus Information System

In a commissioned survey, 96.1% of respondents said that they were satisfied with the information (13.7% were very satisfied and 82.4% were satisfied) provided by Seoul's Bus Information System and that explained the increase in Seoul residents' satisfaction with the public transportation system.

Figure 1-2 | Satisfaction of Seoul Residents with the Information Provided by Seoul's Bus Information System

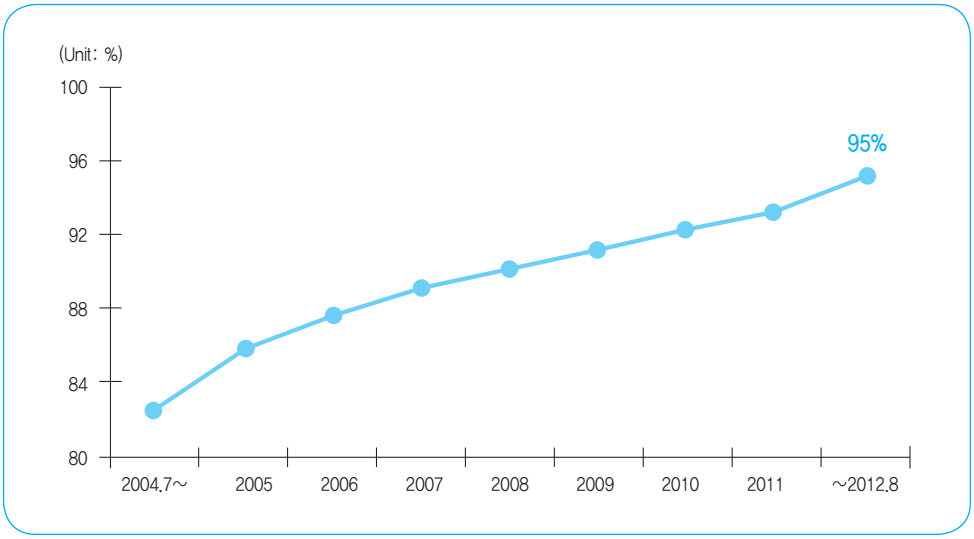


Source: the Government of Seoul, Report on Current Status of the Use of Seoul's Bus Information System, April 2012, p17.

2.2.2. Use of Public Transportation Cards in Seoul

Seoul first employed public transportation cards in 1996. The number of residents who use public transportation cards has steadily increased for the last 10 years and as of August 2012, 95% of public transportation users used public transportation cards. Thanks to such a high usage rate, public transportation passengers can cut public transportation costs by receiving transfer discounts and bus companies and local governments can clearly figure out incomes earned by buses and establish plans for buses.

Figure 1-3 | Usage Rate of Transporation Cards among Seoul Residents



Source: Korea Joongang Daily, Transfer Discounts of 58% of Transportation Costs are given to 95% of Seoul Residents who Use Public Transportation Cards, October 21, 2012.

2013 Modularization of Korea's Development Experience
Establishment of Intelligent Transport Systems (ITS)

Chapter 2

Background and Necessity of the ITS in Korea

1. Surrounding Situations when the ITS was Introduced
2. Causes and Grounds Surrounding the Introduction of the ITS
3. Procedures to Set and Decide Objectives and Policies
4. Overseas Cases of Implementing the ITS
5. Current Situations of Korea's ITS

Background and Necessity of the ITS in Korea

1. Surrounding Situations when the ITS was Introduced

1.1. Situations Surrounding Korea when the ITS was First Introduced

From 1945 when Korea was liberated from Japanese colonial rule to 1960, urban growth and development in Korea were driven by political and social changes. After 1960, urban growth and development in Korea was closely related to economic development that was strongly promoted by the government. Economic development plans in the 1960s and 1970s concentrated on large cities which had some economic infrastructure and showed economic agglomeration effects in order to maximize the effectiveness of economic resources which were insufficient. As a result, urbanization of large cities focused on Seoul, Busan, Daegu, and Incheon.

However, urbanization after 1970 resulted in the excessive concentration of the capital area and overcrowded Seoul. The distance between workplaces and homes became longer and longer as a shortage of homes in the capital area became apparent due to the large influx of people into the area while the public transportation system in urban areas was well developed. As a result, suburbanization in Korea has unique characteristics compared to that of developed nations and the speed of expansion and growth of cities continued to accelerate.

In conclusion, Korea's urbanization and economic development caused the increase of registered vehicles after the 1970s but new roads to accommodate these new vehicles were unable to meet their increase rates as there was not enough space for new roads, which led to an increased costs for the government to buy the land for new roads.

1.2. Situations Surrounding Foreign Nations when the ITS was First Introduced

In developed nations including Korea, the US, Japan, and those in the EU, scientific and technological fields converged with information technology were selected as the future growth engine as a means to promote industries, develop social infrastructure, accumulate capital, and address social problems. In 2002, the US National Science.

Foundation[4] introduced NBIC[5] into the public as converging technologies to improve people.[6]

The EU published "Shaping Europe's Future Through ICT" to stress the importance of information and communication technology (ICT) and the convergence of ICT with other fields in terms of economy and society. Japan's 2nd Science and Technology Master Plan released in 2001 set information technology, biotechnology, nanotechnology, and environmental technology as the four main objectives and sought the convergence of these objectives with manufacturing and convergence technologies which Japan excelled and their commercialization.

In the early 2000s when Korea first introduced the ITS, convergence between technologies was stressed by developed nations as a future growth engine and the ITS was also stressed by the nations as part of converging technologies.

2. Causes and Grounds Surrounding the Introduction of the ITS

2.1. Rate of Increase in Vehicles in Comparison with that in Roads

Urbanization focused on Seoul and surrounding capital areas led to an influx of population and concentration of the nation's functions; the percentage of the population in the capital area had increased from 20.8% in 1960 to 28.3% in 1970 and 35.5% in 1980.

4. National Science Foundation: United States government agency that supports fundamental research and education in all the non-medical fields of science and engineering by publishing reports and providing policy suggestions about related government policies and research and development strategies.

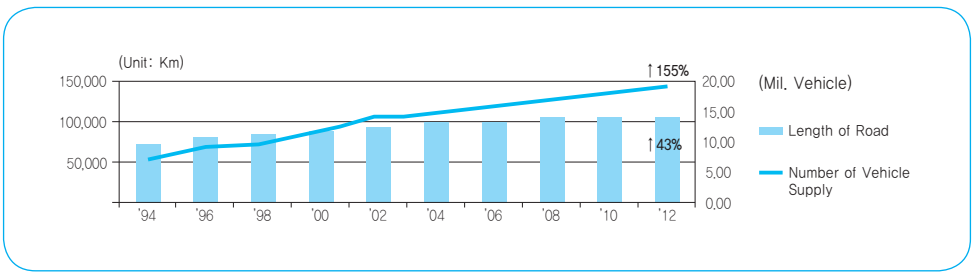
5. An acronym for Nanotechnology, Biotechnology, Information technology and Cognitive science – they were selected as emerging and converging technologies which contributed to human enhancement and improvement of quality of life.

6. See the following for your reference: Moon-goo Kim, Developed Nations' Policies on the Convergence of IT with Other Technologies and Korea's Response, 2012.

Such urbanization and economic development also resulted in growth of the number of registered vehicles after the 1970s. But the growth caused heavy traffic congestion as construction of new roads was unable to meet the increasing demand.

Even after Korea adopted the ITS in 2000, Korea's urbanization has not slowed down; in 2010, the percentage of the population in the capital area was 49.1% and from 1994 to 2012, the length of roads increased by 43% but the number of registered vehicles increased by 155%.

Figure 2-1 | Biennial Data on the Growth of the Length of Roads and the Number of Vehicles



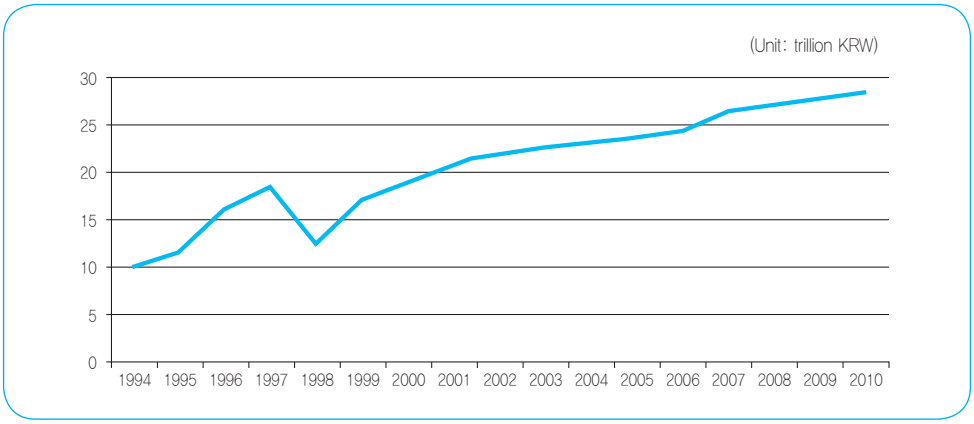
Source: Statistics Korea (www.index.go.kr).

2.2. Increase in Social Costs due to Traffic-Related Problems

Heavy traffic congestion due to the increasing number of vehicles causes major traffic congestion costs.[7] Traffic congestion costs in 1994 were 10 trillion KRW and since then the costs have increased continuously except for in 1998 (35% year-on-year decrease) when Korea was heavily hit by the Asian Financial Crisis in 1997. Though the increase slowed down after 2000 when the ITS was introduced, traffic congestion costs reached about 30 trillion KRW, 2.43% of Korea's GDP. Traffic congestion costs of the roads in Korea's seven biggest cities are estimated to be 1.73 times more than those of expressways connecting cities.

7. Traffic congestion costs: a type of the social costs related to the increase in traffic demands; environmental costs and traffic accident costs are other types of the social costs.

Figure 2-2 | Yearly Data on Traffic Congestion Costs



Source: Statistics Korea (www.index.go.kr).

2.3. Disconnected Flow of Information between the Components of the Transportation System (such as roads, vehicles, and users)

Before the introduction of the ITS, traffic signal cycles were inflexible without considering real-time traffic conditions, traffic volume and traffic control signals at crossroads weren't linked with to one another. As a result, traffic flow was frequently interrupted, which caused confusion, and utilizing roads in a more efficient way was not possible as drivers were unable to receive information about congestion, accidents, road conditions, and detours.

In addition, as cargo transport operators were unable to obtain information about the location of buses and cargo trucks, the amount of cargo transported by roads, locations where future demands for transportation exist, and estimated time for transportation. Due to this lack of information, operators were unable to place trucks in a more efficient way to maximize profits.

2.4. Inefficient Operation and Management of Traffic by People

Detecting traffic violations and overloading violations and charging tolls were operated by people, which meant permanent enforcement of violations were not possible and automatic processing of relevant information and the use of the information together with related agencies were also not possible.

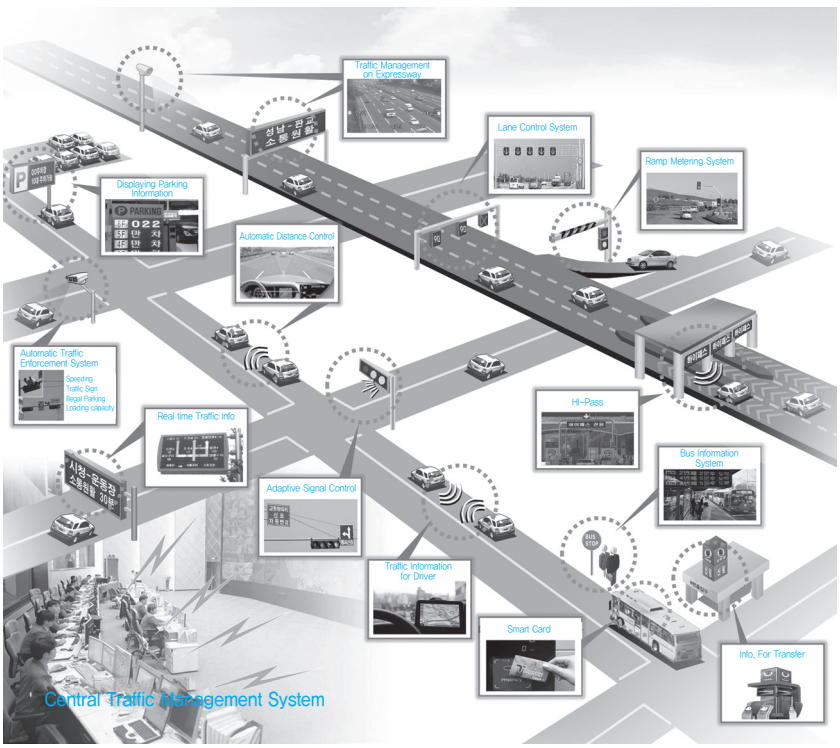
To deal with such inherent problems with the urban traffic system, the adoption of the ITS was considered as early as the 1990s and the development of IT in the 2000s facilitated the introduction of the ITS.

【About the ITS】

1. Definition of the ITS

The Intelligent Transport Systems (ITS) is a type of transport system which strives for automated and scientific management and operation of the transport system and improved efficiency and safety of traffic by introducing electronic control systems, communications technologies, and other advanced technologies to different modes of transport and traffic facilities and by utilizing traffic-related information.

Figure 2-3 | Conceptual Design of the ITS



Source: ITS Korea, 2013.

3. Procedures to Set and Decide Objectives and Policies

3.1. Launching the National Transport Board

In December 1999, the Ministry of Construction & Transportation (previous name of the Ministry of Land, Infrastructure, and Transport) launched the National Transport Board to deal with the policies related to Korea's transport system and to deliberate on the policies relevant to traffic formulated by acts and regulations in accordance with Article 106 of the National Transport System Efficiency Act and the Enforcement Decree of the same Act.

3.1.1. Role of the National Transport Board

The National Transport Board establishes and modifies the plans related to Korea's transport policies including master plans for the ITS, secures resources for the construction of transport facilities, and designates and changes the locations for transport and logistics hubs and multimodal transfer stations.

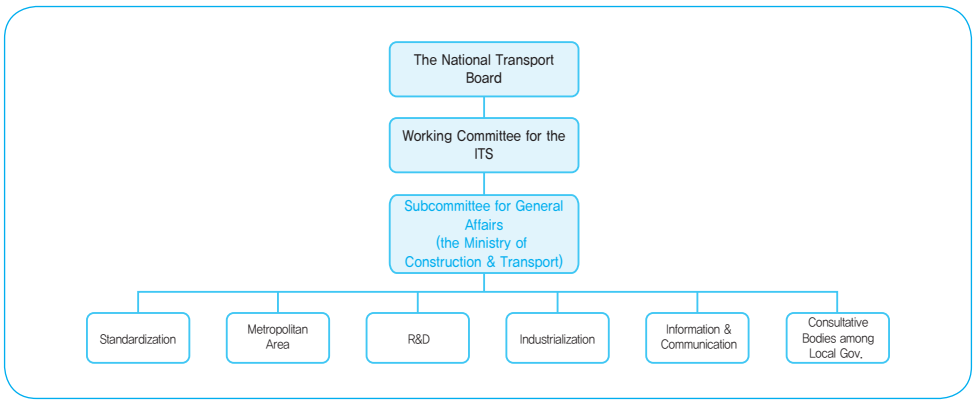
3.1.2. Composition of the National Transport Board

The National Transport Board consists of about 30 members including the Minister of the Ministry of Land, Infrastructure, and Transport, who is the chair and the Vice Minister is the vice chair. Members are composed of vice ministers (as well as public officials of the vice-minister class) of relevant central administrative agencies, heads of public organizations, and individuals with expertise and experience about traffic-related fields and are appointed by the chair.

The National Transport Board has a Working Committee for National Transport composed of public officials from relevant administrative agencies and those with extensive expertise and experience about traffic-related areas. The Working Committee reviews and adjusts the agenda for the National Transport Board and issues commissioned by the National Transport Board after its resolution.

Each of the city and provincial governments has its own Transport Committee, each are headed by a major of the city or a governor of the province to deal with transport policies of local governments. Other issues related to the composition and operations of each local transport committee are established as ordinances included in local government.

Figure 2-4 | Organizational Chart of the National Transport Board

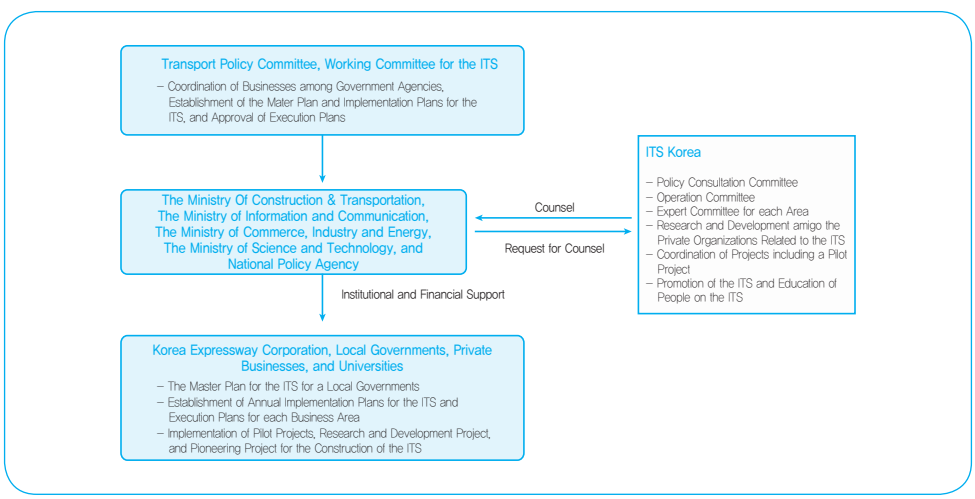


Source: Policy Materials of Lawmaker Hong-il Kim, Research on the Methods to Establish Efficient Intelligent Transport Systems for the 21 Century, August 2001, p15.

3.2. Promotional Bodies when the ITS was First Introduced

When the Korean government first introduced the ITS, its initial plan was that the public sector provided the services related to transport infrastructure such as traffic management and the private sector provided traffic information and the services related to traffic facilities operated by the private sector.

Figure 2-5 | ITS Promotion System at the National Level



Source: Policy Materials of Lawmaker Hong-il Kim, Research on the Methods to Establish Efficient Intelligent Transport Systems for the 21 Century, August 2001, p15.

Table 2-1 | Government Agencies and Organizations Related to the ITS when the ITS were First Introduced to Korea

National Transport Board	Digitization Promotion Committee
■ Working Committee for Transportation Policies ■ Working Committee for the ITS	■ Working Committee for Digitization Promotion ■ Digitization of Social Overhead Capitals and Subcommittee for the ITS
Relevant Government Agencies	**ITS Korea**
■ The Ministry Of Construction & Transportation ■ The Ministry of Information and Communication, the Ministry of Commerce, Industry and Energy, and the Ministry of Science and Technology ■ National Police Agency, the Seoul Government, and other Local Governments	■ Consultative Body for the Private Sector ■ Policy Consultation Committee, Research and Technology Committee, International Exchange Committee, and Education and Promotion Committee

Source: Policy Materials of Lawmaker Hong-il Kim, Research on the Methods to Establish Efficient Intelligent Transport Systems for the 21 Century, August 2001, p14.

3.3. Role of the Central Government

The central government established the foundation where local government could implement the ITS by developing and devising relevant plans, acts, regulations, and guidelines and consequently each local government (city government) could devise its own plan to establish the ITS and then implement its own ITS project systematically. In addition, the central government subsidizes a local government's budget allocated to launch the ITS and their test run and therefore the local government could implement its ITS projects with reduced financial burden.

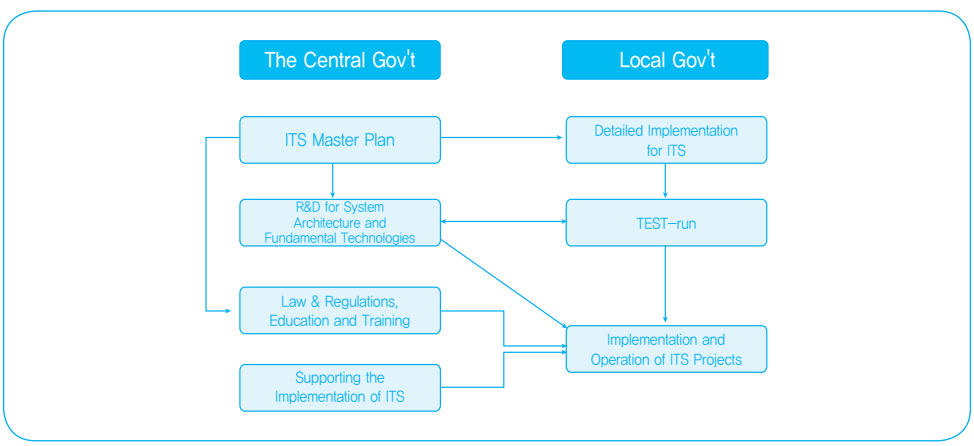
Table 2-2 | Role of the Central Government for each ITS project

Project Name	Role of the Central Government
BIS	■ To deal with such cases where each city government establishes its own bus information system not linked with other city's, the central government promotes the launch of the interregional bus information system which provides bus information between neighboring cities and regions and subsidizes local governments' budget to launch the system.
ATMS	■ To ensure that the advanced traffic management system is implemented by many local governments, the central government subsidizes each city government's budget to build the system and devises system guidelines.
EFCS	■ As each city has a different electronic fare collection system and fare collection system for each mode of public transportation, they are incompatible, thus requiring passengers to carry different types of public transportation cards. To address this incompatibility issue, the central government develops the standards for the plans and technologies to enable different public transportation cards to be compatible with one another nationwide and recommends private companies to follow these standards.

Source: ITS Korea, 2013.

This figure below illustrates the relationship between the central government and local governments when ITS projects are carried out. Local governments receive subsidies from the central government to implement the ITS.

Figure 2-6 | The Relationship between the Central Government and Local Governments when Implementing ITS Projects



Source: Seoul Institute, 1997.

4. Overseas Cases of Implementing the ITS

The US, Japan, and members of the EU launched initial research into the ITS in the early 1970s and since then, they have conducted research and development of each area of the ITS and performed test-runs of the ITS until the mid-1990s. After the 1990s they concentrated on the convergence and standardization of the technologies related to the ITS which had been developed and since the 2000s, they have put the ITS in practice.

4.1. The US

The US planned and made public and private investments of 214.5 billion USD for the ITS after the establishment of the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991. Federal and State Departments of Transportation led the plan for the ITS and the Intelligent Transportation Society of America (ITS America) dealt with issues related to the ITS for private and public sectors.

Table 2-3 | Stages to Implement the ITS in the US

Summary			
	Stages	**Focus**	**Details**
Establishment Plan	First Stage (1997~1999)	Traffic Information and Traffic Management System	■ Objective: Share all information originated from ground transportation and deliver the information to the general public at effective and appropriate times by establishing a channel between the government and the public ■ Details: - Providing the services related to the ITS to metropolitan and local areas - Giving services such as information sharing, positioning, and navigation for commercial purpose vehicles - Establishing automatic fare collection systems - Offering more chances to private businesses to participate in the market

Summary			
	Stages	**Focus**	**Details**
Establishment Plan	Second Stage (2000~2005)	Traffic Management System	■ Objective: Establishing the system and the infrastructure to provide stable and reliable traffic information, thereby guaranteeing effective traffic management for individuals and the public sector ■ Details: - Establishing a method to deliver traffic information most efficiently in each local area - Providing enhanced real-time traffic information - Using an integrated system for automatic fare collection - Establishing the nationwide customs clearance system - Applying relevant technologies to aerospace and military technologies
	Third Stage (2006~2010)	Advanced Vehicle System	■ Objective: Establishing more accurate and reliable ITS ■ Details: Providing sophisticated vehicle safety systems, advanced collision avoidance systems, and brake and driving assistance systems
Features	■ Seeking standardization of the ITS through cooperation with the EU (before then, lackluster efforts for standardization led to issues in compatibility with global systems) ■ First nation where the market for on-vehicle information system was in place; multimedia systems were adopted to implement the information system ■ The US government focused on the electronic toll collection system and the advanced vehicle system ■ Government-led ITS projects resulted in less flexibility of the private sector. ■ Topographic conditions in the US prohibit the provision of vehicle navigation services for all routes in the nation		

Source: The Electronics and Telecommunications Research Institute (ETRI), Report on Market Trend of 15 Items, 2003, p52.

