Effective ITS Services in Korea

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I. Introduction of ITS in Korea

1. Milestone

1991~1995
- Beginning of ITS Pilot Project
- Development of Advanced Traffic Signal System
- FTMS Pilot Project (GyeongBu Expressway)

1996~1998
- National Promotion Establishment Plan

1999~2000
- Make a ITS Regime
- Formulation of Transportation System Efficiency Act
- Establishment of 2nd National ITS Master Plan

2001~2003
- Construction of ITS Model City (Daejeon, Jeonju, Jeju city)
- ITS Wide-area Plan & Local Government Plan
- ETCS Pilot Project (Seoul Metropolitan Expressway)

2004~
- Spread & Growth of ITS
- ITS Operation of Expressway (3,400km) & National Highway (1,909km)
- BIS Operation of Wide area & Local Government (About 32 Local Govern.)
- Construction & Operation of ETCS (About 595 Lanes, 2,000,000 OBUs)
1. Introduction of ITS in Korea

2. ITS Master Plan in Korea

1. Backgrounds
- 1997. 9: 1st National ITS Master Plan
- 2000.12: 2nd National ITS Master Plan
- 2011.07: Renewal of National ITS Master Plan

2. Objective
- Provide Master Plan for the Deployment of ITS with newly defined user service areas, timetable, and budget.

3. User Service
- ITS User Service of National ITS Architecture
- 7 service areas – 23 services – 46 unit services
II. ITS Architecture and Services

**Electronic Fare Payment Service (EFPS)**
- Electronic Toll Collection Service
- Electronic Fare Collection Service

**Advanced Public Transportation Service (APTS)**
- Public Transportation Information Service
- Public Transportation Management Service

**Advanced Traffic Management Service (ATMS)**
- Traffic Flow Control Service
- Incident Management Service
- Automatic Traffic Enforcement Service

**Advanced Traffic Information Service (ATIS)**
- Basic Information Broadcasting Service
- Traffic Information Management Coordination Service
- Vehicle Traveler Additional Information Service
- Non-vehicle Traveler Additional Information Service
- Safety Driving Support Service
- Automatic Driving Support Service

**Commercial Vehicle Operation (CVO)**
- Logistic Information Management Service
- Hazard Material Vehicle Management Service

**Advanced Vehicle and Highway Service (AVHS)**
- Safety Driving Support Service
- Automatic Driving Support Service
3. ATMS – Advanced Traffic Management Systems

- **Data Collection**
  - CCTV
  - VDS camera
  - Loop detector
  - Police
  - Users
  - Sudden incidents

- **Information Processing & Monitoring**
  - Traffic Information Center
  - Traffic Information Management

- **Information Provision**
  - Internet
  - VMS
  - Emergency management
  - Traffic management
  - Parking availability info
  - Traffic signal controls
3. ATMS – Advanced Traffic Management Systems

- 3,132 km (100% of total 3,400 km) of expressways are ITS equipped.
- 1,909 km (14% of total 14,224 km) national highways are ITS equipped.

**Before ATMS**
- Concentration of traffic on single road

**After ATMS**
- Traffic info on road ahead provided
- Traffic dispersed to alternate roads/routes
- Reduced congestion & delays
II. ITS Architecture and Services

4. ATC – Advanced Traffic Signal Control Systems

Signal Control Center

1. Vehicle detection, Data Gathering
2. Data Analysis
3. Integrated Signal Information Supply, Data Gathering

Before

After

Intersection 1
Intersection 2
Intersection 3

Signal Controller
Signal Controller
Signal Controller

VDS
VDS
VDS
II. ITS Architecture and Services

4. ATC – Advanced Traffic Signal Control Systems

• Signal Control center: Local Government, Regional Police Agencies
• Under Improvement of Signal Light System: Electronic Controller → Advanced Signal Controller
• Advanced Signal Controller: 10,000 over constructed (expanding)

- Vehicle detection and information collection
- Analysis algorithm
- Optimized signal display algorithm
- Monitoring circumstances at intersections
- Administrator control system
- Manual operation of signal operating cycle

Anticipated Effects

- Increase of 10km/h on average per intersection
- Reduction of up to 170 hours at a certain distance

