Korea Expressway Corporation

INTRODUCTION of KEC' ITS

May. 2015

Ahn, Ji-sung
Senior Manager / Overseas Project Division
Korea Expressway Corporation
E-mail : earing76@ex.co.kr

Contents

Korea Expressway Corporation

1. Introduction of KEC

2. Present ITS of KEC

3. Smart Highway Research

Korea Expressway Corporation

1. Introduction of KEC

- Overview

Mission &Function

Korea Expressway Corporation

- 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 …

Construction, O&M of Expressways	Installation & Management of Subsidiary Facilities	Development of Areas Adjacent to Expressways	Research & Development




Core Business

Korea Expressway Corporation

Core Business Areas

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

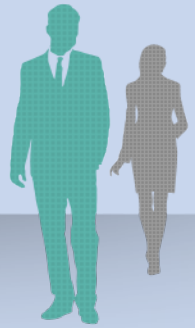
Overseas project

- Road Engineering and Construction
- 19 countries

Personnel & Budget

Organization

Korea Expressway Corporation



Auditor

President

BOD

Vice President

- Planning
- Administration
- Traffic Management
- Construction Management
- Business Management

- Regional HQ (7)
  - Maintenance Office (52)
    - Toll Office (336)
- Construction Office (15)
- Expressway & Transportation Research Institute
- Traffic Information Center

Construction Plan

Korea Expressway Corporation

Present	3,817 km
2020 (7 by 9)	6,076 km ● 7 corridors north-south ● 9 corridors east-west ● Within 30-minutes access to expressways nationwide ● Increase alternative routes

