ITS & Traffic Management System using Traffic Volume Data

April 9, 2026

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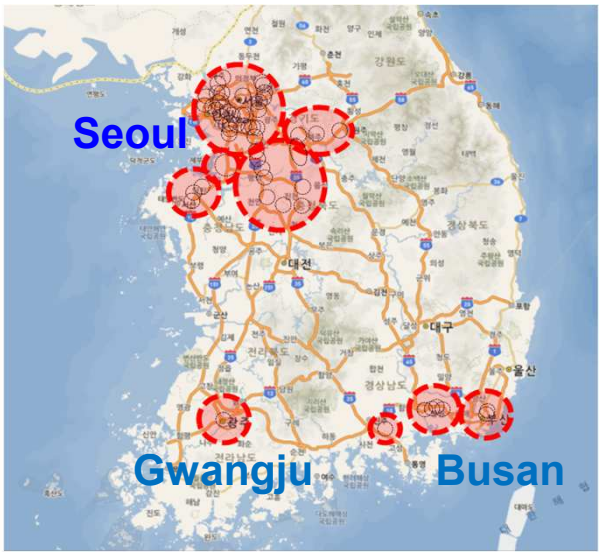
韓國道路公社
Korea Expressway Corporation

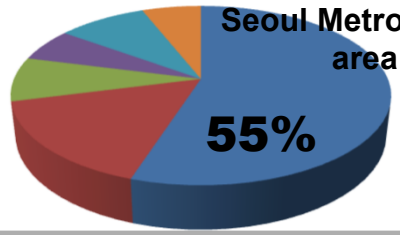
What is the problem?

Traffic Congestion on Expressways

Major Congestion Area



Travel Demand



Trip Characteristics

Major congestion occur in urban areas

- Seoul metropolitan area : 42 sections
- Other urban area : 21 sections

Serious traffic congestion occur in Seoul metropolitan area

- The length of expressways in Seoul metropolitan area is 19%
- But, travel demand in Seoul metropolitan area is 55%


TAXI


MERITZ
http://blog.naver.com/topjja

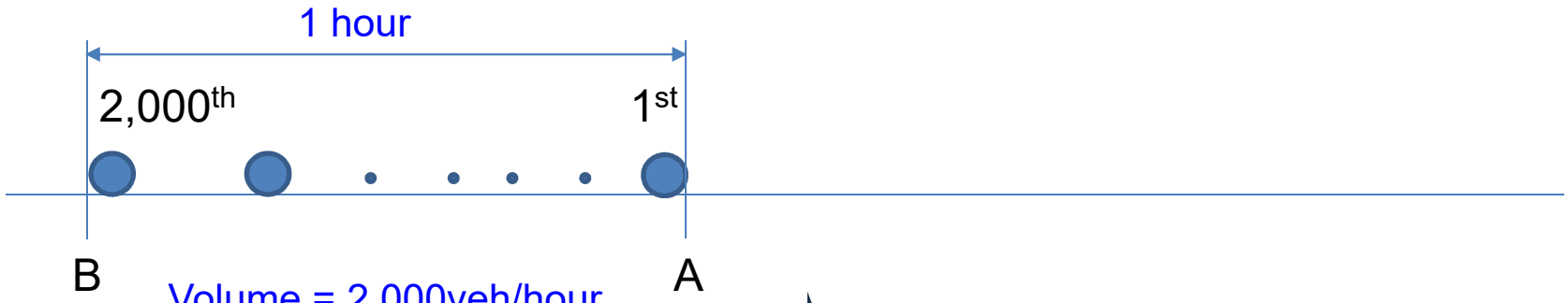
Traffic Flow Fundamentals

Volume

Traffic volume is defined as the number of vehicles passing a point or section on a highway or lane during a specified period.

- It is the most basic of all traffic parameters and the one most often used in ***planning, design, control, operation, and management analysis***.

Volume vs. Demand

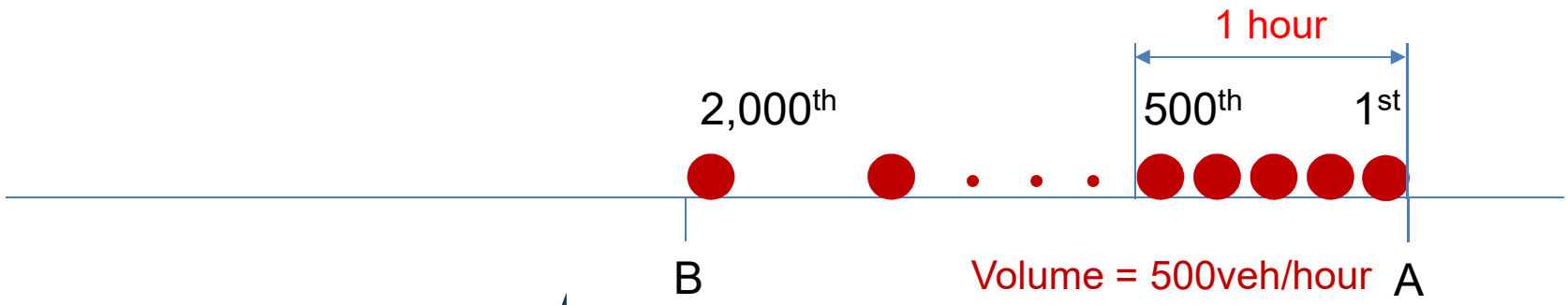


Volume = 2,000veh/hour

Demand = 2,000veh/hour

Volume = Demand

[Uncongested Section]



Volume = 500veh/hour

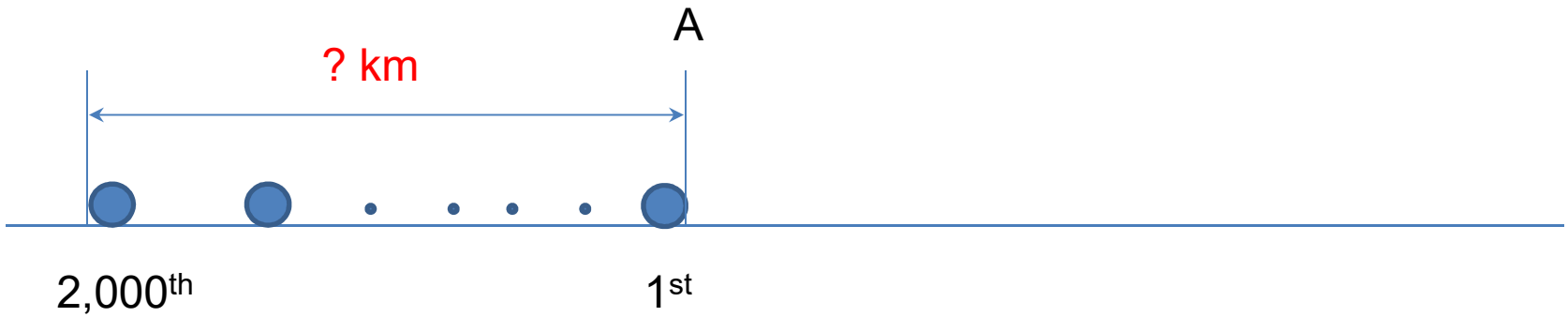
Demand = 2,000veh/hour

Volume ≠ Demand

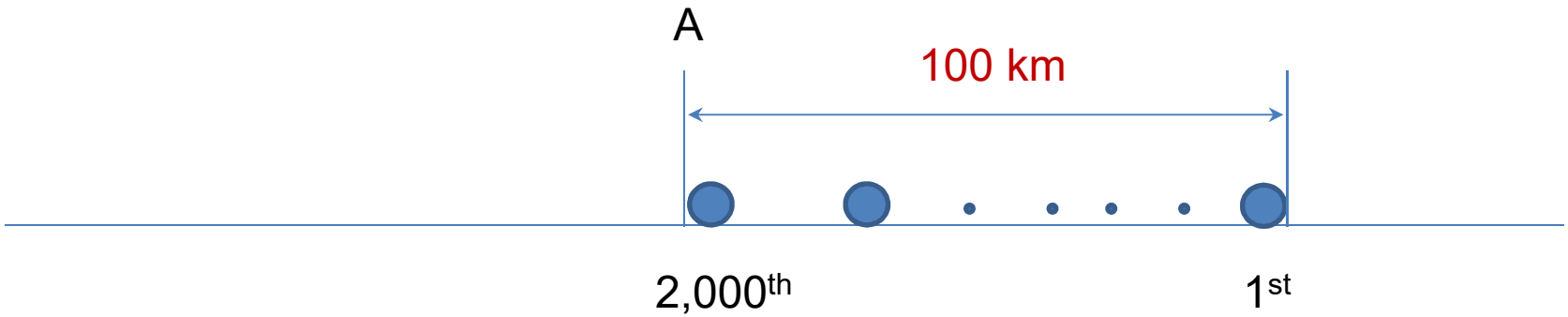
[Congested Section]

Speed

Speed is defined as the distance to pass a certain section on a highway or lane during a specified period.



