# ITS on Seoul's Urban Expressway

**Prepared by: Shin Lee[1]**

## 1. Policy Implementation Period

The freeway traffic management system (FTMS) of Seoul's urban expressway was first designed by the Seoul Development Institute (currently known as Seoul Institute) in the mid-1990s, and implemented in the 18 km leg of Olympic Expressway in July 1997. After six-month operation as pilot project, the FTMS was used in earnest since February 1998.

Since then, FTMS project has been implemented and expanded in phases. In the phase 1 (from May 2000 to June 2002), the FTMS was introduced to the 40.1 km stretch of the Naebu Inner Beltway. During phase 2, the transportation management system had been established in the 21.7 km segment of the Gangbyeon Riverside Expressway and the Bukbu Northern Arterial Road during November 2001 and June 2004. In addition, segments stretching 49.3km in the Olympic Expressway and Nodeul Road & Han River Bridge also had been equipped with FTMS from October 2003 to September 2005. In Phase 3, the FTMS was installed on the 45.7 km of Dongbu Eastern Arterial Road and Gyeongbu Expressway (managed by the City of Seoul) which began in April 2005 and completed in April 2007. Phase 4 dealt with arterial roads rather than urban expressway. (refer to page 4 Relevance with Other Policies). Phase 5 is in its implementation covering 12.4 km of Gangnam Beltway. Table 1 below gives a summary of Seoul's FTMS project.

In December 2000, Seoul developed a plan to build "Urban Expressway Traffic Control Center" and in April 2001 it established operation plan for the "Urban Expressway Traffic Control Center."

[1] Translation by ESL®

Table 1. Seoul's Urban Expressway FTMS Projects in Phases

| | Segment | Start | Completion | Segment Length |
|---|---|---|---|---|
| Initiation | Olympic Expressway | 1997.7 | 1998.2 | 18km |
| Phase 1 | Naebu Inner Beltway | 2000.5 | 2002.6 | 40.1km |
| Phase 2 | Gangbyeon Riverside Expressway/Bukbu Northern Arterial Road | 2001.11 | 2004.6 | 21.7km |
| | Olympic Expressway/ Nodeul Road & Han River Bridge | 2003.10 | 2005.9 | 49.3km |
| Phase 3 | Dongbu Eastern Arterial Road/Gyeongbu Expressway | 2005.4 | 2007.4 | 45.7km |
| phase 5 | Gangnam Beltway | 2015.5 | 2016.5 | 12.4km |
| Total | | | | 187.2km |

## 2. Background Information

Rapid development of Korean economy and the car manufacturing industry in 1980s had brought about a sharp rise in the traffic volume. The number of passenger cars exceeded 1 million and in the year 1990 it was over 2 million units. A half of those passenger cars, about 1 million units, were used in Seoul. In less than five years, the number of cars owned by Seoul citizens almost doubled to 2 million. Such a surge in the car ownership had led to snowballing social costs including road congestion and traffic accidents in the City of Seoul.

The decision-makers of transportation policy in that period shared the view that supply-oriented approach, which focused on expanding facilities including expanding transportation system or road construction, might no longer be effective and started seeking a new approach away from the conventional transportation policies. At that time, other countries showed keen interests in intelligent transportation system (ITS), which applied cutting-edge technology to transportation facilities. ITS was an innovative approach and very appealing to the policy makers as it helped efficient management of existing traffic facilities by enabling efficient traffic flow at much more affordable costs compared with the provision of infrastructure facilities including road construction. For that reason, increasing number of cities in other countries showed interest in adopting ITS. South Korea pursued various ITS research and development programs and pilot projects in the 1990s. In line with such a move, the City of Seoul also promoted to adopt advanced overseas ITS. In the initial period, the urban expressway FTMS started to be promoted in large scale. Urban expressway FTMS was one of the most representative ITS projects that had dramatically improved the efficiency of Seoul's urban expressway. With the

introduction of the project, urban expressway FTMS started to be established and extended.

Article 77 Implementation of Project for Establishment of Intelligent Transport Systems of the National Transport System Efficiency Act ([Enforcement Date 15. Jul, 2014.] [Act No.12248, 14. Jan, 2014, Amendment by Other Act]) provides legal grounds for the project establishing urban expressway traffic control system.

## 3. The Importance of the Policy

Implementation of FTMS on Seoul Urban Expressway started in mid-1990s when Intelligent Transportation System (ITS) was gaining a huge attention and it meant Seoul's introduction of ITS in earnest.

