Directions for Linking Big Data with Transportation Policies

Introduction to TOPIS, a city management hub

Seoul Metropolitan Government

ITS Global Leader, the Seoul TOPIS

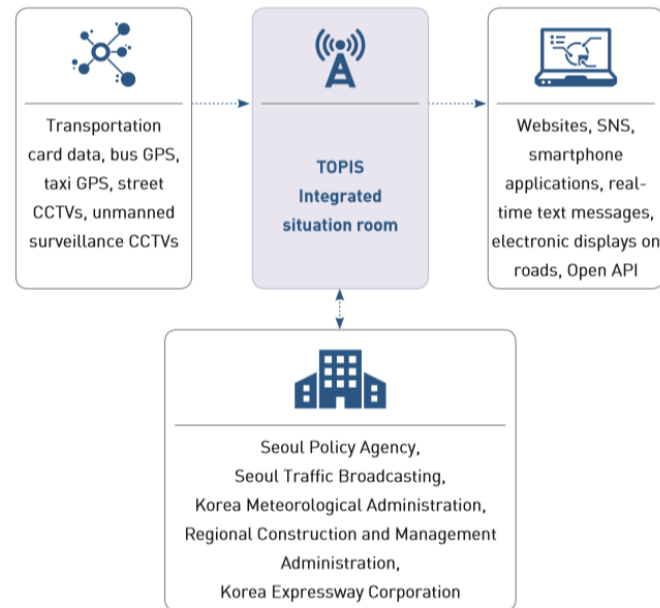## Seoul **TOPIS** (Seoul Transport Operation and Information Service)

Seoul TOPIS is the Intelligent Transportation System (ITS) brand of Seoul Metropolitan Government. As the first-of-its-kind service in Korea, it was introduced in 1998 to address urban transportation problems.

TOPIS 3.0, a city management hub

TOPIS 3.0 is a smart metropolitan city management hub that manages transportation, disasters, and other security-related events in an integrated manner. It is an advanced transportation information system that allows prompt judgments and responses to be made in times of emergency and predicts and prevents transportation problems through big data analysis.

Information flow chart

Transportation card data, bus GPS, taxi GPS, street CCTVs, unmanned surveillance CCTVs → TOPIS Integrated situation room → Websites, SNS, smartphone applications, real-time text messages, electronic displays on roads, Open API

Seoul Policy Agency, Seoul Traffic Broadcasting, Korea Meteorological Administration, Regional Construction and Management Administration, Korea Expressway Corporation

TOPIS 1.0 Seoul TOPIS

2004 : Opened TOPIS and installed the Smart Card System
2005 : Introduced the Unmanned Regulation System

1998

2004

"The starting point" of ITS in Seoul

1998 : Implemented the ITS in Nam-San area(10.6km)
2000 : Adopted and advanced traffic management
systems in urban expressways

TOPIS 3.0

SEOUL TOPIS

2013 : Opened the integrated control center to cover transportation, disasters and emergency response
2014 : Released the TOPIS Platform (Seoul's ITS Solution)

2008

2013

TOPIS 2.0

SEOUL TOPIS

2008 : Installed Bus Information Terminals (BIT) on a pilot scale and expanded it
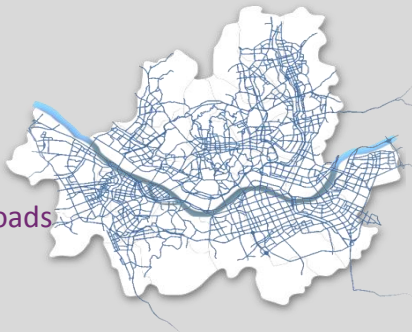2009 : Opened the mobile transportation information service
2010 : Opened the transportation data in the private sector
2011 : Introduced standard designs for ITS facilities (VMS, VDS)

ITS Global Leader,
The Seoul TOPIS

1,436km
Extended length of roads for travel speed data collection

App. 70,000 vehicles
No. of taxis where GPS data can be collected

VDS
Volume Speed Incident – for contingencies e.g. traffic volume/speed/accident

1,969 detectors

477 CCTVs
24-hour traffic surveillance & monitoring

339 Variable Message Signs(VMS)

반포IC 방향 / 이수교차로 방향

4,070 controllers
Real-time traffic signal controller

92systems
Lane Control System (LCS)

31 systems
Ramp Metering System (RMS)
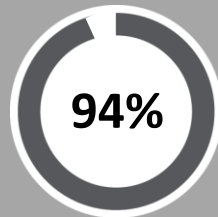
68%

with BIT installed in bus stops out of total

4,506

서울역 버스환승센터 02-006
100   5분   151   7분
421 저상 8분 504 10분
1711   6분 7011 15분
SEOUL TOPIS
곧도착 : 471

Bus Information Terminal

1200요금
34800단위
T money

9,453 devices
BMS & Transportation card devices

94%
Accuracy on bus information

96%
User Satisfaction
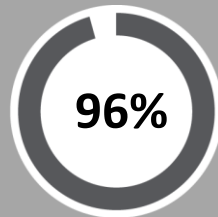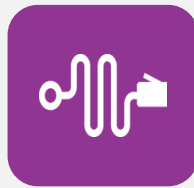
API OPEN DATA information traffic

24 mil. cases/day
The number of open data (traffic & bus information)

85 mil. cases/day
The number of transportation card date being collected

367 km
The length of the autonomous transportation network of Seoul

3,000 Persons/year
No. of foreign visitors experiencing Seoul TOPIS

Introduction to TOPIS : Seoul TOPIS Today (2)