Traffic Volume of Expressway

Korea Expressway Corporation

Traffic Volume

3.7 million vehicles / day

1.3 billion vehicles / year

Toll Revenue

$ 9.2 million / day

$ 3.3 billion / year

PR Video of KEC

Korea Expressway Corporation

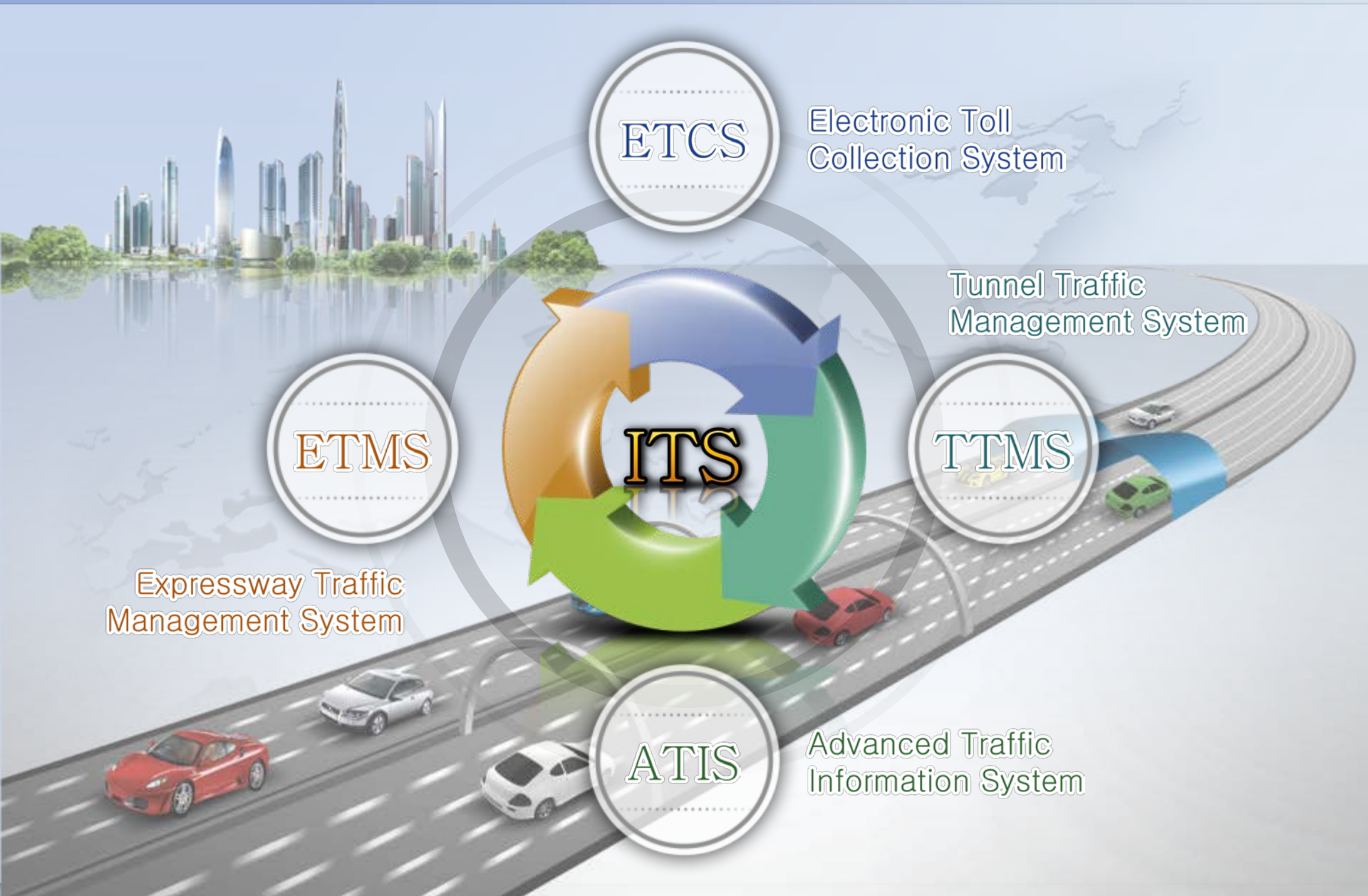
Korea Expressway Corporation

2. Present ITS of KEC

- Components of ITS
- ETCS
- ETMS

Components of KEC'ITS

Korea Expressway Corporation



History of ETMS

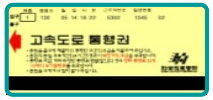
Korea Expressway Corporation

- 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

1970 ~ 1994

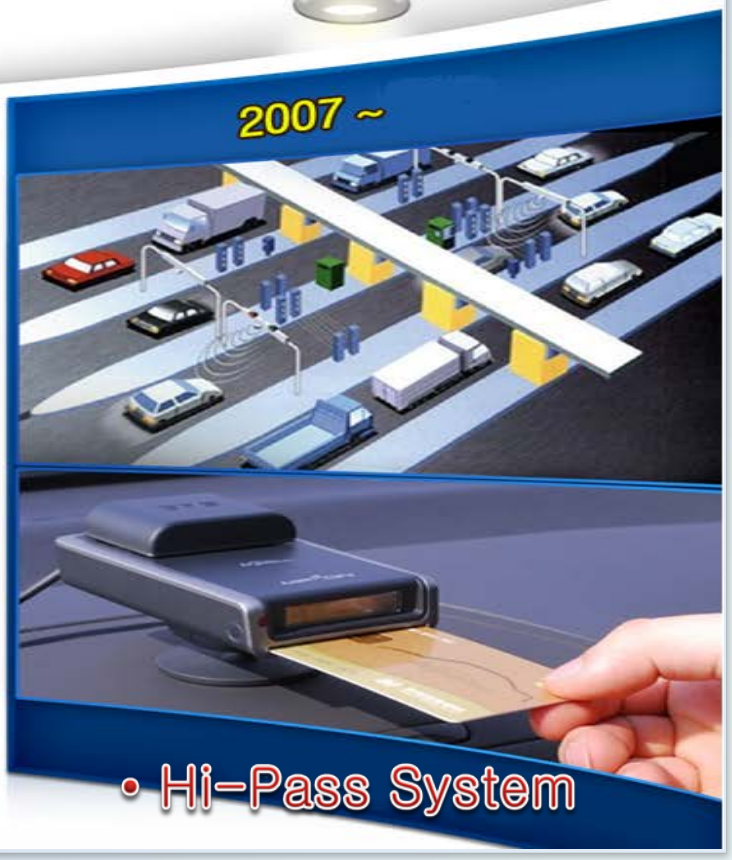
• Manual Collecting

1994 ~



• Toll Collection System

2007 ~



• Hi-Pass System

Differences of System

Korea Expressway Corporation

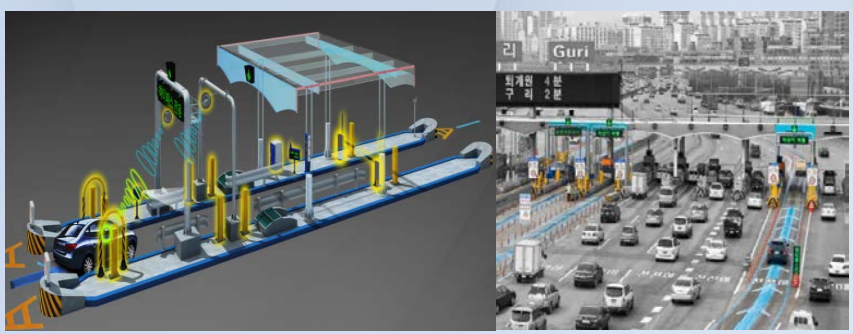
Equipment Status

Facilities	Hi-Pass (875 lanes)			TCS (1,920 lanes)		
Quantity	Closed Type		Open Type	Closed Type		Open type
	Entry	Exit		Entry	Exit	
	382	406	87	621	1,142	157

Processing Speed : Hi-Pass is 3~5 times faster than TCS

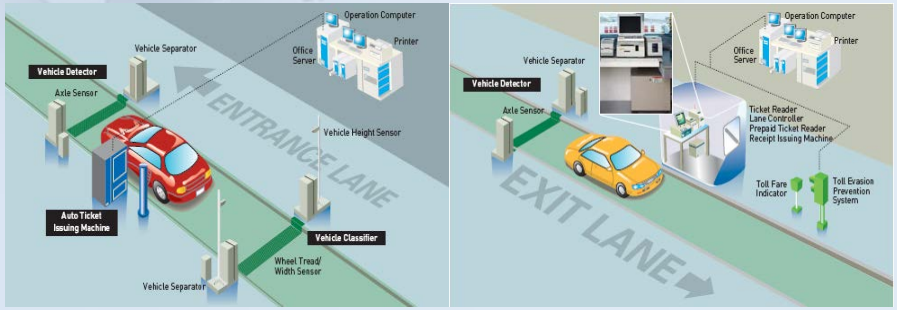
ETCS(Electronic Toll Collection) : Hi-Pass

- 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



Data Flow of ETMS

Korea Expressway Corporation

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

Provide Information

Variable Message Sign (VMS)