4.2. The EU

Table 2-4 | Stages to Implement the ITS in the EU

	Summary
Current Situation	■ In 1986, as part of the EUREKA project, the PROMETHEUS Project was implemented by major car companies with the funding of 6.62 billion KRW for research and development and it continued for the next eight years ■ The EU is implementing DRIVE C2X, a project of installing road facilities and relevant information and communications facilities to improve traffic safety and efficiency in member states of the EU ■ Since the mid-1990s, the EU has focused on addressing urban traffic problems and securing the global market share of relevant fields as the efficiency of road networks improved by the development of information and communications technologies ■ EU's ITS concentrated on road transport telematics (RTT) and on the research and development of advanced road traffic and advanced cargo transportation
Features	■ As EU's ITS shall cover all EU member states, conflicts of interest existed among members ■ EU's ITS mainly dealt with driver safety, unmanned driving, and provision of traffic information ■ As each ITS project was allocated with relatively small budget, the scale of one project was not large

Source: The Electronics and Telecommunications Research Institute (ETRI), Report on Market Trend of 15 Items, 2003, p53.

4.3. Japan

Table 2-5 | Stages to Implement the ITS in Japan

	Summary
Current Situation	■ At the initial stage, the Ministry of Construction, the Ministry of International Trade and Industry, National Police Agency, the Ministry of Transport had developed their own ITS ■ As the need for an integrated coordination agency was heightened, the Vehicle, Road and Traffic Intelligence Society (VERTIS) / TMC (Toyota Motor Corporation) – a coordinating body among the government, the academy, the industry, and research institutes – was established ■ Since the 1970s, the Japanese government has led research and development of the traffic sign system for urban areas, the automatic navigation system, and the expressway control system

Summary	
Current Situation	■ During the 1980s, the government focused on the establishment of the integrated traffic control system based on the above systems ■ Since the mid-1990s, Japan has focused on addressing urban traffic problems and securing the global market share of relevant fields as the efficiency of road networks improved by the development of information and communications technologies ■ Japan started the vehicle information and communication system (VICS) in 1996 ■ Japan provides traffic information to the public through the most advanced vehicle navigation technologies and traffic information technologies
Features	■ Government-led ITS projects in Japan resulted in less flexibility of the private sector ■ Topographic conditions in Japan prohibit the provision of vehicle navigation services for all routes in the nation ■ Products are highly priced ■ Lackluster efforts for the standardization led to troubles in compatibility with global systems

Source: the Electronics and Telecommunications Research Institute (ETRI), Report on Market Trend of 15 Items, 2003, p52.

4.4. Future Trends

Urbanization and increase in the number of vehicles resulted in heavy traffic congestion in large cities all over the world. To deal with such problems, many governments have hurried to adopt the ITS since the 2000s. However, the current ITS cannot stop the increase in social costs due to traffic accidents and fully guarantee traffic safety. As a result, developed nations speed up the development of the cooperative ITS (C-ITS) which focus on safety and efficiency and gather to establish relevant standards via ISO/TC204/WG18 (CS WG).

Table 2-6 | Plans to Implement Cooperative ITS in the EU, the US, and Japan

Region	Details
EU	■ Setting up the projects to verify the concept of the C-ITS (CVIS, SAFESPOT, and COOPERS) in six stages (from 2002 to 2006) ■ Setting up the projects to test run the C-ITS (such as Drive C2X and FOTsis) in seven stages ■ Setting up the projects to prepare for the commercialization of the C-ITS (COMOS and Compass4D) (from 2013 to 2016) ■ Reaching an agreement that the C-ITS will be in place by 2015 via the consortium with vehicle manufacturers (Car-2-Car Consortium)

Region	Details
US	■ Setting up the projects to verify the concept of the C-ITS (VII, CICAS, VCS, and VCS-A) ■ Setting up the projects to test run the C-ITS (Connected Vehicle Program and Safety Pilot in Michigan) ■ Forming the ITS America Connected Vehicles Task Force as a consortium to discuss related issues ■ Focusing on the communications between vehicles (vehicle-to-vehicle) and reviewing relevant restrictions and regulations after 2013
Japan	■ Setting up the projects to verify the concept of the C-ITS (Smartway, ASV, and DSSS) ■ Setting up the project to test run the C-ITS (ITS Safety 2010) ■ Launching the C-ITS projects nationwide: ITS Sport (1,600 places as of 2011) and DSSS (15 places as of 2010) ■ Japan's C-ITS projects are based on existing dedicated short range communications infrastructure and the vehicles which use the infrastructure (vehicle-to-infrastructure)

【Introduction to the C-ITS】

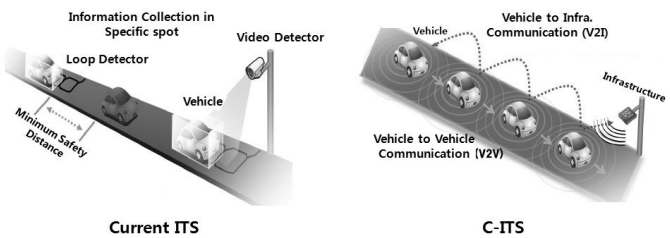
1. Current ITS

The current ITS have several inherent limitations: they offer one-sided provision of traffic information (which means traffic information is conveyed from one spot to the traffic information center or the traffic information center to one spot, not simultaneously); and collection and provision of traffic information between vehicles and between vehicles and roads are carried out separately without any information exchange between them. Drivers are unable to respond to emergency situations swiftly while driving on roads due to their limitations on recognition response and the current ITS aims to provide swift response to traffic accidents.

2. C-ITS

The C-ITS provides two-way provision of traffic information (which means traffic information is exchanged between vehicles and between vehicles and roads) and enables traffic information to be exchanged and shared through ceaseless mutual communication with neighboring vehicles and roads. The C-ITS can respond to traffic conditions swiftly and actively in accordance with changes in roads and enable vehicles to avoid and prepare for traffic accidents.

Figure 2-7 | Current ITS vs. C-ITS



Source: ITS Korea, 2013.

5. Current Situations of Korea's ITS

Korea's ITS have expanded overseas on the basis of their successful establishment and operation stories, and as a result the ITS generated revenues of 100 million USD from overseas export.

Export of Korea's ITS increased after the success of the 17th 2010 ITS World Congress in Busan. Seoul's Seoul Transport Operation and Information Service (TOPIS) and the National Traffic Information Center of Korea Expressway Corporation have been quoted as successful establishment examples of the ITS and now are an essential part of field trips by overseas public officials. A report submitted by the Information Technology & Innovation Foundation of the US to the Congress states that Korea, Japan, and Singapore are global leaders of the ITS.

Korea's reputation for the ITS has improved as countries in the Middle East, Latin America, Southeast Asia, and Central Asia are sending more requests for technical consultation and joint projects with Korea.

5.1. Competitiveness Evaluation

An analysis of the level of Korea's ITS-related technologies and services concluded that Korea ranked 9th for its technology level and 5th for its service level. In this analysis, a technology level refers to the overall level of ITS-related technologies in terms of the number of patents for core technologies related to the ITS and the development level of key technologies such as Vehicle to Infrastructure (V2I) and Vehicle-to-Vehicle (V2V)

technologies. A service level refers to the overall level of ITS-related services in terms of the number of the people who use traffic information, the level of the information provided, and the usage level of real-time traffic information by using the navigation system.[8]

Table 2-7 | Competitiveness of Korea's ITS

Ranking	Technology Level	Service Level
1	Japan	Japan
2	USA	USA
3	Germany	Germany
4	France	France
5	The UK	Korea, the UK
6	Sweden	Swiss, Sweden
7	Belgium, the Netherlands	Belgium, the Netherlands
8	Swiss	Taiwan, Singapore
9	Korea, Taiwan, Singapore	

Source: the Presidential Council on National Competitiveness, Strategy to Development the ITS for Smarter and Greener Transportation and for Nurturing New Growth Engines, 2012, p38.

In terms of the competitiveness of each ITS-related service, Korea's Bus Information System (BIS) and Electronic Toll Collection System (ETCS) are the best in the world but others like the traffic management system are similar to or somewhat inferior to those of other advanced countries.

8. See the following for your reference: the Presidential Council on National Competitiveness, Strategy to Development the ITS for Smarter and Greener Transportation and for Nurturing New Growth Engines, 2012.

Table 2-8 | Competitiveness of each ITS-related Service Provided by Korea

Services	Details	Competitiveness
Bus Information System (BIS)	■ A typical ITS-related service and adopted by many nations; Korea is said to have the best BIS technologies in the world	Comparatively Advantageous
Electronic Fare Collection System (EFCS)	■ As seen in the success story of Bogota, Columbia, which employed Korea's EFCS, Korea is one of the few nations that can provide the most advanced EFCS-related services	
Navigation System	■ Korea's navigation system is very convenient for users and provides advanced technologies at a reasonable price; as a result, Korea's navigation system is very popular in the EU	Comparatively Advantageous
Automatic Traffic Enforcement System (ATES)	■ Korea's ATES excels at reading license plates and automatic detection of illegally parked vehicles and is worth the investment	
Advanced Signaling System	■ Korea's signaling products including LED traffic signs and traffic sign controllers are competing against those by global businesses like Siemens and Fujitsu	Equivalent or Comparatively Inferior
Advanced Traffic Management System (ATMS)	■ Korea's ATMS-related products like vehicle detectors and variable message signs (VMS) are not competitive enough with those by Germany, China, and Russia. But Korea's ATMS-related services like traffic flow management and traffic information provision are somewhat competitive ■ Korea's competitiveness of next generation ITS technologies such as vehicle to infrastructure (V2I) and vehicle to vehicle (V2V) is equivalent to that of the US, the EU, and Japan	
Electronic Toll Collection System (ETCS)	■ Korea has one of the best ETCS technologies and is very accurate. But the devices for Korea's ETCS are active devices, not passive ones mainly used in other nations of the world, and therefore Korea is facing difficulty in exporting devices	

Source: the Presidential Council on National Competitiveness, Strategy to Development the ITS for Smarter and Greener Transportation and for Nurturing New Growth Engines, 2012, p38.

5.2. Overseas Export

Korea records strong exports to Latin America, Central Asia, and Southeast Asia and has successfully expanded into the US and the EU. Korea's main ITS exports are the public transportation cards system, the bus information system, and the traffic enforcement system.

LG CNS won a 300 million USD (about 330 billion KRW) project to establish the automatic fare collection (AFC) system for public transportation and the bus management system in Bogota, Columbia. This is the biggest contract in which a Korean business has participated in for the ITS.

Here is the list of overseas ITS projects worth one billion or more KRW where a Korean business is participating.

Table 2-9 | List of Overseas ITS Projects worth One Billion or More KRW where a Korean Business Participate

Year	Country (City)	Details	Company Name	Budget (USD in thousands)
2006	China (Beijing)	The Automatic Fare Collection System and etc.	LG CNS	50,000
2007	Ecuador (Quito)	The Integrated Public Transportation Cards System	eB Card	4,700
2008	Azerbaijan (Baku)	The Traffic Information System, the Traffic Management System, the Bus Information System, Establishment of the National Traffic Information Center and etc.	SK C&C	110,000
2008	Mongolia (Ulaanbaatar)	The Traffic Information System, the Signal Control System, Establishment of the National Traffic Information Center and etc.	SK C&C	12,000
2008	India (New Delhi)	The Automatic Fare Collection System and etc.	Samsung SDS	20,000
2008	Ecuador (Quito)	The Integrated Public Transportation Cards System	eB Card	47,400
2008	Ecuador (Cuenca)	The Automatic Fare Collection System, the Bus Management System	eB Card	2,600
2008	New Zealand (Wellington, Auckland)	The Public Transportation Cards System, Establishment of the Infrastructure for Distribution and Payment and etc.	Korea Smart Card	23,000

Year	Country (City)	Details	Company Name	Budget (USD in thousands)
2009	India (Bengaluru)	The Automatic Fare Collection System and etc.	Samsung SDS	15,000
2009	Mexico (Guadalajara)	The Automatic Fare Collection System	eB Card	2,100
2010	China (Chengdu)	The Automatic Fare Collection System and etc.	Samsung SDS	20,000
2010	USA (Washington D.C., LA, Alexandria, and etc.)	The Electronic Payment System for Taxis	Samwon FA	2,000
2010	Iran (Mayad)	The Automatic Fare Collection System	eB Card	2,900
2011	Columbia (Bogota)	The Bus Information System, Establishment of the Public Transportation Cards System and etc. (BOT financing[9], operated by LG CNS for the next 15 years)	LG CNS	300,000
2011	Kazakhstan	The Traffic Enforcement System against Speeding and Traffic Signal Violation	Keon-a Information Technology	1,808
2011	Malaysia (Kuala Lumpur)	The Bus Cards System, the Establishment of the Infrastructure for Distribution and Payment, and the Bus Payment System	Korea Smart Card	38,000
2011	Columbia (Bogota)	Project to Establish LED Traffic Signal System	Korea Electric Traffic	2,000
2012	Kazakhstan	The Traffic Enforcement System against Speeding and Traffic Signal Violation	Keon-a Information Technology	3,490
2012	India (Jaipur)	The Automatic Fare Collection System for Trains and etc.	Samsung SDS	5,000
2012	USA (Dallas, LA, and etc.)	Establishment of the Electronic Fare Collection System for Taxis	Samwon FA	4,200
2012	Iran (Esfahan)	Provision of 10,000 Devices to Taxis for Electronic Fare Collection	eB Card	1,300
2012	Saudi Arabia	Surveillance Cameras and etc.	Inpeg Vision	1,734

Year	Country (City)	Details	Company Name	Budget (USD in thousands)
2012	Columbia (Bogota)	Provision of Devices for the Automatic Fare Collection System	Korea Smart Card	13,140
2013	India (Hyderabad)	The Automatic Fare Collection System for Trains and etc.	Samsung SDS	8,000
2013	Panama	The Bus Management System	Samwon FA	2,000
2013	Kazakhstan	The Traffic Enforcement System against Speeding and Traffic Signal Violation	Keon-a Information Technology	5,200

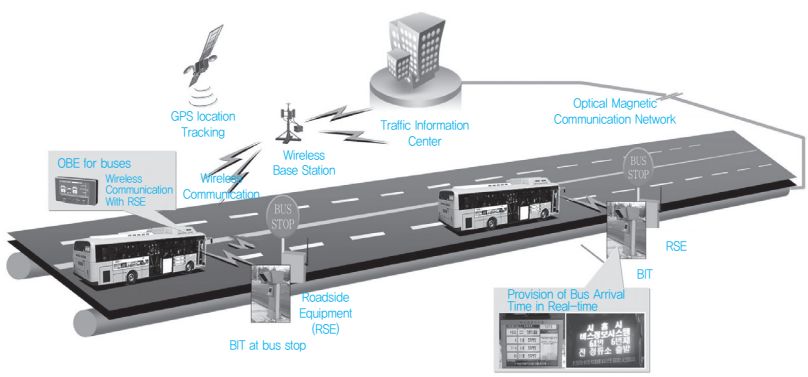
Source: Intelligent Transport Society of Korea (ITS Korea), 2013.

【BIS & EFCS】

1. BIS (Bus Information System)

A system to manage buses on the road and provide real-time information on buses by collecting and processing such information as the real-time positions of buses on the road and their driving status.

Figure 2-8 | Conceptual Design of the BIS



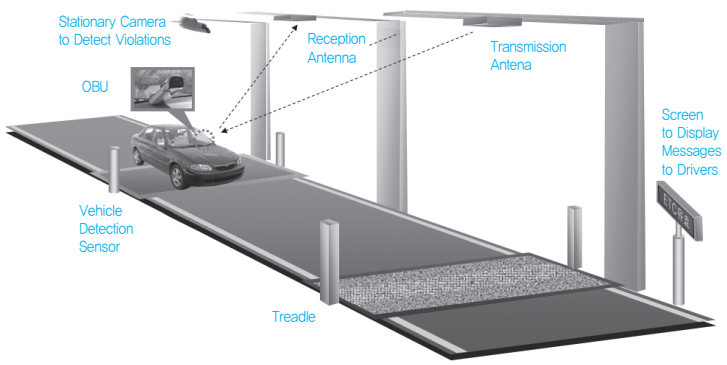
Source: ITS Korea, 2013.

9. BOT (Build-Operate-Transfer) financing: a form of project financing which enables the project proponent to recover its investment, operating and maintenance expenses in the project.

2. EFCS (Electronic Fare Collection System)

A system provided by a service provider to enable the collection of fares to registered users in a form of infrastructure and the mode of transportation associated with the system.

Figure 2-9 | Conceptual Design of the EFCS



Source: ITS Korea, 2013.

2013 Modularization of Korea's Development Experience
Establishment of Intelligent Transport Systems (ITS)

Chapter 3

Strategies and Systems to Implement the ITS

1. Establishment and Revision of the National Transport System Efficiency Act
2. Establishment of the Master plan and the Standardization Plan for the ITS
3. Creation and Reorganization of Relevant Bodies
4. Promoting and Supporting the Test-run of the ITS
5. Financing Methods

Strategies and Systems to Implement the ITS

1. Establishment and Revision of the National Transport System Efficiency Act

1.1. Significance of the Establishment and Revision of the Act

1.1.1. Establishment of the Traffic System Efficiency Act

In 1999, the Korean government enacted the Traffic System Efficiency Act to facilitate the coordination of traffic-related polices, to establish investment plans for transport facilities, to evaluate the investment, and to enable the intelligent transport system. "Establishment of the Intelligent Transport Systems" prescribed in the Act is legal grounds for the government to make and carry out ITS-related plans for the operation of new ITS businesses and the standardization of the ITS.

1.1.2. Establishment of the National Transport System Efficiency Act

In the mid-2000s, local governments started to establish their own ITS as they realized the necessity for the ITS promoted by the central government. City and provincial governments in the capital area had improved awareness of the ITS and higher level of fiscal self-reliance compared to other local governments and therefore they had continuously invested in ITS projects.

The Traffic System Efficiency Act, however, had provisions overlapping with those of the Road Act, the Road Traffic Act, the Act on the Support and Promotion of Utilization of Mass Transit System, and other Acts related to the ITS and such provisions could cause discrepancies in interpretation. Though the Traffic System Efficiency Act prescribed the

establishment of ITS-related plans, designation of government agencies to control the plans, and standardization of the ITS, the Act was came into action long ago and therefore failed to meet social and technological changes which the ITS was experiencing.

As a result, the government realized the need to revise the Traffic System Efficiency Act and it was revised into the National Transport System Efficiency Act.

In addition, the government also revised ITS-related provisions in the Road Act, the Road Traffic Act, the Act on the Support and Promotion of Utilization of Mass Transit System, and other Acts related to the ITS to facilitate coordination among relevant administrative agencies, to prevent overlapping investment, and to remove contradictory provisions.

1.2. Details of the National Transport System Efficiency Act

1.2.1. History

In the early 1990s, the government started to discuss the introduction of the ITS and established the plans to implement ITS projects in a more systematic way. As legal grounds which prescribed the method to secure the budget for the ITS and to carry out ITS projects were required, the government passed the Traffic System Efficiency Act in 1999 and the Act was revised into the National Transport System Efficiency Act in 2009, which is Korea's principal legal grounds for ITS-related issues.

Here is the history of the establishment and revision of the Act

A. February 1999: Establishment of the Traffic System Efficiency Act

B. January 2000: Partial Revision (making provisions which required all mass-scale construction project to establish plans to improve interregional traffic conditions)

C. May 2001: Partial Revision (establishing interregional and local plans)

D. June 2007: Started to conduct researches into total revision of the Act as well as other acts related to the ITS

E. 2009: Complete revision of the Act (renamed as the National Transport System Efficiency Act)

1.2.2. Details

The National Transport System Efficiency Act 2009 is a revised and improved version of the Traffic System Efficiency Act as legal grounds for coordination of air, land, and sea transportation, the intermodal transportation system, and multimodal transfer centers combined with shopping malls.

Here are the details of ITS-related provisions in the National Transport System Efficiency Act.

A. Establishing the master plan for the ITS

B. Establishing the ITS for local governments

C. Applying provisions to other plans

D. Establishing the implementation plans for the ITS

E. Implementing ITS projects

F. Preparing guidelines for implementing ITS projects

G. Establishing and approving enforcement plans

H. Concerning permission and authorization in accordance with other acts

I. Completion inspection

J. Standardization of the ITS

K. Certification of the standards and quality of the ITS and cancellation of the certification

L. Cancellation of organizations for standard certification and quality certification of the ITS

M. Evaluation of the performance of the ITS and management of the safety of the ITS

N. Facilitating the participation of the private sector and international expansion

O. Establishing the nationwide information center for the ITS

P. Establishing ITS Korea

Q. Concerning other businesses related to ITS Korea

2. Establishment of the Master plan and the Standardization Plan for the ITS

2.1. Establishment of the Master Plan for the ITS

2.1.1. Background to the Establishment

After the government decided to adopt the ITS, it established the master plan for the ITS to make sure that the procedures to introduce the ITS should be done in a systematic and efficient way. Then the government enacted the Traffic System Efficiency Act, which requires the central and local governments to make long and mid-term plans to facilitate the

development and distribution of the ITS. In addition, other relevant organizations are also designing their own long and mid-term plans to facilitate the systematic implementation of the ITS in accordance with the Act.

2.1.2. History of the Master Plan for the ITS

The government established the draft plan to promote the ITS in 1993 as it decided to introduce the ITS and the master plan for the ITS was first drawn up in 1997. After a series of research studies to supplement the relevant plans and revisions, Master Plan 21 for the ITS was finalized in 2001.

The National Transport System Efficiency Act prescribes that the master plan for the IPS should be revised every 10 years, thus the Master Plan 2020 for the ITS was formulated.

A. October 1993: Social Overhead Capital Investment Planning Group established the promotion (draft) plan for the IVHS[10]

B. December 1993: Decided to carry out the Master Plan for the IVHS on a pan-governmental basis

C. July 1994 to July 1996: Research was conducted to implement the ITS

D. September 1997: The Master Plan for the ITS was drafted

E. December 1999: Research was conducted to revise the Master Plan

F. March 2001: The Master Plan 21 for the ITS was finalized

G. December 2011: The Master Plan 2020 for the ITS was established

2.1.3. Details of the Master Plan for the ITS

The Master Plan for the ITS is located at the top layer of ITS-related plans, aims to provide a basic direction for effective implementation of the ITS, defines the scope of services provided by the government and the role of each relevant government agency in order to prevent overlapping or creation of blind spots with other projects promoted by relevant government agencies, and sets up the framework where ITS projects can be effectively carried out and ITS-related information and common ITS-related infrastructure can be shared.

Here are the areas defined by the Master Plan.

- Current traffic conditions and future prospects

10. IVHS: Intelligent Vehicle Highway System.

- Objectives of and basic directions for the promotion of the ITS / Promotion plans of each of the ITS-related fields
- Plans to lay the groundwork for the implementation of the ITS including research and development and standardization
- Plans for the establishment of the system to promote the ITS and for division of labor in financing

2.2. Establishment and Implementation of the Standardization Plan for the ITS

2.2.1. Background to the Establishment and Implementation

The government drafted the standardization plan compatible and interoperable nationwide to guarantee effective system operation and prevent overlapping investment while considering the fact that the ITS will be operated individually or interconnectedly in a wide range of areas. So the Ministry of Construction and Transportation formed the foundation to implement the national standardization plans for the ITS in accordance with the Traffic System Efficiency Act and drafted more detailed implementation plans based on the basic direction for the standardization of the ITS prescribed in the Master Plan 21 for the ITS.

2.2.2. History of the Standardization of the ITS

The government realized that the standardization efforts for the ITS conducted by the International Organization for Standardization should be followed as standardization is necessary for the introduction of the ITS. For this purpose, the government launched the Expert Committee for Traffic Information in 1995. Then, the government developed relevant standards based on international efforts for ITS standardization and established the national plan for the standardization of the ITS in 2002 in accordance with the Traffic System Efficiency Act 1999.