ITS Global Leader, The Seoul TOPIS
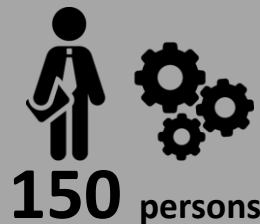
308
Unmanned Regulation System
(Surveillance for illegal parking, exclusive bus & bicycle lane violation)

4 teams

31 persons

Organization of TOPIS

150 persons
Involved in maintenance personnel

Media platforms

Web, Mobile

Broadcasting (Radio, IPTV)

VMS & BIT SNS, LED Sign

240,000
cases/year
The number of penalties being charged

157km

Length of roads based on traffic condition forecasts

Main System of Seoul TOPIS : Integrated Control Center System

ITS Global Leader,
The Seoul TOPIS

Control Tower

Real-time Response and Analysis

24-hour Integrated Monitoring and Surveillance
(Road traffic, Transit, Disaster & Emergency management)

Data Integration & analysis

Monitoring

Control & Operating

Analysis

VDS/CCTV/AVI Bus OBE/Taxi GPS

Incident & Disaster Information

Traffic Signal

Transportation Card Data

기상청

Korea Meteorological Administration

Citizen Reports

경찰청

National Police Agency

Manager/Operator

Control all devices & Provision of overall information

VMS/Traffic Signal/Web/ Mobile/SNS/LCS/ Broadcasting

Main System of Seoul TOPIS : BMS & BIS (1)

Data Collection

Incident

Seoul TOPIS

Collecting Data
1) Real time bus location(GPS coordinates, etc.) & bus speed
2) Arrival and departure time for bus stops
3) Data on driving (non-stop, sudden stop, sudden acceleration and starting with doors being opened, etc.)
4) Number of passengers riding on and taking off for each bus stop (including the number of those for a re-ride)
5) Various contingencies e.g. detours and accidents

Information Process & Management
1) Information on bus intervals/the last bus
2) Bus arrival time
3) Analysis of bus operation conditions
4) Analysis of bus passengers
5) Analysis of total traveling distance and time (used for time & distance revenues for buses, etc.)

Main System of Seoul TOPIS : BMS & BIS(2)

Integrated "bus + subway" public transport information

1) Integrated service for arrival time of all buses and subways
2) Information service the last bus and subway
3) All bus and subway routes and transfer information service
4) Bus detour & congestion information
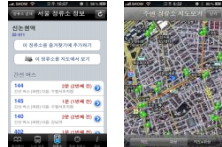5) Information on contingencies e.g. bus accident

Information Provision Media

BIT	Web, Mobile

Web Portal(OpenAPI)	Telecommunication company

Bus Policy Division

Bus driver

Integrated Management

Ubiquitous Service

Bus company

Seoul TOPIS
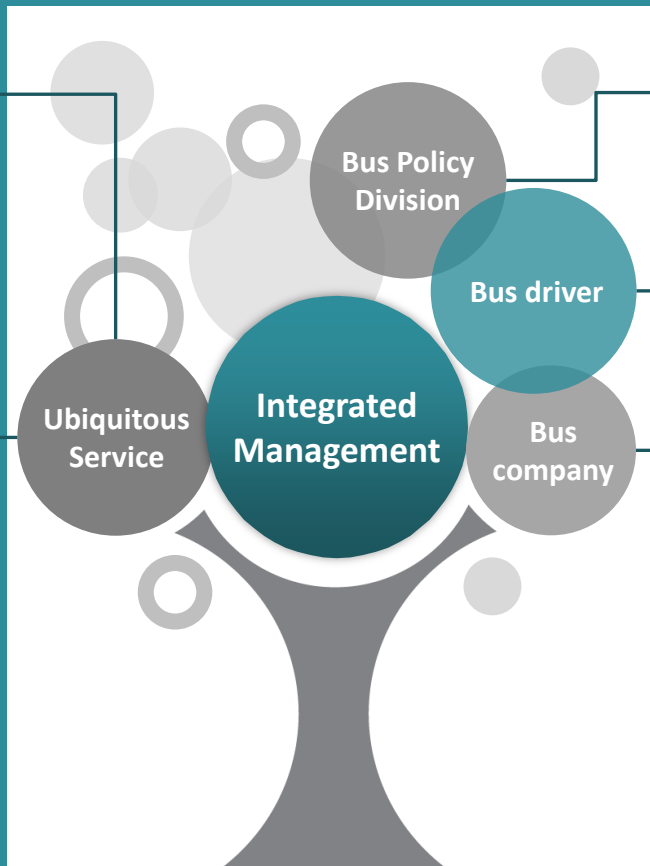
Evaluation of Bus Companies

1) Results of bus operation (non-stop, reckless driving, etc.)
2) Basic data for driving for making payment for bus operation and overall evaluation of bus companies (total travel distance, interval of bus operation, etc.)