The Intelligent Transportation System (ITS) is an advanced traffic management system which enhances the efficiency and stability of transportation and conducts scientific and automatic operation and management of transportation system and provides traffic information and services by applying cutting-edge technology including electronic technology, control technology and communications technology to the means of transportation, transportation facilities and infrastructure.

Implementation of FTMS enabled real time traffic control and automatic information/data collection of urban expressway, leading to providing prompt response in traffic condition/emergency and to the improvement of efficiency of traffic system which was previously manually operated.

## 4. Relevance with other Policies

Seoul's FTMS Project in 4 Phases

Phase 4 was designed to improve major bypass of urban expressway and FTMS had been installed in a total of 82.5 km between period of August 2011 and August 2013.

During the first to third phase FTMS projects, as mentioned earlier, FTMS had been successively implemented in Olympic Expressway, Naebu Inner Beltway, Gangbyun Riverside Expressway/Bukbu Northern Arterial Road, Nodeul Road & Han River Bridge, Dongbu Eastern Arterial Road, Gyungbu Expressway (managed by City of Seoul). In the 4th phase, FTMS, the advanced management system was installed on major arterial road of urban expressway which aimed to disperse traffic volume and enable optimal dispersion of traffic volume based on real-time FTMS implemented on major bypass. The followings are the arterial roads that implemented FTMS:

- 1st group: Banporo, Hannamro, Gangnam dae-ro, Heolleungro, Dongjak dae-ro, Doomoogae road and etc (42km)
- 2nd group: Hwarangro, Jeongneung-ro, Segeomjeonggil, Jinheungno, Tongilro and etc. (23km)
- 3rd group: Dongilro (18km)

FTMS System Advancement

Installation of FTMS on arterial roads set the corner stone for the 'FTMS System Advancement' project which highlighted the integration and linkage of urban expressways and arterial roads. The goal of FTMS System Advancement project is to promote closer linkage of traffic data between urban expressway and arterial roads, integrated linkage control and to provide risk alert service that warns risk factors in safe driving. More details will be covered at the last part (Limitations and Resolutions) of this article where policy and future is discussed.

FTMS on Expressway

FTMS had been installed not only on urban expressways in Seoul but had been promoted to be installed in expressways across the nation managed by Korea Expressway Corporation. Due to the widespread implementation of the FTMS on expressway across the nation, Intelligent Transportation System (ITS) is most well or even perfectly realized on the expressway among all types of roads in Korea.

In order to provide efficient management of the expressways based on 'intelligent' expressways across nation, KEC has deployed and operated high-speed optical communications network in a total of 2,646km of the 24 expressway routes including in Gyeongbu Expressways since 1993.

The communications network provides on-site IT infrastructure for the KEC's work and has been used as field communications network for FTMS, toll collection system (TCS), hi-pass system (toll payment system) and emergency call.

## 5. Policy Objectives

FTMS aims to enhance the efficiency of expressways and more specific policy goals could be summarized as below:

① To check transportation and road situations of urban expressways, identify the cause of

congestions and how to improve, and eventually promote efficiency in traffic management system.

② To guarantee mobility of urban expressways (maintaining travel speed of 40km/h or faster)

③ To guarantee safety of urban expressways(zero traffic fatality)

④ To reduce travel costs by removing the cause of irregular traffic congestion based on automatic detection of unexpected incidents and prompt responsive measures.

⑤ To establish convenient and pleasant traffic environment by offering traffic information to road users and

