Free-flow Multi-lane SMART TOLLING SYSTEM

Na-kyung Nam, Smart Highway Project Team
Seoul Women’s University
2014.04.18
Contents

- Toll System History & State
- Technology trends
- Background and Necessity
- Research development
Toll System History & State
Toll System History

1970 ~ 1994
- Manual Collecting

1994 ~
- Toll Collection System

2007 ~
- ETCS
Toll System State

- **Hi-Pass System**
  - 4-Types OBU, 5.5 millions OBU, 27 Companies, 124 Models
    - General (80%)
    - Room Mirror (16%)
    - Navigation (4%)
    - Disabled Person (0.1%)

- 2-Types Smartcard, 11.5 millions Card
  - Prepayment card (37%)
  - Credit card (Post payment) (63%)
High-Pass OBU supply: Increased by more than 10 times in 5 years

Day by car: 4 times the increase over
Technology Trends
Technology Trends

Asia, Oceania

Korea
Hi-Pass
Active DSRC Dual System (5.8GHz, IR)

Singapore
ERP
Passive DSRC 5.8GHz

Australia
E-Toll
Passive DSRC 5.8GHz
Technology Trends

Canada
ETR
RFID (Tag) 900MHz

America

Western US
Fast Track
RFID (Tag) 900MHz

Central US
Sun Pass
RFID (Tag) 900MHz

Eastern US
E-Zpass
RFID (Tag) 900MHz
Technology Trends

Europe

England
Congestion Charge
ANPR

Germany
Truck Tolling
Passive GSM/GPS, DSRC 5.8GHz
Background and Necessity
Background and Necessity

Electronic Toll Collection System
- Law speed
- Congested lanes are closing for maintenance

Smart Tolling System
- High speed
- 24 hours 365 days non-stop operation
- Smoothly
- Eco-friendly

Free-flow Multi-lane SMART TOLLING SYSTEM
Research Development
Research development

- Vision

Any device, Any Lane
Free-flow, Multi-lane
Smart Tolling System

- Definition

Smart Highway

Road Technology + IT Technology + Automotive Technology
Research development

Core Values

- **Limitations of the existing system**
  - Single-Lane
  - Stop and then Charge
  - Maintenance after blocking

- **Smart Tolling System**
  - Multi-Lane
  - Free-Flow
  - 24-hour non-stop operation

- **Convenience**
  - Diversification of payment means
  - Diversification of payment method
  - Autonomous driving without acceleration and deceleration

- **Safety**
  - Keep driving on the main line
  - No change line
  - No non-stop blocking

- **Accuracy**
  - Max 160km/h – Min 100km/h guarantee
  - Remove the flow block of the traffic

**Smart Highway traffic operations of high speed environment and designed to maximize management efficiency research**
Research development

- Goal

**Step 1** 2009~2010
- Requirements elicitation and System design
- System construction of 3 gantry Smart Tolling System (YeoJu Experience Road)
- Any Media Electronic payment system design

**Step 2** 2011~2012
- Core-based technology development

**Step 3** 2013~2014
- Change from 3 gantry to 2 gantry
- Development of technology for the commercialization
- Apply to Real Road (Toegyewon IC)

Technical requirements analysis and design
Research development

- System Configuration

- Vehicle Classification Unit
- RF antenna
- IR antenna
- Enforcement Camera #1
- Enforcement Camera #2

1st gantry
Recognize and categorize a vehicle by type and charge toll

2nd gantry
Filming the plate number of vehicles that did not pay toll
Research development

- SMART Highway test road

- Completed performance test for Electronic Toll Collection System on non-stop/multilane roads.
- Completed tests for various requirements such as fee charging, multilane/high speed based communication, vehicle differentiability and additional video for vehicles that evade fee charges

[2012.05 Yeoju SMART Highway test road ]
Research development

- Public Highway Pilot operation

Public Highway System construction on Seoul Outline highway Toegyewon IC
Early Commercialization by real highway operation

[2013.11 Public Highway System pilot operation : Seoul Outline highway Toegyewon IC]
Early Commercialization for 2 lane

By promoting the commercialization and the early commercialization of technology research based on the construction lane of Free-flow Multi-lane Smart Tolling

- Location: SeoBusan Toll gate 2 point, Southern Sea 2 local line
- When: Scheduled for the end of July, 2014
### Expected Effectiveness

- **Comparison of CO2 emissions per year**
  - High-Pass: 152 ten thousand metric tons/year
  - Smart Tolling: 86 ten thousand metric tons/year
  - 43% Decrease

- **Compare vehicle processing capacity per lane**
  - Crossing gate: 1,200 number/hour
  - No crossing gate: 1,800 number/hour
  - Smart Tolling: 2,170 number/hour
  - 17~45% increase

- **High-pass by car traffic accident current state**
  - 2008: 32 units
  - 2009: 24 units
  - 2010: 29 units
  - 2011: 40 units
  - 2012: 32 units

Unit: number/week
Thank you