A. March 1995: The Expert Committee for Traffic Information was launched to address issues related to ISO/TC204 for the Traffic Information and Control System (TICS) and ITS

B. December 1998: Established a five-year plan for standardization of the ITS

C. February 1999: The Traffic System Efficiency Act was established as the grounds for ITS standardization

D. March 2000: Developed 14 draft standards including an ITS data dictionary and its data format

E. December 2000: The Master Plan 21 for the ITS was established

F. March 2001: The Expert Committee for Traffic Information was reshuffled and expanded – each working group in the Committee had relevant experts

G. June 2001: The Subcommittee for the ITS Standardization under the National Transport Board was launched

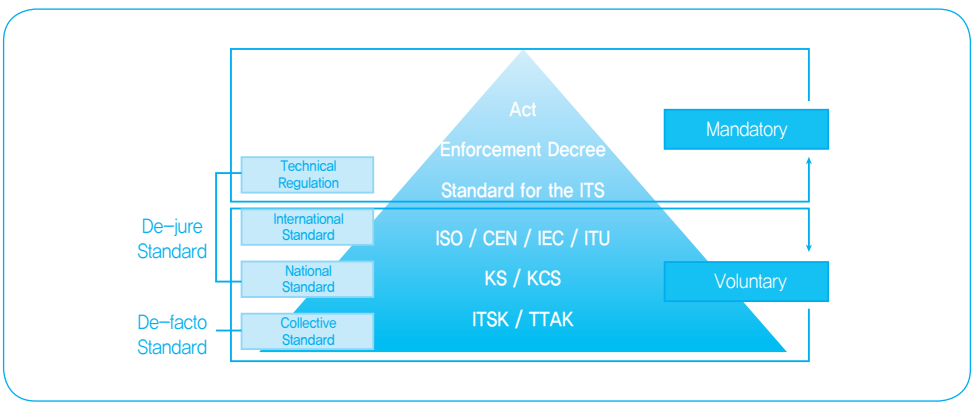
H. November 2001: Developed six draft standards including ITS data registry and its data format

I. July 2002: National standardization plans for the ITS were finalized

2.2.3. Details of the Standardization of the ITS

The national standardization plans for the ITS 2002 prescribes directions, strategies, structures, and procedures for the ITS standardization and laid the foundation for more efficient standardization by developing plans to form the groundwork for national standardization efforts and to share the responsibility for financing among interested parties.

Figure 3-1 | Types and Stuctures of Korea's ITS Standards



Source: ITS Korea, 2013.

2.3. Guideline on the Roles of Each Area Participating in the Establishment of the ITS

2.3.1. Background to the Guideline

The government drew up this guideline for the specific roles of each area and interested parties related to the project for the establishment of the ITS. The areas that have roles that are prescribed in this guideline are as follows: planning, construction, standardization, operation and management, performance evaluation, and effectiveness analysis.

2.3.2. History of the Guideline

This guideline was first formulated in 2005 while ITS projects were underway.

A. August 2005: The first official announcement about this guideline was made under a directive from the Ministry of Construction and Transportation

B. August 2009: One new provision was created (the period during which a directive shall be repealed or modified was prolonged)

C. August 2012: The deadline by which this guideline shall be reexamined was prolonged (by August 2015)

2.3.3. Details of the Guideline[11]

In accordance with Article 3 of the Traffic System Efficiency Act "Establishment of the Intelligent Transport System", this guideline prescribes detailed methods and procedures for the implementation of the ITS to ensure that the ITS is effectively established and operated. Here are the details of the areas that have roles that are prescribed in the guideline.

a. Planning

This guideline helps relevant government agencies to formulate their own ITS plans and recommends what should be included in the contents of ITS planning and the procedures for establishing ITS plans to achieve consistency in the plans. The types of ITS plans prescribed in the guideline are the master plan, metropolitan plan, local plan, promotion plan, and implementation plan. The following table explains the details of these plans.

11. Abridged version.

Table 3-1 | Details of Each ITS Plan

Master Plan	Metropolitan Plan	Local Plan	Promotion Plan
■ Current traffic conditions and future prospects ■ Objectives and basic directions for the promotion of the ITS ■ Promotion plans of each of the ITS-related fields ■ Plans to lay the groundwork for the implementation of the ITS including research and development and standardization ■ Plans to establish the system to promote the ITS and for division of labor in financing	■ Conducting research into and analysis of the current traffic conditions in metropolitan areas ■ Conducting analyses on the current situations concerning the establishment and operation of the ITS in metropolitan areas ■ Setting objectives of and basic directions for the promotion of the ITS in metropolitan areas ■ Selecting ITS services to be provided in metropolitan areas and organizing service priorities ■ Planning to establish and operate the infrastructure for the ITS in metropolitan areas ■ Planning to coordinate with other systems operated in metropolitan areas and to carry out businesses ■ Developing methods to implement plans	■ Conducting analyses on the current traffic conditions in the area covered by the plan ■ Conducting analyses on the current situations concerning the establishment and operation of the ITS ■ Reviewing transportation policies ■ Reviewing plans related to the ITS ■ Setting objectives of promoting the ITS in metropolitan areas ■ Selecting ITS services to be provided and organizing service priorities ■ Designing a system to provide ITS services ■ Developing plans to establish and operate the ITS ■ Devising methods to evaluate expected effects ■ Developing methods to implement plans	■ Conducting analyses on the current traffic conditions in the area covered by the plan ■ Conducting analyses on the current situations concerning the establishment and operation of the ITS ■ Reviewing transportation policies ■ Reviewing plans related to the ITS ■ Setting objectives of promoting the ITS in metropolitan areas ■ Selecting ITS services to be provided and organizing service priorities ■ Designing the system to provide ITS services ■ Developing plans to establish and operate the ITS ■ Devising methods to evaluate expected effects ■ Developing methods to implement plans

Source: The Ministry of Construction and Transportation, Task manual for ITS, 2006.

b. Construction

This guideline prescribes procedures and methods to be complied with at each stage of constructing ITS facilities from the design to completion.

Table 3-2 | Details of the Processes to Establish the ITS

Planning	Designing	Construction	Completion of Construction
Developing plans to establish the ITS	Order placement and selection of constructors	Construction begins	Completion of construction
Preliminary inspection	Developing draft designs	Reviewing the report on the start of construction	Inspection of completion
Establishing the Master Plan	Notice of Tender	Construction Process Control	Holding a briefing session about completion
Establishing the Enforcement Plan	Decision of successful party	Quality Management	Operation plans for the future
Commissioning construction	Developing the Enforcement Design	Test-run and Evaluation	Management of construction and supervision of construction
Decision of whether to commission construction or not	Reviewing the Enforcement Design	Test-run	Roles and scope
Designating the scope of each work area	Calculation of costs	Technical Evaluation	
Management of Construction v.s Supervision of Construction	Developing a construction schedule	Evaluation through Experience	

Source: The Ministry of Construction and Transportation, Task manual for ITS, 2006.

c. Standardization

This guideline prescribes the regulations which operators, constructors, or relevant parties at each stage of ITS projects (planning, order placement, designing, construction, completion of construction, and operation) should comply with when they engage in standardization, the information required for standardization which they should obtain, and the duties and obligations related to ITS standardization of the Ministry of Construction

and Transportation and of the organizations which specialize in standardization (such as the organization in charge of ITS standardization and the organization which applies and verifies ITS standards). Operators, constructors, or relevant parties at each stage of ITS projects should adopt this guideline as reference.

Table 3-3 | Details of ITS Standardization Activities

A. Planning	B. Order Placement	C. Designing	D. Construction
Application of ITS standards	Proving Directions for Construction (while Reflecting Standards)	Reflection of Existing Plans	Beginning of Construction
Application of standards to the Enforcement Plan	Quantitative Inspection of the Plan for Evaluation and Review	Checking whether Standards are Applied to Enforcement Designs	Duties Related to Construction Process Control
	Inquiry about Standards-related Issues	Inspection of Construction Budget	Test-run and its Evaluation
		Plan for Schedule Management and Quality Management	

E. Completion of Construction	F. Operation	G. Others
Checking whether construction complies with standards	Effectiveness of the verification	Procedures to develop and establish ITS standards
Requesting the organizations which verify whether standards have been Met	Priority on the results of the verification	Establishment and operation of the national ITS Standardization Plan
Conducting tests to check whether standards have been met	System diagnosis	Technological exchange of ITS standards
Evaluation of the tests	Operation of the support system	Organizations in sharge of ITS Standardization
	Proposal of new technological standards	Organizations which check whether ITS Standards have been met

Source: The Ministry of Construction and Transportation, Task manual for ITS, 2006.

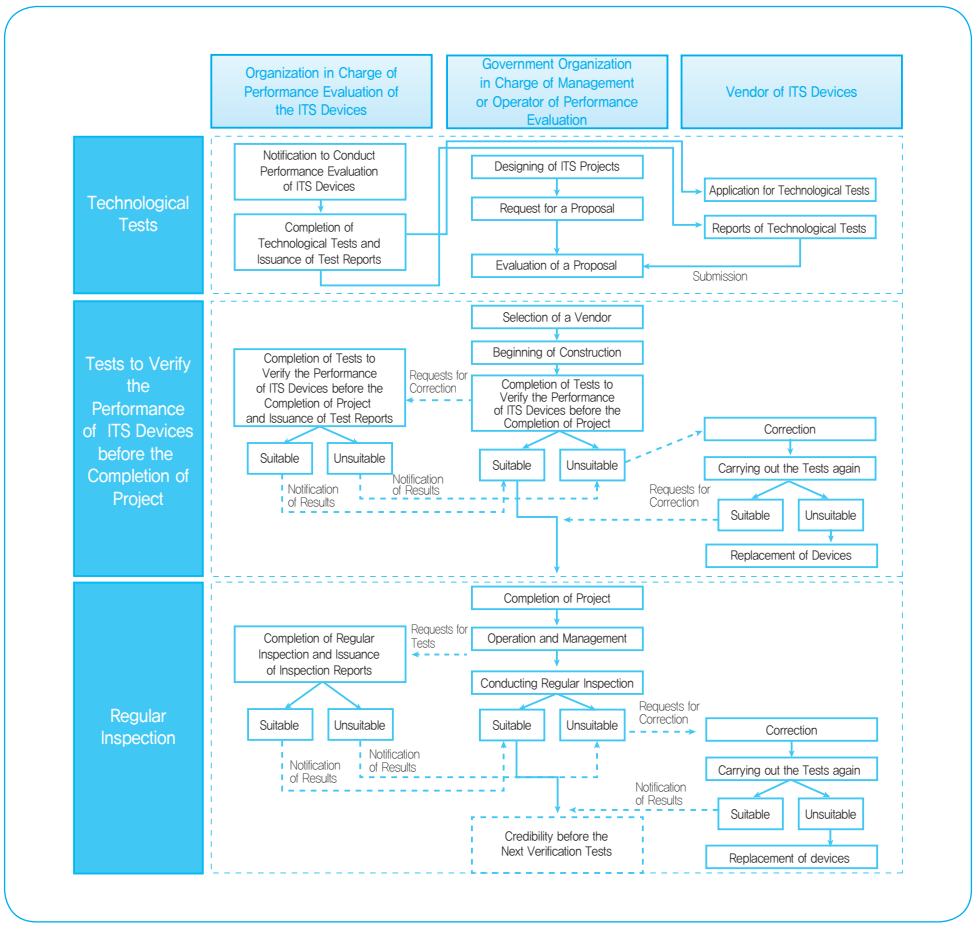
d. Operation and Management

This guideline prescribes the details of the duties which each person in charge of operating and managing the ITS center which is constructed, is operated, or will be established in the near future shall perform. The duties consist of general management, operation, maintenance, and improvement of performance management. General management is composed of plans for operation and management, education and training, policy support management for extraordinary traffic situations, document management, operation of advisory committees, and promotional activities. Operations consist of operation of the control room, system management, management of interconnected systems, and recoding and managing documents.

e. Performance Evaluation

Performance evaluations prescribed in this guideline consist of the checkpoints and items of performance evaluation, designation of the organization in charge of performance evaluation, duties of the organizations, the fees for performance evaluation, overall procedures and details concerning the establishment and operation of the plan to conduct performance evaluation, and the process of performance evaluation for each ITS device. The figure below illustrates the process of performance evaluation for each ITS device.

Figure 3-2 | Work Process to Evaluate the Performance of ITS devices



Source: The Ministry of Construction and Transportation, Task manual for ITS, 2006.

f. Effectiveness Analysis

This guideline prescribes the basic directions for how to analyze the effectiveness of each of the ITS, selection of Measures of Effectiveness (MoE), the methods to conduct preliminary and follow-up inspections, and the methods to analyze the results of the inspections. The objective of this guideline is to encourage objective verification of ITS projects. Effective Analysis shall be carried out into a single ITS project or a single system (provision of basic traffic information, electronic fare collection, management of emergency situations, management and provision of the information on public transportation, and detection of illegal parking and stopping).

2.4. Development of the Guidelines to Build Standard Nodes/ Links for the ITS

2.4.1. Background to the Development

As more people begin to engage in economic and social activities in a more diversified method and throughout several regions, the demand for interregional traffic information in an integrated format increases. However, the problem is that each ITS operator and local government develops and has its own system and therefore compatibility between different intelligent traffic systems cannot be guaranteed.

As a result, the government thought that the database for ITS nodes and links and data transmission protocols, which are essential for nationwide compatibility of traffic information, should be standardized and assigned a unique identification number to each node and link on national highways, expressways, and provincial roads all over the nation and developed the "guidelines to build standard nodes/links for the ITS" for systematic management and operation of the standard nodes and links.

2.4.2. History of the Development

Since each ITS operator and local government had its own standard nodes/links for the ITS, compatibility of traffic information between regions was low, therefore the government developed and distributed the guidelines to build stand nodes/links for the ITS in 2004.

A. December 2004: Developing the guidelines to build standard nodes/links for the ITS

B. December 2004: Distributing standard nodes/links for the ITS for provincial roads across the country

C. June 2005: Updating standard nodes/links for the ITS for provincial roads across the country

D. July 2005: Establishing and operating the system to manage standard nodes/links for the ITS for provincial roads across the country

2.4.3. Details of the Guidelines

Standardization of data transmission protocols and electronic network of roads are required to efficiently share real-time traffic information between ITS operators and to improve the quality of traffic information services provided to the public. The government completed the standardization nationwide by developing relevant guidelines.

The government guidelines largely consist of methods to build standard nodes/links, storage and provision of data, and management of data. Here are the details of the guidelines.

Table 3-4 | Details of the Guidelines for ITS standard nodes/links

Elements	Details
Composition of Identification Numbers for Standard Nodes/Links	Definition of the components and format of identification numbers for standard nodes/links on electronic network of roads
Methods to Give Identification Numbers to Nodes/Links	Detailed explanation of the components of identification numbers and definition of the methods to give identification numbers to nodes/links
Methods to Build Standard Nodes/Links on National Road Networks	Definition of procedures to build standard nodes/links, reference maps and systems of coordinates, and the methods to build the standard nodes/links
Inputting Basic Information	Basic information on nodes/links, components of extra information, and definition of data format and input methods
Reviewing Data	Definition of the checkpoints and methods to review the building of standard nodes/links
Storage and Provision of Data	Definition of the storage modes and provision of the data on established nodes/links
Management of Standard Nodes/Links	Definition of the scope for the establishment of standard nodes/links, management body of the standard nodes/links, methods to modify and report on the standard nodes/links, and management structure

Source: the Ministry of Construction and Transportation, Handbook for the Guidelines to Build Standard Nodes/Links for the ITS, p 2, June 2005.

【Node & Link】

1. Node

A point where the speed of a vehicle changes on a road.

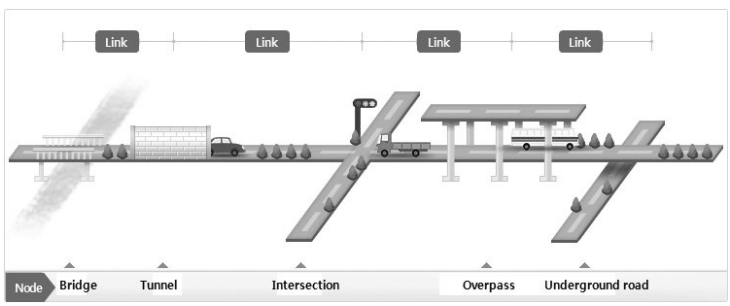
- e.g. intersections, start and end points of bridges, overpasses, underground roads, and tunnels, administrative boundaries, interchanges and junctions.

2. Link

A linkage of nodes.

- e.g. roads, bridges, overpasses, underground roads, and tunnels.

Figure 3-3 | Conceptual Design of Nodes and Links



Source: ITS Korea, 2013.

3. Creation and Reorganization of Relevant Bodies

3.1. Creation of the Government Agency in Charge of the ITS

3.1.1. Background to the Creation

As the government decided to introduce the ITS in the early 1990s, a government agency in charge of the ITS at the central government became a necessity. As a result, the Traffic Information Planning Division in the Ministry of Construction and Transportation was selected as the government body in charge of the ITS.

3.1.2. History after the Creation

After the decision to introduce the ITS in the early 1990s, a government agency in charge of the ITS at the central government became a necessity and therefore a division in the Ministry of Construction and Transportation in charge of the ITS was created in 1995.

A. May 1995: Traffic Information Planning Division at Transportation Policy Bureau was designated as the government organization in charge of the ITS

B. March 2008: Traffic Information Team at Traffic Policy Bureau took the charge the ITS due to the government reorganization

C. May 2009: ITS and Road Environment Division was created to be in charge of the ITS for road traffic and relevant government organizations assumed other ITS-related duties

D. 2013: ITS and Road Environment Division at Road Bureau started to be in charge of the ITS after the government reorganization

3.1.3. Details of the Duties which ITS and Road Environment Division Carries out

Here are the details of the duties which ITS and Road Environment Division Takes on.[12]

A. Overall management and coordination of ITS policies

B. Establishment and operation of ITS plans including the Master Plan

C. Establishment and operation of the ITS

D. Formulation of ITS standards, establishment and operation of standardization plans, standardization projects, establishment and management of standardization architecture

E. Adoption and research and development of new ITS technologies

F. Evaluation of the performance of ITS technologies and devices and operation of the system in charge of certification of performance

G. Optimization of traffic management including electronic toll collection and automatic traffic enforcement

H. Provision of support to local governments and private organizations that want to launch ITS projects

12. See the following for your reference: the National Legal Information Center of the Ministry of Government Legislation, Revision to the Enforcement Rule on the Reorganization of the Ministry of Land, Transport and Maritime Affairs and its Affiliated Organizations, 2008.

I. Establishment and operation of the National Traffic Information Center

J. Trial run of ITS projects including the establishment of "Advanced Transportation Model City"

K. Guidance and supervision given by government organizations in charge of the ITS, organizations designated to take charge of ITS-related matters, and other associations and organizations related to the ITS

L. Provision of nationwide real-time traffic information and establishment and operation of the system to provide traffic information

M. Development and operation of the policies to facilitate the distribution and use of traffic information such as calculation of fees to use traffic information

N. Creation of the foundation for the ITS such as facilitation of ITS-related industries and exports and international cooperation, training and education of experts, and promotional activities

【Change in the Name of the Ministry in Charge of the ITS due to Reorganization】

The ministry in charge of the ITS when it was first introduced was the Ministry of Construction and Transportation and the name of the Ministry has changed due to reorganization.

- the Ministry of Construction and Transportation: 1994 to 2008
- the Ministry of Land, Transport and Maritime Affairs: 2008 to 2013
- the Ministry of Land, Infrastructure and Transport: 2013 to now

3.2. Creation of Intelligent Transport Society of Korea (ITS Korea)

3.2.1. Background to the Creation

The 5th ITS World Congress held in Seoul in 1998, peaked interest in the ITS and the government realized that an organization which provides technical advice about ITS policies and supports research and development of ITS technologies by the private sector was needed. In order to effectively establish the ITS, close cooperation between government agencies (the Ministry of Construction and Transportation, the Ministry of Information and Communication, the Ministry of Commerce, Industry and Energy, the Ministry of Science

and Technology, and National Police Agency) and the private sector (the industrial sectors, the academia and research institutions related to the ITS) is required.

As a result, the government created ITS Korea as a means to strengthen the private sector's capacity for the ITS, to enhance the cooperation between the public and private sectors, and therefore to facilitate the development of the ITS.

3.2.2. History of ITS Korea

ITS Korea was created in 1999, one year after the 5th ITS World Congress. ITS Korea was designated as a statutory body under the Ministry of Land, Infrastructure and Transport prescribed in the National Transport System Efficiency Act in 2011.

A. April 1999: Held the inaugural ceremony; the permission of the incorporation of a juristic body was permitted and registry of its incorporation was made

B. November 1999: Held the inaugural seminar and exhibition

C. March 2000: Established the mid and long-term development plans for ITS Korea

D. July 2002: Hosted the 5th ITS Asia-Pacific Congress in Seoul

E. May 2005: Designated as a national organization that verifies the application of ITS standards (in accordance with Notice No. 2005-139 by the Ministry of Construction and Transportation)

F. May 2008: Designated as a national organization in charge of ITS standardization (in accordance with Notice No. 2008-157 by the Ministry of Land, Transport and Maritime Affairs)

G. June 2010: Designated as a national organization that evaluates the performance of ITS devices (in accordance with Notice No. 2010-409 by the Ministry of Land, Transport and Maritime Affairs)

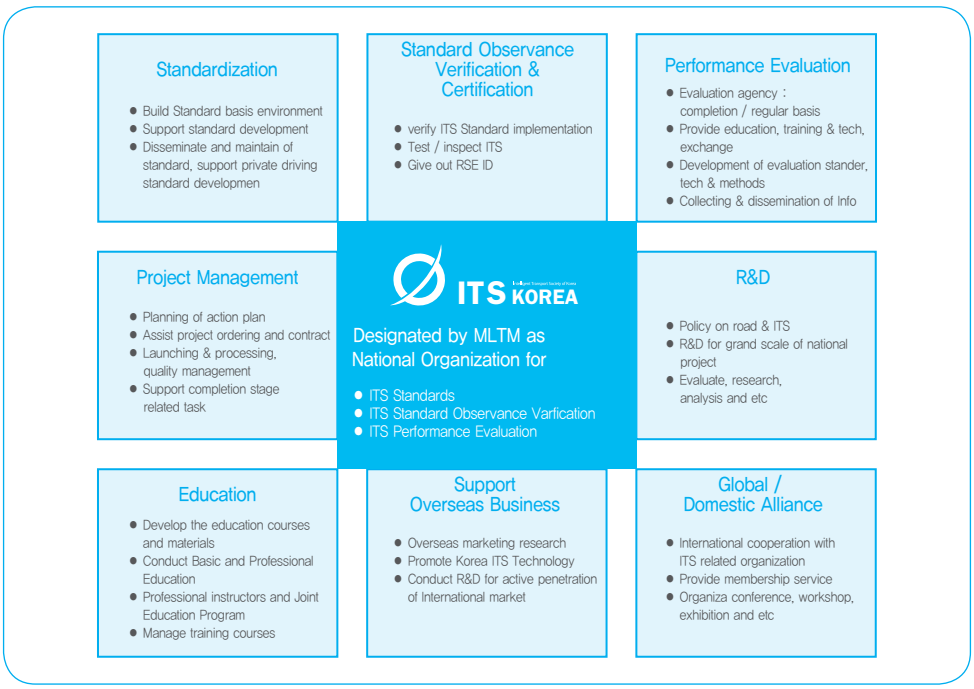
H. October 2010: Hosted the 17th ITS World Congress in Busan

I. May 2011: Designated as a statutory body under the Ministry of Land, Infrastructure and Transport (in accordance with Article 91 and 92 of the National Transport System Efficiency Act)

J. December 2013: Designated as a national organization in charge of ITS standardization for road traffic

3.2.3. Details of the Tasks of ITS Korea

Figure 3-4 | Main Tasks of ITS Korea



Source: ITS Korea, 2013.

3.3. Designating an Organization in Charge of the ITS

3.3.1. Background to the Designation

In 1999, the government passed the Traffic System Efficiency Act to accelerate nationwide efforts for the establishment of the ITS and the Act prescribed matters related to the designation of the organizations in charge of ITS standardization and performance evaluation of ITS devices and the tasks of these organizations. In accordance with the Act, the government designated the organization in charge of ITS standardization and the one in charge of the performance evaluation of ITS devices.

3.3.2. History of the Designation

The government designated the organization in charge of ITS standardization in accordance with the Traffic System Efficiency Act 1999 and in 2005 the government

designated the organization to evaluate the performance of ITS devices. ITS Korea was designated as the national organization in charge of ITS standardization for road traffic to ensure that one organization shall be totally in charge of all ITS standardization matters related to road traffic.