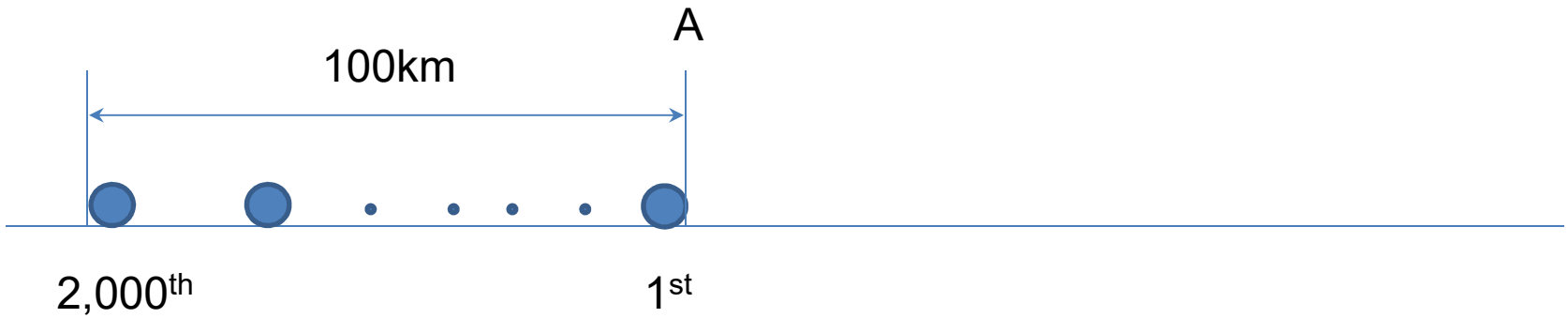
Speed = 100km/h



In an hour

Density

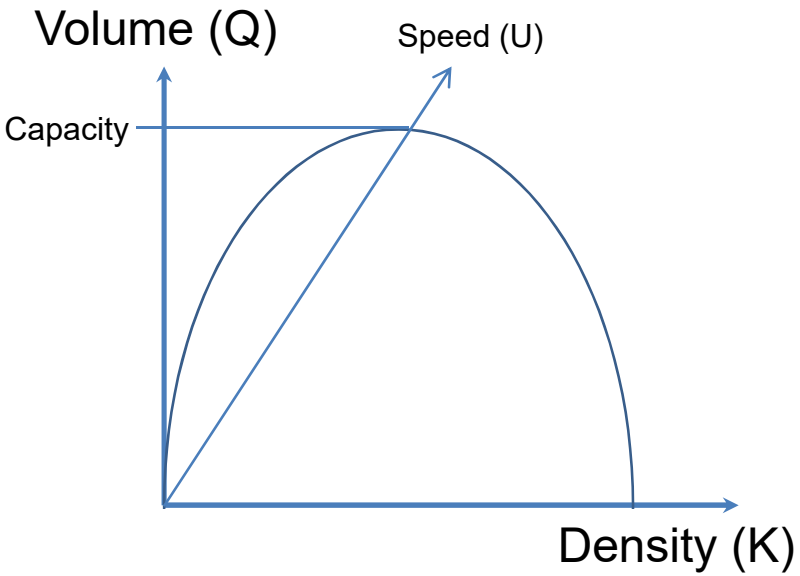
Density is defined as the number of vehicles existing within a certain section on a highway or lane at a specific moment.

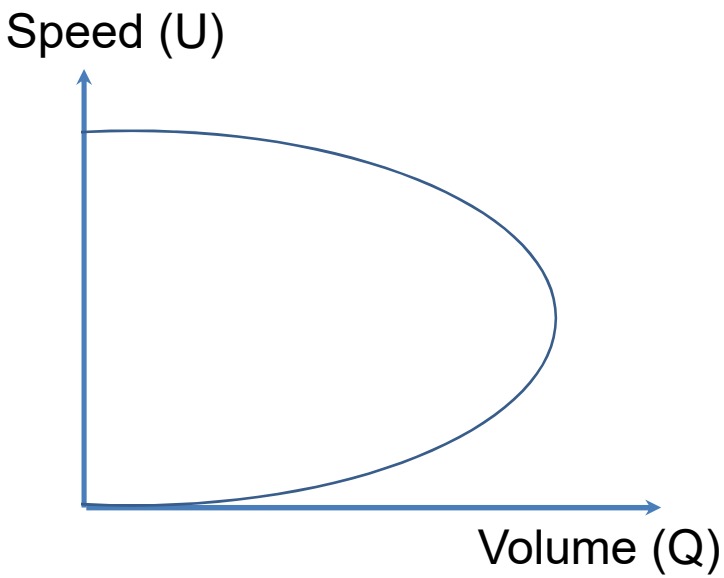


Density = 2,000veh/100km

= 20veh/km

Relationship – Traffic Flow Fundamentals

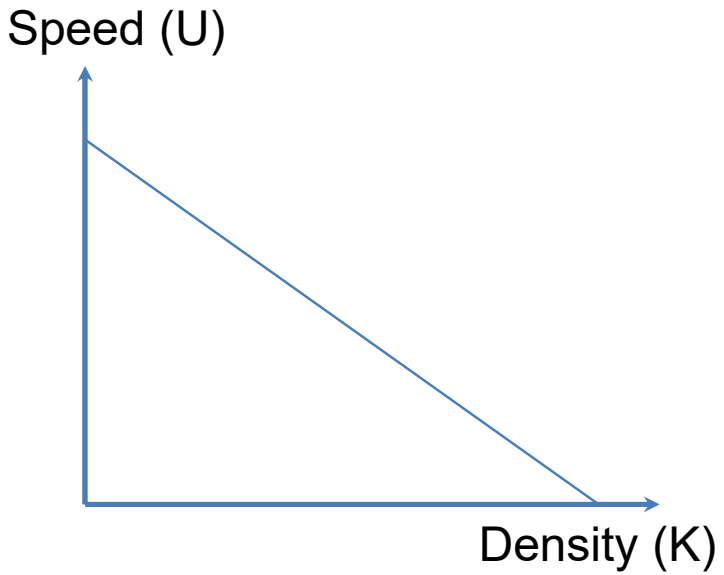




$Q = U \cdot K$

$K = Q / U$

$U = Q / K$



Example

Q = 2,000 veh/h

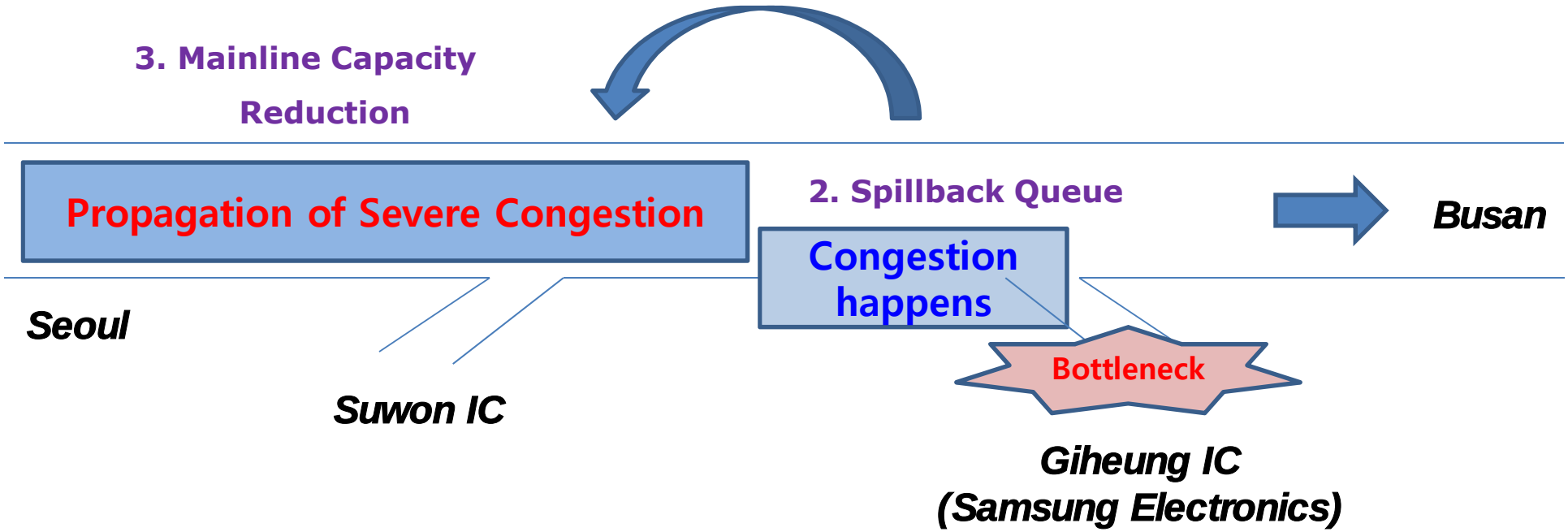
U = 100 km/h

K = ? veh/km

Congestion Management

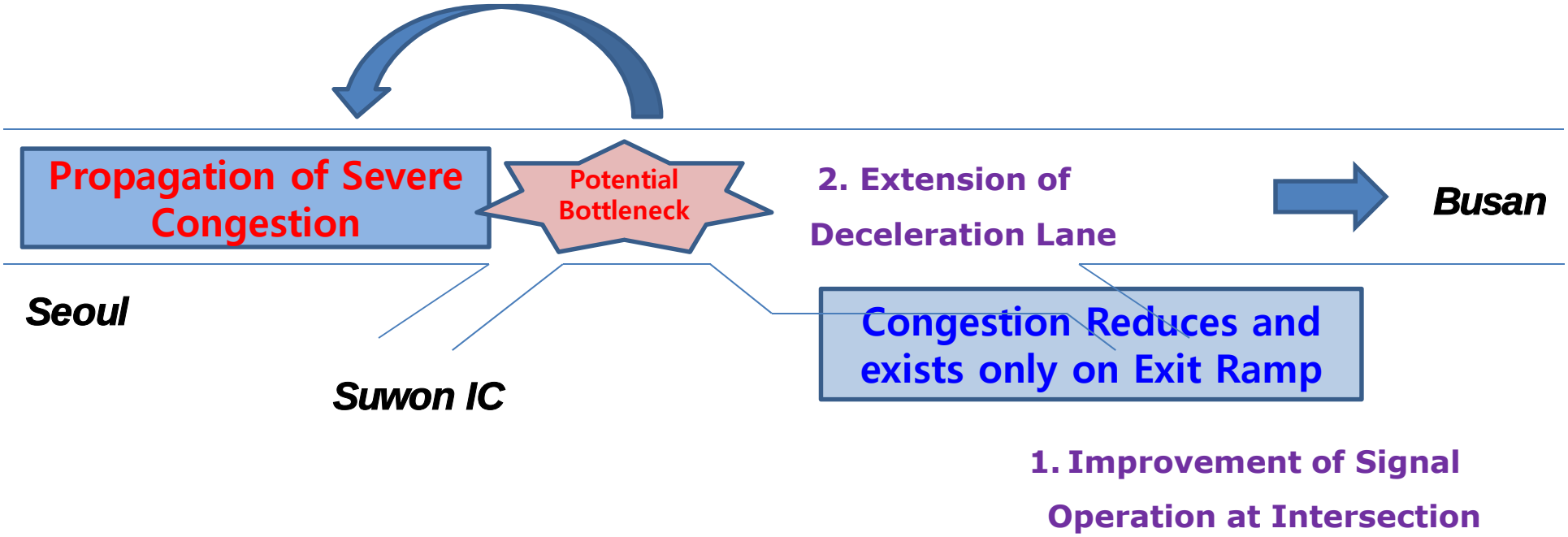
(Examples)