## 6. Main Policy Contents

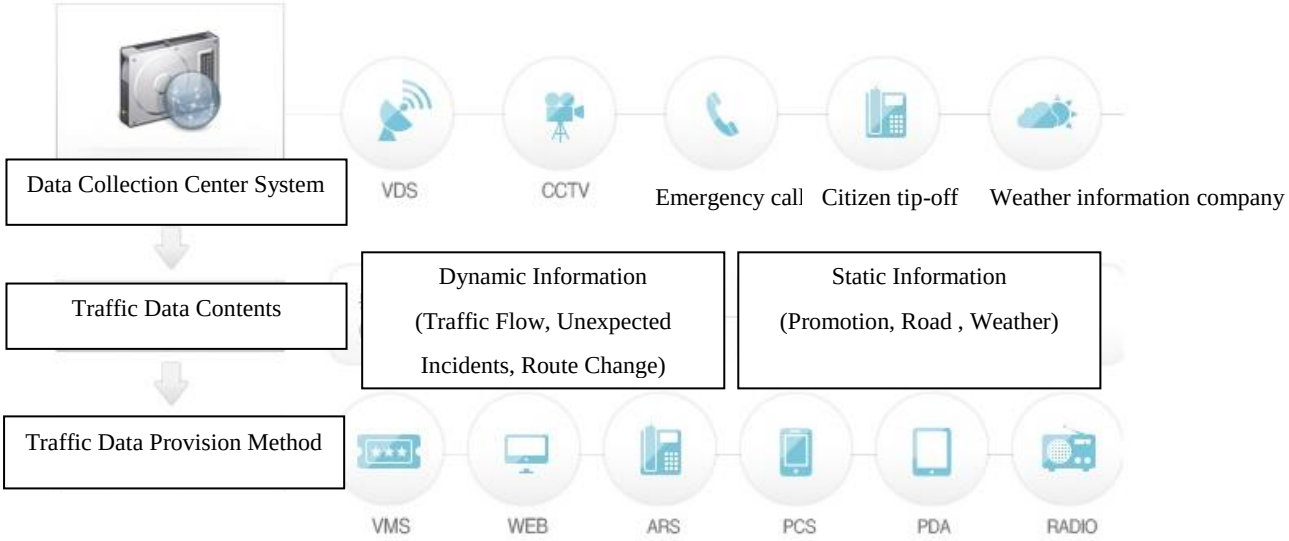
FTMS is the short form for the Freeway Traffic Management System and Seoul Urban Freeway Traffic Management System is a intelligent transportation system (ITS) for expressways, installed by SMG to centrally manage traffic situations and to provide detailed traffic information real-time to the drivers on the expressways.

ITS efficiently manages traffic flow through a combination of technologies, both “hardware” (road, construction, transportation, communications, electricity, electronics, automobiles, etc.) and “software” (operating methods, information processing techniques, etc.) without resorting to huge manpower. The goal of deploying ITS is to provide optimal route to the individual passengers, to induce convenient and safe passage, to detect the cause of delays including unexpected incidents, to provide solution, and ultimately to maximizes the efficiency of overall transportation system.

After all, the main function of FTMS is to collect various traffic situations’ information and to process and use the collected data. Information is gathered using loop vehicle detector, installed under the road and detects traffic flow, and video vehicle detector, which identify traffic flow based video recording, as well as CCTV and emergency phone calls. In addition, tip-offs from the road users provides good source for information. Figure 1 schematically and substantively shows devices and information media used for data collection, data process and information provision.

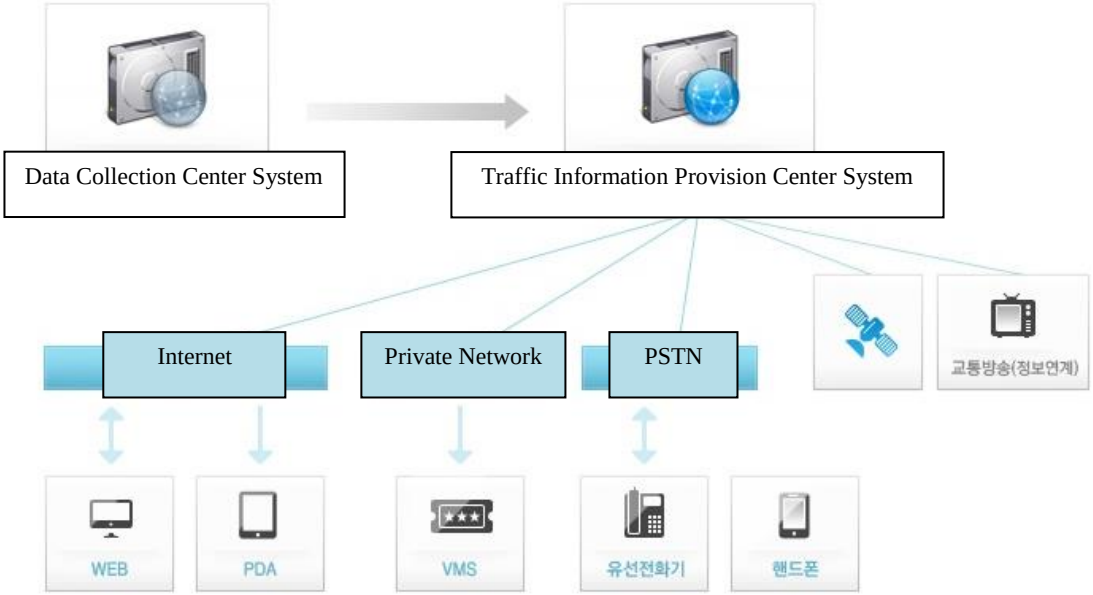
**Transportation Data Collection System**

Transportation Data Collection System collects traffic flow, weather changes, unexpected incidents that happen on expressway using VMS, CCTV and emergency call.




