Introduction to Hi-pass & Smart Tolling System

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Toll Collection Systems

Technology Design Considerations
- Accuracy, Reliability, Functionality, Standards, Operations

Toll Collection Process Segments

Motorist Sub-System
- Traffic Information System
- Personal Interface System

Toll Collection Sub-System
- Toll Collection Components
- Traffic Control Components
- Video Tolling & Enforcement System
- Vehicle Detection And Classification System
- Data Storage System

Back Office Sub-System
- Image Processing Centre
- Call Service Centre
- Computer System
- Asset Management System
- Financial System Interface
- Billing & Accounting System

Source: Booz Allen Hamilton
Toll Collection Processing & Method

(1) Inform \(\rightarrow\) (2) Detect \(\rightarrow\) (3) Classify \(\rightarrow\) (4) Declare

Source: Booz Allen Hamilton
# Toll Collection Process Segments

<table>
<thead>
<tr>
<th>Toll Options</th>
<th>Toll Volumes</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manual</td>
<td>250 - 350 VPH</td>
<td>98.00%</td>
</tr>
<tr>
<td>Automatic Coin Machine w/ Barrier (five coins)</td>
<td>450 - 550 VPH</td>
<td>98.50%</td>
</tr>
<tr>
<td>Automatic Coin Machine w/o Barrier (one coin/token)</td>
<td>500 - 700 VPH</td>
<td>95.00%</td>
</tr>
<tr>
<td>Vouchers/Script</td>
<td>500 - 900 VPH</td>
<td>98.50%</td>
</tr>
<tr>
<td>ANPR</td>
<td>600 - 1000 VPH</td>
<td>85.00%</td>
</tr>
<tr>
<td>Smart Card w/Barrier</td>
<td>700 - 900 VPH</td>
<td>99.50%</td>
</tr>
<tr>
<td><strong>Now</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electronic Toll Collection - Dedicated Lane w/Barrier</td>
<td>900 - 1100 VPH</td>
<td>99.96%</td>
</tr>
<tr>
<td>Electronic Toll Collection - Free Flow Lane</td>
<td>1800 - 2400 VPH</td>
<td>99.25%</td>
</tr>
</tbody>
</table>

Source: Booz Allen Hamilton
Examples of Toll Collection System

Manual

Automatic Coin Machine
Examples of Toll Collection System

Single Lane – ETC
(Japan)

Free Flow - Hybrid Toll
(Express E-Zpass, USA)

Multi Lane Free Flow
(City Link, Australia)
Change of Toll Collection Systems in Korea

- Manual
- TCS(Magnetic)
- Smart card

ETCS(Hi-pass)
Hi-pass System

Milestones

1997. 12 : Decision for the ETCS promotion (National ITS Master Plan)

2000. 6 : Passive RF Test Operation

2001. 7 : Notification Active RF type in ETCS of the Ministry of Information and Communications

2004. 2 : Introduce Infra-red type in Hi-pass

2005. 10 : Dual System Operation (Active RF, IR)

2007. 12 : Nationwide Operation of Hi-pass (262 Tolls)

2011. 11 : Automatically pay toll without stopping at tollgate (Nationwide 344 Tolls, 868 Lanes, 6.2 million OBU’s)
Hi-pass System

Specification

- **Smart Card**
  - ISO 7816, ISO 14443 B Type
  - 3 type: Pre-paid, Credit, Automatic Charging

- **OBU & Communications**
  - IR(870nm), Active RF(5.8GHz) type
  - Data Rate: 1Mbps(up/down)
  - OBU & Communications
  - More than 80 models (IR, RF, Navi, Mirror)

- **Performance & Accuracy (up to 160km/h)**
  - Communications: more than 99.5%
  - Vehicle Classification: 97%
  - Enforcement Camera: 95%
It is very efficient to use those Hi-pass OBU equipped cars as a probe car data for traffic management.