A. 1999: The Traffic System Efficiency Act prescribed the matters related to the designation of an organization in charge of ITS standardization

B. July 2004: Korea Research Institute for Human Settlements (KRIHS) was designated as the organization in charge of ITS standardization

C. May 2005: ITS Korea was designated as a national organization that verifies the application of ITS standards

D. May 2005: The Korea Institute of Construction Technology (KICT) was designated as a national organization to evaluate the performance of ITS devices

E. May 2008: The Korea Transport Institute (KOTI) and KICT were designated national organizations in charge of ITS standardization

F. June 2009: Systems were established for reasonable verification of the application of ITS standards (application of the ITS standards and adoption of performance evaluation)

G. May 2010: Five organizations were designated in charge of ITS standardization for vehicles and road traffic

H. May 2010: Three organizations were designated in charge of performance evaluation of ITS devices for vehicles and road traffic

I. December 2013: ITS Korea was designated as a national organization in charge of ITS standardization for road traffic

3.2.3. Details of the Tasks of the Designated Organizations

Each organization designated to carry out ITS standardization shall have the following tasks in accordance with the Enforcement Decrees of the National Transport System Efficiency Act:

A. Survey into demand, analysis of trends, and expectations of the ITS standards for road traffic

B. Collection, analysis, distribution, and guidance on the information and data about the ITS standards for road traffic

C. Promotional activities for the ITS standards for road traffic

D. Support of international cooperation on the ITS standards for road traffic

E. Verification and confirmation of the application of the ITS standards for road traffic, expansion of ITS standards for road traffic, and support to facilitate the use of ITS standards for road traffic

F. Cooperation with the industry sector, academia, or research institutes in terms of the ITS standards for road traffic

G. Other activities required for ITS standardization for road traffic such as training, education, and exhibition

Each organization designated to carry out performance evaluations of ITS devices will have the following tasks in accordance with the Enforcement Decrees of the National Transport System Efficiency Act:

A. Being in charge of all matters related to the performance evaluation of ITS devices

B. Research and development of the standards, technologies, and methods for the performance evaluation

C. Development and distribution of standard facilities and equipment for the performance evaluation

D. Acting as a proxy to evaluate the performance of ITS devices for the participants in the establishment of the ITS

E. Collection, analysis, and distribution of the information and data about the matters related to the performance evaluation of ITS devices

F. Training, education, technological exchange, and international cooperation of the matters related to the performance evaluation of ITS devices

G. Acting as a proxy to evaluate the performance of ITS devices for the participants in the establishment of the ITS

3.4. Coordination with Central Government Agencies

The Master Plan 21 for the ITS announced in December 2000 prescribed the role of the central government, local governments, and the private sector for the establishment of the ITS. Here are descriptions of the roles of the Ministry of Science and Technology, the Ministry of Commerce, Industry and Energy, the Ministry of Information and Communication, the Ministry of Construction and Transportation, and National Police Agency when the ITS was first employed.

3.4.1. The Ministry of Science and Technology

This Ministry was in charge of developing the technologies essential for the ITS such as collection of traffic information, analysis of traffic information, and evaluation of traffic flow.

3.4.2. The Ministry of Commerce, Industry and Energy

This Ministry developed ITS-related technologies (the in-vehicle navigation system, automatic distance control, the in-vehicle fire surveillance system, and vehicle obstacle avoidance technologies) by matching funds with private businesses.

3.4.3. The Ministry of Information and Communication

This Ministry led the standardization of IT technologies for the ITS and of the digital road database, developed dedicated short range communications for the ITS, GPS data processing technologies in real-time, the locationing system in place of GPS, the system for gathering, processing and transferring traffic information using FM DARC, and the automated control system (ACS), conducted research on the high-speed communication network for the automatic traffic management system, and devised the visual information system for road traffic which uses the communication network.

3.4.4. The Ministry of Construction and Transportation

This Ministry was in charge of general matters regarding ITS projects and research projects and provided ITS services through ITS centers and seven systems (the traffic control system at crossroads, the automatic traffic enforcement system, the public transportation information system, the parking guidance system, the driving guidance system, the heavy vehicle management system, and the automatic fare collection system).

In addition, this Ministry established the metropolitan traffic information system (including the capital area), provided traffic information through in-vehicle devices, online services, instant messaging, telephone, the automatic response system, and variable-message signs, and also provided other information such as traffic flow on expressways and national highways and flight and train reservations through the National Traffic Information Center.

3.4.5. National Police Agency

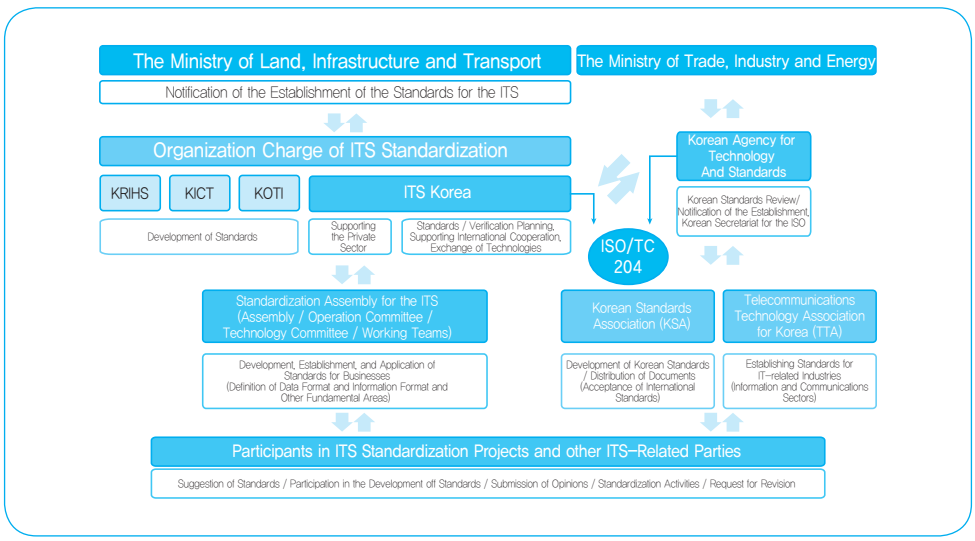
The National Policy Agency was in charge of traffic signals-related issues on expressways and national highways, developed the advanced signaling system, installed and operated the unmanned traffic enforcement system to detect traffic violations, and established its own traffic information system.

3.5. Collaboration with Other Relevant Organizations

3.5.1. ITS Standardization

The Ministry of Land, Transport and Maritime Affairs designated several organizations as proxies in charge of standardization matters and ITS Korea led ITS standardization for the public and private sectors through operation and support of the Standardization Assembly for the ITS, a private standardization agency.

Figure 3-5 | Collaboration Map for ITS Standardization



Source: ITS Korea, 2014.

3.5.2. Research and Development for the ITS

The Ministry of Land, Transport and Maritime Affairs commissioned part of its ITS-related research and development projects and their management to the Korea Agency for Infrastructure Technology Advancement (KAIA) to ensure that ITS-related research and development projects are managed systematically by experts. KAIA conducted the commissioned ITS-related research and development projects in accordance with the scale of each project while adopting various methods and led the projects while concentrating on the commercialization of project results. Other organizations which specialized in traffic and transport (including ITS Korea and Korea Expressway Corporation) as well as private businesses participated in ITS-related research and development projects.

Table 3-5 | Procedures for Commissioned ITS-related R&D Projects

The Ministry of Land, Infrastructure and Transport		Korea Agency for Infrastructure Technology Advancement		Organizations Specializing in Traffic and Transport and Private Businesses
Development of Plans for ITS-related Research and Development Projects	→	Commission and Management of ITS-Related Research and Development Projects	→	Carrying out the Commissioned ITS-related Research and Development Projects
	←		←	
Formulation of Policies in Accordance with the Results of the Commissioned Projects		Public Contest of New ITS-related R&D Projects		Request for New ITS-Related R&D Projects

Source: ITS Korea, 2013.

4. Promoting and Supporting the Test-run of the ITS

4.1. Test-run of the ITS in Gwacheon

4.1.1. Background to the Test-run

In 1995, the Ministry of Construction and Transportation decided to perform a test-run of the ITS in Gwacheon as an opportunity to review ITS projects which had been carried out rather sporadically from a comprehensive perspective and to prepare itself for establishing the ITS nationwide in the future.

4.1.2. History of the Test-run

The Ministry of Construction and Transportation, the government of Gwacheon, and National Police Agency agreed to select Gwacheon as the location for the test-run as Gwacheon had a higher level of fiscal self-reliance and was the ideal location to monitor urban and regional traffic status.

A. January to April 1995: screening and selecting candidates for the test-run of the ITS

Table 3-6 | List of Candidates and Checkpoints for Test-run of the ITS

Checkpoints / Location	Gwacheon	Bundang	Ansan	Yeouido	Gangnam
Grid Roads	o	o	o	o	o
Urban Expressways	Industrial Roads	Gyeongbu Expressway	x	Olympic Blvd. Expressway	x
Availability of New Traffic Signals	o	o	o	o	o
Congestion	Moderate	Light	Moderate	Heavy	Heavy
Roads Linked to Neighboring Areas	Congestion in Namtaeryeong	Good	Good	Congestion near Hanganggyo	Congestion
Promotional Effects	Satisfactory	Ordinary	Ordinary	Satisfactory	Satisfactory
Number of Traffic Signs	13 at Crossroads (26 when those at crosswalks are added)	30 at Crossroads (80 when those at crosswalks are added)	40 at Crossroads (90 when those at crosswalks are added)	25 at Crossroads (70 when those at crosswalks are added)	40 at Crossroads (150 when those at crosswalks are added)
Investment Costs	Small	Moderate	Large	Moderate	Too Heavy
Others	Connected to Building #2 of Gwacheon Government Complex	-	-	-	-

Source: the Ministry of Construction and Transportation, Evaluation of Test-Run of the ITS in Gwacheon, 1998.

B. June 1996: Formulating the master plan and commissioning the formulation of the enforcement design

C. June 1996: Forming an advisory board composed of 16 representatives

D. July 1996: Holding two presentations to explain the finalized version of the test-run plan

E. August 1996: Receiving proposals and selecting private businesses

F. October 1996: Selecting the finalized version of the basic and enforcement design of the test-run

G. December 1996: Initiating the construction of the systems required for the test-run

H. April 1997: Selecting the location of the ITS center

I. October 1997: Completion of construction

J. December 1997: Holding the first coordination council for the test-run (discussion over the methods to operate the ITS and training sessions for operators)

K. January 1998: Holding the second coordination council for the test-run (discussion over the methods to transfer test-run results to others)

L. March 1998: Holding a coordination council presided over by the Gwacheon Police Station for the authority to operate the ITS

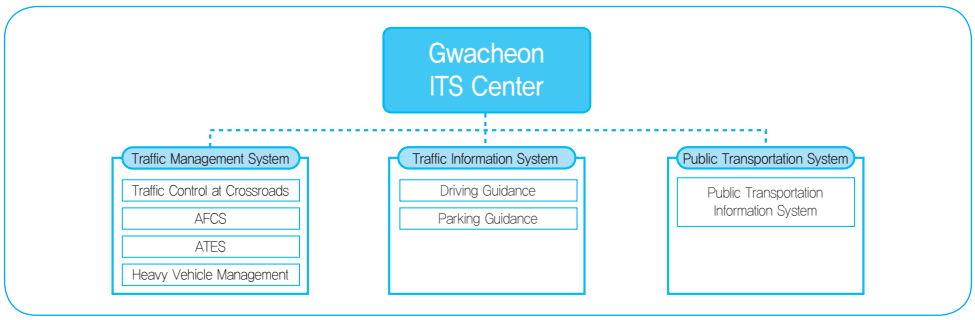
M. July 1998: A memorandum of agreement on the transfer of test-run results to others was signed by the Ministry of Construction and Transportation, the government of Gwacheon, Gwacheon Police Station, and the Korea Transport Institute

4.1.3. Details of the Test-run

The principal objective of the test-run of the ITS in Gwacheon was the provision of various types of convenience to government agencies, research institutes, private businesses, and ordinary citizens. The government and research institutes checked the expected effects of the ITS quantitatively, provided private businesses with the opportunity to use advanced devices of the ITS, which worked as a testing ground for the credibility and efficiency of developed ITS devices, promoted people's awareness of the ITS by offering convenient services such as real-time traffic information, and relieved the public of the burden of traffic congestion through the ITS. The test-run of the ITS in Gwacheon was presented at the 5th ITS World Congress Seoul held in October 1998.

The test-run in Gwacheon was a valuable opportunity to estimate the effectiveness of the plan to expand the ITS to other areas and the guideline for other local governments that want to implement the ITS.

Figure 3-6 | Components of the ITS Center in Gwacheon



Source: Kim Hong-il, Research on the Methods to Establish Efficient Intelligent Transport Systems for the 21 Century, 2001.

Here are the details of the systems installed in Gwacheon for the test-run of the ITS.

Table 3-7 | Details of the Systems Installed in Gwacheon for the Test-run of the ITS

Systems	Details
System Integration	■ One Central System
Traffic Control System at Crossroads	■ 14 traffic signal controllers (5 at crossroads with heavy traffic and nine at those with light traffic) ■ 3 CCTVs, 2 variable-message signs, 13 video detectors at 4 places ■ 159 loop detectors (112 with six-sided shape and 47 with 32-sided shape)
Public Transportation Information System	■ 148 in-bus terminals (145 of them were simpler type and the remaining (3) were guidance type) ■ 11 bus information terminals (3 of them were expanded type, 4 of them were standard type, and the remaining (4) were collection type / two bus transfer information terminals
Driving Guidance System	■ 8 driving guidance devices (5 of them were for information collection and guidance and the remaining (3) were for guidance only)
Parking Guidance System	■ Parking guidance devices at four areas
Automatic Traffic Enforcement System	■ Automatic traffic enforcement devices (speeding) at four areas

Systems	Details
Automatic Fare Collection System	■ Installed at the tollgate of an expressway which connects Uiwang and Gwacheon (one on each of the northbound and southbound lanes) ■ 520 vehicles with in-vehicle devices
Heavy Vehicle Management System	■ One on Gwacheon-daero

Source: The Ministry of Construction and Transportation, Evaluation of the Test Run of ITS in Gwacheon, 2008.

4.2. Advanced Transportation Model City Projects for Daejeon, Jeonju, and Jeju

4.2.1. Background to the Projects

Though Gwacheon was able to lay the foundation for the ITS through the test-run, local governments outside the capital area weren't able to do the same as they faced difficulty in securing required budget and had little knowledge and experience in the ITS.

As a result, in 2000, the Ministry of Construction and Transportation launched the Advanced Transportation Model City projects for Daejeon, Jeonju, and Jeju to establish the ITS in these cities. The objectives of these projects were to promote the introduction of the ITS across the country, to gain experience in the ITS, to improve the technological prowess of the ITS, to development the industries related to the ITS, to provide guidelines for local governments to implement the ITS, and, by presenting evaluations of the ITS-related services and expected improvements by the ITS in urban areas, to facilitate the adoption of the ITS by local governments.

4.2.2. History of the Projects

The Ministry of Construction and Transportation signed an agreement concerning the "Advanced Transportation Model City" projects with Daejeon Metropolitan City, Jeonju, and Jeju in September 2000 and agreed that the ITS in these cities would be established and launched by July 2002 when the first round of the 2002 FIFA World Cup began.

a. Daejeon

A. August 2000: Selected as an Advanced Transportation Model City

B. September 2000: Signing an agreement with the central government (regarding the plan for government subsidies, designation of the organization in charge of the management of this project, and etc.)

C. May to June 2001: Selecting the enforcement design and the organization in charge of construction of the ITS

D. July to August 2001: Formulating the enforcement design

E. August 2001: Conducting technology reviews on the enforcement design

F. October 2001 to September 2002: Signing construction agreements with subcontractors and completing construction of the ITS

G. September to December 2002: Performing the test-run of the ITS

b. Jeonju

A. August 2000: Selected as an Advanced Transportation Model City

B. September 2000: Signing an agreement with the Ministry of Construction and Transportation

C. May 2001: Selecting an organization to formulate the enforcement design

D. September 2001: Completing the evaluation of the enforcement design

E. November 2001: Signing construction agreements with subcontractors

F. May 2002: Performing the test-run of the ITS and providing relevant services to citizens

c. Jeju

A. August 2000: Selected as an Advanced Transportation Model City

B. December 2000: Reviewing invitation for bids

C. January to February 2001: Requesting bids, posting the notice of tender, and holding briefing sessions

D. April to May 2001: Reviewing project proposals and selecting an organization to formulate the enforcement design

E. July to August 2001: Completing the formulation of the enforcement design

F. September 2001 to July 2002: Signing construction agreements with subcontractors, initiating construction, and performing the test-run of the ITS

4.2.3. Details of the Projects

Systems used for the Advanced Transportation Model City projects were selected in accordance with geographical and industrial properties of the cities while focusing on the provision of traffic information, traffic management, and traffic signal control. In conclusion, 16 subsystems categorized into five areas were selected: optimization of traffic management, electronic fare collection, facilitation of the distribution of traffic information, provision of qualified tourist information, and facilitation of the public transportation system.

Table 3-8 | Details of Advanced Transportation Model City Projects

		Daejeon Metropolitan	Jeonju	Jeju
Optimization of Traffic Management	Controlling Traffic Signals on Urban Arterial Roads	○	○	○
	Providing Traffic Information on Urban Arterial Roads	○	○	○
	Dealing with Emergency Situations on Urban Arterial Roads	○	○	○
	Management of Traffic Conditions on Urban Expressways	○ (private investment)	-	○
	Dealing with Emergency Situations on Urban Expressways	○ (private investment)	-	○
	Detecting Speeding Vehicles	○	○	-
	Detecting Traffic Signal Violations	○	-	○
	Detecting Bus-only Lane Violations	○	○	-
Electronic Fare Collection	Automatic Fare Collection	○ (private investment)	-	-
	Electronic Public Transportation Fare Collection	○ (private investment)	○ (private investment)	-
Facilitation of the Distribution of Traffic Information	Provision of Basic Traffic Information	○	○	○

		Daejeon Metropolitan	Jeonju	Jeju
Provision of Qualified Tourist Information	Provision of Traffic Information before Travel	○	○	○
	Dynamic Driving Guidance System	-	-	○ (private investment)
	Parking Guidance	-	○	-
Facilitation of Public Transportation System	Information on Intra-City Buses	○ (private investment)	-	○ (private investment)
	Management of Intra-City Buses	○ (private investment)	-	-

Source: The Ministry of Construction and Transportation, Analysis on the Effects of Advanced Transportation Model City Construction Projects, 2004.

4.3. Helping Local Governments to Establish the Bus Information System through the Regional Bus Information System

4.3.1. Background to the System

In the early 2000s, large cities in Korea (including those in the capital area) started to launch their own Bus Information Systems (BIS). But each system was not designed to be interoperable with others and therefore one city's bus information could not be collected by or provided to another city. As a result, Seoul and four capital area cities (Gwacheon, Anyang, Uiwang, and Suwon) agreed to launch the "Regional Bus Information System Covering Sadang to Suwon", this bus information was to be shared.

The objectives of this System are to provide enhanced bus information services to citizens as well as to deal with traffic congestion by increasing the modal share of buses and lowering the modal share of privately owned vehicles. The government provided subsidies to local governments to help establish their own BIS.

4.3.2. History of the System

Korea's first BIS was introduced in Bucheon in 2001 and since then other cities have launched their own projects to establish the BIS. But since the BIS in Korea was city-oriented, interoperability of information on buses moving from one city to another was not possible. To address this, the Ministry of Land, Transport and Maritime Affairs launched the regional BIS in 2005.

A. 2001: Korea's first BIS was introduced in Bucheon.

B. April 2005: Seoul established the BIS.

C. August 2005: The Regional Bus Information System covering Sadang to Suwon was established (total length of 25.3km).

D. 2006: The BIS for Gyeonggi Province was established.

E. 2011: A project to link with the bus information systems in the capital area was launched.

F. 2013: About 53 cities in Korea have the BIS.

4.3.3. Details of the System

The BIS greatly improves the quality of public transportation by providing useful real-time information, such as arrival time, estimated travel time, and transfer information, as well as by optimizing the management of buses. As of today, about 53 cities in Korea (including Seoul and Busan) have established and launched the BIS and the number will increase.

Figure 3-7 | Bus Information System

Source: ITS Korea, 2013.

4.3.4. Expected Benefits

The BIS is expected to have the following benefits for its various stakeholders.

a. For Passengers

A. Enhanced convenience for passengers as they do not have to wait indefinitely for the bus

- Estimated bus arrival time and real-time location of buses are provided.
- In addition to this, other information such as bus route maps, transfer information, arrival time of the first and last buses of a day, bus card balance, advertisements of local governments, and news can be provided via the BIS.

Figure 3-8 | Various Types of Bus Information Provided via Bus Information Terminals and Smartphones

Source: ITS Korea, 2013.

b. For Drivers

A. Enhanced quality of services through efficient operation of buses

- Distance and arrival time between buses can be displayed and the interval between buses is adjustable.
- Traffic and road conditions can be checked in real-time.

Figure 3-9 | Display for Drivers

Source: ITS Korea, 2013.

c. For Bus Operators and the Government Organization in Charge of Buses

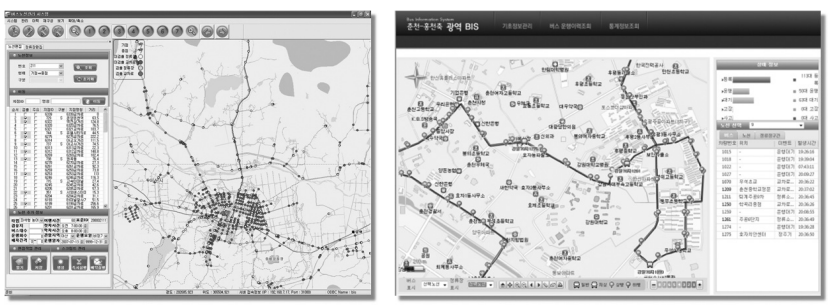
A. Cost reduction by upgraded methods of bus management

- Real-time location of buses and the intervals between buses can be checked and therefore violation of bus operations (such as skipping a bus stop, speeding, moving, and starting to move with doors open) can be detected.

B. Highly efficient and systemized management and monitoring of buses.

- This contributes to improved management of bus routes and bus intervals as well as to a better public transportation system.

Figure 3-10 | Displayed Data of the Bus Management System



Source: ITS Korea, 2013.

4.4. The Government's Project to Establish the Automatic Traffic Management System

4.4.1. Background to the Project

As of 2009, the ITS was installed on 100% of the expressways (total length of 3,447km), 18% of national highways (2,415km), and 2% of urban arterial roads (1,038km). As seen in the figures, the distribution rate of the ITS for urban arterial roads was very low, which led to inconveniencing drivers and decreased benefits of the ITS. This also left negative impacts on the business of private firms who utilized the data from the ITS as the coverage of ITS services was restricted by low distribution and therefore there were blind spots of information services.

As a result, the government launched the automatic traffic management system (ATMS) project which aimed to provide traffic information services with no blind spots by establishing the ITS on urban arterial roads connected to expressways and national highways.

4.4.2. History of the Project

The ATMS project was first launched in 2009. The government received proposals from the cities which applied for the ATMS project, evaluated the proposals, and selected future project participants.

A. April 2009: 14 out of 21 applicant cities were selected

B. December 2009: 9 out of 16 applicant cities were selected

4.4.3. Details of the Project

The ATMS is a system which collects information through data-collecting devices such as detectors and in-vehicle terminals, processes the information into the one that helps drivers to select the most optimal route (i.e. traffic flow, road construction, accidents, events, and etc.), and then provides the information via various media (variable-message signs, the in-vehicle navigation system, smartphones, and the Internet) to drivers.

The chart below explains the ATMS established in Korea's large cities.