**Traffic Information Provision Center System**

Traffic Information Provision Center System promptly provides information on expressway with drivers and users by processing collected traffic information via VMS, LCS, ARS, emergency broadcast system, WEB and etc.



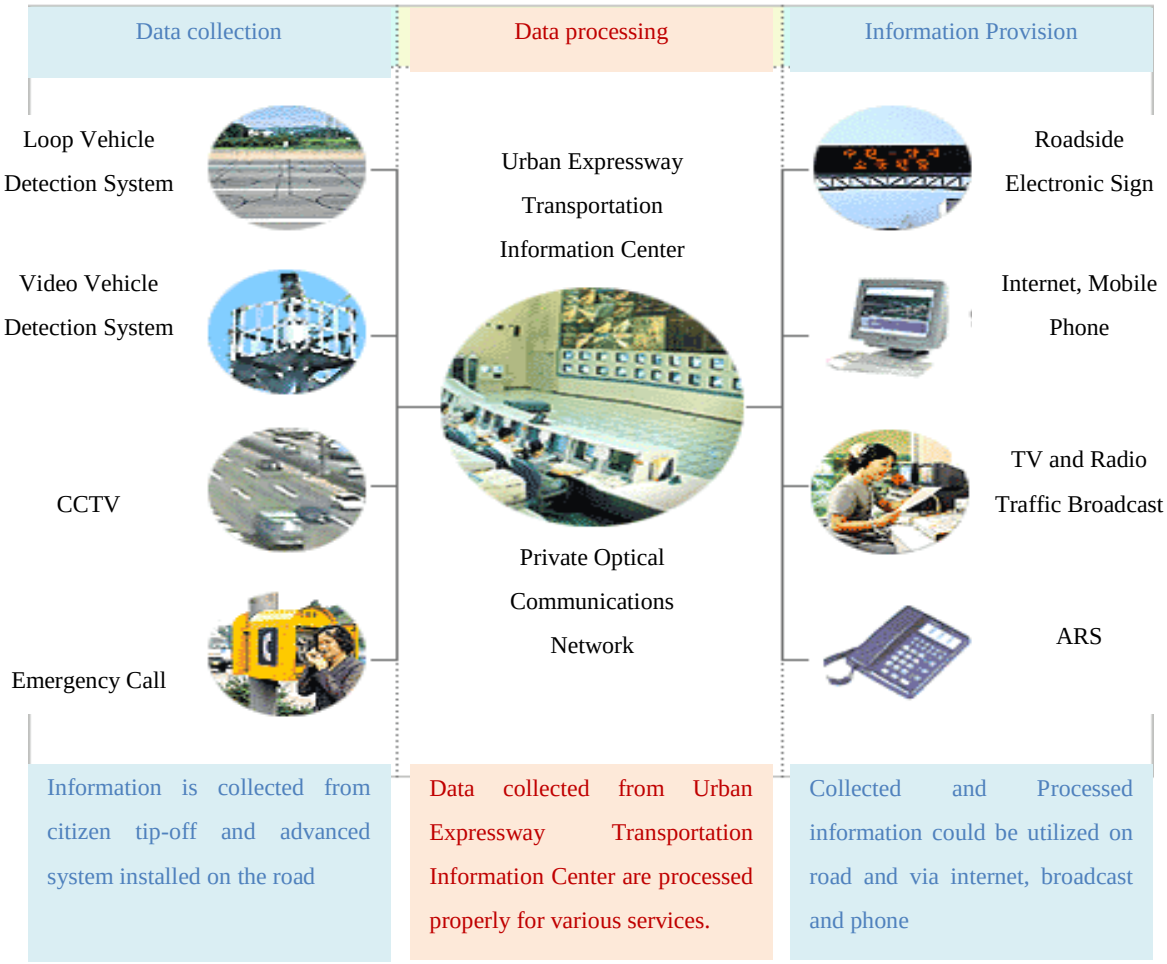



Figure 1. FTMS Data Collection Processing Provision

Source: Seoul Metropolitan Government (2013)

As of 2013, a total of 1,193 units of traffic data collection devices are installed across the urban expressway in Seoul, which includes 1,047 units of Vehicle Detection System (VDS), 144 units of CCTV, 2 units of Road Weather Information System (RWIS). Media providing traffic information includes 260 units of Variable Message Signs (VMS) as well as the websites of the Seoul Urban Expressway Traffic Control Center, ARS and fax. On top of these, traffic flow control devices are installed such as 30 units of RMS (Ramp Metering System), 33 units of LSC (Lane Control System) and 2 units of cutting-in controller.