Change in travel hours per travel distance

Change in travel speed

Before execution: Black
After execution: Yellow

Detection loop

Advanced Signal controller

VDS

Total travel distance (vehicle x km)

Total traffic hours (vehicle-hours)
5. BIS/BMS – Bus Information/Management Systems

- **GPS**
- **Wireless Network** (CDMA, GPS, TRS, Wireless LAN, DSRC)

**Bus Information Control Center**

Local Government → Bus Company

Bus Company → Bus Driver → Passenger

1. **Data Collection**
2. **Data Processing**
3. **Information Supply**

**Before**

**After**

**THE KOREA TRANSPORT INSTITUTE**
5. BIS/BMS – Bus Information/Management Systems

- Capital area, 5 Wide-area cities, local government: Self-construction of BIS
- Local medium-size cities introduced and operating the systems

Bus Information System (BIS)
Bus Operation Management System (BMS)
Facilities
  - OBU
  - Bus stop information display terminal
  - Information display terminal for passengers

Anticipated Effects

- Increased satisfaction with mass transportation
- Improvement of on-time arrivals, reduction of waiting time
- Reduction of accident rate, prevention of aggressive driving
- Management profitability improvement, efficient management

Increase in the number of bus passengers

<table>
<thead>
<tr>
<th>Man/hour</th>
<th>Increase in the number of bus passengers</th>
</tr>
</thead>
<tbody>
<tr>
<td>After Passenger</td>
<td>181 (7.7%)</td>
</tr>
<tr>
<td>Going up</td>
<td>168</td>
</tr>
<tr>
<td>Going down</td>
<td>175 (5.4%)</td>
</tr>
</tbody>
</table>
6. ETCS – Electronic Toll collection Systems

ETCS Vehicle Process
- Toll Center
- ETCS Charging Data
- OBU Info Receiving

"ETCS capacity: 1,800 vehicles /hour"

TCS Vehicle Process
- Toll Center
- TCS Charging Data
- Toll Charging

"TCS capacity: 450 vehicles /hour"
6. ETCS – Electronic Toll collection Systems

- Toll Collection System: 268 tolls and 2,382 lanes (as of December 2007)
- ETCS: 268 Tolls  595 Lanes
- TCS: 268 Tolls 1,787 Lanes

Case Studies for ITS in Korea

ETCS

Anticipated Effects

- Processing time per Vehicle (sec)
- Consumed time (sec)
- Number of processed vehicles (1000 vehicles/day)
- Number of Passed Vehicles per day (/Lane)
### 7. EFC – Electronic Fare Collection & Card

**Bus aggregation systems**
- Bus number
- Location of bus stop
- Boarding date & time
- User information (Adult, child, student)

**Getting off the bus**
- Location of bus stop
- Date & time alighted
- Distance traveled
- Applicable fare

**Transfer to subway**
- Subway station location
- Date & time of transfer

**Getting off the subway**
- Subway station location
- Date & time alighted
- Total distance traveled
- Total fare

**Fare adjustment**

**Subway aggregation systems**
7. EFC – Electronic Fare Collection & Card

- **1. Use of Mass Transportation/Transit/Payment**
- **2. Data Processing**
- **3. Information Supply Exact Calculation**

**Before**

**After**

Traffic Card Management Center

Card & Mobile

User of mass transportation

Transportation company

Bank/card company

Telecommunication provider

The Korea Transport Institute
|| . ITS Architecture and Services

7. EFC – Electronic Fare Collection & Card

- Traffic card system of Local Governments
- Offer Services: mobile phone, credit card, IC card, paper ticket/free transit services
- Number of traffic cards sold: 44.66 million sheets (throughout Korea)
- Number of traffic card users: 47.81 million passengers / monthly
  : (Approx. 70% of total passengers)

- Totalizing system (bus, railroad, etc.)
- Payment control
- Charging and reimbursement
- Card issuing
- Traffic card terminal
- Ticket vending machine
- Traffic card (IC card)

→ Anticipated Effects

- Increased satisfaction with the use of mass transportation
- Guaranteed transparency of transportation profits
- Establishment of a national mass transportation master plan
- Increase in the rate of mass transportation use
- Increase in the rate of traffic card use
8. PIS – Parking Information Systems