Traffic Broadcasting System

Call Center

Internet, Mobile Phone & etc

Less than 2 Minutes

Ways of Providing information

Korea Expressway Corporation

Smartphone app

- 2010 launching of 1st version
- 2012 launching of simplified version
- Traffic Condition and more

Downloaded over 12million 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

Korea Expressway Corporation

- 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

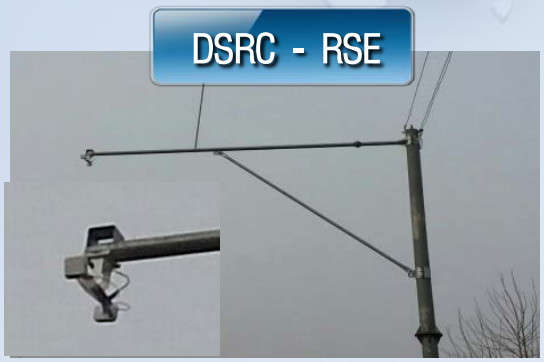
VDS(Image)

CCTV

VMS(Text)

VDS(Loop)

DSRC - RSE



VMS(Graphic)

3. Smart Highway Research

- Background of Research
- Overview of Research
- Developed Technologies

Background of Research

Korea Expressway Corporation

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

Korea Expressway Corporation

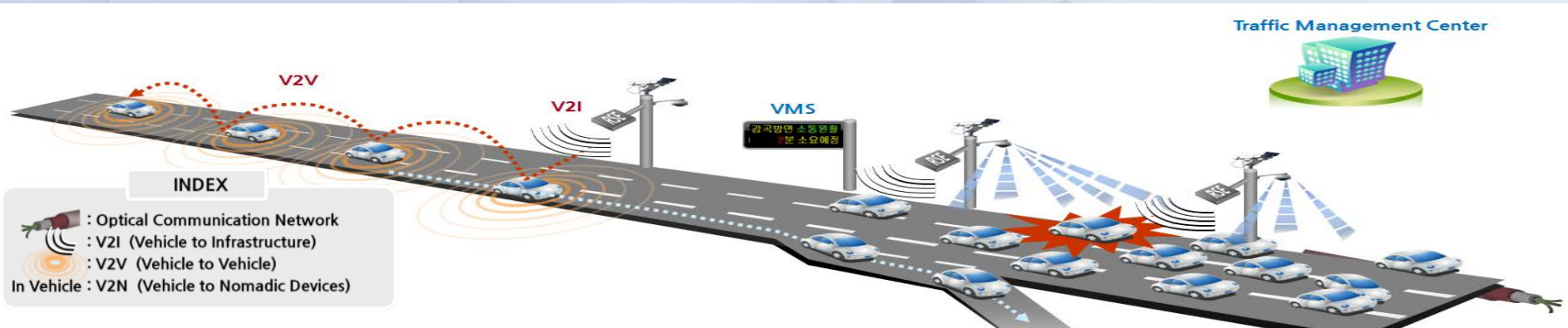
Suggesting New Concept

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

Korea Expressway Corporation

SMART Highway

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

- Period : 2007. 10 ~ 2014. 12
- Budget : $88million(Gov : $64million, Private : $24million)