Table 2 below shows how many on-site data collection devices, which compose Seoul's urban expressway FTMS, has been in operation for each phase FTMS project. The collected data goes to the Urban Expressway Traffic Control Center where all traffic information is supposed to be collected. The center provides collected data directly to the users or sends it with other relevant institutions. It also receives information from other institutions and offers them to users via various media, which is well summarized in table 3.

Table 2. Installation of FTMS in Seoul Urban Expressway

| Category | Data Collection Devices | | | | Data Provision and Control Devices | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | VDS | | CCTV | RWIS | VMS | RMS | LCS | cutting-in | Internet | Others |
| | Video | Loop | | | | | | | | |
| Phase 1 | 213 | 24 | 38 | - | 62 | 12 | - | - | web page | ARS/ FAX |
| Phase 2 | 120 | 2 | 22 | - | 43 | - | - | - | | |
| | 218 | 124 | 40 | 2 | 81 | - | 19 | - | | |
| Phase 3 | 194 | 10 | 36 | - | 61 | 19 | 14 | 2 | | |
| Phase 5 | | | | | | | | | | |

Source: Seoul Metropolitan Government (2013, 2014)

* Acronym
VDS: Vehicle Detection System
RWIS: Road Weather Information System
VMS: Variable Message Sign
CCTV: Closed-Circuit Television
RMS: Ramp Metering System
LCS: Lane Control System

Table 3. External Information Links to the FTMS

| Category | | Information Details | Frequency | Use of the Information |
|---|---|---|---|---|
| From | Seoul Metropolitan Police Agency | Traffic flow at a fixed point (1 min interval), traffic flow at a fixed segment (1 min interval), unexpected incidents | 1 min | - |
| | | CCTV feed | - | - |
| | Korea Expressway Corporation | Traffic flow at a fixed segment (1 min interval) | 5 min | - |
| | Traffic Broadcasting Station (TBS) | CCTV feed | - | - |
| | Seoul Transport Operation & Information Service (TOPIS) | Traffic flow at a fixed segment (1 min interval) | 5 min | - |
| | | CCTV feed | - | - |
| | Expressway to Incheon International Airport | Traffic flow at a fixed segment (1 min interval), unexpected incidents | 5 min | - |
| To | Expressway to Incheon International Airport | Traffic flow on the Incheon Airport Expressway (Bukno JC – Airport) | 10 min | Traffic information provided online |
| | | Traffic flow on the Gyeongbu Expressway (Hannam – Shingal), Oegwak Outer Beltway (Toegyewon – Ilsan) | 5 min | Traffic information provided online, displayed on operation devices and online maps |
| | Seoul Metropolitan Fire & Disaster Headquarters (Seoul Emergency Operations Center) | Weather data | 1 min | Weather information provided online |
| | | Data on dams, Han River level, and precipitation | - | Operation devices |
| | Namsan Zone Traffic Data | Traffic flow at a fixed segment (1 min interval) | 1 min | Traffic information on the Namsan Zone via VMS |

Source: Seoul Metropolitan Government (2013)

Seoul Metropolitan Government has installed FTMS in 9 segments of the urban expressway, stretching 180.4 km (April 2007) based on a high-speed communications network. As of 2013, a total of 1041 units of vehicle detection system (VDS), 144 units of CCTV and 260 units of

roadside electronic sings are installed across Seoul's urban expressway for collection and provision of traffic data.

Seoul Urban Expressway Traffic Information Center serves an information source on the Korea Expressway Corporation that provides effective and proactive traffic management 24/7 and accurate and real-time traffic information. The information center provides prompt traffic management in times of unexpected emergencies including traffic accidents, disasters happening on the expressway and helps smooth traffic flow by swift provision of traffic data after the collection and analysis of real-time traffic data. In particular, it helps drivers find optimal route by offering integrated transport information including national highway and urban roads as well as expressway information. Integrated traffic data are provided in real time to various broadcasting media including TV, radio station and DMB and to mobile phone, PDA, navigation devices, ARS and internet. Drivers on the expressway may figure out traffic information from the roadside electronic signs.

