Intelligent transport systems in Korea

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Abstract

Intelligent Transport Systems (ITS) are advanced transportation systems that aim to advance, automatize the operation and management of transport systems, and thereby improve efficiency and safety of transport. ITS combine cutting-edge technology such as electronic control and communications with means and facilities of transportation. This paper reviews Korean ITS Initiative.

Keywords*: Intelligent Transport System, Expressways, National highway, Urban Roads, Performance evaluation*

1. Introduction

Intelligent Transport Systems (ITS) are advanced transportation systems that aim to advance, automatize the operation and management of transport systems, and thereby improve efficiency and safety of transport[4, 6]. ITS combine cutting-edge technology such as electronic control and communications with means and facilities of transportation. ITS are intelligent transport systems designed to maximize transport efficiency and operation, and enable users to enjoy greater safety and convenience with sophisticated technology applied in transportation systems. ITS are 21st century transport systems that realize environmentally friendly transport systems in light of maximized efficiency, enhanced safety and convenience and energy-saving by applying high-tech technology such as transportation, electronic technology and communications to roads and vehicles, and collecting and providing real-time transport information for users.

With the development of advanced traffic light control systems and the FTMS pilot project of expressway traffic control systems in the early 1990s along with the ITS establishment project in Gwacheon, the "National Transport System Efficiency Act," which is the foundation of the ITS project, was enacted in 1999 and the ITS master plan was drawn up in 2000, laying the groundwork for the ITS initiative. As "a project of ITS modeling city" the ITS project was launched in Daejeon, Jeonju and Jeju in order to provide an ITS standard model for local governments in the 2000s. Hi-Pass was established as an e-payment system that enables drivers to make the expressway toll payment automatically without any need to stop their cars, together with a bus information system that provides users with real-time bus information and a transportation card system that helps people pay transportation fares without cash. As of now, ITS is being expanded with a view to easing traffic congestion, reducing accidents and improving transport conditions, serving as a locomotive for eco-friendly green growth.

Annual investment in national intelligent transport systems amounts to 234.5 billion Won, totaling 2.1 trillion Won from 2001 through 2009, and the annual growth rate is 11.2%. As of 2009, intelligent transport systems were established, with a distance of 7,384 km including 3,794 km(100%) of national expressways, 2,552 km(19.9%) of national roads and 1,038 km(2%) of other roads. A total of 44 authorities are engaged in supervising the systems while the Ministry of Land, Transport and Maritime Affairs (Main office and regional construction and management administrations), Korea Expressway Corporation and 28 local governments have traffic information centers[8].

Table 1. Annual investment in ITS (Unit: Million Won)

Year	2001	2002	2003	2004	2005
Central government expense	965	946	726	877	1,816
Local government expense	917	465	618	497	1,067
Private	258	336	87	19	229
Totals	2,140	1,747	1,431	1,393	3,112
Year	2006	2007	2008	2009	Sum
Central government expense	990	952	944	1,837	10,053
Local government expense	1,032	904	1,016	1,321	7,837
Private	324	1,023	597	346	3,219
Totals	2,346	2,879	2,557	3,504	21,109

2. Status of ITS in KOREA

2.1 ITS of Expressways

ITS aims to optimize expressway traffic management by constructing advanced and intelligent expressways, thereby dispersing traffic flows in light of time and space with a view to better traffic management and control on expressways[4].

Figure 1. Expressway traffic management system in 2009

Korea Expressway Corporation has expanded traffic services for newly built roads since it started operating traffic centers in July 1992 for the purpose of collecting and providing transportation information on expressways. Privately financed expressways are commonly managed by either nine private institutions or the Korea Express Corporation, while the privately-funded new Incheon International Airport Expressway was first constructed in 2000 and has provided ITS service. Korea Expressway Corporation and then ministry of construction and transport (now the Ministry of Land, Transport and Maritime Affairs) conducted a feasibility study of auto-charging systems in 1995 so as to redress the inconvenience of cash payment and eliminate the need to stop vehicles, installed the systems in Cheonggye, Pangyo and Seongnam areas in 2000 and started pilot operation[4]. Traffic management service started in some sections of the Gyeongbu expressway and Jungbu expressway in 1999 and has been expanded with new roads constructed. As of 2009, the service is provided in all the sections of the expressways.

Expressways consist of 30 routes reaching 3,497.2km managed by Korea Expressway Corporation and six privately funded routes of 280.3km (Total 36 routes of 3,777.5km). Traffic information service, emergency management services and traffic flow control service for tunnel management are provided for the entire distance of 3,777.5km. 79% of loop detectors and 20 % of video image detectors are utilized respectively including the ones for tunnel management while there are radar detection systems in privately-financed sections with magnetic detectors in public-financed sections. Ultrasonic vehicle detectors are used on the Cheonan Nonsan Expressway for tunnel management[8].