Provision of Information on Driving to Bus Drivers
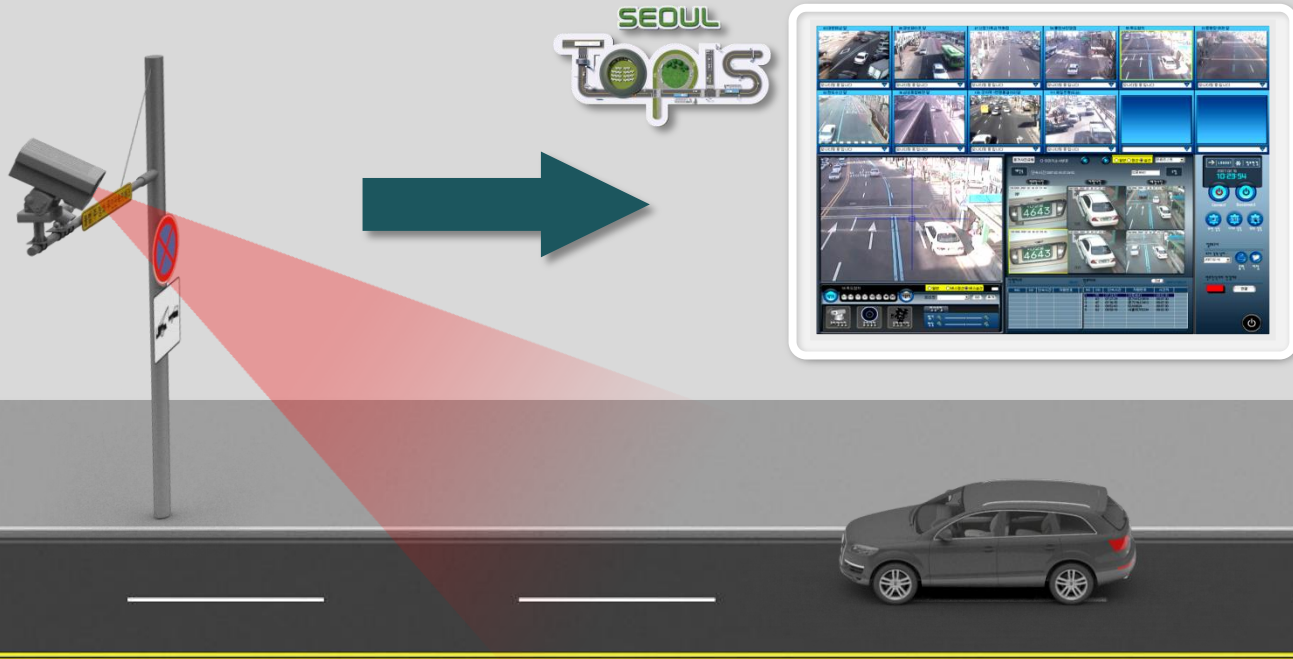
1) Real-time interval (time interval with a bus in front and at the back)
2) Real-time detour route information (for road controls during rallies, etc.)
3) Information on contingencies, etc.

Provision on Driving Information to Bus Companies

1) Basic operation information e.g. bus location and speed for each company
2) Data related with bus operation management

SEOUL TOPIS

Fixed unmanned regulation system(308)
1) Automatic enforcement for illegally parked cars within 200m
2) Controlling vehicles violating bus and car-only roads

Automatic enforcement System (7 routes, 28 buses)
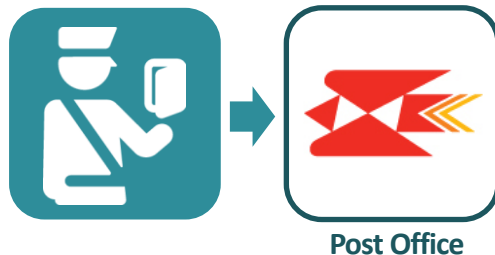1) Automatic detection and enforcement violation at all routes using camera systems mounted on the bus
2) All bus route enforcement(from the origin to the final destination)

1) Searching for vehicle owners found in violation

Searching for vehicle owners in violation and their address

2) Issuing a fine bill and electronically sending it

Post Office

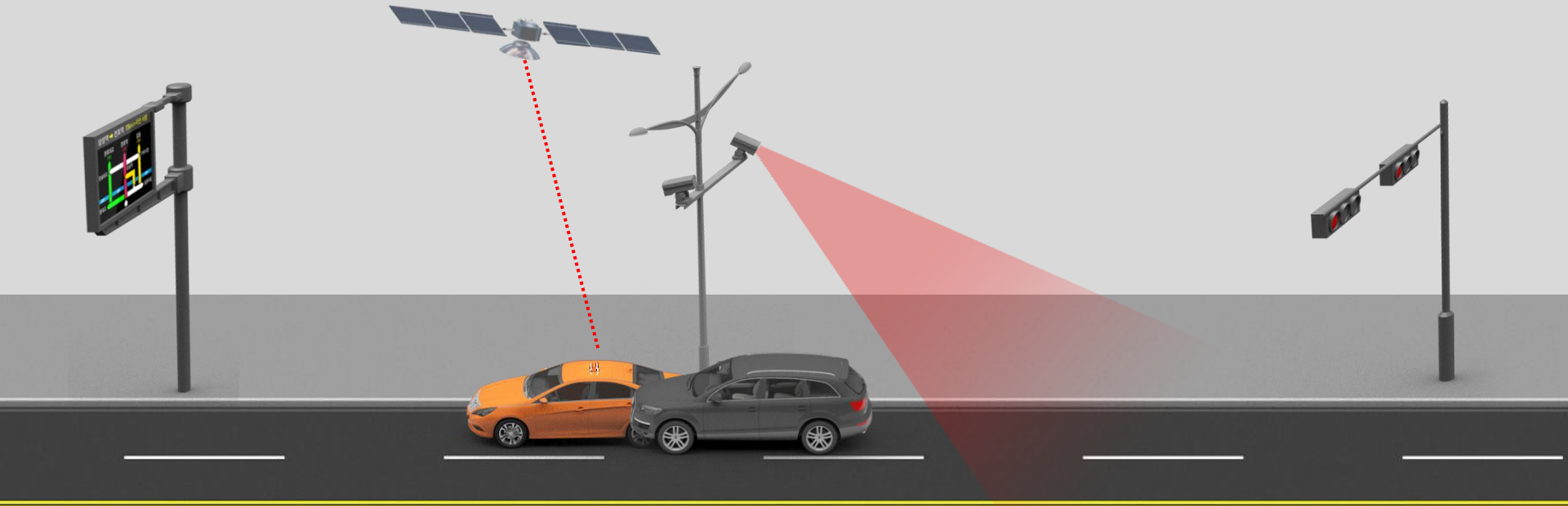Sending an electronic fine bill to the Post Office