SMART Highway

Advanced ICT

Automobile

Road-Infra

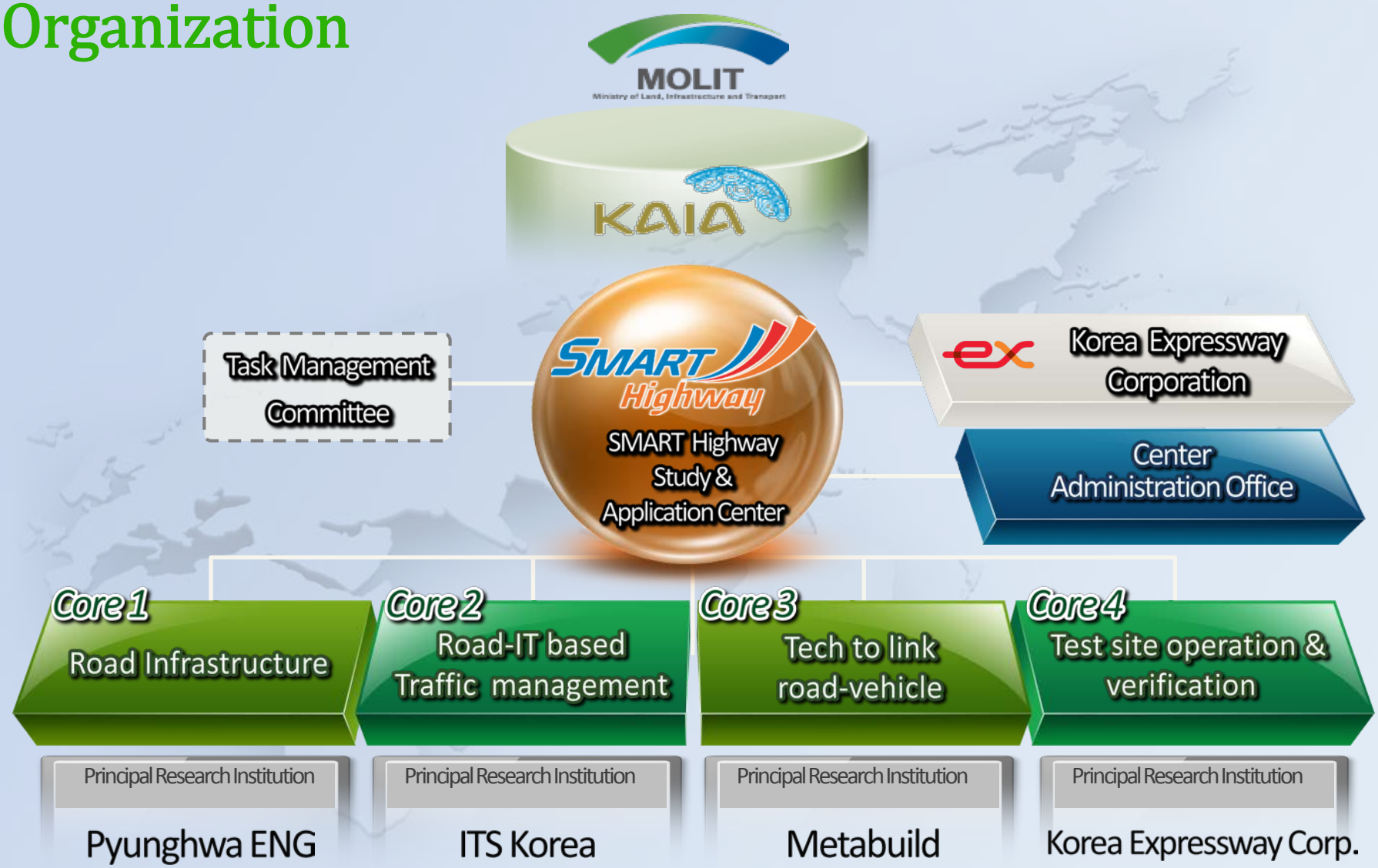
Core Values

Safety, Convenience, On-time, Eco-friendly

Overview of Research

Korea Expressway Corporation

Organization



Developed Technologies

Korea Expressway Corporation

Test site

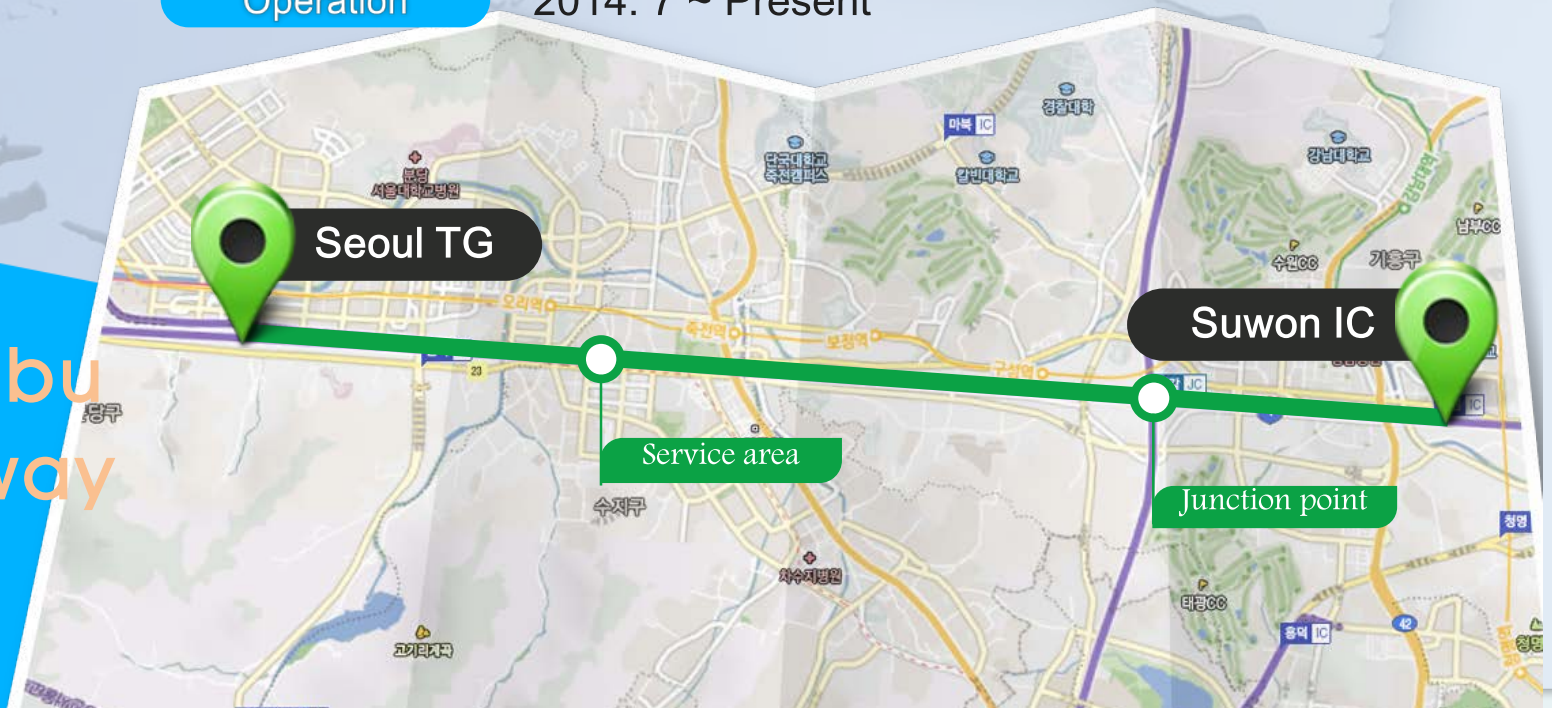
Section — Gyeongbu expressway - Seoul TG ~ Suwon IC(11km, 8~10 lanes)