Table 3-9 | Details of the ATMS Established in Korea's Large Cities

City	Year	Coverage	Objective	Established ATMS
Seoul	2009	Roads linked with expressways and other roads to cities and provinces (length of established roads: 37Km)	Notification of the information on detours	■ Vehicle detection system at 80 locations ■ CCTVs at 20 locations ■ Variable-message signs at 12 locations ■ 37km of communications network ■ One information center (upgraded)
	2010	Urban arterial roads (length of established roads: 10km) and main points which connects Seoul with others	Notification of the information on urban arterial roads	■ Dedicated short range communications at 10 locations ■ Variable-message signs at 25 locations ■ One information center (upgraded)
Incheon	2009	6 urban arterial roads	Notification of the information on traffic flow of the detours in place of expressways	■ Vehicle detection system at 40 locations ■ Variable-message signs at 8 locations ■ CCTVs at 6 locations ■ Roadside equipment at 100 locations ■ 12km of communications network ■ One information center (upgraded)
	2011	Main roads (length of established roads: 66km)	Preparation for the 2014 Asian Games	■ Dedicated short range communications at 20 locations ■ Vehicle detection system at 20 locations ■ Variable-message signs at 20 locations ■ CCTVs at 7 locations ■ One information center

City	Year	Coverage	Objective	Established ATMS
Daejeon	2009	All over the city	Smooth urban traffic flow	■ 300 pieces of Roadside equipment ■ 500 on-board units ■ Vehicle detection system at 16 locations ■ One information center
	2010	Main roads (length of established roads: 50Km)		■ Dedicated short range communications at 50 locations ■ Vehicle detection system at 60 locations ■ Web cameras at 20 locations ■ Variable-message signs at 2 locations ■ 23km of communications network ■ One information center (upgraded)

Source: ITS Korea, 2013.

4.5. Devising Methods to Establish the Public Transportation Cards System and Supporting the Development of the Standards of Public Transportation Cards which Guarantee Nationwide Compatibility

4.5.1. Background

When public transportation cards were first used, passengers rarely used the cards out of the area where they lived and worked due to the lack of compatibility. As the number of passengers using public transportation cards increased and service coverage of the cards expanded, nationwide compatibility of public transportation cards became a necessity. As a result, the government found legal grounds to develop standard public transportation cards that could be used without geographic limitations or restrictions of service coverage. Then, policies were launched to develop these standard cards and by doing so, the government aimed to make it easier and more convenient for people to use and to increase usage of the public transportation system.

4.5.2. History

Public transportation cards were first used for intra-city buses in Seoul in July 1996 in accordance with the government's "plan to pay public transportation fees via prepaid cards" released by the Ministry of Construction and Transportation in May 1995. Public transportation card used in one area were not compatible with other cards used in different areas and this was a nuisance for passengers and a stumbling block to the increased use of public transportation cards. As a result, the government initiated developing a new technology which enabled the compatibility of public transportation cards with others. As of 2014, the development of the technology is complete.

A. May 1995: The Ministry of Construction and Transportation released the "plan to pay public transportation fees via prepaid cards"

B. July 1996: A commercially sold public transportation card was first used in intra-city buses in Seoul

C. February 1998: "Hanaro Card" was first used in intra-city buses and subway in Busan

D. June 1998: Public transportation cards were first used in Seoul Subway Line 1 to 4

E. October 2001: Passengers using public transportation cards in Seoul could get transfer discounts between buses and subway

F. July 2004: New types of public transportation cards were developed by Korea Smart Card[13]

G. July 2007: The coverage of transfer discounts expanded to buses travelling in Seoul and Gyeonggi Province and subways

H. November 2007: Research and development of the standards of public transportation cards with nationwide compatibility initiated[14]

I. March 2008: Revision of the Act on the Support and Promotion of Utilization of Mass Transit System[15]

J. December 2008: The government established "the master plan to guarantee nationwide compatibility of different public transportation cards (2009~2013)"

13. Shareholders of Korea Smart Cards are the government of Seoul (35%), LG CNS (32%), ATEC (10%), credit card companies (16%), and solution providers (7%).

14. "Development of standard technologies for One Card All Pass and management of the test bed for the technologies" lead by Research Affairs of SNU & SNU R&DB Foundation.

15. This Act prescribes that operators of the public transportation system should install and operate the equipment that accepts the public transportation card with nationwide compatibility.

K. April 2010: Notification of "the methods to obtain certification that a public transportation card is compatible with others all over the country"

L. March 2011: "Hanpay CARD", a public transportation card with nationwide compatibility, was used in Gwangju

M. November 2011: Public transportation cards with nationwide compatibility were enabled for use on expressways

N. February to September 2012: The Ministry of Land, Transport and Maritime Affairs held three conferences on the promotion of the public transportation cards with nationwide compatibility

O. May to November 2012: The Ministry of Land, Transport and Maritime Affairs commissioned research and the development of the standards to calculate fees prepaid by the public transportation cards with nationwide compatibility

P. January 2013: The Ministry of Land, Infrastructure and Transport inspected all public transportation card operators and facilities to check if the infrastructure for the public transportation cards with nationwide compatibility was built or not

Q. June 2013: The Ministry of Land, Infrastructure and Transport held an agreement ceremony which pledged to facilitate the distribution of the public transportation cards with nationwide compatibility

Table 3-10 | History of Public Transportation Cards in Korea in Three Stages

Stages	Features	Details
Introduction (1996 to 1997)	Public transportation cards were first introduced	■ Introduction of public transportation cards ■ Seoul started to accept public transportation cards ■ Operators of the public transportation cards system began to appear
Development (1998 to 2004)	Technologies and facilities related to public transportation cards were developed and distributed	■ Public transportation cards expanded into many areas ■ Public transportation cards became used in many places ■ A new type of public transportation cards that which provided various additional services and had advanced technological features were developed and used ■ Facilities which could accept the new type of public transportation cards were established

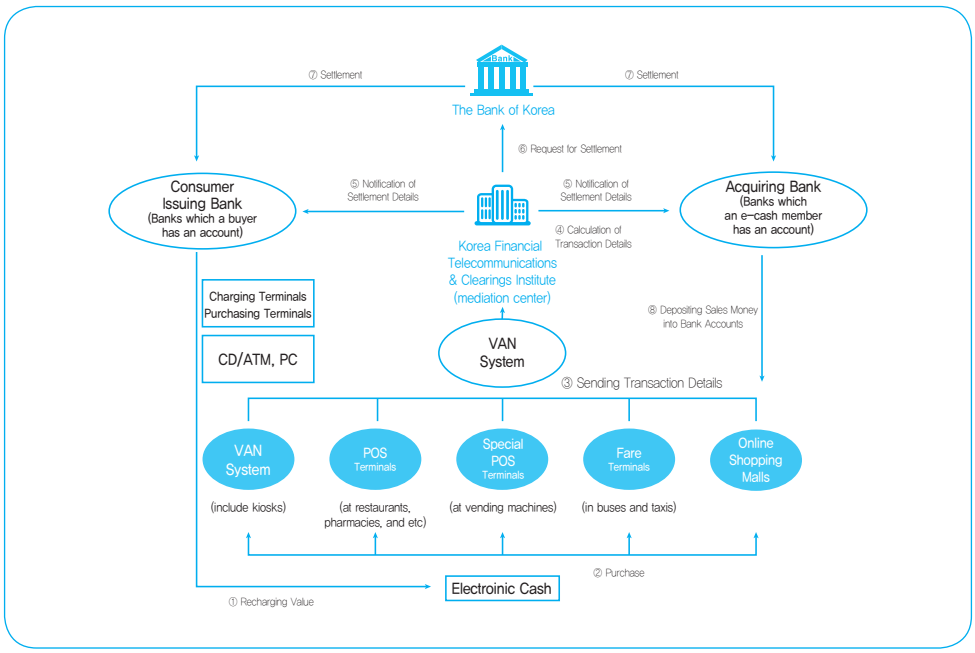
Stages	Features	Details
Maturity (2005 to now)	The public transportation cards industry became stabilized, reached maturity, and is being converted into a service industry	■ Public transportation cards with nationwide compatibility became a necessity ■ Standardization of public transportation cards ■ Public transportation cards with multiple and advanced features ■ Operators of the public transportation cards system started to give their business priority to provision of services over development and manufacturing ■ Operators of the public transportation cards system started to combine their business with technologies to provide applied services

Source: Korea Financial Telecomunications and Clearings Insitute, 2010.

4.5.2. Benefits (Functions and Roles)

With the introduction of public transportation cards, passengers are no longer required to pay fares with coins, buy bus tokens or tickets whenever they take or transfer buses or subway and can enjoy transfer discounts, which leads to the reduction in transportation expenses. Operators of the public transportation system can cut the fixed costs to sell tickets and to manage collected fares and prevent the omission of collected fares. Drivers can focus on safe driving as they do not need to receive fares in person. It becomes easy for the government to check whether the operators manage their business transparently and to make sure they do not embezzle fares as all the fares are processed electronically. And the government can establish public transportation policies and provide extra services based on the data collected through the public transportation cards system. The introduction of public transportation cards increase the benefits of all interested parties, improves the quality of the public transportation system, and the use of public transportation.

Figure 3-11 | Electronic Cash (K-Cash) Payment Process



Source: Korea Financial Telecommunications & Clearings Institute, current conditions and future prospects of prepaid public transportation cards, 2010.

4.6. Test-run of Hi-Pass by Korea Expressway Corporation

4.6.1. Background of the Development of Hi-Pass

Paying expressway tolls at toll gates is one of the main reasons for expressway congestion; toll gate gridlock is evident as increasing numbers of vehicles caused by rapid economic development already exceeded the capacity that the toll gates could process. To address the gridlock, the government devised various solutions such as installing more toll booths, using parallel lanes, and receiving tolls while moving from vehicle to vehicle. But such solutions also failed to reduce gridlock and therefore the development of the Electronic Toll Collection System (ETCS) became a necessity.

As a result, the Korea Expressway Corporation (EX) and the Ministry of Construction and Transportation developed and implemented Hi-Pass, Korea's first ETCS, to reduce toll gate gridlock and increase convenience for drivers.

4.6.2. History of the Development of Hi-Pass

The government and the Korea Expressway Corporation started to consider the development of the ETCS in 1995, established the master plan in 1997, and performed a test-run of Hi-Pass in 2000. Hi-Pass was launched nationwide launch in 2007. Now the government and the Korea Expressway Corporation are developing technologies for Hi-Pass that allow electronic collection of tolls from multiple lanes.

A. October 1995: At a meeting about how to improve traffic flow on expressways hosted by the Ministry of Construction and Transportation, the government started to consider using Hi-Pass

B. March to September 1997: Performing the test-run of Hi-Pass two times

C. September 1997: Formulating the master plan of Hi-Pass

D. August 1998 to April 1999: Selecting operators of Hi-Pass after running Hi-Pass at toll gates two times

E. January 2000: The Korea Expressway Corporation announced a plan to select several tollgates to operate Hi-Pass

F. June 2000: Toll gates in Seongnam, Cheonggye, and Pangyo were selected as test beds to run Hi-Pass

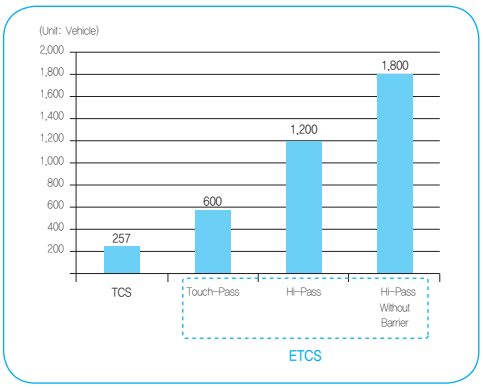
G. December 2007: Hi-Pass expanded into all toll gates in Korea

H. March 2009: Hi-Pass began to provide the post payment service

4.6.3. Benefits of Hi-Pass (Functions and Roles)

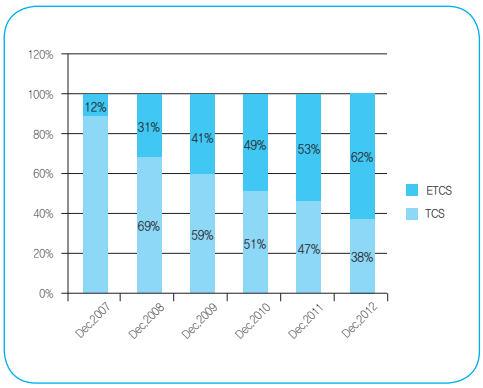
In June 2000, two lanes of three expressway tollgates in Seongnam, Cheonggye, and Pangyo (the number of toll booths with Hi-Pass increased to six lanes) were selected as Hi-Pass lanes for the test-run of Hi-Pass and privately-owned vehicles and buses passing through the gates could pay tolls electronically. To test the performance of Hi-Pass at that time, 7,000 on-board Hi-Pass terminals and 10,000 Hi-Pass cards were distributed. To increase the use of Hi-Pass, promotional activities were conducted via various media and drivers with the Hi-Pass system could benefit from toll discounts.

Figure 3-12 | Comparison of the Capacity between Toll Gates with the ETCS and Those without the ETCS



Source: Korea Expressway Corporation, 2013.

Figure 3-13 | Change in the Percentage of the Use of the ETCS and the TCS



Source: Korea Expressway Corporation, 2013.

When Hi-Pass was first introduced, the government and the Korea Expressway Corporation checked the effectiveness of Hi-Pass by comparing the data before and after the use of Hi-Pass. Though each toll gate recorded different numbers at different times, the data showed that all three toll gates with Hi-Pass experienced positive results at peak times in the morning when the number of drivers passing through the toll gates was relatively high. In addition, 84% of drivers with Hi-Pass said that they were satisfied with the service.

Table 3-11 | Details of the Survey to Check the Effectiveness of Hi-Pass

Checkpoint	Details	Survey Methods
Passing Time	■ Recording the time vehicles with and without Hi-Pass took to pass through a toll gate (from a start to end points) ■ Recording the direction of vehicles with and without Hi-Pass as well as the time the vehicles took to pass through a toll gate during the test-run period	Sample survey
Vehicles in Gridlock	■ Recording the number of vehicles with and without Hi-Pass waiting for passing through a toll gate for a designated time (or unit time, i.e. one minute), except for those passing through a toll gate	Complete enumeration survey

Source: "Analysis on the effectiveness of the test-run of the ETCS", Journal of Korean Society of Transportation, Vol. 19 No. 4, 2001.

Table 3-12 | Comparison of Average Time for a Vehicle to Pass through a Toll Gate

(Unit: second /one vehicle)

		Seongnam		Cheonggye		Pangyo	
		Before	After	Before	After	Before	After
Peak time in the morning	South to North	79.26	66.84	95.07	101.17	28.94	28.27
Not peak time	North to South	-	-	87.68	90.65	18.11	21.23
Not peak time	South to North	69.84	62.33	87.85	103.31	43.98	52.39
Peak time in the afternoon	North to South	59.69	61.69	163.16	187.37	30.87	33.11

Source: "Analysis on the effectiveness of the test-run of the ETCS", Journal of Korean Society of Transportation, Vol. 19 No. 4, 2001.

Table 3-13 | Comparison of the Length of Waiting Vehicles before Passing through a Toll Gate

(Unit: one vehicle /minute)

		Seongnam		Cheonggye		Pangyo	
		Before	After	Before	After	Before	After
Peak time in the morning	South to North	4.011	3.404	6.924	6.539	1.831	1.971
Not peak time	North to South	-	-	3.269	1.603	2.575	1.313
Not peak time	South to North	2.206	1.276	3.403	4.286	2.313	3.801
Peak time in the afternoon	North to South	1.960	2.549	16.569	23.106	9.507	12.598

Source: "Analysis on the effectiveness of the test-run of the ETCS", Journal of Korean Society of Transportation, Vol. 19 No. 4, 2001.

5. Financing Methods

5.1. Selecting and Supporting National Policies

The US, Japan, and members of the EU already developed ITS-related technologies which combined advanced communications and electronics technologies with road engineering as early as the 1980s. But Korea finalized the Master Plan for the ITS in September 1997 and also finalized and published the Master Plan 21 for the ITS in 2001 with an investment of 8 trillion KRW from the Ministry of Construction and Transportation. Compared to other developed countries, Korea was late implementating the ITS.

Table 3-14 | Allocation of Budget for the Master Plan 21 for the ITS

(Unit: billion)

Service	Total			
	The Central Government	Local Governments	The Private Sector	Sum
Optimization of Traffic Management	28,589	29,614	-	58,203
Electronic Fare Collection	2,257	2,330	2,535	7,122
Facilitation of the Distribution of Traffic Information	580	570	1,150	2,300
Provision of Qualified Tourist Information	496	992	3,872	5,360
Facilitation of Public Transportation System	157	701	3,134	3,992
Improved Efficiency of Cargo Transportation	859	-	215	1,074
Application of Advanced Technologies to Vehicles and Roads	1,903	421	3,040	5,364
Sum	34,841	34,628	13,946	83,415

* These figures are estimates where the ITS is implemented nationwide. Budget details shall be defined by the plans of the participants.

Source: The Ministry of Construction and Transportation, ITS master plan 21, 2000.

5.2. List of the ITS Policies Promoted by the Government

The Ministry of Land, Transport and Maritime Affairs divided the national policies for the successful implementation of the ITS in each city conducted by the central and local governments into five groups and then focused its efforts in a more systematic way.

Table 3-15 | Korea's National Policies to Implement the ITS

Category	Details
Plans	■ Establishment of the Master Plan for the ITS (1997) ■ Establishment of the National ITS Standardization Plan (2002) ■ Establishment of the ITS Plan 2020 for Vehicles and Road Traffic (2012)
Legal Grounds	■ Establishment of the Traffic System Efficiency Act and going into effect (1999) ■ Complete Revision of the Traffic System Efficiency Act (2008) ■ Development of the guidelines for the ITS (2006) ■ Designation of the organizations in charge of evaluating ITS standards and the organizations in charge of performance evaluation of ITS devices (2004, 2005, 2008, and 2010)
Researches	■ Development of national ITS architecture (1999) ■ Researched in a project name "SMART Highway" (2007) ■ Revision of national ITS architecture (2009)
Test-run and Applications	■ Test-run of the ITS in Gwacheon (998) ■ Test-run of Hi-Pass, an Electronic Toll Collection System developed by the Korea Expressway Corporation (2000) ■ Advanced Transportation Model City project (for Jeonju, Jeju, and Daejeon) (2003) ■ Test-run of the Regional Bus Information System Covering Sadang to Suwon (2005) ■ Promotion of the automatic traffic management system (ATMS) for local governments (2010)
Others	■ Hosting the 5th ITS World Congress in Seoul (1998) ■ Hosting the 17th 2010 ITS World Congress in Busan (2010)

Source: ITS Korea, 2013.

5.3. The Budget Spent for the ITS

Korea spent 2.9 trillion KRW to implement the ITS from 2001 to 2012. By 2020, Korea plans to spend an additional 2.5 trillion KRW.

Table 3-16 | The Budget Spent on the ITS in Korea

(Unit: billion KRW)

	'01	'02	'03	'04	'05	'06	'07	'08	'09	'10	'11	'12	Total
For the Central Government	965	946	726	877	1,816	990	952	944	1,578	832	748	725	12,099
For the Local Governments	917	465	618	497	761	977	611	719	1,321	765	877	964	9,492
For State-owned Companies	258	336	87	19	535	379	1,316	894	643	1,293	970	1,545	8,275
Total	2,140	1,747	1,431	1,393	3,112	2,346	2,879	2,557	3,542	2,890	2,595	3,234	29,866

Source: the Ministry of Land, Transport and Maritime Affairs, the ITS Plan 2020 for Vehicles and Road Traffic, June 2012.

5.4. Financing from the Central Government, Local Governments, and the Private Sector

5.4.1. Financing from the Central Government

The Ministry of Land, Transport and Maritime Affairs sets the guidelines which prescribe the type of ITS projects that will receive the central government's subsidies, a percentage of the subsidies out of the total budget for the projects, and the process for subsidies. In accordance with the guidelines, the three types of projects to receive subsidies from the central government are a project to apply national ITS standards and ITS technology standards, a project to coordinate the ITS between nearby local governments and the agencies in charge of transport facilities, and a project to establish the infrastructure for the provision of ITS services.

The scale of the subsidies given by the central government is proportional to the total budget of a project. For a project to establish the connection between local governments for information sharing, a local government in a metropolitan area can receive 40~50% of the total budget of the project from the central government as subsidies and a local government in other areas can receive 20~30% of the total budget of the project from the central

government as subsidies. On a project for standardization efforts, a local government can receive 40~50% of the total budget of the project from the central government as subsidies. In case of a project to establish the connection between expressways and national highways or between local roads and urban roads for information sharing, a local government can receive 50~100% of the total budget of the project from the central government as subsidies. When the total budget is less than 100 million KRW, a fixed amount is given to the local government.

The Ministry of Information and Communication spent part of the Digitization Promotion Fund to establish the communications infrastructure for the ITS. The Ministry of Commerce, Industry and Energy, the Ministry of Information and Communication, and other relevant government organizations supported the development and industrialization of ITS-related technologies by increasing the Engineering Development Fund or creating another fund.

5.4.2. Financing from Local Governments

In accordance with the Urban Traffic Improvement Promotion Act, "a special account for local urban traffic projects" can be established in the Special Metropolitan City, a Metropolitan City, or a city in order to implement a basic plan, to secure financial resources necessary to improve urban traffic, and to efficiently operate and control the urban traffic. In addition, this Act prescribes that revenue in a special account shall be expanded in each of the following projects:

A. Projects undertaken to expand traffic facilities and improve the operation of such transport facilities

B. Projects undertaken to survey and research urban traffic

C. Projects undertaken to improve services of the means of transport and the operators' management of the mass means of transport

D. Projects undertaken to control traffic demands and implement measures to control traffic demands

E. Projects undertaken to upgrade road facilities and traffic safety facilities

5.4.3. Financing from the Private Sector

ITS projects require a large amount of initial investment and though in principle, the public sector is in charge of all expenses for projects almost solely for the benefit of the public or those with little profitability, the private sector is encouraged to invest in projects with profitability in order to reduce financial burdens and improve the quality of services.

【Financing from Local Government for the ITS】

Korea's local governments can spend from special accounts for local urban traffic projects, funded by congestion fees, allotment to traffic congestion causes, and penalties on ITS projects, especially those related to the improvement of services of public transportation and related to the management of traffic demand. In addition, part of the investment in roads can be spent on ITS projects if the projects are related to roads.

2013 Modularization of Korea's Development Experience
Establishment of Intelligent Transport Systems (ITS)

Chapter 4

Details of ITS Projects

1. Change in the Focus of ITS projects
2. Seoul (a city with the population more than one million)
3. Anyang (a city with the population less than one million)

Details of ITS Projects

1. Change in the Focus of ITS projects

1.1. Before 2000 (Stage one)

The government formulated the Master Plan for the ITS in 1997, which worked as the guideline of ITS services provided to users and the establishment of ITS systems. The Master Plan also prescribed the objectives of ITS projects, systems that ITS projects were implemented, the level of implementation, and other basic directions for ITS projects as well as priorities of ITS projects. In addition, the Master Plan laid the groundwork for the implementation of the ITS including research and development and standardization and presented financing methods as well as elements of financing and division of labor in financing to ensure every city could implement its own ITS projects.

1.2. After 2000 (Stage two)

1.2.1. From 2001 to 2005

During this time, the government focused on laying the foundation for the promotion of ITS projects and provision of entry level ITS services, set standards for improvement of system compatibility as a means to lay the foundation for the promotion of ITS projects, improved relevant acts, regulations, and the legal system, conducted research and development of the technologies related to ITS as well as effective to the public, expanded the application of qualified ITS technologies into major arterial roads and urban areas, and supported the incorporation of ITS services with new advanced technologies into existing ITS projects after performing the test-run of those services based on the achievements of research and development.

1.2.2. From 2005 to 2010

The government concentrated on the development and nationwide expansion of ITS services, devised methods to expand ITS services into other parts of Korea, conducted research and development of advanced technologies for vehicles and roads, conducted test-runs of these advanced technologies, and therefore took preliminary actions to provide new ITS services to the public. ITS services researched by the government were applied to major arterial roads and urban areas.

1.3. After 2010 (Stage three)

After 2010, ITS projects focused on the provision of fully developed and sophisticated technologies. The government is leading various research and development projects related to the C-ITS (cooperative intelligent transport systems), a new paradigm of the ITS, performing the test-run of the C-ITS, concentrating on "open platform" based ITS which allows the private sector to participate in the provision of ITS services, taking various efforts to create new ITS services which reflect the current traffic conditions, and conducting research and development of advanced technologies for vehicles and roads which enable vehicles to move without drivers.

【Policy Directions for the C-ITS】

1. Introduction to Policies to Establish the C-ITS

The government aims to adopt the C-ITS, an advanced version of the ITS and established worldwide, to dramatically reduce traffic accidents. "Reduction of traffic accident mortality in half" and other relevant policies to reduce traffic accidents and mortality on roads have failed to meet their goals. The government plans to make roads safer and smarter and to build the infrastructure for road safety through the introduction of the C-ITS.