3) Automatically sending the fine bill

Automatically sending the notice to the owners

Takes 2-3 days to deliver the fine bill to vehicle owners (without the automatic system: 10~15 days)

Main System of Seoul TOPIS : Advanced Traffic Management System(ATMS)

Collecting Traffic Data

1) **Travel speed** using detectors(Urban express way) or taxi GPS data(City road)
2) **Weather conditions** from Korea Meteorological Administration
3) **Traffic volume** / Traffic situation from CCTC
4) **Incident** / data of real time traffic signal operation
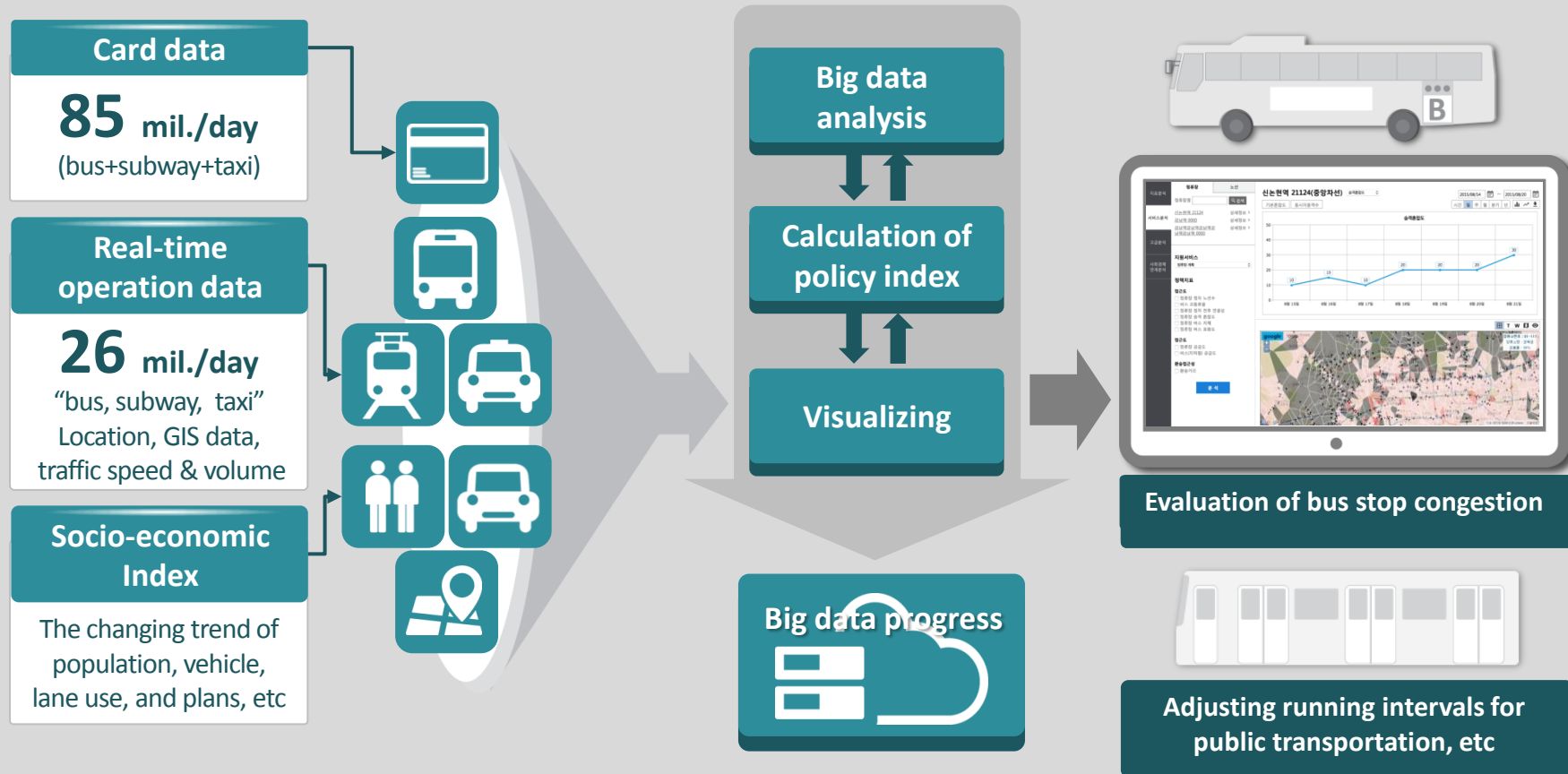
Information Process & Management