1. A parking possibility number
2. Data Processing
3. Information Display

Before

After

Traffic Management Center
8. PIS – Parking Information Systems

- Public parking lots and transit centers of local government
- Parking lots at large department stores and convention centers
- Urban parking towers and underground parking lots of tall buildings

Parking Information System
- Supply of space available for parking lots
- Supply of parking information (Internet/mobile phone)

Parking guidance system
- Calculating number of parked vehicles: sensors under
- Parking guidance: LED displays and indication lights parking spaces

System for controlling vehicle access

→ Anticipated Effects

<table>
<thead>
<tr>
<th>Hovering time</th>
<th>Before</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 min. 15 sec.</td>
<td></td>
<td>4 min. 53 sec.</td>
</tr>
</tbody>
</table>

Reduction of hovering time: 46.1%
Example of operation in Seoul

### Operation of automatic enforcement

<table>
<thead>
<tr>
<th></th>
<th>Parking Violation</th>
<th>Bus-Exclusive Lanes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipped areas</td>
<td>107</td>
<td>35</td>
</tr>
<tr>
<td>Violation criteria</td>
<td>Parked for more than 5 minutes at a no parking area</td>
<td>Used by 35-passenger capacity or smaller vehicles</td>
</tr>
<tr>
<td>Enforcement hours</td>
<td>07:00 ~ 22:00</td>
<td>Bus-Exclusive lane effective hours</td>
</tr>
</tbody>
</table>

1. Warning of illegal parking & stopping
2. Remote Enforcement
3. Message Transmission

Transmit message

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**II. ITS Architecture and Services**

9. PES – Parking and Bus Exclusive Lane Enforcement Systems
10. ATE – Automatic Traffic Enforcement

- Control of signal violations
- Control of speed limit violations
- Control of parking and stop rule violations
- Control of overloaded vehicles

1. Warning of Violation
2. Remote Control
3. Message Transmission
II. ITS Architecture and Services

10. ATE – Automatic Traffic Enforcement

- Automatic Plate number recognition algorithm
- Automatic penalty management
- Signal violation control system
- Parking & stop rule violation control system
- System of control for overloaded vehicles
- System of controlling bus lanes rule violations

Anticipated Effects

Introduction background:
- Increase of traffic demand
- Increase of roadway capacity
- Increased necessity of violation control

- Anticipated effects of ATE system
  - Decreased by 29% in number of traffic accidents
  - Decreased by 40% in number of persons killed by traffic accidents
11. Integrated Traffic Management System

- Bus Information System
- Traffic Signal Control System
- Traffic Card System
- Automatic Control System
- ETCS/TCS
- Bus Rapid Transit Control System
- Parking Information System

Integrated Traffic Management System
### ITS Cities in Korea

#### ITS city – Bucheon

**Summary**
- Population: 864,037 persons (Density: 16,150/㎢)
- Area: 53.50 ㎢
- Location: Nearby Seoul
- Characteristic:
  - Dualistic city
  - Residential area
  - Increase in traffic congestion
  - The entrance and exit vehicle of Seoul and Incheon metropolis circle is many

**Provide Service**
- High-tech signal control system in real-time
- Information provide system (Internet, BIT, Mobile, CNS)
- Exclusive bus lanes/Parking Enforcement system

**ITS Construction object**
- High-tech traffic management control system Construction (expand to U-city combination information center Construction)
- Smooth traffic flow inducement & control
- Efficient use of city & promotion of traffic safety inference
- Monitoring of traffic situation in real-time

**Service conceptual diagram**

- **Collection**:
  - GPS
  - UTIS(CNS)
  - RSE

- **Processing**:
  - Internet
  - CNS
  - Parking
  - VMS
  - Bus stop conduct (BIT)
  - Center control terminal

- **Provision & Control**:
  - Exclusive bus lanes / Illegral parking Enforcement
  - Roadside warning conduct
  - High-tech signal control

- **Location of Bus/unexpected situation information**
Traffic Information System

- Internet Information Service
- CNS (Car Navigation System)
- Real Time Traffic Information
- VMS Information Service
- Parking Information Service