Congestion Management - Example



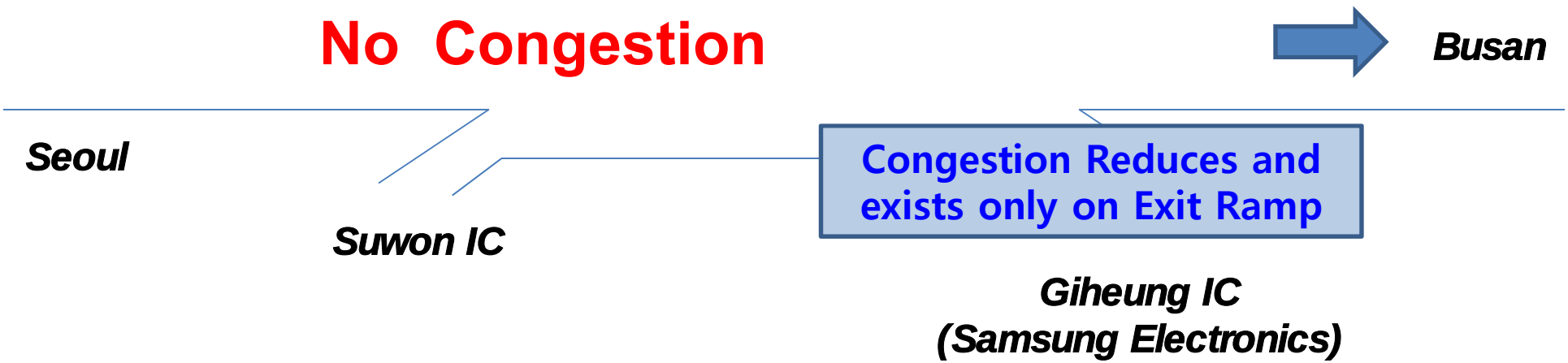
[Current State]

Congestion Management - Example



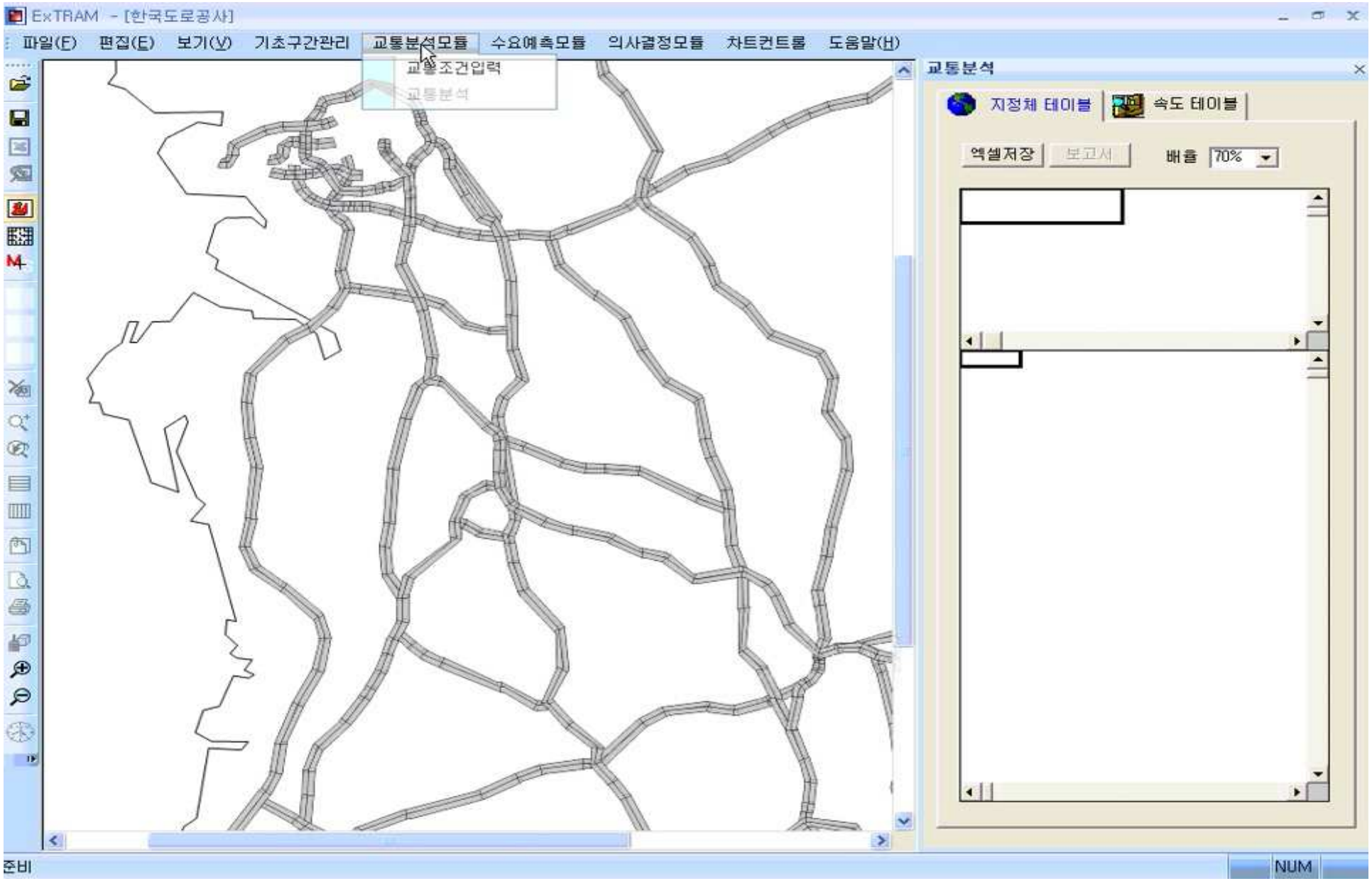
[Potential Bottleneck by incomplete improvement]

Congestion Management - Example

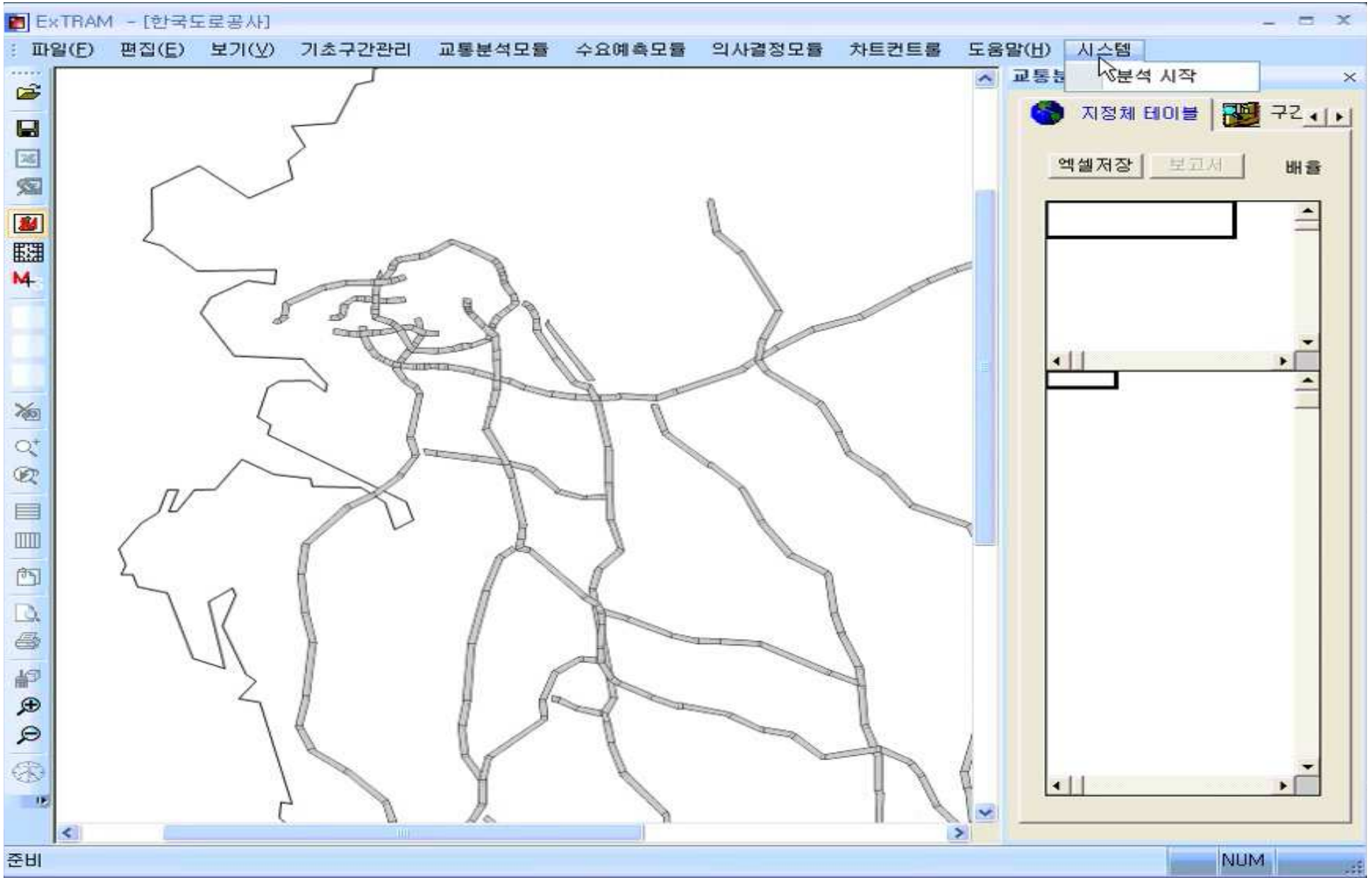


[Final Improvement]