2. Plans to Establish the C-ITS

The government aims to be ranked in the top 10 in road safety among OECD members and to reduce traffic accident mortality to zero by adopting the C-ITS. In order to fulfill this, the government plans to provide services for improved road safety that connects vehicles and roads on expressways and national highways by 2020 and to provide services for improved road safety that connects vehicles, roads, and passengers on all roads in the country.

Source: the Ministry of Land, Infrastructure and Transport, the master plan for the next generational ITS (draft) 2014~2030.

Table 4-1 | History of ITS Services in Korea

Stage One (1991 to 2000): Introduction of the ITS and Laying the Legal Grounds for the Introduction	
The Central Government	Local Governments and Other Relevant Organizations
■ 1993: Social Overhead Capital Investment Planning Group under the President reviewed the possibility to introduce the ITS ■ 1994: Conducting research to finalize the Master Plan for the ITS ■ 1994: The Korea Expressway Corporation established the freeway transportation management system (FTMS) ■ 1997: Finalizing the Master Plan for the ITS ■ 1998: Performing the test-run of the ITS in Gwacheon ■ 1998: The 5th ITS World Congress held in Seoul ■ 1999: The Traffic System Efficiency Act was passed and released ■ 1999: Conducting research into the revision of the master plan for the ITS ■ 1999: Development of national ITS architecture	■ 1990: Traffic Broadcasting System opened in Seoul ■ 1994: Test-run of the new Traffic Signal System developed by the Seoul Metropolitan Police Agency ■ 1994: National Policy Agency established the system to detect speeding ■ 1997: Test-run of Seoul's BIS ■ 1997: The first public transportation cards in Busan (Hanaro Card) ■ 1999: Establishment of ITS Korea
Stage Two (2001 to 2010): Development and Expansion of the ITS	
The Central Government	Local Governments and Other Relevant Organizations
■ 2002: Establishment of the National Standardization Plan for the ITS ■ 2003: Advanced Transportation Model City project for Daejeon, Jeonju, and Jeju ■ 2003: Expansion of the ITS to detours. ■ 2005: Test-run of Regional Bus Information System Covering Sadang to Suwon ■ 2006: Finalizing the guidelines for ITS projects ■ 2007: Formulating the guideline on procedures for the establishment and operation of the BIS ■ 2008: Total revision of the Traffic System Efficiency Act and architecture ■ 2010: Promotion of the ATMS for local governments ■ 2010: The 17th ITS World Congress in Busan	■ 2000: Establishment of the plan for the ITS in Seoul, Busan, Daejeon, and Gwangju ■ 2001: Test-run of Hi-Pass (an electronic toll collection system) developed by the Korea Expressway Corporation ■ 2002: Korean Agency for Technology and Standards set the standards for the ITS ■ 2002: SK Telecom started to provide "Nate Drive" service ■ 2003: Establishment of Standardization Assembly for the ITS and setting collective standards ■ 2005: TOPIS Center was established in Seoul ■ 2006: Satellite and terrestrial DMB TPEG[16] Services ■ 2007: Nationwide Expansion of Hi-Pass

16. DMB TPEG: Digital Multimedia Broadcasting Transport Protocol Expert Group.

Stage Three (2011 to 2020): The ITS of the Future
The Central Government
■ 2012: The ITS Plan 2020 for Vehicles and Road Traffic ■ 2013: Conducting research into the employment of the C-ITS[17] ■ 2013: Development of the technology that guarantees nationwide compatibility of public transportation cards ■ 2014: An ITS project named "SMART Highway" is underway ■ In the near future: Test-run of the C-ITS

Source: The Korea Transport Institute, a white paper of Korea's ITS based on the analysis into the current status of ITS all over the nation, July 2010.

※ Most of the ITS were established in cities; to improve the understanding of our prospect partner who would cooperate in the ITS, we would like to present two successful ITS cases: one is a city with the population of more than one million and the other is a city with the population of less than one million.

2. Seoul (a city with the population more than one million)[18]

2.1. Composition of Seoul's ITS

Seoul established the traffic information center (Seoul Metropolitan Police Agency) in 1990, the traffic information service center (Korea Transportation Safety Authority) in 1997, the Urban Expressway Traffic Management Center in 2002, the Transport Operation and Information Service (TOPIS) center in 2005, the Daily Life Information Center of Seoul Traffic Broadcasting System, the bus management control room, and unmanned automatic public parking lots to operate the ITS.

17. C-ITS: Cooperative ITS (the ITS of the future; developed nations are undertaking various efforts for the adoption of the ITS such as test-running, researches, and standards setting).

18. See the following for your reference: Seoul's master plan for the ITS, 2008.

Table 4-2 | Major Components of Seoul's ITS

Name	Operator	Features
Seoul TOPIS	Government of Seoul	■ Comprehensive management of traffic information via information sharing between the BMS, the BIS, the public transportation cards system, the automatic traffic enforcement system, and other relevant organizations
The Urban Expressway Traffic Management Center in Seoul	Government of Seoul / Seoul Metropolitan Facilities Management Corporation	■ Operation of the urban expressway management system in Seoul ■ Management of traffic on the Naebu Expressway, the Gangbyeon Expressway, the Olympic highway, the Bukbu Expressway, and the Dongbu Expressway
The Seoul Metropolitan Police Agency Traffic Information Center (SPATIC)	Seoul Metropolitan Police Agency	■ Traffic signal controls and the collection of traffic information on urban arterial roads ■ Traffic management due to congestion or emergency situations
Daily Life Information Center of Seoul Traffic Broadcasting System	Traffic Broadcasting System	■ Collection of traffic information (using correspondents) ■ Provision of traffic information

Source: Seoul's master plan for the ITS, 2008.

2.1.1. Traffic Management on Seoul's Urban Expressways

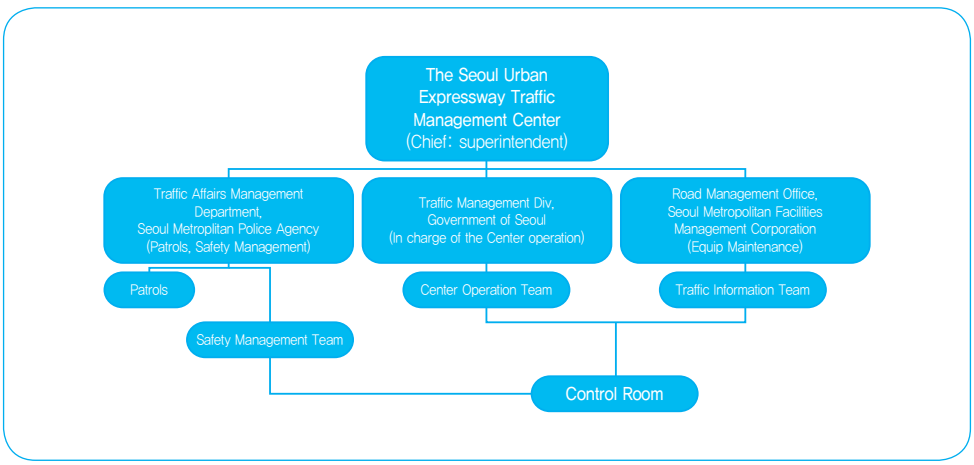
Seoul wanted to improve efficiency on urban expressways as congestion became heavy due to the increased demand of interregional transportation. Seoul established the Urban Expressway Traffic Management Center to find the cause of traffic congestion and devise ways to remove congestion through real-time analysis of traffic and road conditions of urban expressways and thereby improve efficiency in traffic management. Operation of the Center is performed by three organizations, the Seoul Metropolitan Police Agency, the Government of Seoul and the Seoul Metropolitan Facilities Management Corporation.

Table 4-3 | Composition and Roles of Personnel in the Seoul Urban Expressway Traffic Management Center (as of December 2007)

Operator	Personnel Composition	
Seoul Metropolitan Police Agency	About 25	Safety Management, Patrol
Government of Seoul	About 3	Center Operation Team
Seoul Metropolitan Facilities Management Corporation (with the support of teams including Traffic Information Team)	About 50	Operation Support, Center Support, Computer Equipment Room, Equipment Maintenance

Source: Seoul's Master Plan for the ITS, 2008.

Figure 4-1 | Organizational Chart of the Seoul Urban Expressway Traffic Management Center



Source: Seoul's Master Plan for the ITS, 2008.

2.1.2. Seoul's Transport Operation and Information Service (TOPIS)

The government of Seoul introduced the Transport Operation and Information Service (TOPIS) to strengthen Seoul's capability to collect public transportation information and road traffic information in Seoul by coordinating and integrating the information gathered by various traffic management systems operated separately, to improve Seoul's ability to analyze and process the collected information, to perform real-time management of Seoul's traffic conditions, and to diversify and develop information delivery channels by which users

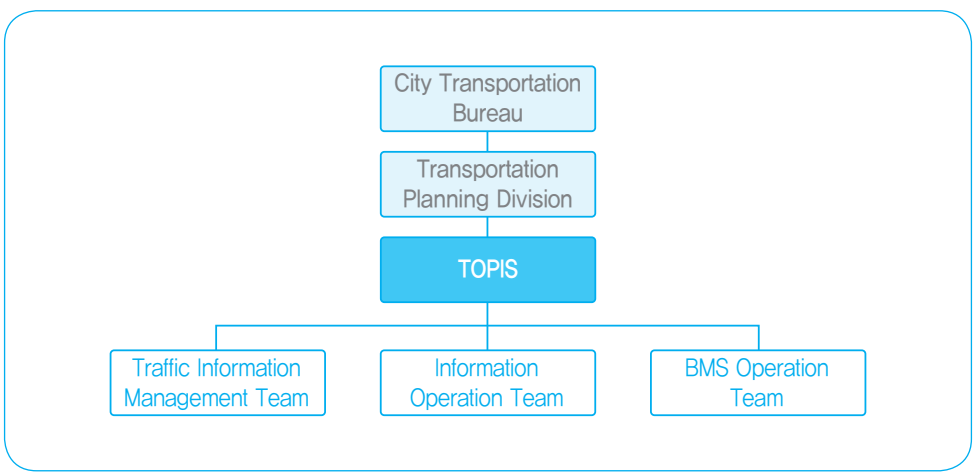
can obtain real-time traffic information. Seoul's TOPIS is composed of three teams under Transportation Planning Division of City Transportation Bureau after the reorganization in 2007.

Table 4-4 | Composition and Roles of Personnel in Seoul's TOPIS

Components	Personnel Composition	
Total	About 35	-
Operation of the BMS	About 25	Maintenance (bus stops, on-board terminals) Management of bus operators
The Automatic Traffic Enforcement System (Illegal parking and stopping)	About 3	Detection of traffic violations (Illegal parking and stopping and violation of bus-only lanes)
The Automatic Traffic Enforcement System (violation of bus-only lanes)	About 3	Supporting the operation of bus-only lanes

Source: The Government of Seoul, Seoul's Master Plan for ITS, 2008.

Figure 4-2 | Organizational Chart of Seoul's TOPIS



Source: Seoul's Master Plan for the ITS, 2008.

2.2. History of Seoul's ITS

Seoul adopted the ITS for the first time in 1995 to detect privately owned vehicles driving illegally in bus-only lanes. Since then, Seoul has introduced various ITS capabilities including those adopted for extensive improvement of the public transportation system such as median bus-only lanes and the revised public transportation cards system.

A. 1995: Introduction of the system to detect violations of bus-only lanes

B. 2000: Introduction of the traffic management system on urban expressways

C. 2003: Introduction of the bus management system

D. 2003: Introduction of the revised public transportation cards system

E. 2003: Introduction of the logistics information system

F. 2004: Launch of the project to promote Seoul's Traffic Broadcasting System

G. 2004: Introduction of the automatic traffic enforcement system to detect illegal parking and stopping

H. 2005: Establishment of Seoul's TOPIS and establishment of links between TOPIS and other ITS in the capital area

I. 2005: Introduction of the one-day-a-week-no-driving system by using Radio-Frequency Identification (RFID)

J. 2005: Introduction of the parking management system

K. 2005: Introduction of the electronic parking fee collection system

L. 2006: Introduction of the bus information system

M. 2006: Introduction of the Urban Traffic Information System (UTIS)

N. 2007: Introduction of the electronic taxi fare collection system

2.3. Details of Seoul's ITS

Seoul established the "Comprehensive Plan for Seoul's ITS Projects" in 2000 when it started to implement various ITS projects and then launched 16 ITS projects categorized into five areas: traffic information, public transportation, maintenance of roads and traffic facilities, traffic management, and the pedestrian safety system.

Table 4-5 | Five Areas of Seoul's ITS Projects when it First Adopted the ITS (2000)

Area	ITS Projects
Traffic Information	■ Promotion of Seoul's Traffic Broadcasting System ■ Establishment of Seoul's TOPIS and establishment of links between TOPIS and other ITS in the capital area
Public Transportation	■ Establishment of the BMS and the BIS ■ Establishment of the automatic fare collection system that can be used interoperably between different modes of public transportation (the revised public transportation cards system named "One Card One Pass")
Maintenance of Roads and Traffic Facilities	■ Computerized management of road facilities and traffic facilities (on the Gangbyeon Expressway and the Naebu Expressway) ■ Consideration of adopting the parking management system ■ The road information system for cargo trucks in Seoul
Traffic Management	■ The traffic management system on urban expressways ■ The traffic management system on urban arterial roads ■ The real-time urban traffic information system ■ The automatic traffic enforcement system against the violations of bus-only lanes ■ The automatic traffic enforcement system against speeding (operated by National Police Agency) ■ The system to detect overloaded or overweight vehicles ■ The electronic toll collection system (the electronic congestion fees collection system at the Namsan Tunnel) ■ Newly revised traffic signals (by National Police Agency)
Pedestrian Safety	■ The Pedestrian Safety System

Source: Seoul's master plan for the ITS, 2008.

2.3.1. Traffic Information

a. Promotion of Seoul's Traffic Broadcasting System

Seoul's traffic broadcasting started with five local broadcasting stations in 1991. This project aimed to facilitate traffic flow by quickly and accurately collecting, coordinating, and processing traffic information and then providing this processed information to drivers via various media.

Traffic information is provided by National Policy Agency and Seoul Metropolitan Facilities Management Corporation and is gathered through phone calls and messages from citizen correspondents. Collected and processed traffic information is offered to the public via radio, TV, DMB devices, cell phones, smart phones, Automated Response System (ARS), and Short Message Services (SMS).

b. Establishment of Seoul's TOPIS

Seoul established TOPIS to collect traffic–related information such as traffic volume, vehicle speed, bus operation, emergency situations, and other traffic information gathered by the private sector, to deal with traffic-related problems such as congestion and emergency situations by utilizing the collected information, and to establish scientific traffic policies for the public through the analysis of the collected information.

Figure 4-3 | Footage of TBS

Source: www.tbs.seoul.kr.

Figure 4-4 | Inside View of the TOPIS Center

Source: topis.seoul.go.kr.

2.3.2. Public Transportation

a. The Bus Management System

Seoul established the bus management system to ensure buses arrive on time, to maintain order while driving, to provide various bus information, to make reasonable public transportation policies based on bus driving records, and ultimately to improve the competitiveness of buses against other modes of transportation through the installation of the bus management control room which oversees buses' operation in real-time.

b. The Bus Information System

Seoul established the bus information system to improve the convenience of citizens by providing bus-related information such as bus arrival times. At first, three bus routes and six bus stops were selected to test-run the BIS and the scope of the BIS gradually expanded.

c. Seoul's Public Transportation Website

Seoul has a website which offers detailed information on the city's public transportation system. Users can search for and access website content via the Graphic Information System (GIS). The website always strives to offer accurate public transportation information to the public by upgrading the website's system and updating the information on the website. The website provides information as bus routes in Seoul and part of Gyeonggi Province, location of bus stops, and information on the transfer to subways, all of which were very different from when Seoul overhauled its public transportation system in July 2004. Based on the information on the website, users can search for bus routes, bus stops, fastest routes, transfer routes, and other information related to Seoul's buses.

d. Seoul's Taxi Management System

Seoul established the taxi management system to computerize administrative duties related to taxis such as license management, fuel subsidies for drivers, management of taxi garages, violation of traffic regulations, manage taxi-related statistics, and then improve the credibility of these statistics.

The taxi management system consists of four subsystems: the license management system, the management of fuel subsidies, the cargo management system and the traffic regulations violations system. The license management system deals with issues related to licenses of drivers who operate corporate cabs or privately owned cabs. The management of fuel subsidies for drivers, enables inputting, correcting, browsing, printing, and collecting statistics of relevant data. The cargo management system deals with issues related to the management of taxi cargo and enables inputting, correcting, browsing, printing, and collecting statistics of relevant data. The system to manage traffic regulation violations deals with issues related to detecting violations, transportation-related complaints, and other administrative issues, which collects statistics about imposition, payment and failure of payment of penalties.

Figure 4-5 | BIS at a Bus Stop in Seoul

Source: topis.seoul.go.kr.

Figure 4-6 | Public Transportation Information Webpage Offered by the Seoul Government

Source: topis.seoul.go.kr.

2.3.3. Traffic Management

Seoul planned eight ITS projects including the traffic management system on urban expressways, the traffic management system on urban arterial roads, and newly revised traffic signals to manage and operate the traffic on urban arterial roads. In addition to the eight projects, Seoul also planned and implemented the urban traffic information system and the one-day-a-week-no-driving system by using Radio-Frequency Identification (RFID).

a. The Traffic Management System on Urban Expressways

Seoul established this system to remove traffic congestion caused by accidents or emergency situations by quickly addressing these issues and improving traffic flow on Seoul's urban expressways by managing the traffic on urban expressways in real-time. This system uses the position detection system to collect traffic information and provides its information via variable-message signs and the Internet.

b. The Urban Traffic Information System

This project aims to establish a wireless communications infrastructure and fiber cable infrastructure via on-board equipment and roadside equipment in order to standardize the traffic information collection system, to manage traffic efficiently through the collection of neighboring cities' traffic information, and to provide real-time traffic information.

c. The Automatic Traffic Enforcement System against Illegal Parking and Stopping

This system aims to effectively detect illegal parking and to manage detection data and is installed at locations which illegal parking and stopping can cause heavy traffic congestion, such as median bus-only lanes, roadside bus-only lanes, and single-track roads. This system is operated by Seoul's TOPIS.

d. The Automatic Traffic Enforcement System against the violations of Bus-only Lanes

This system consists of the central processing system at the central operations center and local control devices installed above bus-only lanes (or surveillance cameras) that can detect violations. The control devices send violation data to the central operations center and violators are charged with penalties.

e. The Parking Management System

Seoul established the parking management system, which is automatically operated with no attendant required to improve the effectiveness of public parking lots owned by Seoul. The system has sensors to identify license plate numbers and whether the parked vehicle is compact, as well as electronic parking fees collection devices, and CCTVs. They collect information on the vehicles moving in and out of a public parking lot and the system management center remotely controls the public parking lots via these devices.

As of 2005, six public parking lots were equipped with the system and the number will continue to increase.

f. The One-day-a-week-no-driving System by Using Radio-frequency Identification

To promote participation in the one-day-a-week-no-driving campaign, Seoul employs the radio-frequency identification system to give drivers who participate in the campaign automobile tax discounts and congestion fee discounts. Stationary RFID readers in several arterial roads connected to urban and suburban areas read a RFID tag attached to each vehicle and check whether the vehicle participates in the campaign.

Figure 4-7 | Urban Expressways Information Webpage Offered by the Seoul Government

Source: smartway.seoul.go.kr.

Figure 4-8 | RFID tag for the One-day-a-week-no-driving System

Source: no-driving.seoul.go.kr.

2.3.4. Electronic Collection

a. The Revised Public Transportation Cards System

Seoul aims to replace existing transportation cards using radio frequency identification with smart cards and enable one card to pay fares for all modes of public transportation, such as buses, cabs, and subway. As of today, the automatic fare collection system in the capital area is interoperable between different modes of public transportation and the government aims to establish the "One Card One Pass" system which allows people to use just one card to pay public transportation fares all over the nation.

b. The Automatic Fare Collection System for Taxis

This system aims to install a set of on-board terminals, which combines such functions as a POS terminal, printing receipts, hands-free mobile device, and making calls. This terminal facilitates fare collection and payment and electronically processed payment data is used to identify taxi operators' management status and their management of drivers' income.

Figure 4-9 | On-board Terminal for Buses

Source: www.koreasmartcard.co.kr.

Figure 4-10 | Set of On-board Teminals for Cabs

Source: www.koreasmartcard.co.kr.

2.3.5. Intelligent Roads

a. The Pedestrian Safety System

This system is installed in the areas with a high volume of pedestrians and where vehicles need to slow down, such as school zones, preschools, and shopping malls. This is to prevent pedestrians from being involved in vehicle accidents and to improve traffic safety. GPS or RIFD-based technologies have been developed and integrated into the system.

2.3.6 Cargo Transportation

a. The Logistics Information System

This system aims to systematically manage and gather logistics data, support logistics-related work, provide relevant services to the public, and ultimately to use collected data for logistics-related research and policy making.

Under this system, the logistics database is created and citizens can access the database online to get such information as cargo volume, logistics facilities, cargo trucks, traffic of cargo trucks, origin and destination of cargo, regulations on cargo trucks, logistics-related laws, logistics-related information for citizens, logistics research data, survey on each group of users of logistics facilities, operation data of cargo trucks, and cargo traffic volume estimated on the roadside. This system was established in June 2004 and follow-up measures for upgrades and maintenance have been taken.

b. The Road Information System for Cargo Trucks in Seoul

This system aims to help shipping centers to set more efficient cargo transportation plans by providing them with information on road conditions such as damaged roads, blocked roads, and roads under construction and therefore, to enhance the efficiency of cargo transportation and to maintain the roads.

2.4. Problems which have Occurred during the Implementation of ITS Projects in Seoul and Successful and Unsuccessful Cases to Overcome Problems

Among the various ITS projects Seoul has implemented, the ITS projects for public transportation have left significant impacts on Seoul's citizens and as public transportation ITS projects generally overhaul the existing public transportation system, several problems have ensued. Seoul has made it a priority to deal with such problems. Four issues that Seoul's revised public transportation cards system incurred when the revised system was first introduced are as follows.

First, public transportation operators had doubts about the revised system and were worried about decreased revenues, which meant the participant rate of private operators would be low. Seoul introduced the semi-public bus system as an essential part of Seoul's plan for the complete revision of the public transportation system with the employment of the ITS. But bus company owners believed the semi-public system could infringe upon their property rights. This was because under the semi-public system the city government came to have sole rights to designate bus routes, order bus companies to follow Seoul's direction, and to manage revenues earn as well as expenses incurred. This was a drastic change compared to the past when bus company owners had more control and Seoul had intervened only in issues related to licensing bus companies and increases in bus fares. To resolve these issues, the city government held workshops with the bus company associations to discuss the complete overhaul of Seoul's bus system and they reached an agreement after reconciling their ideas and having several discussions and Seoul agreed that it would guarantee bus companies' management rights and provide reasonable compensation to the bus companies.

Second, a significant amount of capital was required to improve the existing roads and establish new IT systems to meet the objectives of the revised public transportation cards system. Seoul considered whether to pay the money with only its budget or to induce private investment and decided to induce private investment and selected LG CNS as the private operator of the project. Since then the overall process to establish the revised system gained momentum. Seoul and LG CNS established Korea Smartcard Co., Ltd. and it developed one of the most advanced public transportation card systems. Now, because of the experience Korea Smartcard has accumulated while operating the public transportation cards system

in Seoul, Korea Smartcard is able to establish more public transportation cards systems in local and overseas cities and generate more revenue.

Third, transfer discounts and free transfers introduced by the revised public transportation cards left a burden on Seoul's budget. Before the introduction of the revised system, a Seoul citizen could transfer onto the subway for free but not when transferring onto a bus. The city government decided to allow free transfers onto buses and ordered system developers to incorporate the function. The problem, however, was that free transfers meant a loss in revenue and to increase basic fares to cover the loss meant more financial burdens on Seoul citizens. The city of Seoul did not wish to allocate budget to cover this loss and to resolve with this issue, without sacrificing free transfers, Seoul adopted the distance-based fare system and upgraded public transportation services while improving bus operators' transparency in management. Due to the city of Seoul's efforts, the revenue of public transportation and the number of its operators increased, which meant the issue of revenue loss was finally overcome.