2.2 ITS of national highway

Road traffic information system has been established and is in operation for traffic management and services of national roads with a view to a better quality of traffic services, mainly managed by regional construction and management administrations[6].

ITS for national roads was established and the operation began in 1997. 「Master plan 2020 of intelligent transport system」has pushed forward with seven key initiatives and proposed phase-by-phase plans comprising a mid-term plan (2011-2015) and a long-term plan (2016-2020). At present, a total of five regional construction and management administrations (Seoul, Wonju, Daejeon, Iksan, Busan) are in charge of traffic information of national roads with a goal to have the system in place for 44% of nationwide roads by 2020.

Table 2. ITS background of national roads

Period	Description
1997~2005	Establishment and operation of ITS for national roads: ITS for roads in metropolitan areas (291km) and for circuit roads of expressways (665km)
April 2004	Drawing up of a mid-term investment plan for ITS construction project of national roads
April 2005	Policy on construction and development plan of ITS infrastructure for national roads by Minister of Construction and Transport[Road Environment Department-698 of Ministry of Construction and Transport]
December 2006	Revising a mid-term investment plan for ITS of national roads
September 2009	Master plan 2020 for ITS of national roads: ITS will be constructed at a distance of 6,177km (about 45% of national roads) by 2020
August 2011	ITS facilitation plan: Apply ITS construction sections of national roads (640km) included in road construction sections to a new road construction

ITS has been established in 2,560km-sections, covering 18.6% of a total of 13,707km of national roads while five regional construction and management administrations have set up and run each regional traffic information center. Traffic information is provided with services of emergency management and safe-driving section management[8].

Table 3. Status of establishment and operation of ITS for national roads

Regional authorities	Coverage (km)	Number of devices			
		VDS	AVI	CCTV	VMS
Total	2,560.4	2,130	673	701	578
Seoul	820.8	763	209	223	224
Wonju	194.6	60	28	70	40
Daejeon	761	657	185	245	163
Iksan	261	197	81	54	43
Busan	523	453	170	109	108

2.3 ITS on Urban Roads

Traffic management systems are in operation in 33 nationwide cities to improve traffic flows and safety. Regarding main roads managed by local governments, traffic information is provided with emergency management and real-time control of traffic signals[8].

As Seoul and Gwangju introduced real-time traffic signal control systems in 1993 with an ITS pilot project in Gwacheon in 1998, traffic management services for urban roads have been introduced, being expanded into each region including metropolitan areas. Three model cities (Daejeon, Jeonju, Jeju) were designated based on the size and characteristics of a city in 2003 and ITS investments worth 85.3 billion won were made in these three cities (48.5 billion on Daejeon, 15.2 billion on Jeonju and 21.6 billion on Jeju).

Twenty-four local governments out of a total of 55 (with populations over 200,000 and ITS in place), or 43.6%, have set up traffic management centers to control traffic flows, collect and provide traffic information. Gyeonggi-do has the system in place with ITS services in a 36km-distance zone. As of 2010, the system is in operation in urban roads of 3,435km among a total of 41,045km (provincial roads, metropolitan roads, urban and county roads) for a better traffic service.

Table 4. Extension and establishment rate of regional ITS for urban roads

Region	Total distance(km)	ITS (km)	Rate(%)
Seoul	8,119	960	11.8
Busan	2,848	180	6.3
Daegu	2,269	61	2.7
Incheon	2,147	190	8.8
Gwangju	1,561	71	4.5
Daejeon	1,810	364	20.1
Ulsan	1,576	133	8.4
Gyeonggi province(do)	6,979	740	10.6
Gangwon-do	1,609	48	3.0
North Chungcheong province	978	27	2.8
South Chungcheong province	1,032	101	9.8
North Jeolla province	1,395	223	16.0
South Jeolla province	1,373	117	8.5
North Gyeongsang province	1,664	0	0.0
South Gyeongsang province	2,998	0	0.0
Jeju Special Self-governing Province	2,687	220	8.2