Selection Reason — Traffic accident-prone and chronically congested section

Period

- Construction: 2013.12 ~ 2014. 6
- Operation: 2014. 7 ~ Present

Gyeongbu Expressway

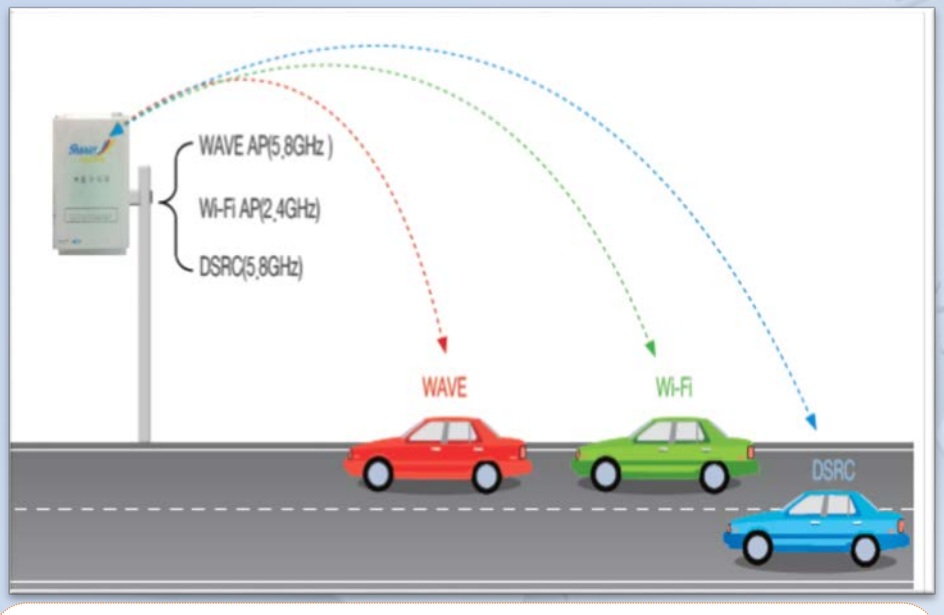


Developed Technologies

Korea Expressway Corporation

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)

Category	WAVE	DSRC
Frequency	5.850 ~ 5.925GHz	5.8GHz
Bandwidth	10MHz	10MHz
Modulation method	OFDM(MDM)	ASK
Transmission speed	Max. 27Mbps	1Mpbs
Vehicle speed	Max. 200km/h	Max. 160km/h
Radius of communication	Max. 1000m	Max. 100m
Support	V2I, V2V, Handover	V2I

Korea Expressway Corporation

SMART IDS(Incident Detection System Using Radar)

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

Radar

Korea Expressway Corporation

SMART IDS(Incident Detection System Using Radar)

Operation S/W(Center)

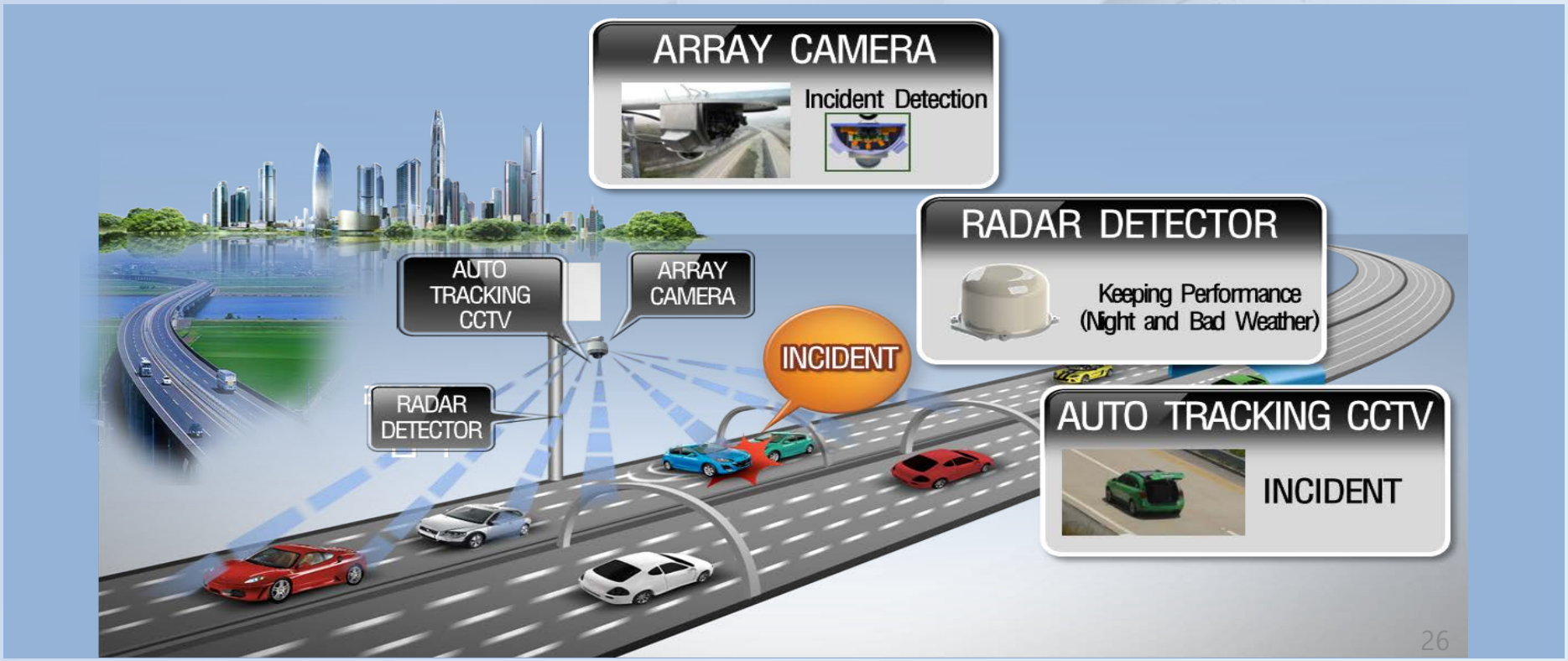
End-user UI(In vehicle)