**7. Technical Details**

FTMS is composed of 'field system', which is to collect and provide traffic information, and 'center system', which manages process and analysis traffic data, system operation and integration of external links to FTMS. As shown in Figure 3, information on weather and transportation collected by vehicle detection system, CCTV (Closed-circuit television), RWIS (Road Weather Information Systems) are processed and analyzed by information processing system, a part of center system, and are offered to users via ARS and internet, or even displayed on the variable message signs (VMS). Also, FTMS exchanges information with organizations including Korea Expressway Corporation, Seoul Metropolitan Agency and Seoul Emergency Operations Center, which are linked via information network.

Figure 2 below schematically shows elements of urban FTMS and their relations.


Figure 2. The Structure of the Urban Expressway Traffic Management System

Source: Seoul Metropolitan Government (2016)

| | |
|---|---|
| 현장(정보수집) | Field (Data Collection) |
| 제어기 | Controller |
| 영상 VDS | Video VDS |
| 루프 VDS | Loop VDS |
| 센터 (정보가공/관리제어), | Center (Data Processing/Management and Control) |
| 광통신 자가망 | Optical Communications Private Network |
| 상황실 | Situation Room |
| 서버 | Server |
| 데이터처리 | Data Processing |
| 자료처리과정 | Data Processing Procedure |
| 신뢰성 검증 | Reliability Verification |
| 관리/제어 전략 | Management/Control Strategy |
| 운영전략 | Operation Strategy |
| 운영알고리즘 | Operation Algorithm |
| 무선망 | Wireless Network |
| 임대망 | Leased Network |
| 정보제공전략 | Data Provision Strategy |
| 반복정체관리 | Management of Chronical Congestion |
| 돌발상황관리 | Management of Unexpected Incidents |
| 정보제공관리 | Information Provision Management |
| 도로침수관리 | Management of Flooded Roads |
| 현장(정보제공) | Field (Information Provision) |

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## 8. Policy Effects

Social Benefits

A report (SMG,2007), released by the end of 2007 when Phase 3 FTMS was completed, provided analysis on the effect of FTMS in terms of social benefits as shown in the table 4 below and the criteria evaluating benefits are specified as shown in the table 5. In other words, social benefits were evaluated in terms of reduced travel time, reduced travel time due to bypass, reduced time responding to unexpected incidents, reduced energy consumption and improvement in air quality in the section where FTMS was implemented. Table 4 shows benefits from reduced travel time accounts for more than 66%, energy reduction 13% and reduced time responding to unexpected incidents 15%.

In the meanwhile, extended networks in general turns out to lead to bigger benefits, which is grounded by figure1s of 2003 when the Phase 1 FTMS project was completed and the system stabilized and the fluctuations of benefits in 2003 and after. In 2007, benefits from energy reduction and improved air quality showed temporary drop over the year, as rise in travel distance and traffic volume, which directly determines energy consumption and air pollutant emissions amount failed to offset benefits generated from rise in travel speed.

Table 4. Social Benefits Generated by FTMS

(Unit: 1 Million Won)

| Category (Year/ Benefits) | Reduced Travel Time in Mainline | Route Change (Bypass) | Reduced Time In Responding to the Unexpected Incidents | Reduced Energy (Operation Costs) | Improved Environment (Air Quality) | Sum |
|---|---|---|---|---|---|---|
| **2003** | 16,634 | 472 | 3,910 | 5,647 | 565 | 27,229 |
| **2004** | 16,673 | 532 | 4,906 | 5,709 | 597 | 28,418 |
| **2005** | 25,181 | 765 | 6,201 | 9,579 | 963 | 42,689 |
| **2006** | 45,319 | 4,935 | 7,739 | 10,769 | 1,053 | 69,815 |
| **2007** | 72,382 | 7,793 | 10,942 | 6,679 | 649 | 98,445 |
| **Total** | 176,189 | 14,497 | 33,697 | 38,383 | 3,829 | 266,595 |
| **Percentage (%)** | 66.1 | 5.4 | 12.6 | 14.5 | 1.4 | 100.0 |

Source: Seoul Metropolitan Government, 2007, Recited by Ministry of Land, Transport and Maritime Affairs 2009

