1. Introduction of KEC
2. Present ITS of KEC
3. Smart Highway Research
1. Introduction of KEC
- Overview
Korea Expressway Corporation was founded in 1969

“We build roads connect people and cultures, Creating a new world”

Construction, O&M of Expressways, Research & Development …
Core Business

Core Business Areas

- CM: Construction Management
- O&M: Operation & Maintenance
- ITS: Intelligent Transport System
- R&D: Research & Development

Overseas project
- Road Engineering and Construction
- 19 countries

Personnel & Budget

- employees: 4,560
- $9.9 billion
Construction Plan

Present 3,817 km

2020 6,076 km
(7 by 9)

- 7 corridors north-south
- 9 corridors east-west
- Within 30-minutes access to expressways nationwide
- Increase alternative routes

Existing Expressways
Under Construction
Designing process
Future plan
Motor-only way
Traffic Volume of Expressway

Traffic Volume

3.7 million vehicles / day

1.3 billion vehicles / year

Toll Revenue

$ 9.2 million / day

$ 3.3 billion / year
2. Present ITS of KEC

- Components of ITS
- ETCS
- ETMS
Components of KEC’ITS

ETCS - Electronic Toll Collection System
ETMS - Expressway Traffic Management System
TTMS - Tunnel Traffic Management System
ATIS - Advanced Traffic Information System
History of ETMS

- KEC began toll collecting business in 1970
- KEC has introduced semiautomatic toll collection system (TCS) since 1994
- ETCS, called Hi-Pass system has been installed since 2007
Differences of System

ETCS (Electronic Toll Collection) : Hi-Pass

- High tech Electronic Toll Collection System without stopping at toll gates
- The world 1st active-frequency and infrared integrated system
- Reducing 40 thousand tons of CO2 Emission (2010)
- Usage rate : More than 60% of users (2014)

TCS (Toll Collection System)

- Entrance : Automatically Classify Vehicles and Issue Ticket
- Exit : Read the Ticket and Get the Information about Vehicle
- Reducing time for Toll collection
- Users can pay in cash

**Equipment Status**

<table>
<thead>
<tr>
<th>Facilities</th>
<th>Hi-Pass (875 lanes)</th>
<th>TCS (1,920 lanes)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Quantity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closed Type</td>
<td>Entry</td>
<td>Exit</td>
</tr>
<tr>
<td></td>
<td>382</td>
<td>406</td>
</tr>
<tr>
<td>Open Type</td>
<td>87</td>
<td></td>
</tr>
</tbody>
</table>

Processing Speed : Hi-Pass is 3~5 times faster than TCS
Data Flow of ETMS

Data Collection:
- VDS (Vehicle Detection System)
- CCTV
- Hi-pass (DSRC)
- Patrol team / Customer call

Provide Information:
- Variable Message Sign (VMS)
- Traffic Broadcasting System
- Call Center
- Internet, Mobile Phone & etc

Less than 2 Minutes
Ways of Providing information

**Smartphone app**
- 2010 launching of 1st version
- 2012 launching of simplified version
- Traffic Condition and more
  - Downloaded over 12 million times

**Internet**
- http://www.roadplus.com
- Electronic Map, Traffic Condition and more
- http://twitter.com/15882504

**Call center**
- Tel. 1588-2504
- Voice Recognition Service
- Short Message Service

**Broadcasting**
- Public TV (KBS, MBC, SBS)
- Cable, Radio, DMB
- 170 times daily
Field Equipments of ETMS

- VDS (Vehicle Detection System): Image type, Loop type, 1km
- CCTV (Closed Circuit TV): Digital type, 2km
- VMS (Variable Message Sign): Text type, Graphic type, Interchange & Junction points
- AVC (Automatic Vehicle Classification): Loop type, Traffic census points
- DSRC-RSE (Road Side Equipment): RF (Radio Frequency) type, 3~4km
3. Smart Highway Research

- Background of Research
- Overview of Research
- Developed Technologies
Background of Research

Fatal Accidents Examples

2006. 10.
- vehicle crash
- victims : 60 persons

2010. 7.
- Bus fall-off accident
- victims : 24 persons

2011. 12.
- 90 vehicle crash
- victims : 30 persons

Why?

✓ Lack of information ahead
✓ Driver mistakes (drowsiness, drunk, texting, limited & wrong perception)
✓ Un-safety road facilities
✓ Bad weather (fog, heavy rains, storms)
Background of Research

Suggesting New Concept

We need new concept to realize safer and more advanced Future road technology, named SMART Highway

But SMART Highway needs....