Fourth, it was not difficult for Seoul to expect that the revised system could cause inconvenience to Seoul citizens and that errors would ensue but it was not easy for Seoul to prepare itself for such issues. Installation of new on-board terminals could not be occur during the day when buses were in operation and therefore about 2,000 people replaced existing terminals with new ones in just one night. In addition to this, bus numbers also had to be renamed at dawn of the day when the revised system was first implemented; in just four hours at dawn all existing bus routes and numbers were replaced with new ones. As a result, many Seoul citizens faced system errors and confusion. But Seoul managed to overcome this issue by placing a guide to help citizens of the revised system at each bus stop and proactively dealing with the issues.

3. Anyang (a city with the population less than one million)

3.1. Composition of Anyang's ITS

Anyang is located near Seoul and has the population of 610,000. To manage the mounting problems of air pollution, traffic congestion, and crime, Anyang decided to establish an efficient and scientific traffic information system and crime prevention system by adopting advanced IT technologies and opened the Anyang Traffic Information Center in March 2009.

Table 4-6 | Roles of the Participants of Anyang's ITS and Crime Prevention System Projects

Participants	Roles
The Central Government	■ Support each local government to digitize itself as the center of Korea's efforts to go digital ■ Conduct mutual coordination with other local governments as the main driver of digitization projects ■ Provide systematic and technological assistance to apply advanced IT technologies to digitization projects
The Government of Anyang	■ Develop detailed implementation plans for digitization and lead its digitization projects ■ Coordinate efforts with relevant administrative agencies and manage operators designated to carry out the projects ■ Acquire products and technologies and participate in system operations ■ Decide policy-related matters and support matters related to administrative permission and authorization
Project Management Organizations	■ Be in charge of overall management of projects and support matters related to processes and quality management ■ Evaluate technologies related to digitization projects and conduct authorization ■ Support design, perform test-runs, support the management of the traffic information center, and conduct promotional activities
Advisory Board	■ Provide technical and policy consultation regarding digitization projects
Inspection Team	■ Have the right and responsibility prescribed in relevant laws and contracts and inspect the construction of IT and electronic facilities as the legal inspector whose role is defined in the Korean Construction Supervision system ■ Inspect and check construction, detection, process, quality, safety management, and other technical matters
Operators	■ Establish and operate the system ■ Establish plans for the test run, conduct training and education, and establish maintenance guidelines

Source: The Government of Anyang, 2013.

3.2. History of Anyang's ITS

Anyang has carried out ITS projects since established its master plan for the ITS in 2004 and its opening of the Anyang Traffic Information Center in 2009 propelled Anyang into one of the cities with the most advanced ITS.

A. March 2004: Formulated the Master Plan

B. December 2005: Formed an agreement with intelligent traffic centers in Seoul, Suwon, Gwacheon, and Uiwang

C. May 2007: Signed an agreement with National Policy Agency on the implementation of the Urban Traffic Information System (UTIS)

D. February 2008: Initiated the construction of the UTIS (until April 2010 in two stages)

E. February 2009: Formed an agreement with the Anyang Police Station on the operation of the Anyang Traffic Information Center

F. March 2009: Opened the Anyang Traffic Information Center

3.3. Details of Anyang's ITS

Since 2003, Anyang has introduced advanced traffic systems including the ITS, the BIS, the Bus Rapid Transit (BRT) and now Anyang citizens can enjoy Anyang's advanced traffic system. The Anyang Traffic Information Center is the first of its kind in Korea, which can manage and provide integrated services encompassing traffic information, crime prevention, and disaster prevention.

Table 4-7 | Main Components of Anyang's ITS

Projects	Details
Establishment of the BIS	■ Bus stop information terminals at 242 locations ■ 125 Bus information terminals ■ Establish connection with other BIS in Seoul and Gyeonggi Province
Establishment of the BRT	■ Establishment of bus-only lanes ■ Installation of cameras to detect violations at 10 locations ■ Installation of advanced traffic signal control systems
Other ITS Projects	■ Establishment of the Anyang Traffic Information Center ■ Installation of CCTVs at 32 location and variable-message signs at 10 locations ■ Installation of on-board terminals in 2,800 cabs ■ Advanced traffic signals
Installation of CCTVs for Crime Prevention	■ Installation of 210 CCTVs for crime prevention and of automatic vehicle identification at 15 locations ■ Monitoring CCTVs with police stations and branch offices ■ Installation of 25 on-board devices into police vehicles

Source: The Government of Anyang, 2013.

3.3.1. Anyang Traffic Information Center

CCTVs are used for various purposes such as crime prevention, traffic monitoring, and emergency warnings (when disasters occur). Though there are already many CCTVs around Anyang, they were installed and managed separately without a unified supervising body, which meant slow responses to any situations shown on the CCTVs. For this reason, the government of Anyang applied the same platform into all CCTVs in the city and then established the Anyang Traffic Information Center which uses CCTVs for the ITS, the BRT and crime prevention.

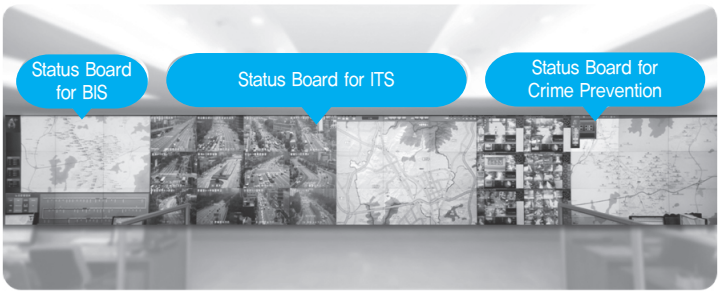
The Anyang Traffic Information Center's total floor space is 440m^2 and is composed of the monitoring room, equipment room, large status boards, and other advanced equipment, and is managed and operated by experts. This Center is considered one of the most successful ITS projects in Korea and is where foreign ITS-related personnel must see when visiting Korea.

Table 4-8 | Operation Structure and Functions of the Anyang Traffic Information Center

Operation Structure	Detailed Functions
■ Operation Time: 24/7 with joint operation ■ CCTV Monitoring: four groups in three shifts (total: 24 people) ■ Total number of Anyang Integrated Information Center Team is six ■ Three police officers reside in the Center - One person stays at night and holidays for staff duty	■ Traffic: provision of various traffic information via the ITS, the BRT, and the BIS ■ Crime Prevention: CCTV monitors all over the city to protect citizens and the Center connects CCTVs with police stations and police vehicles ■ Disaster Prevention (including surveillance of urban facilities and areas): using CCTVs to monitor forests, rivers, and roads with representatives from different organizations

Source: The Government of Anyang, 2013.

Figure 4-11 | Integrated Status Boards in the Anyang Traffic Information Center



Source: The Government of Anyang, 2013.

The Anyang Traffic Information Center is to control Anyang's traffic monitoring, crime prevention, and disaster prevention services in one place to enable efficient interoperability among different systems while providing balanced information. The monitoring room in the Center works as the control center where the city government can manage Anyang's overall situations.

Integration leads to several benefits such as integration of Traffic-related systems (such as the ITS, the BIS, and the BRT) with the crime prevention system saves office space and equipment; sharing status boards with one another and using the same servers, network system, and uninterrupted power supplies cuts overall management expenses; sharing management and maintenance activities with different organizations reduces personnel expense and operational costs.

Figure 4-12 | Monitoring Traffic Flow

Source: The Government of Anyang, 2013.

Figure 4-13 | Monitoring Forest Fire

Source: The Government of Anyang, 2013.

Figure 4-14 | Monitoring Stream Flooding and Areas Prone to Floods

Source: The Government of Anyang, 2013.

Figure 4-15 | Monitoring Snow Clearing

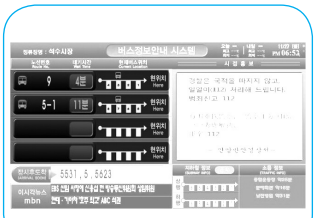
Source: The Government of Anyang, 2013.

3.3.2. Establishment of the BIS in Anyang

Anyang introduced the BIS in 2003 to enhance the convenience of passengers by providing them with bus information. Anyang's BIS is the first of its kind to have subway arrival information near a bus stop displayed along with bus information through the collaboration with Korean Railroad Corporation. This is very convenient for the passengers who want to transfer from a bus to subway.

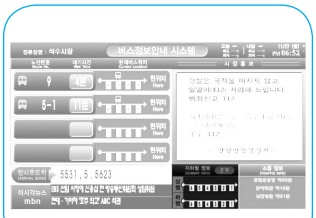
Anyang's BIS also provides various types of information such as audio guidance of bus arrivals for transportation, traffic flow to the destination, news, public transportation card balance check, weather, climate, and ozone levels to provide benefits to passengers and to increase the use of public transportation.

Figure 4-16 | Bus Arrival Information



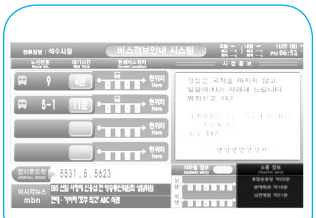
Source: The Government of Anyang, 2013.

Figure 4-17 | Subway Arrival Information



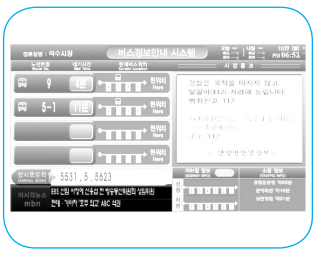
Source: The Government of Anyang, 2013.

Figure 4-18 | Traffic Flow Information



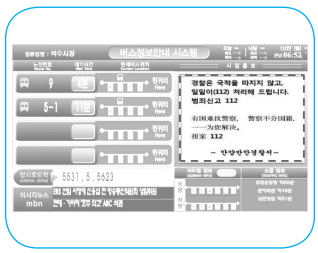
Source: The Government of Anyang, 2013.

Figure 4-19 | News



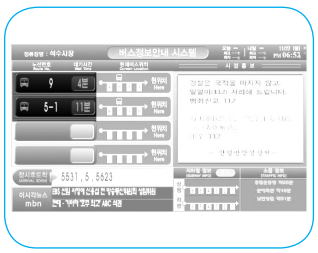
Source: The Government of Anyang, 2013.

Figure 4-20 | Advertisements of Local Governments



Source: The Government of Anyang, 2013.

Figure 4-21 | Low-floor Bus Arrival Information



Source: The Government of Anyang, 2013.

3.4. Problems which have Occurred during the Implementation of ITS Projects in Anyang and Successful and Unsuccessful Cases to Overcome the Problems

It took some time until the Anyang Traffic Information Center was finally established. At first, most CCTV surveillance was conducted at each department in city hall separately and the concept of sharing CCTV data and collaboration of surveillance activities were not launched yet. As the result, applying the same platform into all CCTVs, centralizing the system and establishing a unified body to provide integrated services met lackluster response from interested parties. To address this, the government of Anyang had continuous discussions with police stations, fire stations, military bases, and neighboring local governments and finally a consensus was reached that an integrated control center was necessary.

There were no experienced professionals with knowledge in the integration of different services into one centralized system. As mentioned earlier, the Anyang Traffic Information Center was the first of its kind and therefore many issues arose during the integration. In order to address this, during the planning stage, the city government clearly defined the role of each component in the integration process (the organization which placed an order of construction, project management organizations, inspection team, construction company, advisory board, and etc.), resolved the solution for each problem together, and completed the integration while maintaining close cooperation. As a result, the Anyang Traffic Information Center was successfully established and the effects of its integration was maximized.

2013 Modularization of Korea's Development Experience
Establishment of Intelligent Transport Systems (ITS)

Chapter 5

Analysis of the Secrets of Successful ITS Projects

1. Seoul's ITS Projects for Public Transportation
2. Anyang (The Anyang Traffic Information Center)

Analysis of the Secrets of Successful ITS Projects

1. Seoul's ITS Projects for Public Transportation

1.1. Analysis of the Secrets of Seoul's Successful ITS Projects

Seoul is the largest city in Korea with more than 10 million residents. The government of Seoul adopted the ITS to establish the traffic system which can confer benefits and convenience to a large population. When Seoul adopted the ITS, the objectives were aimed to increase the modal share of public transportation as public transportation is more efficienct than other modes of transportation and, ultimately, to remove traffic congestion on urban roads by reducing the number of privately-owned vehicle owners. Therefore after Seoul adopted the ITS for the public transportation system as a means to enhance people's satisfaction about public transportation, the number of public transportation passengers, which was decreasing, started to increase.

The BIS and the public transportation cards system are the ITS which Seoul introduced for the public transportation system and here are the factors which contributed to Seoul's successful achievement of its objectives when it adopted the ITS.

First, the BIS and BMS were adopted to improve the management of buses and the provision of bus information brought great satisfaction to citizens. Before the establishment of the ITS, buses were infamous for speeding, skipping bus stops, and irregular intervals between buses. But such problems were resolved after the adoption of the ITS, which lead to positive results such as evident satisfaction among passengers and an increase of buses in the modal share.

Second, Seoul adopted the public transportation cards system and formulated appropriate policies to be in line with its adoption. To increase the use of public transportation cards,

card holders could receive 10% discount off basic fares and transfer discounts and the city government established and developed technologies which allowed card holders to use different modes of public transportation such as tolls, parking lots, and trains. As a result, the user rate of public transportation cards in Seoul is now 95%, a successful result from its objective when the system was first introduced. In addition, the fare collection system was used to gather traffic information and the data gathered through the system has been used as valuable grounds to make traffic-related policies.[19]

Third, the effectiveness of the ITS for public transportation is maximized as Seoul has continuously invested in the infrastructure for public transportation and implemented new policies such as changing the location of bus-only lanes from the roadside to the middle of roads. Bus-only lanes were essential to ensure buses arrive on time and to keep the distance between buses constant. In addition, bus-only lanes should be located in the middle of road rather than the roadside to reduce intervention by turning vehicles. So Seoul moved the location of bus-only lanes, installed new traffic signals, and replaced protective materials over bus-only lanes. Seoul still allocates a certain amount of the budget for the expansion of the median bus-only lanes.

Fourth, Seoul was not reluctant to reforms against strong opposition from interested parties especially when it changed the location of bus-only lanes and introduced the semi-public bus system. The government of Seoul never ceased to persuade bus operators who opposed the semi-public bus system and street vendors who were against the median bus-only lanes through a series of discussions.

Fifth, Seoul's public transportation cards system enables micropayments as well as paying fares; card holders now can purchase goods at stores, see movies, and pay for various services, which improves card holders' convenience.

1.2. What Still Needs to be Done

Traffic information provided by Seoul's ITS is mainly supplier-oriented, not receiver-oriented. Each mode of public transportation (buses and subway) has its own traffic information collection and provision system. This means that passengers need to use two different information services and can they feel inconvenienced when they have to find optimal travel routes in a short period of time or when real-time transfer information is necessary and as a result the effectiveness of traffic information could be reduced. In addition, traffic information for mini shuttle buses is not available and there are no specially designed traffic information provision services for the transportation vulnerable, such as children, the elderly, pregnant women and physically handicapped people.

19. The government of Seoul has utilized the data gathered through the public transportation cards system, such as the number of passengers, to make policies like designating or changing bus routes.

To deal with this, Seoul plans to establish the integrated traffic information system for public transportation that encompasses traffic information for all modes of public transportation in Seoul, and therefore increases the consistency and effectiveness of traffic information. In addition, Seoul is planning for customized services for the transportation vulnerable, which will provide information about the most appropriate mode of public transportation as well as the most optimal routes for them.

1.3. Similar Overseas Cases

Lots of large cities in the world also introduced the Bus Rapid Transit (BRT) to increase the modal share of public transportation and therefore lower urban traffic congestion. The Multilateral Development Bank (MDB) supports developing nations that want to initiate BRT projects in order to help them to establish traffic policies which guarantee their sustainable development. Even though the BRT has already been adopted by many nations all over the world, it will be introduced by developing nations and therefore every nation that wants to adopt the ITS needs to check the data regarding the adoption of the BRT for reference.

Table 5-1 | Quantitative Parameters of Large Cities which Adopted the BRT

City	pphpd[20] at Peak Time	Speed at Peak Time (Km/h)	bphpd[21] at Peak Time	Average Modal Share of Buses (%)	Total Length of Dedicated Busway (km)	Operation Time	Infrastructure Cost (million USD)
Amsterdam	960	34	18	53	44.5	Trunk-feeder	2.4
Beijing	3,800	21	50	76	374.5	Trunk-feeder	4.8
Bogota	30,500	23	310	98	87	Trunk-feeder	18.6
Brisbane	6,500	29	175	37	19.3	Open	30
Changzhou	7,400	18	77	96	41	Direct service	4
Dalian	5,800	24	75	77	9	Direct service	2.6
Guangzhou	27,400	18	350	78	22.5	Direct service	4.4
Jakarta	3,000	20	40	75	119	Trunk-feeder	1
Kunming	3,500	14	120	29	46.7	Open	1
Lima	13,950	25	101	138	27.1	Trunk-feeder	262
Nantes	2,100	21	17	124	6.2	Trunk-feeder	50
Seoul	8,400	16	210	40	43	Open	1.2

Source: www.chinabrt.org.

20. pphpd: passenger per hour per direction.

21. bphpd: bus per hour per direction.

a. BRT in Guangzhou, China

The Guangzhou BRT opened in February 2010 and accounts for 70% of the city's traffic demand. Like Seoul, Guangzhou has median bus-only lanes and, to prevent possible traffic accidents, passengers who want to access to bus stations have to take an overpass. Guangzhou has a highly developed BRT and it greatly contributes to the city's development.

【Details of Guangzhou BRT】

- The number of passengers moving in a single direction per an hour at peak time: 27,400
- Average number of passengers per day: 843,000
- Operation Hours: 5:30am~11:00pm
- The number of buses moving in one direction per an hour at peak time: 350
- The number of BRT stations: 26
- Average distance between stations: 880m

Figure 5-1 | Median Bus Exclusive Lane

Figure 5-2 | View of BRT Station

Figure 5-3 | Pedestrian Overpass for BRT Station

Source: http://www.chinabrt.org.

b. BRT in Bogota, Columbia

Bogota is the capital of Columbia and has the most successful BRT system called the TransMilenio. On its opening day in December 2000, the system carried 19,000 passengers and the average number of passengers per day reached 792,000 by May 2003. Now TransMilenio is an essential part of the lives of Bogota citizens.

Passengers of Bogota's BRT can park their bicycles for free, which improves the accessibility of the BRT and contributes to the increase in the number of BRT passengers. This should be taken into account when Seoul makes its transportation policies.

【Details of TransMilenio】

- The number of passengers moving in a single direction per an hour at peak time: 37,700
- Average number of passengers per day: 1,650,000
- Operation Hours: 5:30am~10:00pm
- The number of buses moving in one direction per an hour at peak time: 312
- The number of BRT stations: 142
- Average distance between stations: 790

Figure 5-4 | Bicycle Parking Facility near BRT Station

Figure 5-5 | View of BRT Station

Figure 5-6 | Median Bus Exclusive Lane

Source: http://www.chinabrt.org.

2. Anyang (The Anyang Traffic Information Center)

2.1. Analysis of the Secrets of the Success of Anyang Traffic Information Center

The Anyang Traffic Information Center is considered a successful ITS project. Since it opened, approximately 5,000 people in Korea and approximately 150 people from 28 countries have visited the Center and media coverage has reported the Center as an exemplary case. Here are the factors which contributed to the success of Anyang Traffic Information Center.

First, the government of Anyang concentrated on qualitative factors rather than quantitative ones during the development of this Center. Anyang installed many CCTVs for crime prevention and, from the initial establishment stage of the Center, focused on the development of the software customized for the existing CCTVs and safeguards against possible issues in solutions. This was because Anyang wanted to make various functions and systems integrated in the Center.

Second, Anyang established a system which guaranteed stable operation and management of the Center after it opened by establishing a series of agreements on the formation of collaborative relationships between interested parties. In addition, to strengthen the social safety net for the residents, Anyang established a more stable and successful system based on mutual trust and on the collaboration between the public sector, the private sector, the police, and the military. Moreover, the city government and the police monitor CCTVs at the Center together due to on-board terminals for police patrols.

Third, Anyang has professionals who can produce the best results at the Center. Anyang realized that skilled experts with ample experience were required to operate the integrated ITS center like the Anyang Traffic Information Center and since 2003, has assigned professionals who had had experience in IT system integration to such tasks as building and operating integrated systems. Today, three police officers and 24 monitoring professionals are deployed at the Center and they are working in three shifts for 7 days a week 24 hours a day. As a result, for three years after its opening, the Center provided 3,335 criminal investigation materials and, based on the materials, the police solved 448 cases and caught 120 criminals in the act. This shows that the Center greatly contributes to the maintenance of public order in Anyang.[22]

In conclusion, the Anyang Traffic Information Center is able to maximize its operational efficiency on a limited budget. For the first time in Korea, the Anyang Traffic Information Center integrated license plate number identification cameras used for traffic and crime prevention purposes and this will stop overlapping investments by different organizations. Since different organizations share the same municipal network, Anyang can reduce about 700 million KRW worth of communication leasing expenses.

2.2. What Still Needs to be Done

Anyang has CCTVs at about 100 locations and they are used for various purposes such as crime prevention, traffic management, disaster and fire prevention, and facilities maintenance. An increase in the number of CCTVs operated by public organizations has not only positive impacts such as crime prevention and improved safety but also has negative impacts such as an infringement of citizens' basic rights including privacy and portrait rights.

This has caused much controversy and therefore the central government recently established provisions concerning the installation of CCTVs and security matters in "the Act on the Protection of Personal Information Maintained by Public Institutions" to prevent any possibility that CCTVs infringe upon fundamental rights of citizens. In accordance with

22. Based on the statistical data from March 4 2009 when the Center opened to late June 2012 provided by Anyang City Hall.

this, the government of Anyang requires all CCTVs are identified with signage to inform citizens of the presence of CCTVs. In addition, to prevent the leakage of personal information, access to the Center is heavily restricted and the personnel at the Center receive training about security on a regular basis and the importance of protecting personal information.

Anyang is well aware of the fact that the increasing number of CCTVs requires strict actions to prevent leakage of personal information. Anyang will do its best to take necessary actions, revise relevant regulations including ordinances about personal information protection, and establish additional provisions if necessary.

2.3. Similar Overseas Cases

Lexington is the second-largest city in Kentucky and includes Fayette county. As of 2011, the city's population was 300,000. It has a Traffic Management Center that can monitor traffic conditions and manage traffic signals in real time and as of 2012, the Center had 8 traffic signal experts and 3 traffic experts.

The Center aims to support drivers' safe and efficient driving by providing real time traffic information and to facilitate traffic flow by controlling traffic signals. Fayette county has 282 CCTVs, mainly installed near major crossroads, and 1,225 loop detectors.

The Traffic Management Center in Lexington is similar to the Anyang Traffic Information Center in that it monitors traffic in real time via CCTVs but the Anyang Center is more advanced than the Lexington Center because it can monitor not only arterial roads but also narrow alleys and therefore can prevent possible crimes.

Figure 5-7 | Inside View of Traffic Management Center in Lexington and its Objectives

[Objectives]

- Increased Safety on Roads
- Reduced Pollution
- Decreased Travel Time

Source: LexingtonKY.GOV, Traffic Management Center Brochure, 2012.

2013 Modularization of Korea's Development Experience
Establishment of Intelligent Transport Systems (ITS)

Chapter 6

Implications for Developing Countries

1. Evaluation of Results: Korea's ITS
2. Possibility to Apply Korea's ITS to Developing Nations
3. Policy Proposals Suitable for Future Partner Nations

Implications for Developing Countries

1. Evaluation of Results: Korea's ITS

1.1. Positive Results

Korea is 10 years late in the introduction of the ITS compared to other developed nations. But the development of Korea's ITS has been exponential as the government has made a significant investment and the private sector has made major achievements in the research and development of ITS technologies.

1.1.1. Enhanced Satisfaction for the ITS and its Consequences

As the traffic situations improved and citizens expressed their satisfaction after the implementation of the ITS, the government allocated more budget to ITS-related issues. In addition, as voters wanted more ITS, lawmakers started to pay attention and promised the establishment of the ITS during campaigns.

1.1.2. Conclusion

The establishment of the ITS requires a clear division of labor between the government and private businesses as ITS projects are for the benefit of the public. The Korean government laid the foundation for the nationwide establishment of the ITS in a short period of time and successfully prevented possible issues and difficulties in advance. In developing countries, the introduction of the ITS is often done unsystematically and sporadically as the central government does not establish or designate a government agency to be in charge of ITS-related matters and therefore, even after the establishment of the ITS, coordination between different ITS and expansion of the scope of the ITS could face limitations.