Prediction of Traffic Condition (Off-Line)



Prediction of Traffic Condition (On-Line)



Integrated Traffic Management (ITM)

Necessity of Integrated Traffic Management

Hard Shoulder Running,

Local-Express Lane,

Ramp Metering,

Hi-Pass,

Toll Metering,

Information Offering

Limitation of Exp. Construction

- Increase of traffic congestion

Individual Traffic Management

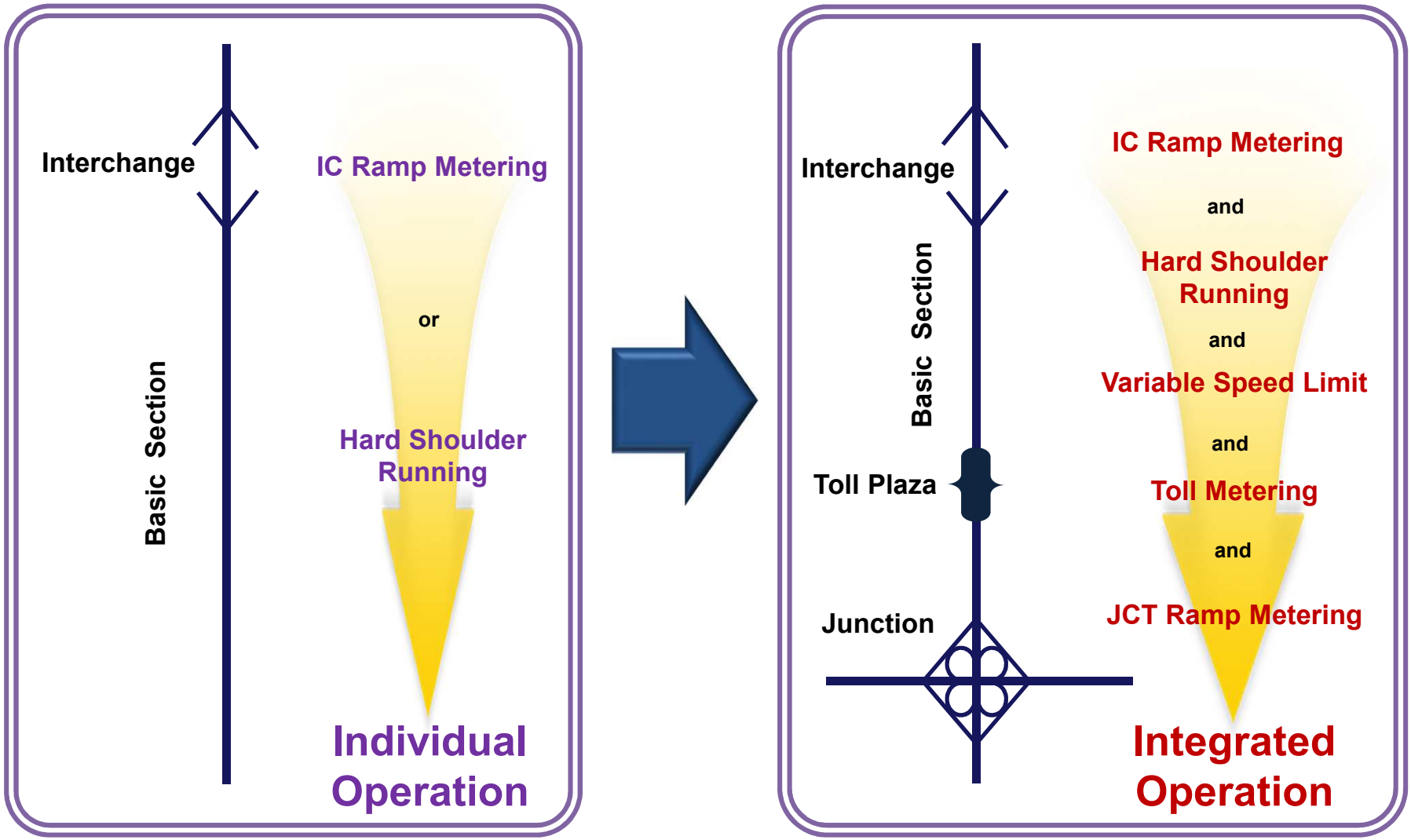
- Reduce congestion sections

Remaining Congestion Sections

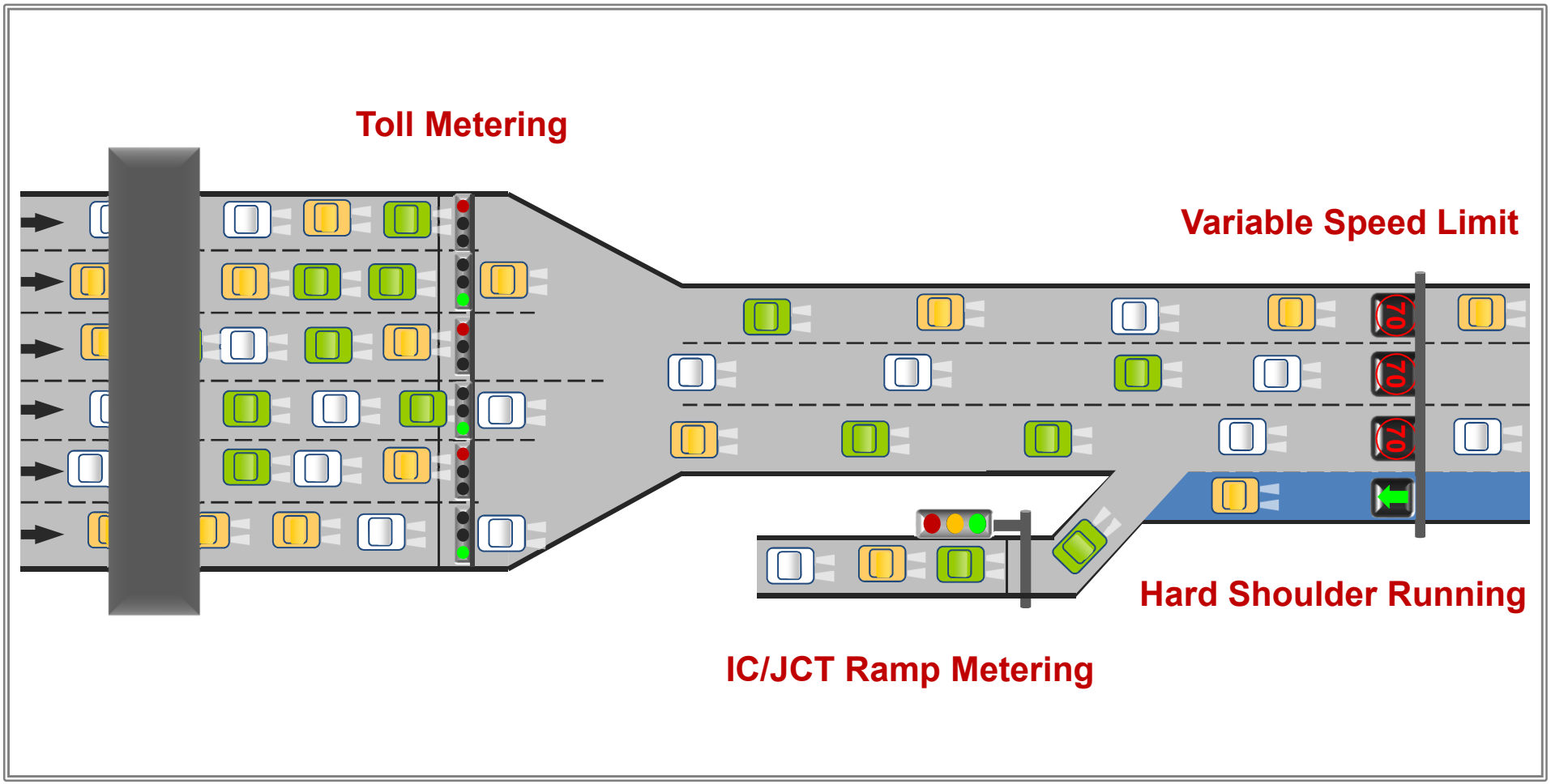
- 51 sections, 373 km

Integrated Traffic Management

Integrated Traffic Management (ITM)



Integrated Traffic Management (ITM)