1) All traffic information process
2) Analysis of traffic congestion areas & roads
3) Planning of real time traffic signal operating
4) Control device & information provision(VMS, LCS, Traffic signal)
5) Real time speed change monitoring of rods → Traffic event detection
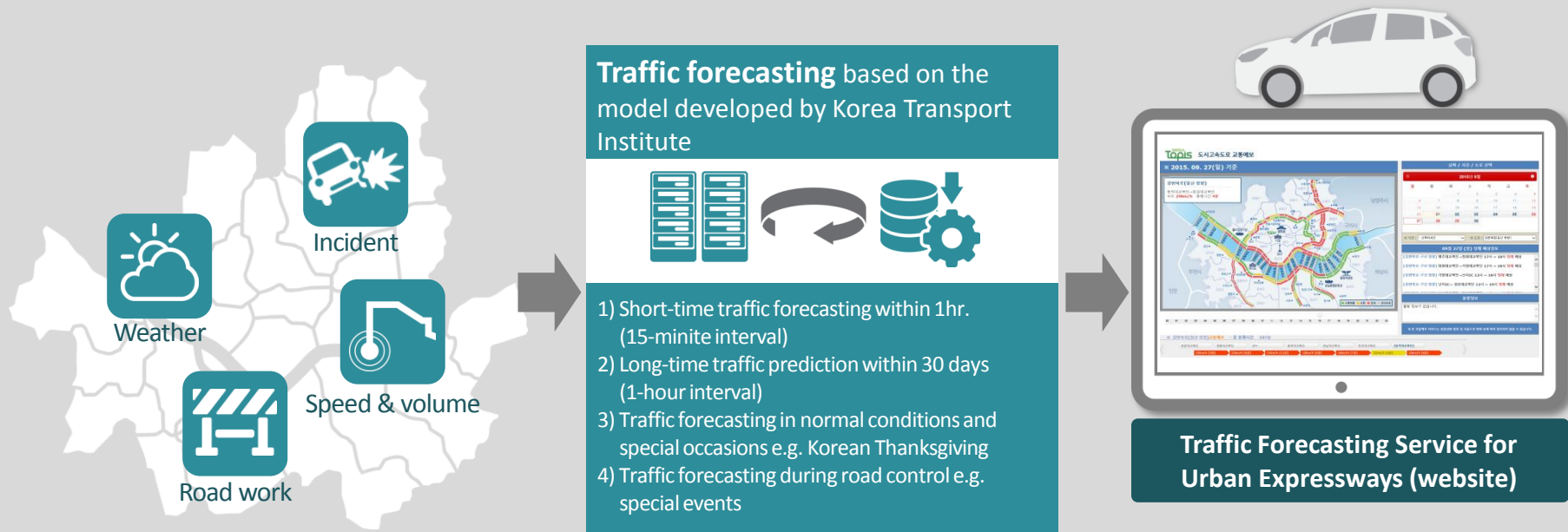6) **Traffic information service** for citizens(Web, Mobile, VMS, etc)

Using the transportation data accumulated for over 5 years

Weather

Incident

Speed & volume

Road work

Traffic forecasting based on the model developed by Korea Transport Institute

1) Short-time traffic forecasting within 1hr. (15-minite interval)
2) Long-time traffic prediction within 30 days (1-hour interval)
3) Traffic forecasting in normal conditions and special occasions e.g. Korean Thanksgiving
4) Traffic forecasting during road control e.g. special events

Traffic Forecasting Service for Urban Expressways (website)

| 2015 | 157km | Urban Expressway |
| 2016 | 574km(417km) | Arterial road |

90%

Accuracy rate of traffic forecasting for urban expressways

Center Platform

Response system for various contingences along with center operation and integrated urban management monitoring

Bus Platform

Bus Information System (BIS)
Bus Management System (BMS)

UR Platform

Unmanned Regulation System
Automatic Penalty Charging System

TOPIS PLATFORM

Total ITS Solution
Based on Seoul City's experience in setting up ITS and required technologies