Control & Enforcement

- Drive Feedback System (DFS)
  - School zone warning
- Parking Enforcement
  - Traffic volume measure signal control in real-time

Bucheon ITS Center

Benefit

- Traffic efficiency maximize contribution by high-tech traffic management
- Speed of traffic 5% ▲
- Regular congestion area traffic confusion ▼
- Around parking zone use convenience ▲
- Child traffic accident ▼
- Information provide Service
- Formation base of U-traffic
### ITS city – Ansan

**Summary**

- Population: 740,720 (persons)
- Area: 141.91 km²
- Location: South-Western part of Seoul (bounded by the West sea)
- Characteristic of city
  - Dynapolis
  - Connection in Seoul by subway
  - The zone has a lot of commuting car around
  - Industrial complex & a public corporation

**System organization**

- **Collection**
  - AVI
  - CCTV
  - VDS
- **Processing**
  - ITS center
- **Information Provision**
  - Mobile terminal
  - Bus stop conduct (BIT)
  - VMS

**ITS Construction object**

- Improving efficiency of Traffic Management
- The integrated operation civil official who leads the expansion in the u-city
- Safety improvement
- Transportation information Service/Control & management

**Provide service**

- High-tech signal control system in real-time
- Information provide system (Internet, BIT, Mobile, CNS)
- Exclusive bus lanes/Parking Enforcement System

**U-City service**

- U-Life
- U-Business
- U-Management
- U-Policy
III. ITS Cities in Korea

ITS city – Ansan

**ITS Service**

**Traffic Information Provision**

- Internet, PDA service (Real-time traffic Info., incident, Route Info. Etc.)

**Variable Message Sign**

- Real-time traffic Info.
- General Info.

**CCTV Image data**

**PDA**

**Bit**

**WIM**

**Benefit**

- Improving efficiency of Traffic Management

  - Travel speed increase
  - 31.02
  - 8
  - 37.2
  - 6.26km/h increase efficiency 14% increase

  - Reduce signal cycle & delay
  - Increase vehicle green time
  - 28% by pedestrian push button

**Reduce Traffic accident by Automatic Enforcement System**

- Reduce Accident

  - 2.61
  - 0

- Reduce Accident about 54%

- Reduce deceased about 32%
### ITS city – Chungju

#### Summary
- Population: 208,000 (persons)
- Area: 983.95 km²
- Amount of cars: About 76,000 vehicles
- Location: The Central part of Korea
- Characteristic
  - Urban-rural multifunctional city
  - The fog occurred occasionally
  - Sightseeing city

#### ITS Construction object
- Urban-rural multifunctional city (Traffic operation, forest fire management, TMS, disaster management)
- Improving efficiency of Traffic Management and Enhance safety
- Eco-friendly system construction (ITS Center using solar power)

#### System configuration

**Collection**
- Real-time image data
- CCTV

**Processing**
- Vehicle volume, speed, occupancy data
- Loop Detector

**Control & Provision**
- Urban-rural multifunctional city
- ITS center
- Disaster management briefing room
- Streetlight Remote control System
- Forest fire briefing room
- TMS

#### Provide Service
- Real-time Traffic signal control system
- Parking Enforcement system
- Traffic Information system
- Disaster management system

#### ITS Construction object
- Internet
- Traffic signal Control
- Variable Message Sign
- Parking Enforcement
- Traffic Travel Information
- Incident
### ITS Service

#### Traffic Information
- Internet service
- VMS

#### Traffic Control & Enforcement
- Parking Enforcement
- Traffic signal Control

### Benefit

#### Improving efficiency of Traffic Management
- Reduce Accident & Improve Incident Management
- Reduce Traffic Congestion
- Improve road capacity
- Reduce energy consumption (CO₂, NOₓ etc.)
- Remove illegal parking

#### Building the advanced & welfare city
- Systematize Traffic operation & management infra (center H/W, S/W, N/W, local equipment etc.)
- Integration of Traffic & Urban infra management systems
- Provide variable information related to Traffic, Public & Urban
KOTI enriches the future by securing harmony among humans, the environment and transport.

THANK YOU!

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