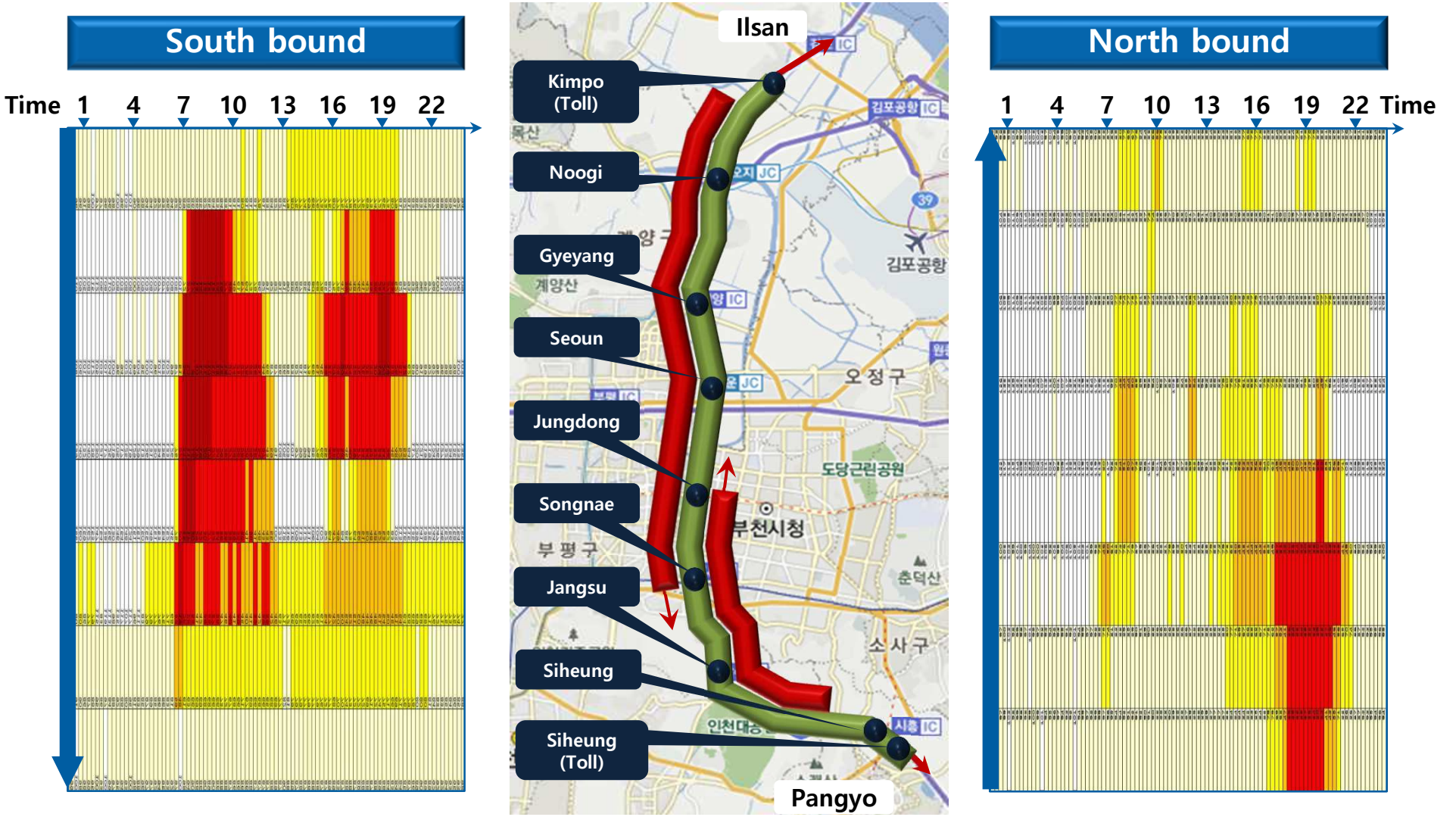


Integrated Traffic Management Section

❖ 14 Sections, 440km

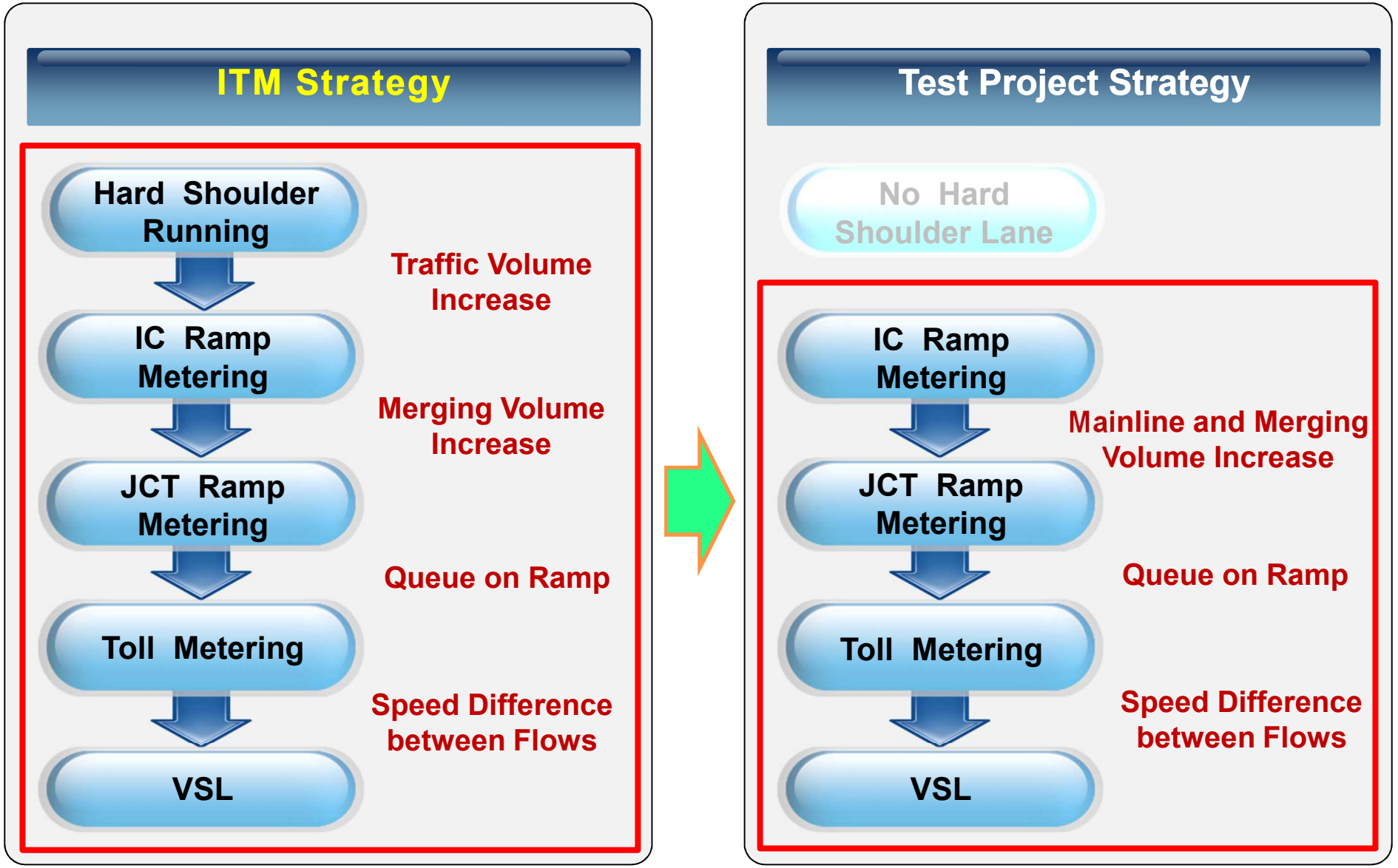
Expressway	Section	Direction	Length (km)	ADT (vehicle/day)	Level of Management goal	Period
Line #100	**Kimpo ↔ Siheung**	**Both**	**20**	**254,819**	**Congestion reduction**	**Test Project**
	Toigyewon ↔ Hanam	Both	14	192,274	**Congestion removal**	Short-term Project
Line #1	Seoul ↔ Ansung	Both	39	189,440	Prevention of existing congestion increase	
Line #15	Seopyungtaek ↔ Jonam	Both	44	193,753	*Congestion reduction*	
	Haemi → Haengdam	Seoul	38	72,010	**Congestion removal**	Mid-term Project
Line #50	Singal ↔ Gunja	Both	31	154,103	**Congestion removal**	
	Manjong → Hobeob	Incheon	50	133,811	Prevention of existing congestion increase	
Line #10	Naengjeong → Gupo	Busan	22	92,772	*Congestion reduction*	Short-term Project
Line #104	Naengjeong → Sasang	Busan	34	102,068	*Congestion reduction*	

Traffic Condition (Test Project - Line #100)