Test Operation

Korea Expressway Corporation

SMART-I(Incident Detection System using Camera)

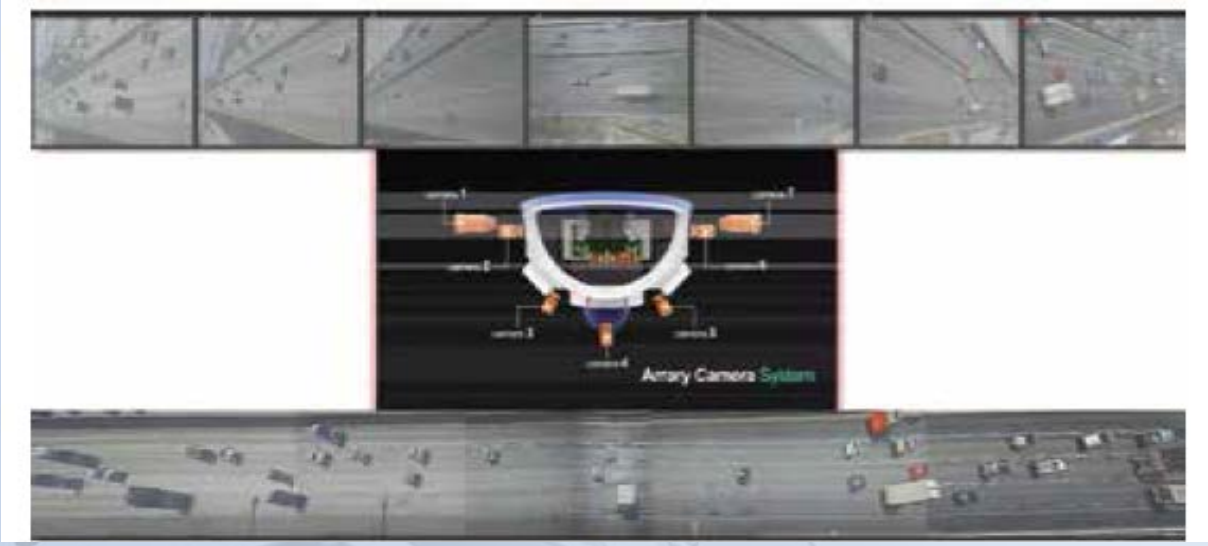
- ✓ Component : Array camera, Tracking CCTV, Radar
- ✓ Detect range : max. 1km
- ✓ Detect Objects : Fell off obstacle, wrong way vehicle, Stopped car, jaywalker



Developed Technologies

Korea Expressway Corporation

SMART-I(Incident Detection System using Camera)



Array Camera(7cameras 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 shooing the place occurred on unexpected event
- Using CCTV of High-Definition, High-Magnification

Developed Technologies

Korea Expressway Corporation

SMART-I(Incident Detection System using Camera)