Installed on All Expressway
Local government’s Fund + Subsidy from MLTM
MLTM decide the city and the scale of subsidies for each city based on the evaluation of the project proposals and performance

Status
In 2009, deploy ATMS at 14 cities
In 2010, deploy ATMS at 9 cities
In 2011, deploy ATMS at 6 cities
Smart Tolling System

Backgrounds
- To develop the advanced payment system for using various methods with accommodating existing Hipass technologies
- R&D of Electronic Payment System based on various of wireless communication
- Period of R&D : 2009~2014
- Total Budget : 14.7 billion won

Goal
- To realize the non-stop electronic tolling system under the conditions of high speed driving and multi-lane during 24hours and all year around
- To accommodate the existing ETCS system(Hi-pass) To provide all the users of Smart expressway with convenient payment system
- To establish the flexible platform for electronic payment system to accommodate the future technology as well as the current one
Smart Tolling System

Main Item

Ongoing R&D (3rd Year, 40% done)  Additional R&D (Launch on 2011.10)

Smart Electronic Payment System

- #1 Antenna
- #2 Antenna
- #1 Enforcement Camera
- #2 Enforcement Camera
- Vehicle Classification Unit
- Smart Lane Controller

Any Media Electronic Payment System

- Mobile Communication Transmission
  - GPS Antenna (Positioning location)
- Enforcement: 2 cameras / 1 lane
- Laser Vehicle Classification
- Vehicle Detection: Loop, Laser
- D3 Gantry

- Smart Electronic Payment System
  - DSRC
  - Enforcement: 2 cameras / 1 lane
  - Laser Vehicle Classification
  - Vehicle Detection: Loop, Laser
  - D3 Gantry

- Any Media Electronic Payment System
  - WAVE, WCDMA, Wibro, WLAN
  - Obtain vehicle ECU information through CAN communication → Vehicle class detector X
  - DSRC, WAVE, GPS coordinates → Vehicle detector X
  - WAVE antenna 1 set / DGPS antenna 2 set
Smart Tolling System

System Configuration (Except for Any-media Tolling System)

- #1 Antenna
- #2 Antenna
- #1 Enforcement Camera
- #2 Enforcement Camera
- Vehicle Classification Unit
- Smart Lane Controller
- IR Antenna: Accuracy 99%
  Infrared type Multi-Lane Free-Flow
- RF Antenna: Accuracy 99%
  Active RF DSRC type Multi-Lane Free-Flow

**Enforcement Camera**
Recognition rate: 95%
Back & forth image max. 160km/h
Cover the Multi-lane (1.5 lane)

**Vehicle Classification**
Accuracy: 97%
6 types of vehicle classification
Max 160km/h

**Smart Lane**
Matching accuracy: 99%
Multi-lane matching
Available the Hi-pass OBU & without OBU
Action Plan of Smart Tolling R&D

Smart Tolling System

- Accounting Reservation S/W
- Smart Tolling Function Unit H/W & S/W
- Build FOT Unit Test
- Connected Test Performance Evaluation
- Remote Monitoring Customer Service
- Any-media Tolling System

- Lab Test
- Development & Test
- Complete & Commercialization
- Performance Test & Improvement

- System Construction on Test Bed (Any-media Smart Tolling R&D Start)

Timeline:
- '11.6
- '11.10
- '12.6
- '13.6
- '14.6
Action Plan of Smart Tolling R&D

YeoJu Testbed – Smart Tolling System

Step 1 : Build FOT & Unit Test
Step 2 : System Integration & Unit Connected Test
Step 3 : Performance Test
Expected Effectiveness

- **Toll Road & Implementing Toll collection System**
  - By implementing multi-lane Smart Tolling, congestion charge/toll collection in highway and center of metropolitan, local government paid road, parking lot and Tunnel

- **Contribute to growth of Electronic Financial Industry**
  - Promote the grow of domestic/international Electronic finance Industry by developing the system for toll collection and its accounting

- **Technology Transfer to Traffic Developing Country**
  - Transfer Road charging Technology to overseas country
  - Transfer Multi-lane ETC system to countries using Mono lane system

- **Reduction of CO₂ emission**
  - Reduce the CO₂ emission by decreasing traffic daily and congestion caused by issuing the toll ticket and blocking the lanes for maintenance
Thank you!

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