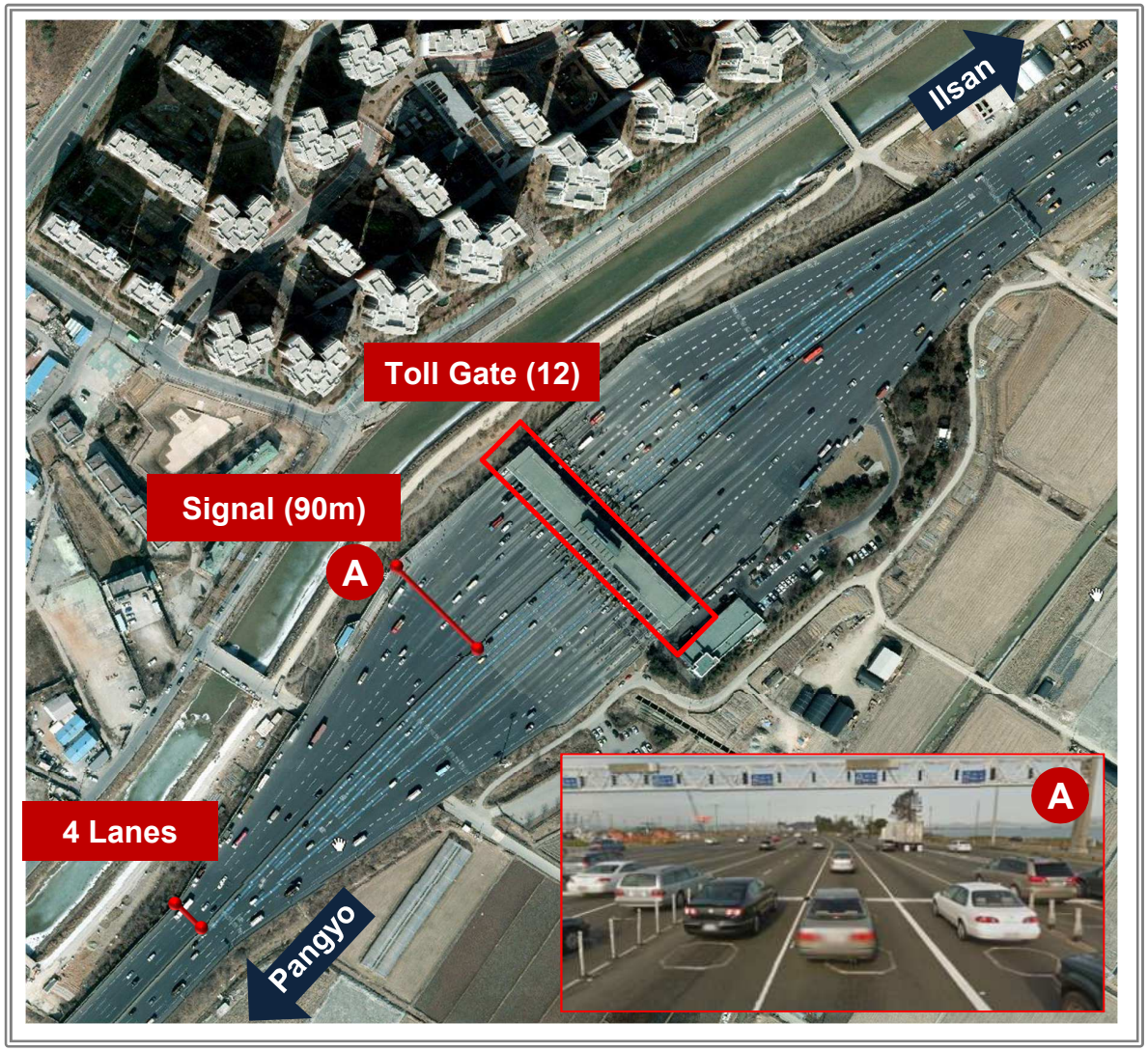
Korea Expressway Corporation

Traffic Control Strategy



Ramp Metering (Test Project - Seoun JCT)

Toll Metering (Test Project – Kimpo Toll Plaza)



Variable Speed Limit (Test Project – Jungdong)

Traffic Simulation (Test Project - Line #100)

Ramp Metering

Toll Metering

Variable Speed Limit

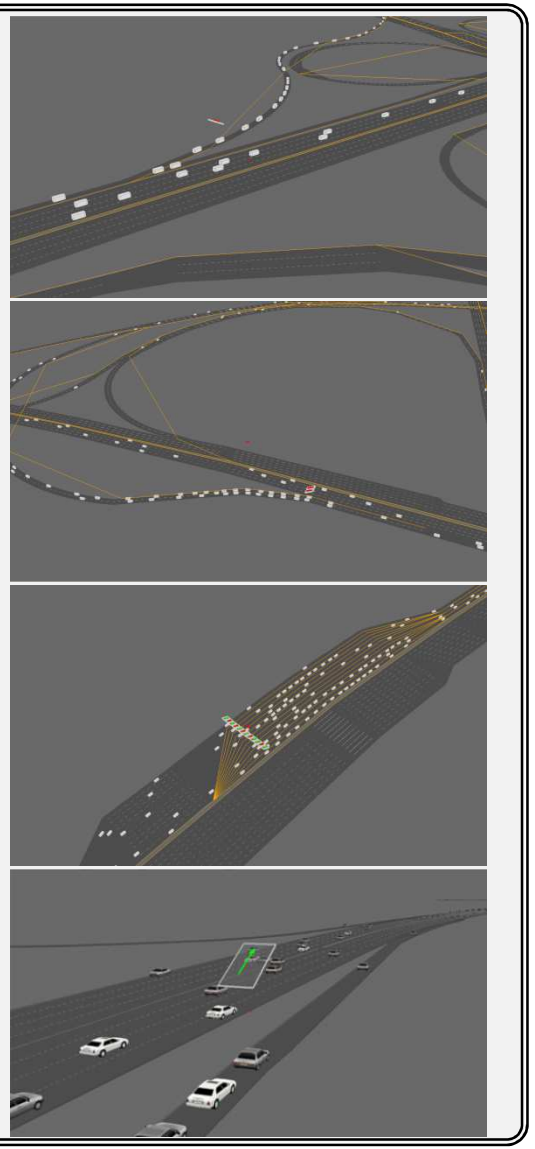
(Time Period : 2~9 pm, Friday)

Present Condition
(individual ramp control)

Prevention of existing congestion increase
(low level of integrated control)

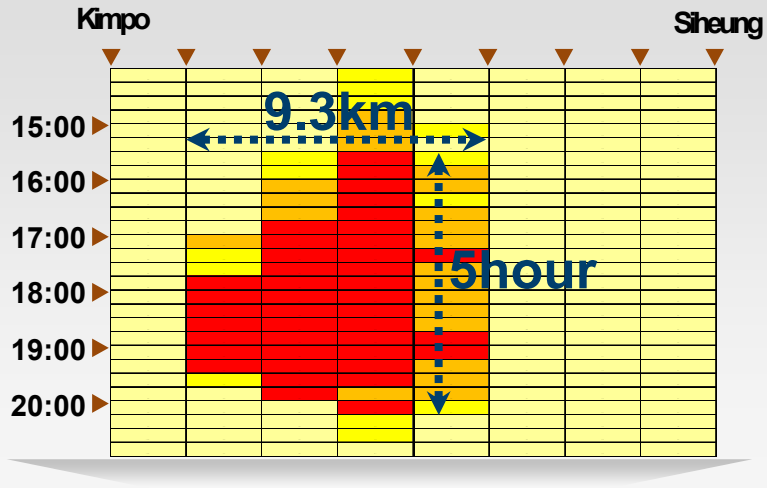
Congestion reduction
(intermediate level of integrated control)

Congestion removal
(high level of integrated control)

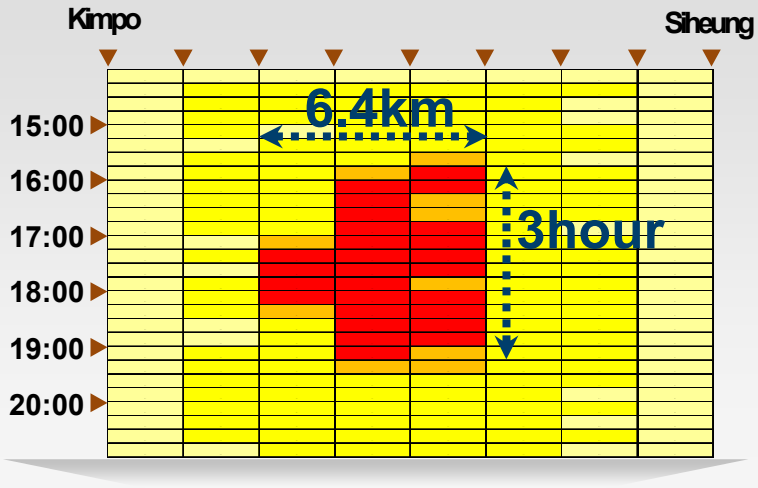


Simulation Results (Mainline)