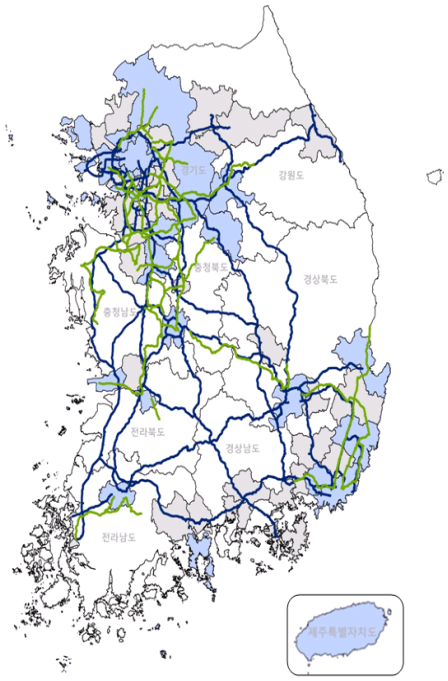

Figure 2. Traffic management scope of urban roads in 2010

2.4 Performance Evaluation

Performance evaluation refers to quality certification, pre-delivery evaluation and regular evaluation, assessing quality and performance of traffic information-gathering and providing devices. As ITS has a close correlation with traffic data, information processing and provision, the accuracy of on-site devices is required to secure reliable ITS traffic information, having a direct impact on the accurate traffic information.

A study on methodology for ITS performance evaluation was conducted and a center for performance evaluation was opened in 2003, resulting in a guideline and methodology for performance evaluation of ITS devices.

Table 5. Background of ITS performance evaluation

Period	Description
2003 ~2005	Methodology study for ITS performance evaluation and a center for performance evaluation construction (VDS, AVI, portable standard devices, VMS, CCTV). Designation of ITS performance test authority in 2005 (Notification No.2005-139 of the (Ministry of Construction and Transport)
2006~	Performance evaluation guideline legislation (Ministry of Construction and Transport), Preparation for a guideline of performance evaluation of ITS devices. ITS project for national roads and performance evaluation of operation devices by regional construction and management administration. Development test for ITS devices: VDS, AVI, portable standard devices
2008 ~ 2009	Development of USB-based portable standard devices and laser-based portable standard devices
2010	Preparation of guidelines for ITS performance evaluation, Research on methodology of DSRC quality certification (assessment cases, assessment system)
2009~	ITS quality certification center design ITS quality certification under construction (VDS, AVI, DSRC, portable standard devices)

ITS quality certification means that the ITS quality certification authority evaluates and certifies devices and products of intelligent transport system suppliers based on ITS quality criteria. The quality certification process includes preparation, device installation, testing, result analysis and result notification. Pre-delivery evaluation is carried out before the ITS project kicks off in order to identify whether the performance of ITS devices installed satisfies the requirements and stipulated performance level of ITS administration. Regular evaluations are carried out on a period basis in order to identify whether the performance of ITS devices in operation can decline for several reasons (worn-out, etc).

3. Future Plan

As intelligent transport systems emerged as a solution to improve road traffic thanks to the development of IT, the then (Ministry of Construction and Transport)(now, (Ministry of Land, Transport and Maritime Affairs) sought to introduce and expand ITS by establishing the「ITS Master Plan 21」(2000). As National Transport System Efficiency Act was enacted and came into force (on Dec. 10, 2009), the scope of ITS master plan which originally focused on vehicles and road traffic was expanded encompassing railroads, shipping and air traffic with the planning period of 10 years.

「ITS Master Plan 2020」provides phase-by-phase action plans of objectives and key initiatives in vehicle and road traffic fields based on a mid (2011-2015) and long-term(2016-2020) basis.

- Seven key initiatives are pushed forward to create accident-free safe roads, easy-to-use roads and highly efficient roads with high punctuality.
- Services are provided in seven areas including traffic management, public transportation, e-payment, traffic information distribution, additional traffic information, intelligent vehicles and roads and cargo transport.

3.1 Expansion of traffic management system to respond quickly to unexpected situations

Expand traffic management system to reduce impact on people and properties and prevent another accidents through speedy responses to unexpected situations and emergencies. Expand systematic traffic management system to nationwide arterial roads to quickly detect unforeseen situations such as accidents, vehicle breakdown and damaged roads.

3.2 Introduction of accident-prevention system to control risky factors on road

Prevent traffic accidents and implement safe traffic management by controlling risky factors of possible accidents on roads and introducing safety management services in vehicles transporting dangerous goods

3.3 Development and distribution of advanced safety vehicles that prevent traffic accidents

Encourage safe driving by developing and distributing advanced safety vehicles capable of detecting and handling risky situations and sending an alert to drivers

3.4 Expansion of traveler-customized traffic information provision

Improve convenience and modal share rate in public transportation by providing public-transport information and customized services on a real-time basis for travelers

3.5 Expansion of compatible fare-payment means

Enhance convenience by distributing a single payment means with which people can use all transport facilities or means with ease

3.6 Expansion of providing traffic information at the right time and right place

Build traffic information network by which drivers can complete their journey within the scheduled time by providing fast traffic information anywhere and facilitating private services

3.7 Expansion of real-time traffic control to maximize available capacity

Realize roads with high punctuality by increasing and stabilizing road capacity through arterial road-based traffic operation management

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