Table 5. The Criteria of Effectiveness for Each Benefit Item

| Category | Benefit Items |
|---|---|
| Direct Benefits | • Reduced Vehicle Operation Costs<br>• Reduced Travel Time (Mainline, Bypass)<br>• Reduced Time for Responding to Unexpected Incidents (Traffic Accidents, Breakdown and etc.)<br>• Reduced Traffic Accident<br>• Increased Pleasantness, Punctuality and Safety |
| Indirect Benefits | • Reduced Environmental Costs<br>• The Effect of Regional Development based on Improved Transportation System<br>• Expanded Market Area |

Source: Ministry of Land, Transport and Maritime Affairs 2009

The Price Consumer/User is willing to pay

User satisfaction on the information provision was computed by quantifying qualitative evaluation items based on the survey on 'the price user is willing to pay' to the FTMS information provision media (excluding Variable Message Sign). Qualitative benefits were calculated by multiplying average price that the 'user is willing to pay' to each information

providing media and the number of annual usage for each media together. As shown in table 6, internet traffic information whose usage had been by far more frequent than other media turned out to have generated the biggest benefits.

Table 6. The Price Each Media Is Willing to Pay for the Data from the Urban Expressway FTMS, Annual Usage and Benefits

| Category | Internet | ARS | SMS | FAX | Cell Phone | PDA |
|---|---|---|---|---|---|---|
| The Price that User is Willing to Pay (won/case) | 55 | 38 | 38 | 24 | 57 | |

| Category | Internet | ARS | SMS | FAX | Cell Phone | PDA |
|---|---|---|---|---|---|---|
| Usage | 3,932,823 | 320,999 | 170 | 625 | 16,742 | 4,764 |
| Benefits (1,000 won) | 216,305 | 12,198 | 6 | 15 | 954 | 272 |

Source: Ministry of Land, Transport and Maritime Affairs 2009

Usage of variable message signs (VMS) was not included in the target of survey above as the usage is not optional. Instead, reliability was checked in the survey and users, in general, turned out to find the information on the VMS reliable. For each type of information, users find the information on delayed and congested area on the expressways (3.64 point out of possible 5 point) the most reliable, followed by information on unexpected incidents and situations (3.54 point). SMG 2007.

More recent survey shows drivers in 2013 used FTMS information by 11.7 million times, a sharp rise from 4.6 million times in 2007. While use of the FTMS information via internet remains high, the number of searching the information using mobile phone was about 5.8 million times in 2013 due to surge in the use of mobile devices including smart phones. Table 7 below indicates annual use of Seoul's FTMS transportation data for each media.

Table 7. Use of Seoul's FTMS Transportation Data for Each Media

(Unit: No. of cases/Year)

| Category | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Total No. of usage | 2,256,940 | 2,780,286 | 3,026,974 | 4,276,123 | 4,593,626 | 4,862,232 | 5,930,403 | 10,449,609 | 18,117,411 | 13,612,320 | 11,777,260 |
| Internet | 2,025,411 | 2,584,203 | 2,822,365 | 3,932,823 | 4,059,065 | 4,294,350 | 5,337,458 | 9,904,212 | 17,759,764 | 13,364,052 | 5,726,604 |
| Mobile | Uncounted | | | | | | | | | | 5,811,771 |
| ARS/FAX | 222,342 | 185,664 | 192,151 | 321,624 | 501,039 | 528,204 | 545,110 | 491,263 | 316,693 | 178,101 | 122,922 |
| Telephone Inquiry | 9,187 | 10,419 | 12,458 | 16,742 | 16,493 | 14,335 | 12,955 | 10,077 | 7,709 | 6,226 | 4,972 |
| Feature Phone, PDA | - | - | 518 | 4,934 | 17,029 | 25,343 | 34,880 | 44,057 | 25,155 | 54,753 | 7,794 |
| Tiwitter | - | - | - | - | - | - | - | - | 8,090 | 9,188 | 9,584 |

Source: Seoul Metropolitan Government (2013)

## 9. Challenges and Solutions

SMG's experience in deployment and operation of FTMS for the past 20 years is by and large positive but there remains some room for improvement in three aspects as follows.