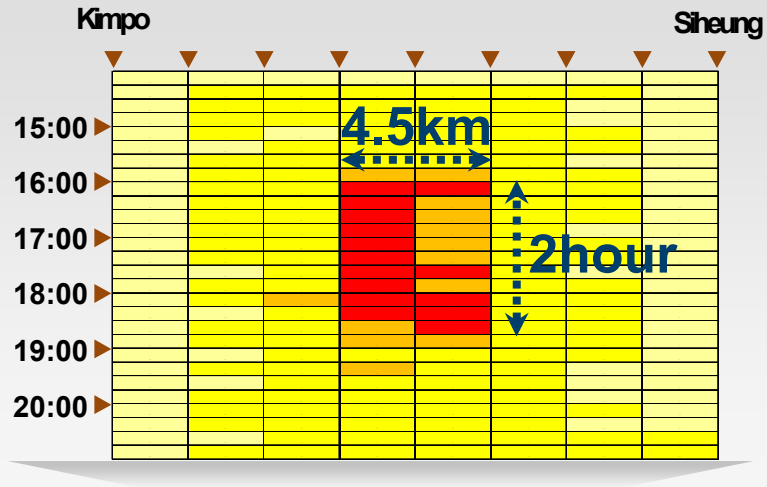
Individual Ramp Control



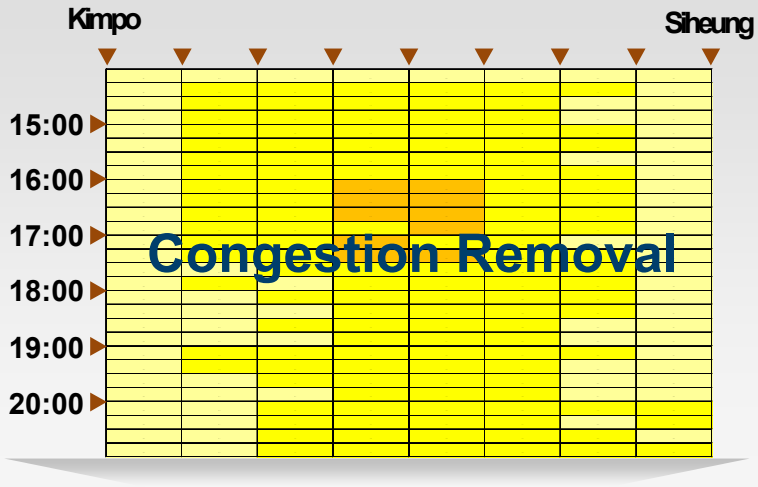
Low Level of Integrated Control



Intermediate Level of Integrated Control



High Level of Integrated Control

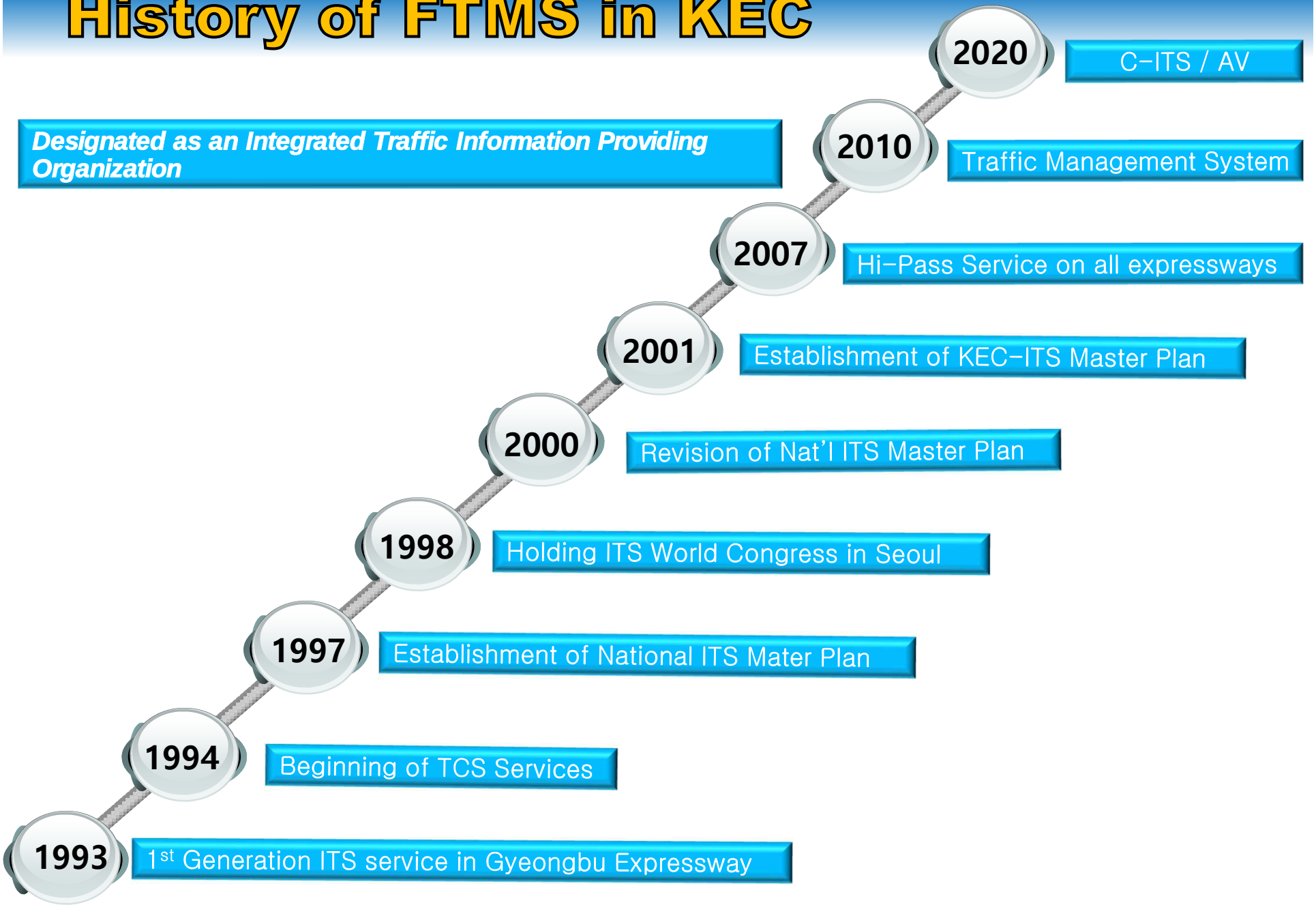


Simulation Results (Queues on Ramp)

Level of Control	Proportion of Signal (%)	
	Red	Effective Green
Low	28.6	71.4
Intermediate	**40.0**	**60.0**
High	50.0	50.0

FTMS in Korean Expressways

History of FTMS in KEC



Traffic Data Collection System

VDS(Vehicle Detection System)

Image Detector

- The Image Processing Technology
- Easy to Install and Fix
- Low Reliability

Loop Detector

- The changing of Magnetic Field of Loop Coil
- High Reliability(97%)
- Hard to Manage and Fix

Traffic Data Collection System

CCTV(Closed Circuit Television)

Traffic Monitoring(TMC)

WEB(Internet)

Broadcast

Application(Mobile)

Traffic Data Collection System

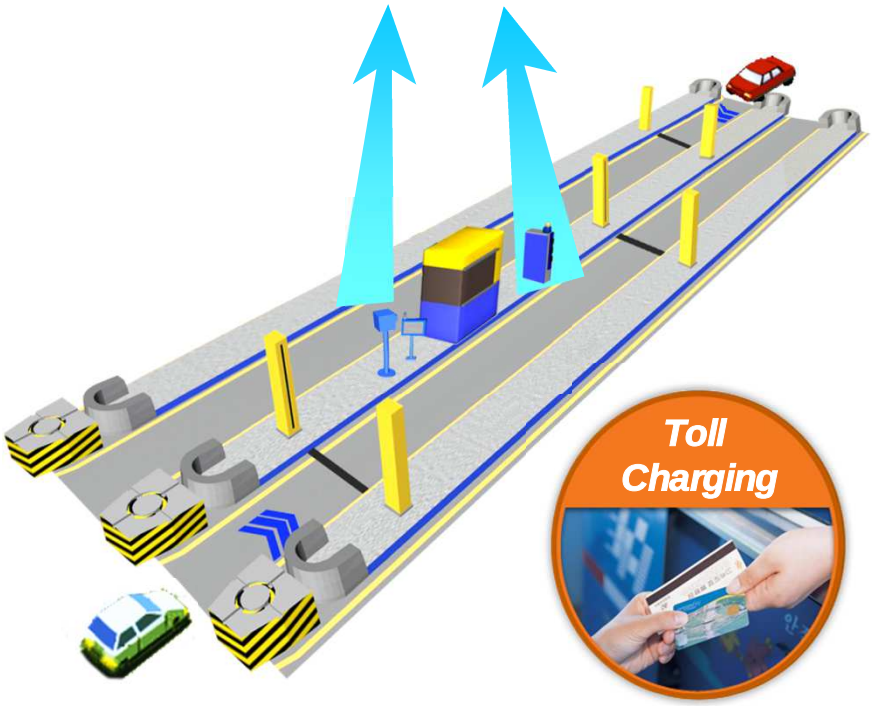
TCS(Toll Collection System) / ETCS(Electronic Toll Collection system)

Electronic Toll Collection

TCS Vehicle Process

Toll Center

TCS Charging Data

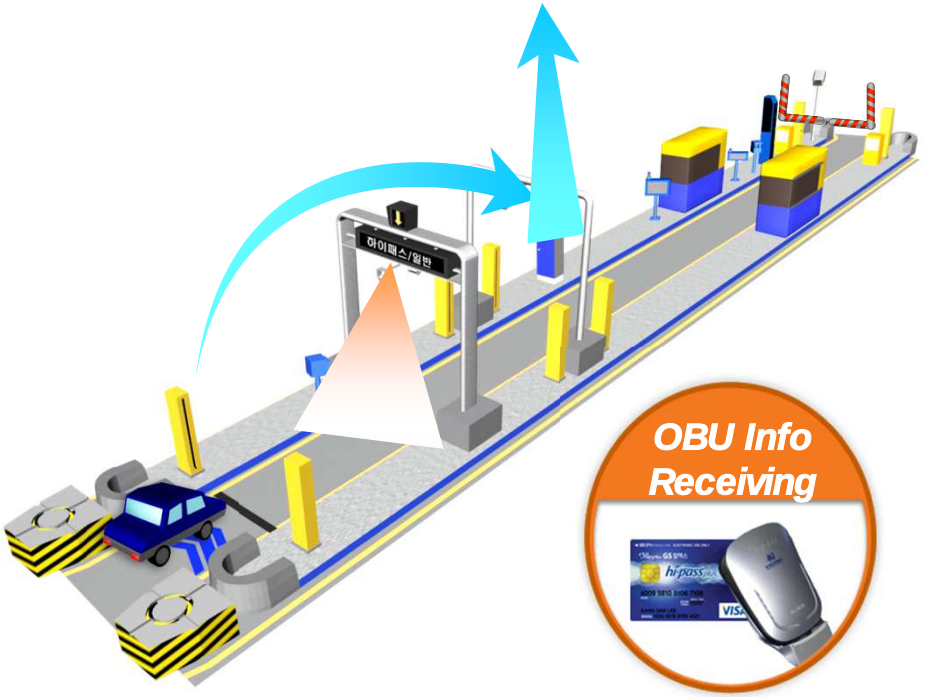


" TCS capacity: 450 vehicles /hour "