Therefore, when the government first introduces the ITS, the establishment of the ITS should be rolled out gradually after the government formulates systematic establishment plans and sets the standards for the ITS. In addition, the government should develop strategies for helping the domestic private businesses to build the capacity for the ITS. Also, the government should form a long-term master plan for the establishment of the ITS, adopt foreign businesses' ITS technologies, and transfer domestic businesses' ITS technologies to foreign companies. This is especially required when the nation wants to improve the quality of ITS technologies owned by domestic private businesses.

The government also nurtures ITS professionals by educating ITS operators while the system is under construction to ensure the ITS is operated efficiently after it has been established.

1.2. Weaknesses in Korea's ITS

Though Korea's ITS has achieved exponential growth in a relatively short period of time, Korea has a structural weakness which prevents Korea's future growth. Korea's ITS businesses can be divided into large enterprises and small and mid-sized enterprises. While working on ITS projects, large enterprises mainly deal with system integration and the production of ITS products are mainly done by small and mid-sized enterprises. As large corporations focus on system integration and its programming, they do not have fundamental technologies for ITS products, which results in less available ITS service for customers and less competitive power in the global market. Though small and mid-sized businesses focus on fundamental technologies for ITS products and research and development of new ITS technologies, they are not known in the global market and have less capital than large enterprises to invest, which also results in less competitive power in the global market.

In 2012, the Korean government revised the "Software Industry Promotion Act" to give more opportunities to small and mid-sized enterprises by restricting large enterprises to bid on smaller projects. But it left negative impacts on the development of ITS technologies, as business opportunities for large enterprises shrank, they were unable to find any need to focus on the development of ITS software technologies, which resulted in less competitive power in the global market. This revision was not that helpful for small and mid-sized businesses as it did not directly help them to expand into the overseas market. Therefore, something had to be done before it was too late.

In addition, some problems arose after the establishment of ITS. Though many local governments adopted the ITS to meet the demands of citizens, the people in charge of traffic issues and the operators of traffic centers often did not have enough expertise to operate the ITS and therefore expansion of the ITS had to stop. To deal with this, some cities hired contractors or commissioned the operation of the ITS to the private sector. But many cities

still faced difficulties which restricted the full operation of the ITS such as a lack of budget, lack of experienced workers, and lack of standards for personnel assignment.

In some cities, a standard guideline for the operation of the ITS which prescribed measures to deal with various traffic issues and detailed measures and procedures to carry out cooperative measures with neighboring traffic centers did not exist and this lowered the effectiveness of the ITS after its implementation.

2. Possibility to Apply Korea's ITS to Developing Nations

2.1. Selection of an ITS Project Suitable to a Developing Nation which Can be Divided into Four Groups in Accordance with its GNI

The ITS should be adopted after a basic traffic infrastructure has been established. Several points should be considered to maximize the effect of the ITS after its establishment.

Developing nations were divided into four different groups in accordance with their Gross National Income (GNI). In this paragraph, we'd like to propose the ITS projects which Korea can cooperate with developing nations to carry out in the nations with considerations to their traffic conditions. Here are the points to be considered when selecting possible ITS projects for future cooperation.

Table 6-1 | Points to be Considered when Selecting Possible ITS Projects for Future Cooperation

	Details
Base Infrastructure	■ Physical conditions of roads (paving and surface marking) ■ Possibility whether base infrastructure such as electricity and communication lines can be installed on the roads
Traffic Infrastructure	■ Whether traffic signs are installed and working properly ■ Whether license number plates are unified
Public Transportation System	■ Whether intra-city buses abide by routes ■ Rate of use of public transportation
Obedience to Traffic Rules and People's Level of Consciousness	■ People's obedience to traffic rules ■ People's level of consciousness about the obedience to traffic rules
Possibility whether to Allocate the Budget for the ITS	■ Total volume of national budget ■ Income levels

Source: ITS Korea, 2013.

Based on the above points to be considered, we'd like to propose the prospective ITS projects which Korea can cooperate with developing nations to carry out in the nations and the reasons why they are proposed with considerations to their traffic conditions.

Table 6-2 | Developing Nations Divided into Four Groups in Accordance with their GNI and Each Group's Prospective ITS Projects which Korea can Cooperate to Carry out the Projects

Group	Nations	Prospective ITS Project	Traffic Conditions and the Reason why they are Selected
Poorest Countries	Afghanistan, Angola, Bhutan, Laos, Nepal, and etc.	Advanced Signaling System	■ Having low level of the above points to be considered ■ Focusing on the advanced signaling system, the most basic one, while building infrastructure for the establishment of the ITS
Countries with GNI per capita less than 1,005 USD (as of 2010)	Kenya, Tadjikistan, Zimbabwe and etc.	BIS, EFCS, ETCS	■ Having moderate level of the above points to be considered ■ Improving people's satisfaction by providing appropriate public transportation services and ultimately dealing with traffic issues by increasing public transportation in the modal share
Countries with GNI per capita between 1,006 USD to 3,975 USD (as of 2010)	Cameroon, Egypt, India, Iraq, Indonesia, Morocco, Paraguay, Sri Lanka, Vietnam and etc.		
Countries with GNI per capita between 3,976 USD to 12,275 USD (as of 2010)	Azerbaijan, Chile, Botswana, Colombia, Dominica, Peru and etc.	ATMS, BIS, EFCS, ETCS, Parking Management	■ Having high level of the above points to be considered ■ It is possible to implement various ITS projects

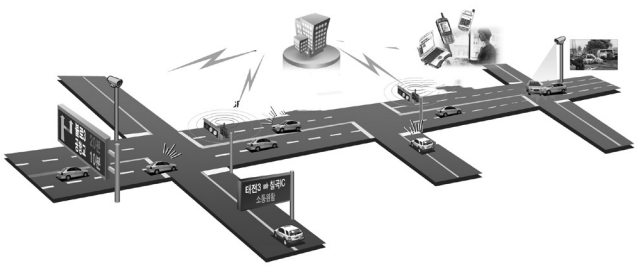
Source: ITS Korea, 2013.

【ATMS & ETCS】

1. ATMS (Advanced Traffic Management System)

The Automated Traffic Management System is a system that can identify traffic flow, accidents, natural disasters and control and manage other aspects which can be dangerous to roads by installing vehicles detectors, surveillance cameras, the VMS, and other facilities. The ATMS can control traffic signals in real-time, control the volume of vehicles moving onto an expressway ramps, and detect vehicles violating traffic rules.

Figure 6-1 | Conceptual Design of the ATMS

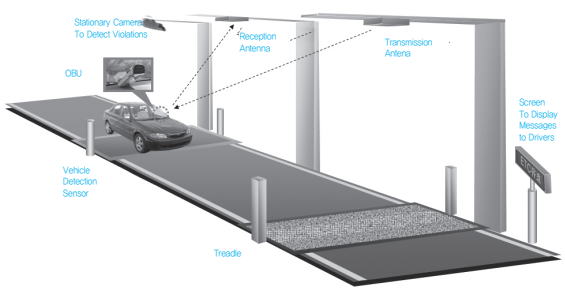


Source: ITS Korea, 2013.

2. ETCS (Electronic Toll Collection System)

The Electronic Toll Collection System (ETCS) is a system through which a driver can pay the toll via radio communication between a roadside antenna and an on-board unit while passing through a toll gate with no need to stop. One toll gate with the ETCS can collect 4 times as much as toll.

Figure 6-2 | Conceptual Design of the ETCS



Source: ITS Korea, 2013.

2.2. Points to be Considered at each Stage of the Establishment of the ITS

Based on Korea's adoption of the ITS after the 1990s, the establishment process of the ITS in a nation can be divided into three stages: the introductory stage, development stage, and maturity stage. At each stage, Korea can propose points to be considered and future directions. What needs to be remembered is that laying the foundation for the systematic establishment of future ITS projects at the introductory stage is very important in order to prevent any possible confusion when the ITS projects expand or new ITS are introduced.

Table 6-3 | Proposed Directions for the Establishment of ITS Projects at each Stage

Stage	Focus	Details
Introductory Stage	Establishment of relevant plans, laws and regulations	■ Establishment of the plans to promote the ITS at each stage on a yearly basis (mid and long-term plans) to establish the ITS systemically ■ Formation of the legal grounds for the implementation of the ITS ■ Establishment of standardization plan for the expansion of the ITS and for coordination between systems and establishment of the methods to carry out the standardization ■ Establishment of the system to successfully perform ITS projects
Development Stage	Establishment of each component of the ITS and devise the method to evaluate the component	■ Implementation of the ITS projects and standardization efforts ■ Development of methods to be connected with relevant government organizations and other cities when implanting the ITS projects ■ Development of methods to evaluate and assess the established systems ■ Use the evaluation results of the established ITS as a basis for future planning
Maturity Stage	More sophisticated system and coordination between different systems	■ Further development of the established ITS ■ Seeking system integration with relevant government organizations and other cities ■ Launching new research and development projects

Source: ITS Korea, 2013.

2.3. Korea's Consulting Programs to Support the Establishment of the ITS

Korea has continued its efforts to increase aid to other nations large enough to be in line with its global position and roles and strengthen the policy grounds. Since its entrance into the Development Assistance Committee (DAC) of the OECD in 2010, the Korean government has increased its efforts to increase its global presence, laid institutional grounds to improve the effectiveness and efficacy of official development assistance by systematically establishing aid plans for each region and sector, and supported various programs.

Korea is helping developing nations to build its ITS successfully through the following programs.

Table 6-4 | Korea's Consulting Programs to Support the Establishment of the ITS

Organization	Details	Support Methods
The Ministry of Foreign Affairs and Trade and the Korea International Cooperation Agency (KOICA)	■ Provision of consultation such as Project Management Consulting (PMC) and Technical Assistance (TA) ■ Services are provided for a designated period of time	■ Consultation programs are selected after having discussions with local branch offices of KOICA
	■ Provision of consultation services via locally residing professionals	
The National IT Industry Promotion Agency (NIPA)	■ Provision of consultation via locally residing professionals who are seniors with expertise sent by the agency ■ Senior experts in the private and public sectors are sent to the area and provide consulting services for a designated period of time	
The Ministry of Strategy and Finance and the Export-Import Bank of Korea (KEXIM)	■ Provision of consultation on the ITS through Knowledge Sharing Programs (KSPs) ■ Services are provided for a designated period of time	■ Requesting nation sends application for the knowledge sharing program to the Ministry of Strategy and Finance when the Ministry conducts surveys on the demand for KSPs

Source: ITS Korea, 2013.

3. Policy Proposals Suitable for Future Partner Nations

3.1. Financing Methods

3.1.1. Using Aid

Multilateral Development Banks (MDBs) like the World Bank and the Asian Development Bank provide financing for developing nations' economic development by financing it in the form of loans and investments. In principle, low-income countries with low credit ratings with poor debt repayment records are unable to receive loans from MDBs as MDBs finance profitable projects with a clear prospect for repayment. Countries with high credit ratings with good debt repayment records can finance their development projects at low interest rates. This is why many of nations and businesses show interest in financing by MDBs.

a. The Asian Development Bank (ADB)

ADB funds projects of developing nations in the form of loans, grants, equity investment, and technical assistance. Notable projects include transport, communications, energy, medicine, technical assistance, consultation, water and sanitation, farming and natural resources, industry and trade, and education. Transport has been one of ADB's main sectors to fight poverty and accounts for 26% of the total loans and 21% of the total grants.

ADB's funding focused on construction of expressways (including bridges), highways, railways, harbors, and airports. But now the proportion of projects to modernize existing urban traffic system (such as the mass rapid transit, the light rail transit, and the bus rapid transit) has grown up and therefore financing ITS projects would be easier when using ADB's loans and grants.

b. The World Bank (WB)

Unlike ADB, WB comprised two instructions and the role of the World Bank Group that make leveraged loans to poor countries is mainly given by the International Bank for Reconstruction and Development (IBRD). IBRD offers loans to middle-income developing countries whose GNI per capita is 6,000 or less USD. IBRD also finances their infrastructure projects including the construction or expansion of IT infrastructure. WB is also aiding ITS projects like those in Botswana.

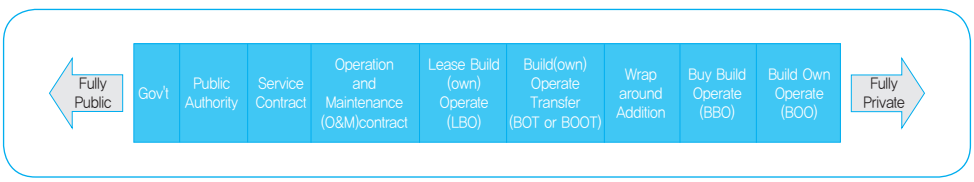
3.1.2. Using a PPP

a. What is a public-private partnership (PPP)?

A Public–Private Partnership (PPP) is a government service or private business venture which is funded and operated through a partnership of government and one or more private sector companies. This is formed when the construction and operation of social infrastructure such as roads, harbors, railroads, and environmental facilities which were originally in the hands of the government are carried out by the private sector.

PPPs helps the government to finance its infrastructure projects which cannot be funded by Official Development Assistance (ODA) by attracting money from the private sector and enables the public sector to harness the expertise and efficiencies that the private sector can bring, leading to better convenience of the people and continuous development of the nation. With PPPs the private sector can launch the project which it cannot launch alone as it has higher risks but lower profits.

Figure 6-3 | Types of Public-Private Partnership



Source: International Contractors Association of Korea, Research on the Use of the Investment by the MDBs and Development Loans, 2010.

This figure above shows types of public-private partnership; as moving to the right, the proportion of the private sector increases and the private sector takes the leading role. For example, in a Build-Own-Operate (BOO) project, ownership of the project is in the hands of the private operator and construction and operation of the buildings of this project is led by the operator. In contrast, as moving to the left, the central or local governments take the leading role and their portions increase. This means the government led the project from the beginning and role of the private sector is limited.

As PPPs become more widely used to finance ITS projects, our understanding about PPPs should be enhanced before adopting them for funding.

b. Transport-related PPPs funded by ADB

Statistics show that out of the 138 PPP projects funded by ADB from 1998 to 2008, there were 69 transport-related projects, accounting for 50% of the total, and were the largest.[23] This is because construction of highways greatly increased in developing nations in Asia and therefore operation and management of transport-related matters became very important.

The ITS are essential for effective collection of tolls and maintenance of facilities and the use of private funds through PPPs could result in improved quality of relevant technologies and reduced financial burden. Project management by PPPs in transport is mainly done by contract on funds from the public sector. Though the investment from the private sector in PPPs is limited, project management by the private sector and the technologies transferred from the private sector in PPPs brings many benefits to the public sector.

3.2. Other Things to be Considered for Successful Establishment of the ITS

3.2.1. Revision of the Public Transportation System

To provide accurate information, the bus information system requires a bus with a certain number should run on a designated route. Before the revision of the Bus System, buses in Korea were given numbers at the request of bus operators with no specific standards. Bus numbers virtually had no meaning and therefore passengers faced difficulty in finding the information on buses whenever bus routes are new or removed. Sometimes two buses with the same number took different routes.

The government of Seoul belatedly realized the importance of bus numbering and completely changed the number of all buses in accordance with specific standards. First, areas in Seoul were divided into 8 areas and each was given an area number from 0 to 7. Buses were given numbers in accordance with area numbers – bus numbers indicate where the route begins and ends. Second, bus numbers also showed the types and functions of buses. With the new numbering system, bus routes can be managed more systematically and scientifically from the administrative perspective.

23. Source: ADB's database on PPPs.

Table 6-5 | Area Numbers for the Revised Bus Numbering System

	In Seoul	Outside of Seoul
Area 0	Jongno-gu, Jung-gu, Yongsan-gu	
Area 1	Dobong-gu, Gangbuk-gu, Seongbuk-gu, Nowon-gu	Uijeongbu, Yangju, Pochun
Area 2	Dongdaemun-gu, Jungnang-gu, Seongdong-gu, Gwangjin-gu	Guri, Namyangju
Area 3	Gangdong-gu, Songpa-gu	Hanam, Gwangju
Area 4	Seocho-gu, Gangnam-gu	Seongnam, Yongin, Bundang
Area 5	Dongjak-gu, Gwanak-gu, Geumcheon-gu	Anyang, Gwacheon, Uiwang, Ansan, Gunpo, Suwon
Area 6	Gangseo-gu, Yangcheon-gu, Yeongdeungpo-gu, Guro-gu	Incheon, Bucheon, Gwangmyeong, Gimpo, Siheung
Area 7	Eunpyeong-gu, Mapo-gu, Seodaemun-gu	Goyang, Paju

Source: The Government of Seoul, 2006.

3.2.2. Unification of License Number Plates

To detect traffic violations through the automatic traffic enforcement system and impose penalties, all vehicles have to have unified number plates so that the system can easily identify the numbers on the license plates. In Korea all vehicles are required to be registered and registered vehicles are given number plates with unique vehicles numbers.

Korea has the technology to gather and use vehicle information through license number plates and the unification of number plates is closely related to the accuracy of this technology. This explains Korea's technology to identify numbers on the plates and the history of changes in the shape of number plates.

a. Introduction

The technology to identify numbers on license number plates is used to track stolen vehicles, find the location of a specific vehicle, and even find tax dodgers. The Automatic Vehicles Identification (AVI) system identifies the numbers of the plate on a moving vehicle and sends the numbers to the traffic information center via the dedicated short range communications, wireless network, or satellite network. Then, the center compares the numbers with those stored in the center, analyze the numbers, and sends analysis data to relevant organization.

b. Changes in the Shape of Number Plates

License number plates were first used in Korea in the 1910s. They had changed several times until 1968 but the plates used that time are no longer used and were all eliminated.

In April 1973, the information on license number plates was arranged in two lines. As you can see in the figure below, a number plate has such information as province/city, vehicle class, type of vehicle, and serial numbers. This type of number plates was used until 1995.

From January 1, 1996, the number of vehicle class became two-digit number as additional digit was required. This type of number plates was used until December 2003.

Figure 6-4 | Number Plate First Introduced in 1973

Source: ITS Korea, 2013.

Figure 6-5 | Number Plate Revised in 2006

Source: ITS Korea, 2013.

From January 1, 2004, the province/city name was omitted. Before then, if a vehicle owner moves to another place, they had to change the number plate. But as the province/city name was omitted, they can keep the plate until the end of life of vehicle. "European" name plates (simple black-on-white design and all on one line) was first introduced for police vehicles and vehicles for the public purpose in February, 2005. This style applied to all passenger vehicles on November 1, 2006 after font and size changes. This type of name plates are the current standard and applies to all passenger vehicles registered.

c. Using the Automatic Vehicles Identification (AVI) System in Korea

Unified shape of license number plates is essential to improve the identification of the numbers of the plate on a moving vehicle. If the shape is not unified, the AVI system will have poor recognition rates and will be detrimental to the management of vehicles. Though

the old type of name plates are still used in Korea, most of them are replaced and therefore the AVI system can be widely used to track the numbers of vehicles.

The AVI system is useful for the following cases.

A. Automatic collection of parking fees and opening and closing of the gate of the parking lot

B. Tracking the location of vehicles on the wanted list

C. Checking whether a vehicle is a stolen or not

D. Tracking the vehicle of a tax dodger and then imposing taxes on the owner

E. Detecting overcrowded vehicles

Vehicle identification technologies can be used for various purposes and will have the potential to create new services using the technologies. Therefore, the shape of license number plates has to be unified. Before the start of unifying the format of all license number plates, a lot of of time and money was spent on this service.

3.2.3. Government's Intensive Efforts to Development the ITS

The Korean government laid the foundation for the nationwide introduction of the ITS by setting the standards of the ITS, formulating guidelines for the construction of the ITS, and revising relevant laws. The Korean government allocated a lot of budget to support research and development of ITS technologies and local governments' ITS projects as well as to help private businesses to develop various ITS-related technologies.

3.2.4. Healthy Development of ITS Technologies by Private Businesses

As the government supported the establishment of the ITS in a systematic way and local governments were quick to implement their own ITS projects, local governments started to carry out several ITS projects (including the bus information system, the electronic toll collection, the automatic traffic management system, and etc.) were carried out nationwide in the early 2000s. The private sector also developed its own ITS technologies such as the in-vehicle navigation system, TPEG[24], and the parking management system.

24. TPEG: a technology which can display real-time tourism and traffic information on the in-vehicle navigation system by receiving information through DMB frequency.

Anyang City Hall (2012), "Construction and Operation Status of in Anyang Traffic Information Center"

Kim, Hong-il (2001), "Research on the Methods to Establish Efficient Intelligent Transport Systems for the 21 Century", pp.15

Korea Automotive Parts Testing Institute (2005), "Analysis on Reduction in Energy Consumption through the Intelligent Transport Systems (ITS)", pp.27~32

Korea Transportation Safety Authority (2005), "Evaluation of Automatic Traffic Enforcement Systems (focusing on speeding violations)", pp.34

Lee, Seung-woo (2010), "The Current Status and Prospects of Prepaid Public Transportation Cards"

Seoul National University (2012) "Research into the Effects of Smart Highways on the National Economy"

The Government of Seoul (2012), "Report on Current Status of the Use of Seoul's Bus Information System"

The Government of Seoul (2008), "Seoul's Master Plan for the ITS"

The Korea Institute of Construction Technology (2008), "Basic Research for the Revision of the Laws and Regulations Related to the ITS"

The Korean Society of Science and Technology (2009), "Research on the role of science and technology to strengthen the competitiveness of the service industry"

The Ministry of Construction and Transportation, "Guidelines to Build Standard Nodes/Links for the ITS"

The Ministry of Construction and Transportation (1998), "Evaluation of the Test Run of the ITS in Gwacheon"

The Ministry of Construction and Transportation (2002), "The National Standardization Plan of the ITS"

The Ministry of Construction and Transportation (2003), "White Paper on Korea's Construction and Transportation"

The Ministry of Construction and Transportation (2004), "Analysis on the Effects of Advanced Transportation Model City Construction Projects"

The Ministry of Construction and Transportation (2005), "Handbook for the Guidelines to Build Standard Nodes/Links for the ITS", pp.2

The Ministry of Construction and Transportation (2006), "Strategies to Implement Hi-Pass on Expressways"

The Ministry of Land, Transport and Maritime Affairs (2008), "Basic Research for the Laws and Regulations Related to the ITS"

The Ministry of Land, Transport and Maritime Affairs (2010), "Korea's National ITS Architecture for Vehicles and Road Traffic"

The Ministry of Land, Transport and Maritime Affairs (2010), "Korea's National ITS Architecture for Vehicles and Road Traffic (ver 2.0)"

The Ministry of Land, Transport and Maritime Affairs (2010), "Research on the Investment Funded by MDB and the Use of Development Loans"

The Ministry of Land, Transport and Maritime Affairs (2013), "Korea ITS Standardization Annual Report(2012~2013)"

The Seoul Institute (1997), "Policy forum on the direction of Seoul's ITS projects"

"Analysis on the effectiveness of the test-run of the ETCS", *Journal of Korean Society of Transportation*, Vol. 19 No. 4, 2001

"Analysis on the regional bus information system covering from Sadang to Suwon", *Transportation Technology and Policy* Vol. 4 No. 4, 2008

"Research on the Analysis of the Effectiveness of the ITS on National Highways", *Journal of the Korea Industrial Information System Society* Vol. 14 No. 4, 2001

"The Master Plan For the ITS in the Capital Area (2002~2020), 2003

Website of Smart Highway, http://www.smarthighway.or.kr

Website of the Ministry of Land, Infrastructure and Transport, http://www.molit.go.kr

Website of Intelligent Transport Society of Korea, http://www.itskorea.kr

LexingtonKY.GOV, Traffic Management Center Brochure, 2012

http://asiabrts.org

http://www.chinabrt.org

http://nodelink.its.go.kr

www.ksp.go.kr

Ministry of Strategy and Finance, Republic of Korea

339-012, Sejong Government Complex, 477, Galmae-ro, Sejong Special Self-Governing City, Korea Tel. 82-44-215-2114 www.mosf.go.kr

KDI School of Public Policy and Management

130-722, 85 Hoegiro Dongdaemun Gu, Seoul, Korea Tel. 82-2-3299-1114 www.kdischool.ac.kr

9 791155 451120 94320

ISBN 979-11-5545-112-0

Knowledge Sharing Program
Development Research and Learning Network

- 130-722, 85 Hoegiro Dongdaemun Gu, Seoul, Korea
- Tel. 82-2-3299-1089
- www.kdischool.ac.kr