① Performance of applied technology

② Securing budgets to replace deteriorated transportation management system

③ Linkage of ITS with arterial roads

Performance of Applied Technology

The performance of devices and facilities collecting traffic information needs to be supplemented. The traffic information bureau of Seoul Metropolitan Facilities Management Corporation has established master plan for the ITS performance evaluation of FTMS and has laid a foundation for the accuracy test of traffic volume and speed measuring for each detector through complete enumeration of vehicle detection system, video frame analysis, relative inspection on traffic volume or reconfiguration (recalibration or change setting) of video-based

vehicle detector. (Seoul Metropolitan Facilities Management Corporation, 2014). Along with the performance test, thorough management will be necessary for measures taken to facilities that failed to meet the standard.

Also, in regards to some FTMS section, ‘simultaneity’ or ‘real-time’ provision of the information has been pointed out to have some limitations. That means it takes long time or update frequency is long for the commercial data to be utilized or for the information to appear on the electronic map of the traffic information center after collecting vehicle data from the vehicle detection system on the road. Therefore, more efforts are needed to provide information in real-time by shortening update frequency and by reducing time required for data processing based on increased and dispersed server load.

Securing Budgets to Replace Deteriorated Facilities

According to the operation and maintenance plan of Seoul’s FTMS, 2015 detailed plan included plan to achieve no-failure in system through exhaustive FTMS pre-inspection activities. On top of regular inspections, the 2015 plan also covered performance of special inspection to prevent any failure and to raise service satisfaction level in preparation for the period including national holidays and monsoon seasons when there is a surge in the use of the traffic information. However, difficulties in securing budgets to replace deteriorated FTMS had been argued. The 2016 Plan includes maintenance of system facilities of center and field, conducting performance test of vehicle detection system and improving the performance of dilapidated FTMS. On top of this, SMG has earmarked to the tune of 2.69 billion KRW for the performance improvement of deteriorated FTMS. Maintenance of the facilities has been delegated to the Seoul Metropolitan Facilities Management Corporation. (Ministry of Land, Infrastructure and Transport 2015).

FTMS System Advancement Plan

FTMS system advancement is included in Seoul transportation master plan (SMG 2014) and Seoul ITS master plan (SMG 2013) which outlines the provision of integrated operation of FTMS both in urban expressways and arterial roads in order to upgrade the efficiency in operation based on the successful operation of the FTMS so far. The master plans also cover the establishment of information service provision for safety.

In Phase 4 FTMS project (2011-2013), FTMS had been deployed in arterial roads, the main bypass of urban expressways, whose goal is to optimally disperse traffic volume to bypass from the urban expressway.

On the basis the FTMS implemented even to the arterial roads, FTMS advancement project will be conducted according to the three ways as specified below.

• To improve linkage of traffic information between urban expressways and arterial roads

• To extend the entrance/exit control to the urban expressways by implementing integrated control and linkage with arterial roads in response to the real-time traffic situations.

• To offer risk alert service that warns risk factors in driving safety including risky section on the expressway.

Besides, SMG plans to promote smooth traffic flow by implementing variable speed limit (VSL) and lane control system (LCS) in the mainline of urban expressway. Variable speed limit designates desirable speed, determined by traffic situations and weather information, in order to maintain optimal traffic flow, which guarantees safe passage and maximizes possible road capacity. This, in turn, leads to smooth traffic flow in the mainline of the urban expressway. Lane control system (LCS) designates optimal route and speed in the case of unexpected incidents or emergencies that needs the dispatch of emergency vehicle. (Seoul Metropolitan Government 2014). Table 8 provides FTMS system advancement plan for each year.

Table 8. FTMS System Advancement Plan for Each Year

| Progress/Year | FTMS System Advancement |
|---|---|
| **2013** | • Design and System Improvement |
| **2014** | |
| **2015** | • FTMS system deployment and control strategy development<br>(Installation of 96.7 km of field system each year)<br>- Control Strategy Development and System Establishment in Mainline and Ramp Segments<br>- Establishment of Intelligent Safety System with its focus on risky segment |
| **2016** | |
| **2017** | |
| **2018** | |
| **2019** | • Implementation of Integrated Linkage and Control between Urban Expressways and Arterial Roads<br>• Widespread Installation of Intelligent Safety System and Advancement using communications technology used between cars. |
| **2020** | |
| **2021** | |

Source: SMG, Urban Transportation Master Plan, 2014

More efficient management of traffic flow is expected if 1) performance test and replacement of deteriorated facilities are effectively performed, 2) FTMS system advancement project is conducted in accordance with its plan, and 3) FTMS information is effectively exchanged with information collected and provided from the private sector.

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