ETCS Vehicle Process

Toll Center

ETCS Charging Data



" ETCS capacity: 1,800 vehicles /hour "

Traffic Management System

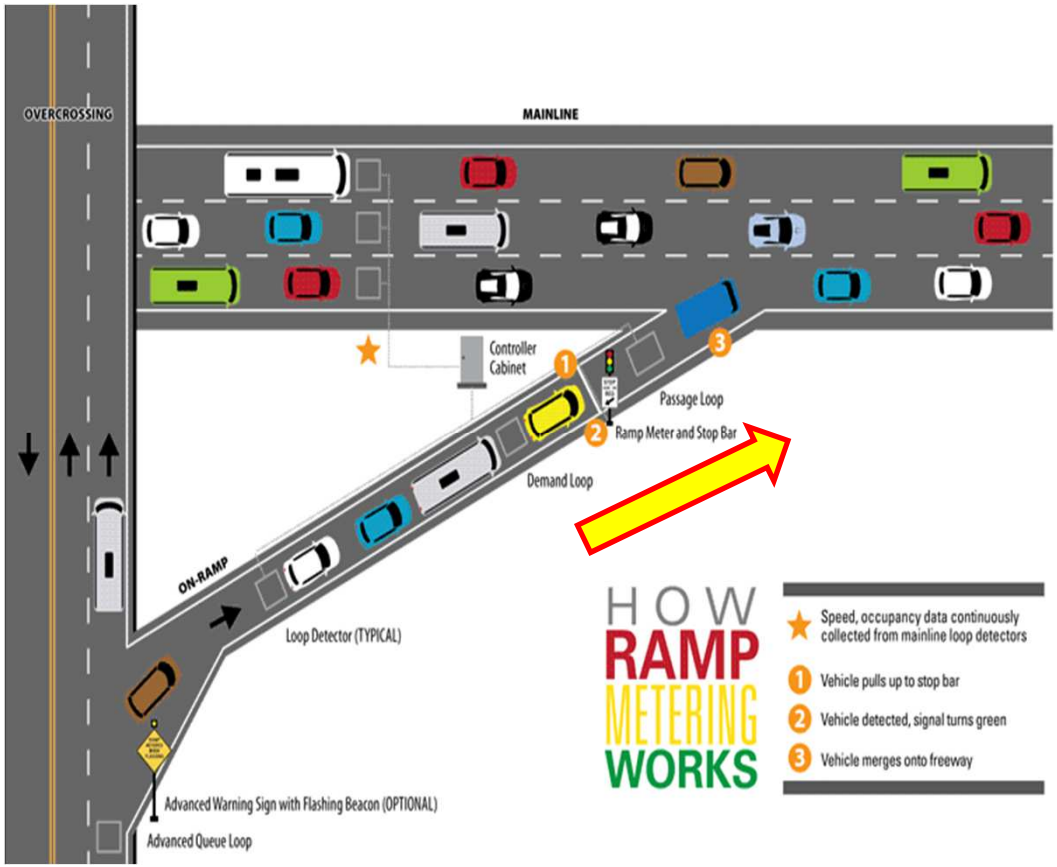
LCS(Lane Control System)

- Controlling Lane usage to increase capacity during congested condition
- Improving Safety in tunnel

Traffic Management System

RMS(Ramp Metering System)

- Mitigate traffic congestion on mainline
- Keep mainline volume below capacity by controlling ramp volume



Traffic Management System

Enforcement System

- Automatic enforcing violation vehicles(Speed Limit, Bus Lane, Over-Weighted Truck)

Traffic Management System

Traffic Analysis System

Details

- Develop an integrated monitoring system for highway, traffic and disaster
- Develop a traffic simulator and an automated incident detecting program
- Develop an integrated traffic information system for Nat'l EWY's and Nat'l HWYs

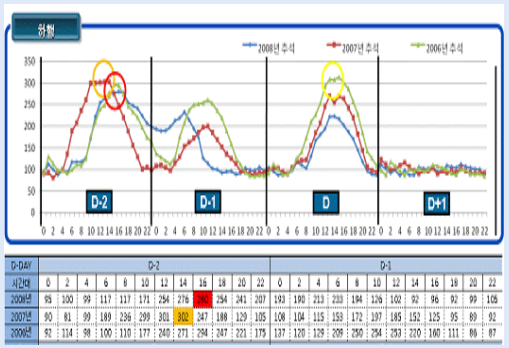
Effects

- Organized management of highway, traffic and disaster
- Automated traffic operation
- Provide high quality of information on estimated traffic condition

Integrated monitoring system

Travel time forecasting

Traffic condition estimation



Traffic simulation

Traffic Information Delivery System

VMS(Variable Message sign)

- Providing drivers with a various traffic information including fast route
- Installation Site : 2~3km ahead of Interchanges and Junctions
- Providing Information : Traffic Congestion, Travel Time, Incidents, etc

Traffic Information Delivery System

WEB/APP

- Function : Providing Traffic Information(Congestion, Travel time, Travel speed)
  Video Clip by CCTV
- Type : WEB(www.roadplus.co.kr), APP(Mobile Application)

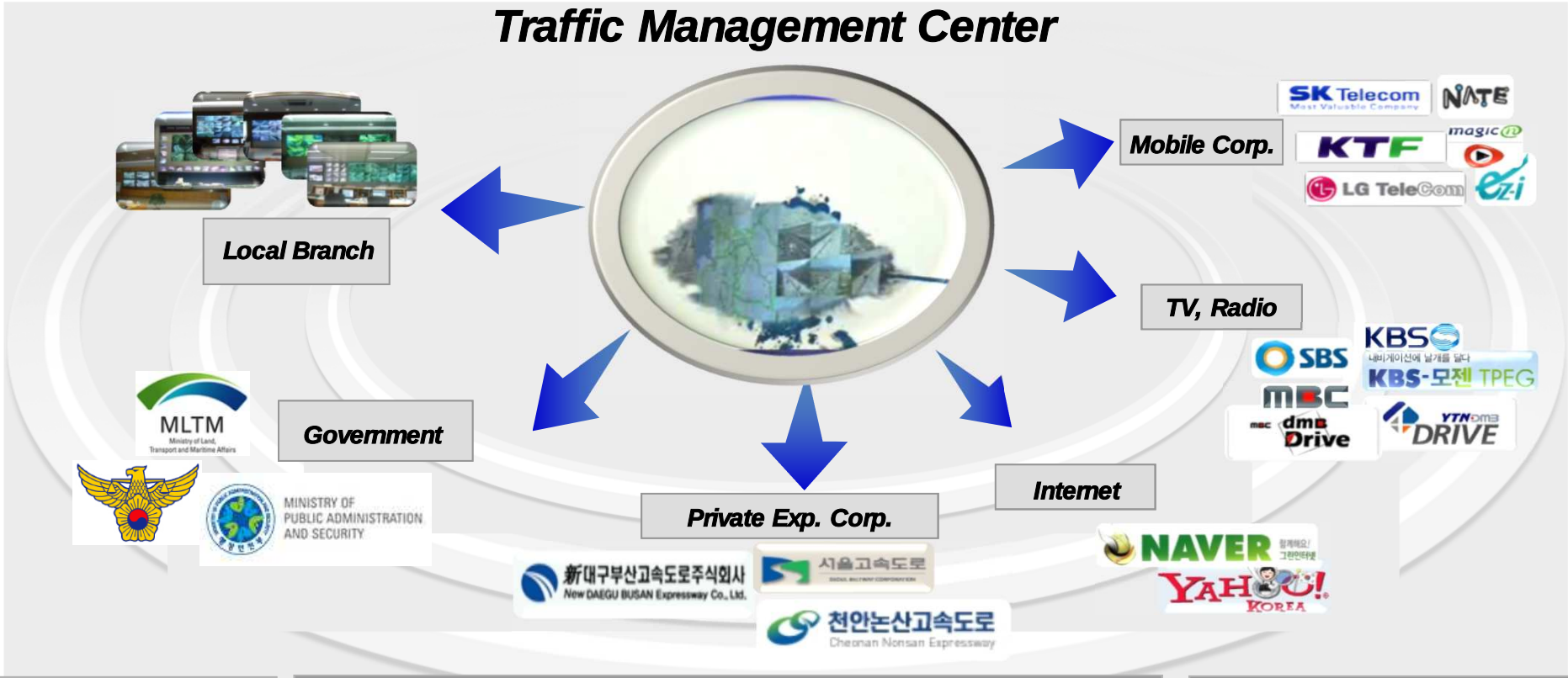
WEB(www.roadplus.co.kr)

APP(Mobile Application)

Traffic Management Center

Traffic Information System

Distribution of Traffic Information



Shares Data	Provides Information			Manages Disaster
▪ 6 Branch centers ▪ Local government (Provinces, Cities)	TV & Internet ▪ Broadcasting (KBS,MBC,SBS,YTN) ▪ Roadplus	Phone ▪ ARS(1588- 2504) ▪ Mobile Comm. (SKT,KTF,LGT)	Vehicle Equipment ▪ Car Navigation System ▪ Digital Multimedia Broadcasting	▪ Ministry of Land, Transport and Maritime Affairs ▪ Ministry of Public Administration and Security ▪ Expressway Police Patrol

Thank You !