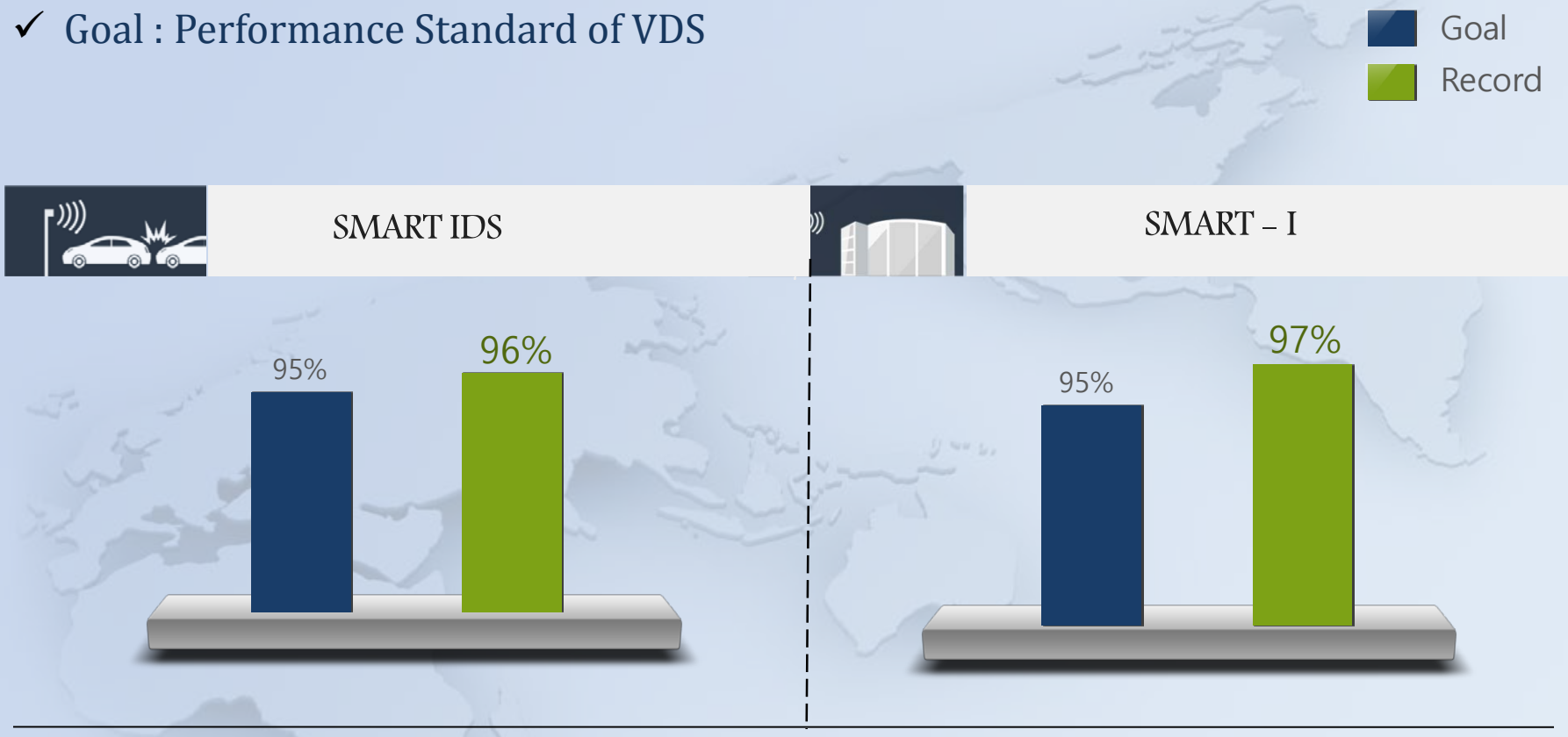
Operation S/W(Center)

Test Operation

Korea Expressway Corporation

Results of Test(Unexpected Situation Detection)