FTMS Platform

Urban expressway traffic management system

ATMS Platform

Traffic Management System for Main Roads
Traffic Signal Operating System

Big Data Platform

Traffic Forecasting System
System for Supporting Transport Policies

ITS Global Leader,
The Seoul TOPIS

1. OS(operating system) **free**
Windows, Linux, Unix OS

2. DB free
Oracle, MS-SQL, My SQL, Tibero

3. Media service free
Global web standard protocol, HTML5

4 Free embedded ITS Solution

5. Hardware free
Global standard connecting
interface & protocol to equipment

Sensing of and Response to Various Incidents

Integrated Monitoring of Traffic Situations

Integrated System Monitoring

Fast incident detection & response
Analysis of incident influence

Congestion area & road
Change of speed & volume

Operation monitoring of
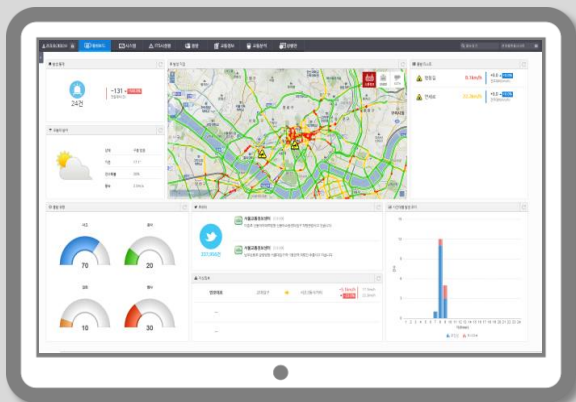all hardware & device
Monitoring of program process
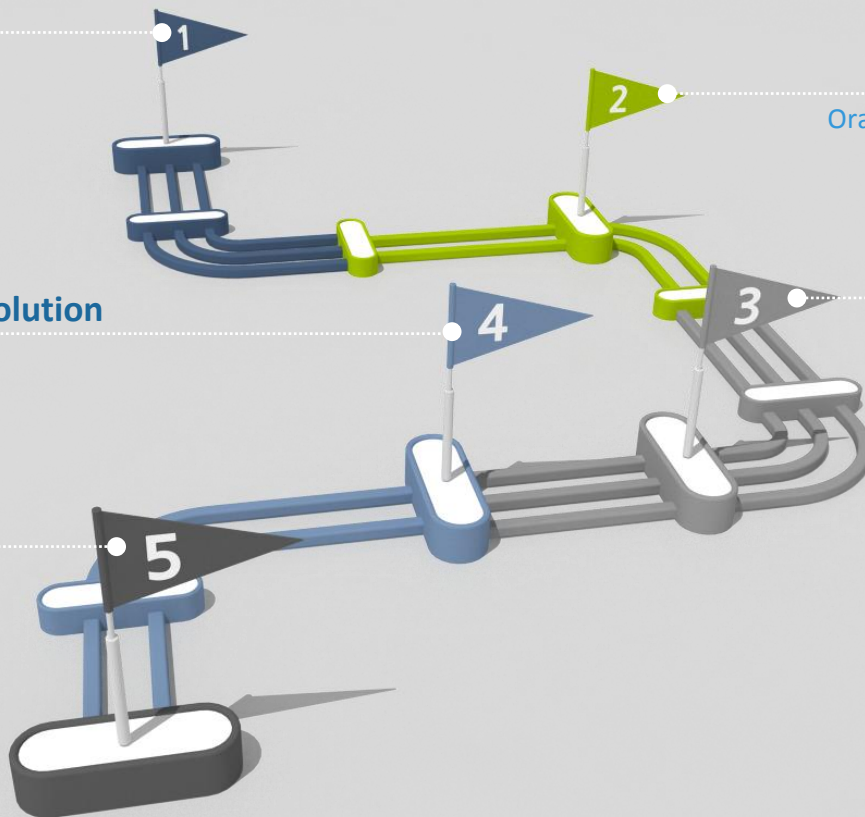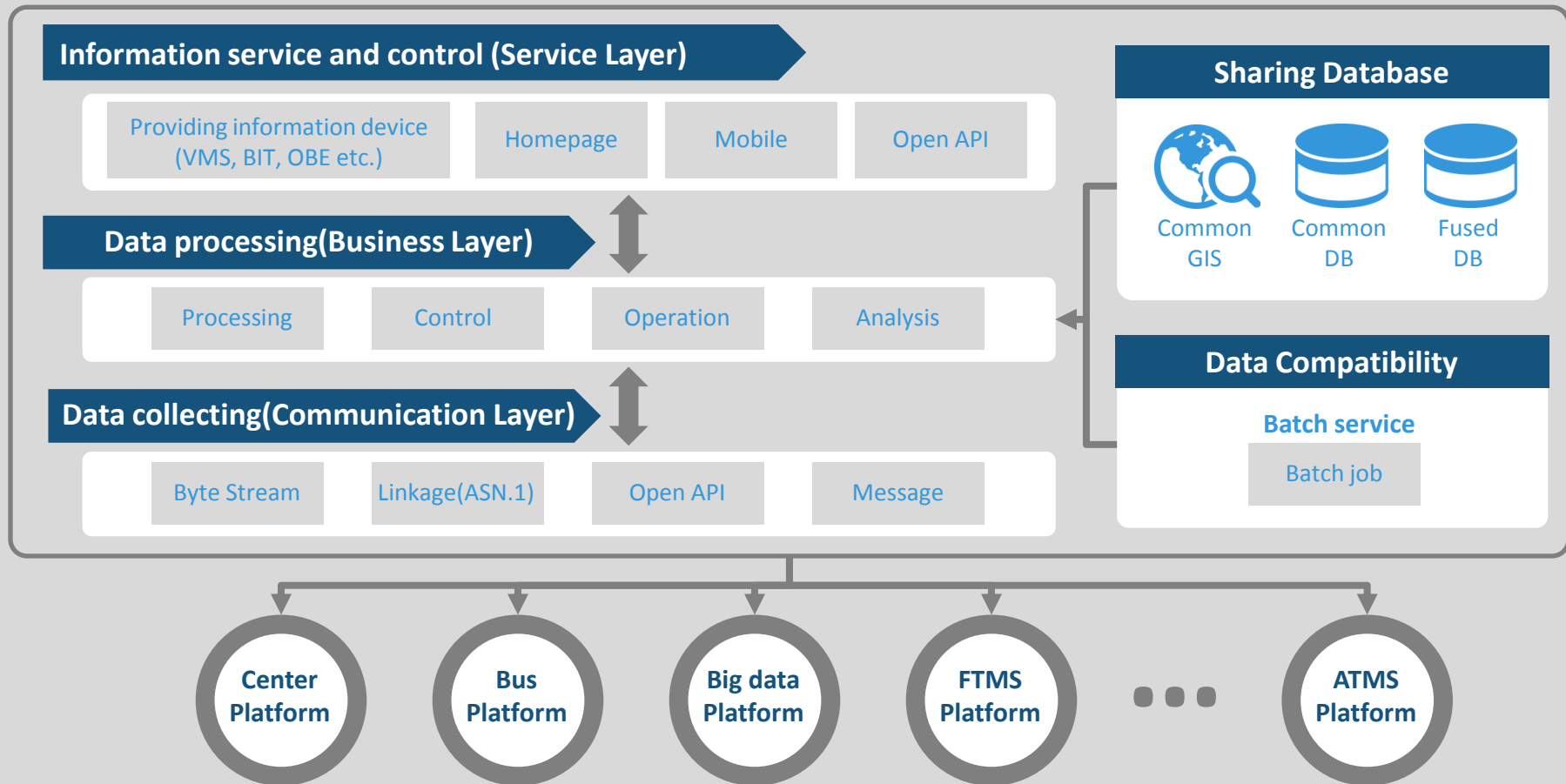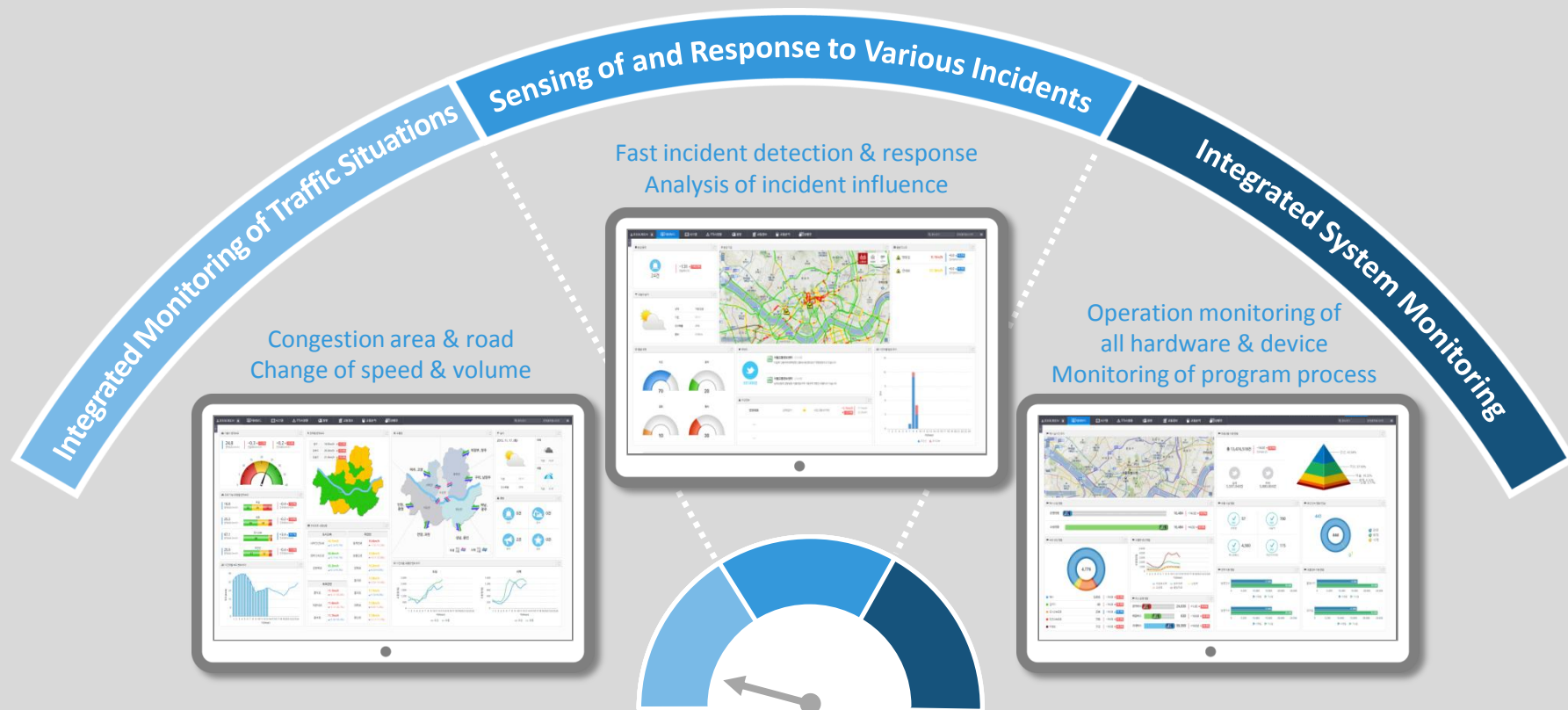
A dashboard-type solution for prompt judgment & response solution