✓ Wireless Communication between vehicles (V2V)
✓ Wireless Communication between vehicles and infrastructure (V2I)
✓ Incident road information gathering equipment in real time
✓ Safer facilities avoiding crash and mitigating the damage
Overview of Research

SMART Highway
Intelligent and safe expressway, converging advanced ICT, Automobile, Road technologies

- Budget: $88million (Gov: $64million, Private: $24million)

Core Values
Safety, Convenience, On-time, Eco-friendly
Overview of Research

Organization

MOLIT
Ministry of Land, Infrastructure and Transport

SMART Highway Study & Application Center

Task Management Committee

Core 1
Road Infrastructure
Principal Research Institution: Pyunghwa ENG

Core 2
Road-IT based Traffic management
Principal Research Institution: ITS Korea

Core 3
Tech to link road-vehicle
Principal Research Institution: Metabuild

Core 4
Test site operation & verification
Principal Research Institution: Korea Expressway Corp.

Korea Expressway Corporation
Center Administration Office
Developed Technologies

Test site

Section
- Gyeongbu expressway - Seoul TG ~ Suwon IC (11km, 8~10 lanes)

Selection Reason
- Traffic accident-prone and chronically congested section

Period
- Construction: 2013.12 ~ 2014. 6
- Operation: 2014. 7 ~ Present
Developed Technologies

SMART RSE (Road Side Equipment)

- Open Platform SMART RSE development for Seamless Communication service Using WAVE communication technology
- Possible to accommodate various communication system (Wi-Fi, DSRC, WAVE)

### WAVE/Wireless Access in Vehicular Environments:
Next generation wireless communication technology to exchange Data between high-speed vehicles (V2V) and between the vehicles And roadside infrastructure (V2I)

<table>
<thead>
<tr>
<th>Category</th>
<th>WAVE</th>
<th>DSRC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>5.850 ~ 5.925GHz</td>
<td>5.8GHz</td>
</tr>
<tr>
<td>Bandwidth</td>
<td>10MHz</td>
<td>10MHz</td>
</tr>
<tr>
<td>Modulation method</td>
<td>OFDM(MDM)</td>
<td>ASK</td>
</tr>
<tr>
<td>Transmission speed</td>
<td>Max. 27Mbps</td>
<td>1Mpbs</td>
</tr>
<tr>
<td>Vehicle speed</td>
<td>Max. 200km/h</td>
<td>Max. 160km/h</td>
</tr>
<tr>
<td>Radius of communication</td>
<td>Max. 1000m</td>
<td>Max. 100m</td>
</tr>
<tr>
<td>Support</td>
<td>V2I, V2V, Handover</td>
<td>V2I</td>
</tr>
</tbody>
</table>
SMART IDS (Incident Detection System Using Radar)

- Radar frequency: 34.5 GHz
- Detect range: 1 km, 5 lane road (Approx. 20 m)
- Detect Objects: Fallen obstacle, wrong way vehicle, stopped car, road condition (icy), jaywalker
Developed Technologies

SMART IDS (Incident Detection System Using Radar)
SMART-I (Incident Detection System using Camera)

- Component: Array camera, Tracking CCTV, Radar
- Detect range: max. 1km
- Detect Objects: Fell off obstacle, wrong way vehicle, Stopped car, jaywalker
Developed Technologies

SMART-I (Incident Detection System using Camera)

Array Camera (7 cameras inside)
- Detecting unexpected event
  - Fallen object
  - Car driving wrong way
  - Car in sudden stop
- Coverage: 1km (Radius 0.5km)

Auto Tracking CCTV
- Automatic tracing and showing the place occurred on unexpected event
- Using CCTV of High-Definition, High-Magnification
Developed Technologies

SMART-I (Incident Detection System using Camera)

Operation S/W (Center)

Test Operation
Results of Test (Unexpected Situation Detection)

- Goal: Performance Standard of VDS

SMART IDS: 95% Goal, 96% Record
SMART - I: 95% Goal, 97% Record
Developed Technologies

SMART Tolling (None stop, Multi-lane)

✓ It can collect tolls despite driving lane change, passing through a gantry at high speed
✓ Drivers can use **SMART Tolling** with existing RF/IR OBU (On Board Unit)
Developed Technologies

Results of Test Operation (Various rate)

- Period: 1 year (2013. 11. ~ Present)
- Goal: Avarage Performance of HI-Pass

Goal | Record
---|---

**Communication accuracy**
- 99.5%
- 99.9%

**Detection accuracy**
- 99.7%
- 99.9%

**Matching accuracy**
- 99.0%
- 99.2%

**Photo accuracy**
- 98.0%
- 99.4%

**Recognition accuracy**
- 97.0%
- 97.8%
Developed Technologies

Testing Wave Tolling (Non stop, Single-lane)

✓ WAVE Antenna (5.9GHz) has been installed on the existing Hi-Pass (ETCS) gantry.
THANK YOU!

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