✓ Goal : Performance Standard of VDS

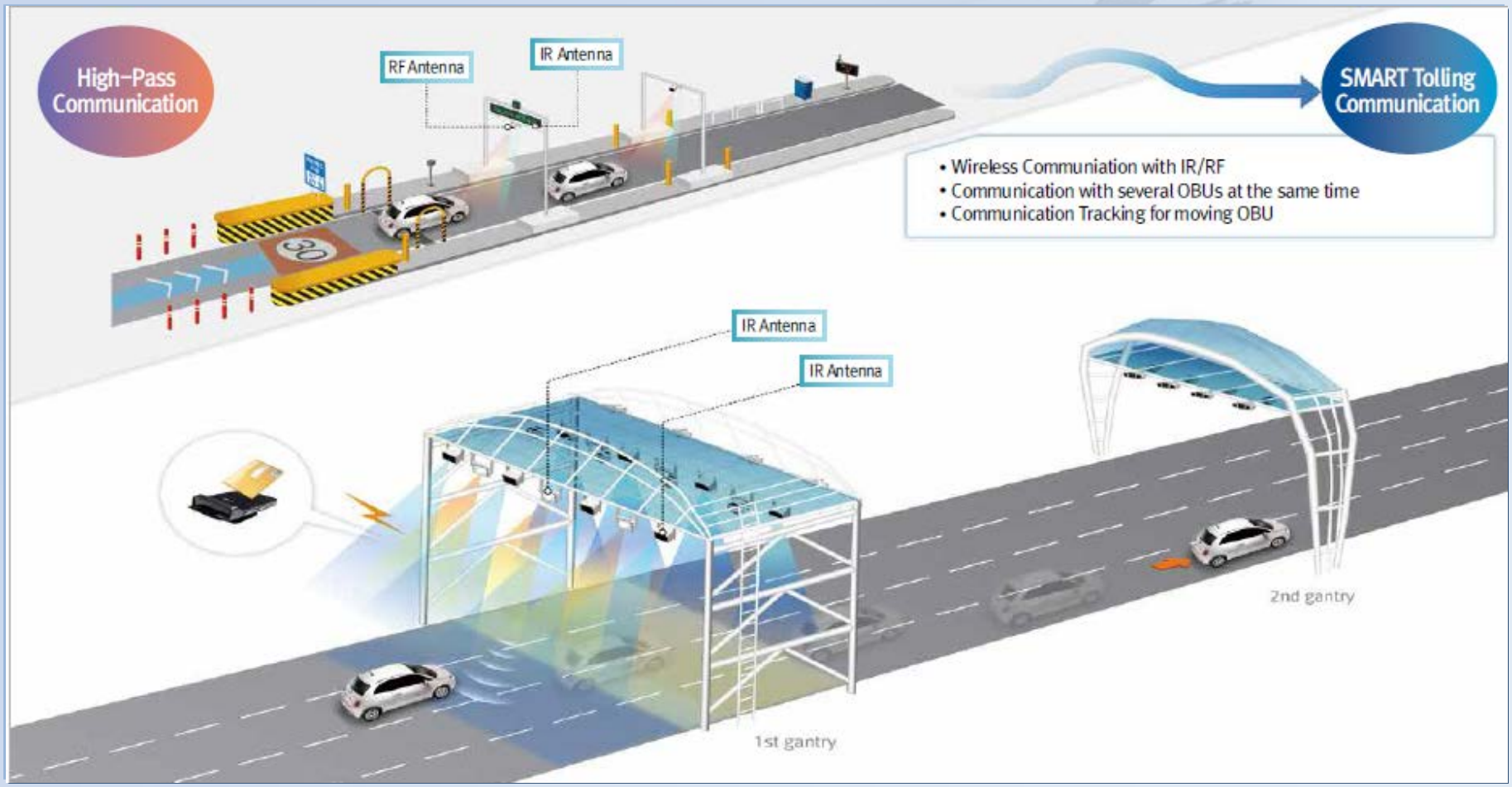


Developed Technologies

Korea Expressway Corporation

SMART Tolling(None stop, Multi-lane)

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



Developed Technologies

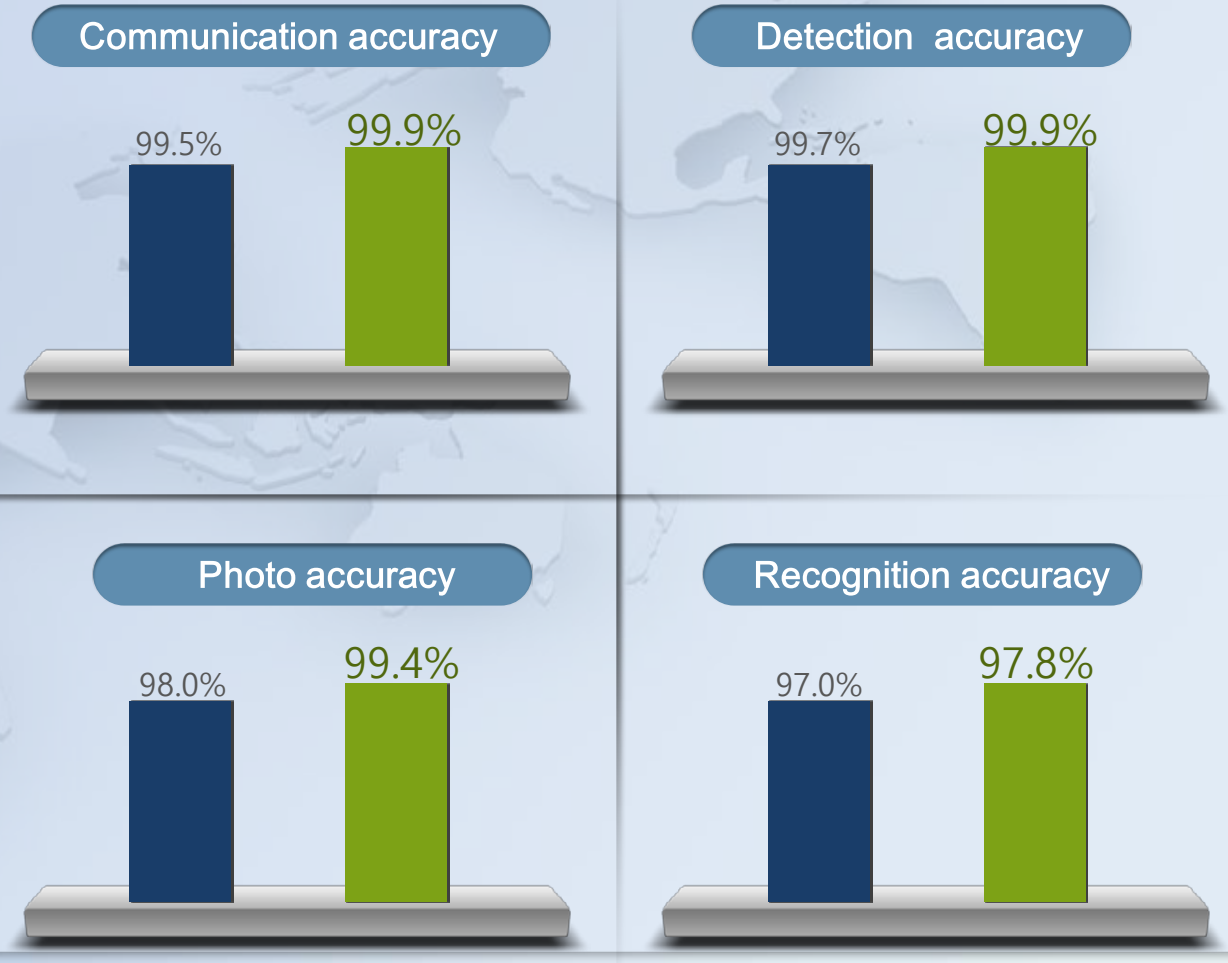
Korea Expressway Corporation

Results of Test Operation(Various rate)

✓ Period : 1 year(2013. 11. ~ Present)

✓ Goal : Avarage Performance of HI-Pass

❖ Seoul Outer Ring Expressway



Developed Technologies

Korea Expressway Corporation

Testing Wave Tolling(Non stop, Single-lane)

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

Korea Expressway Corporation

THANK YOU!

Ahn, Ji-sung
Senior Manager / Overseas Project Division
Korea Expressway Corporation
E-mail : earing76@ex.co.kr