Integrated control of ITS devices on site

VMS, VDS, CCTV, LCS, RMS, BIT,
Bus OBE & Traffic Signal

Strict management of authorized users
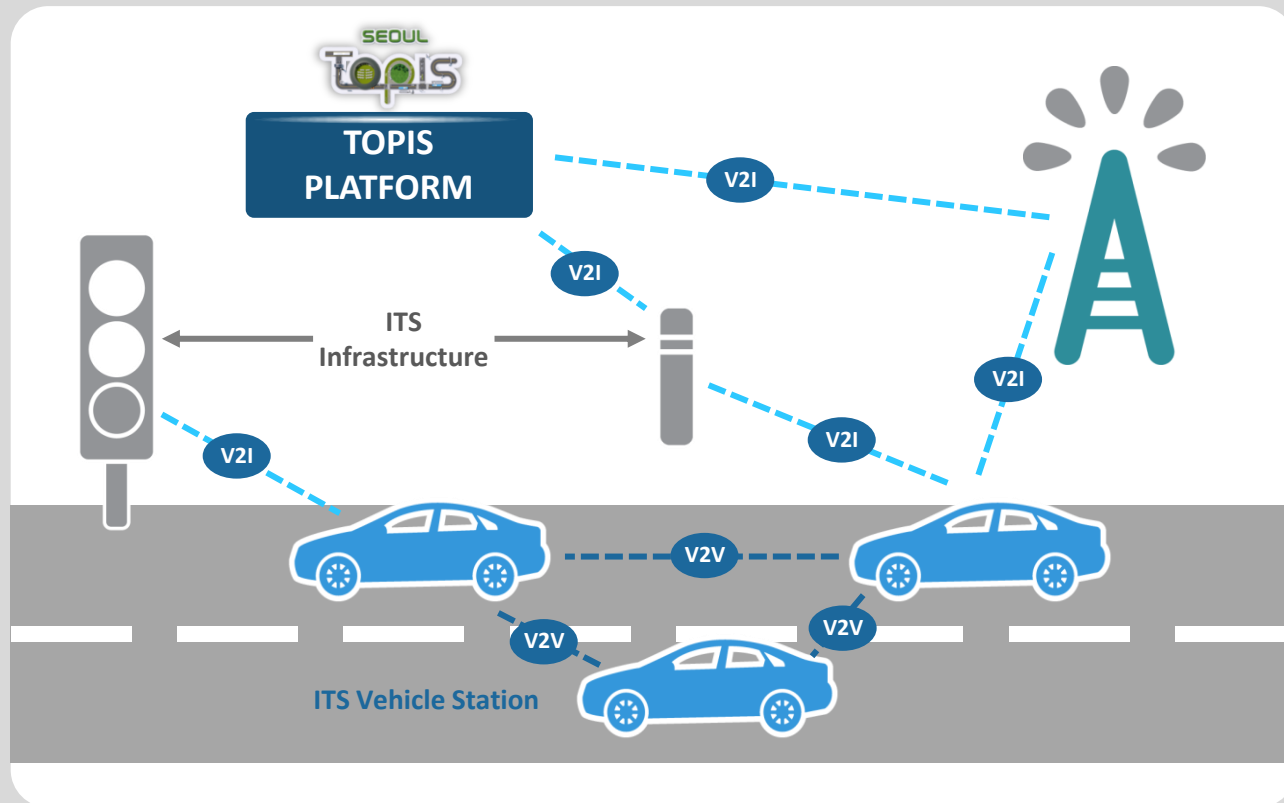
User-specific menu options, and
authorization per user level, etc.

Service using all media
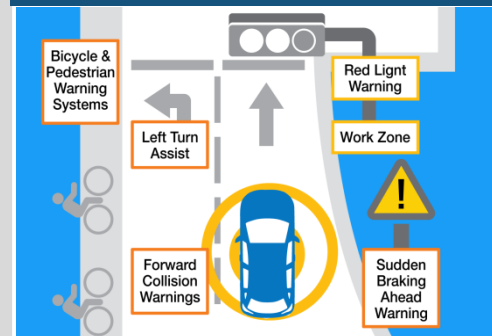
Web, Mobile, Open API, IPTV,
Digital panel, etc

Next Vision of Seoul TOPIS : C-ITS

TOPIS PLATFORM

V2I

ITS Infrastructure

V2I

V2I

V2I

V2I

V2V

V2V

V2V

ITS Vehicle Station

Good driving

110

92 km/h

7.83 km

Reduce the travel time up to 20%

Safe driving

Bicycle & Pedestrian Warning Systems

Red Light Warning

Left Turn Assist

Work Zone

Forward Collision Warnings

Sudden Braking Ahead Warning
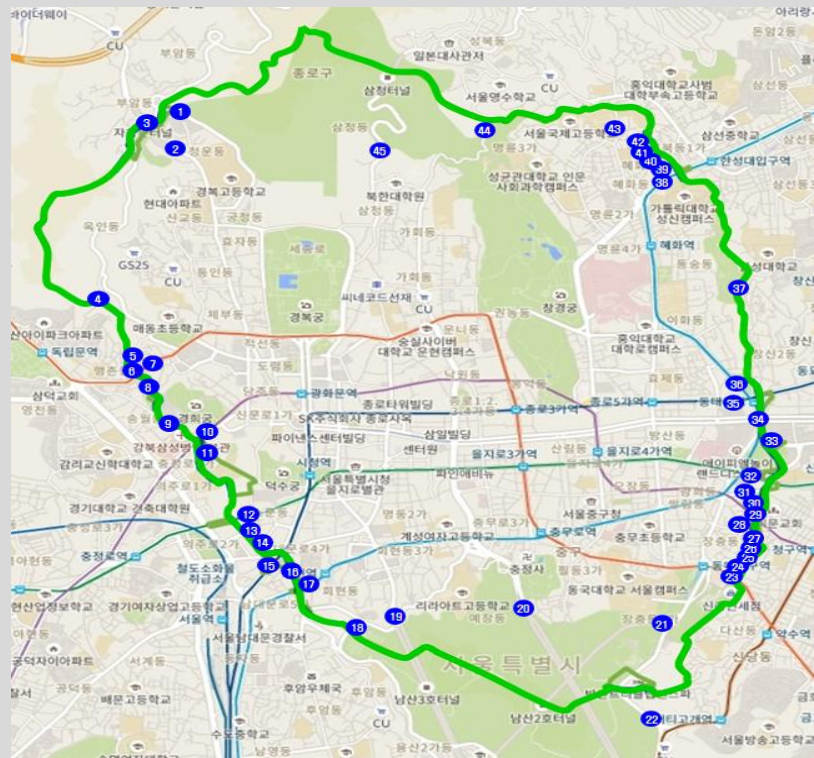
Reduce the travel time up to over 58%

Traffic Volume Management System in the Green Traffic Zone: 45 entry points (ANPR)

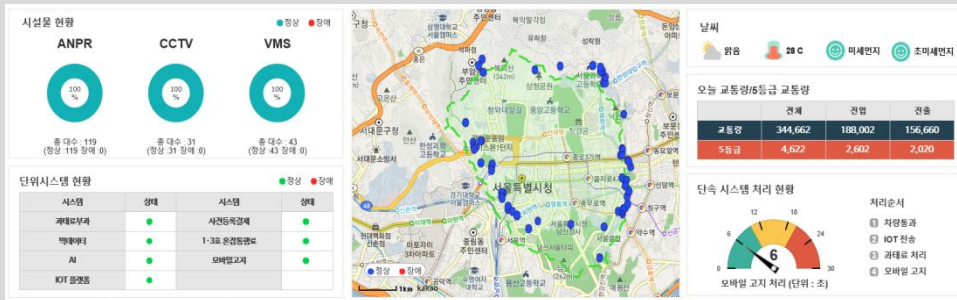ANPR (Automatic Number Plate Recognition) Location

- Traffic volume management
- Operation management in consideration of the atmospheric environment
- Traffic congestion management

- Information collected – entry & exit per hour
- Vehicle information
- Old diesel vehicle volume & enforcement information

Advancement in Seoul TOPIS leading changes in global ITS