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KGID 2025 Green Growth: The Path to Sustainable Jobs

Traffic Congestion Reduction Measures: Experiences in Korea

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Korea Transport Institute

01 Mission and Vision

A National Transport Think-Tank for People's Life and Economic Development

Seeking to Convenient and Safe Transport System For All	Strengthening Research Management Systems to Enhance Outcomes	Improving Research Capabilities and Sustainable Management System
Support for National Transport Innovation Tasks	Transport Research Planning and Management System for Mid-to-Long-Term Strategies	Strengthening Research Capabilities and Sustaining Research Activities
Enhancing Balanced and Convenient Transport Services for All	Advancing Research Capabilities using Transport Data and AI	Transport Technology Capacity Building and System-based Research Performance Management
Establishing Innovation Plans for Transport and Logistics Technology Industry	Research Quality Control for Various Customers	Social Responsibility through KOTI-ESG Management

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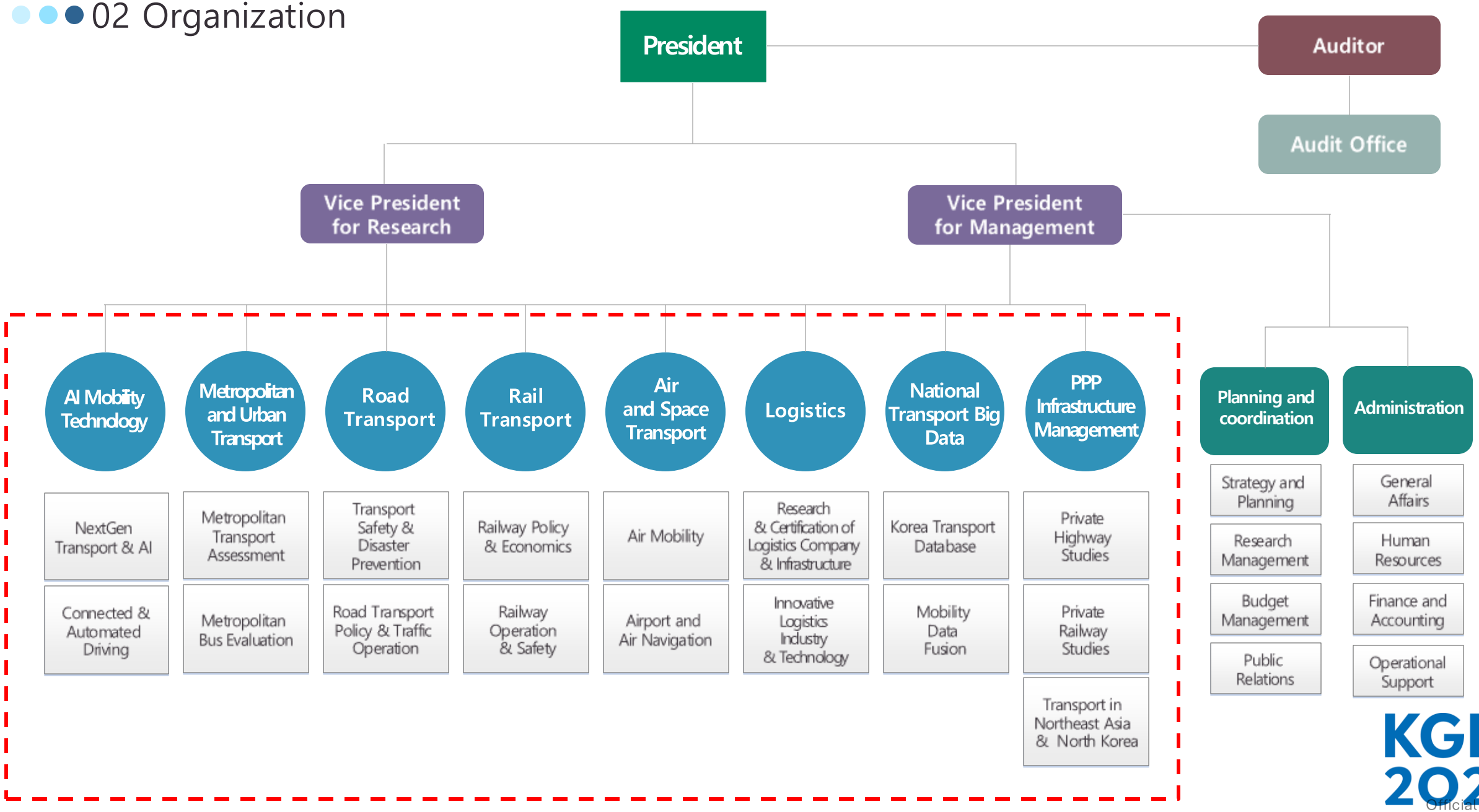
02 Organization



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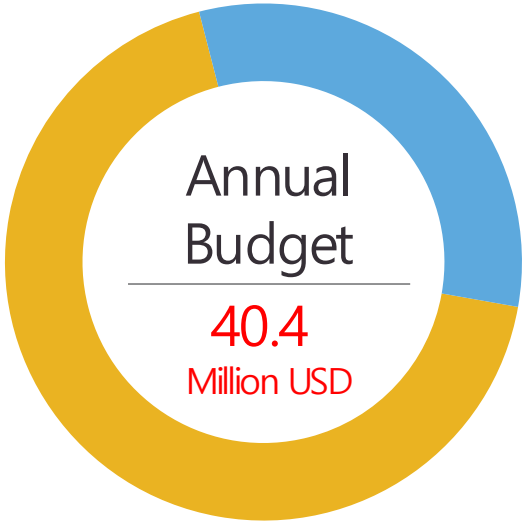
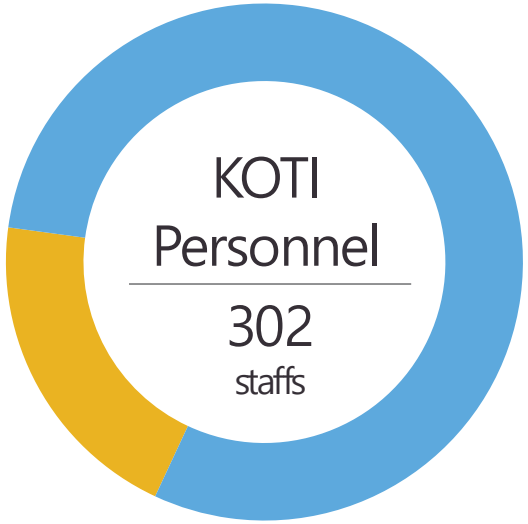
03 State of Institute(2025)



- Government Support 12.8 Million USD (34%)
- Commissioned Projects 27.6 Million USD (66%)



- 241 Regular Workers
- 61 Contract Workers

- 85 Government Funded
- 100 Non-Government Funded
- 23 R&D Projects

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Contents

- Why traffic congestion matters?
- Causes of traffic congestion
- Economic solutions
- Infrastructure solutions
- Engineering solutions
- Lessons and insights from Korea’s experiences

01. Why Traffic Congestion Matters?

- **Background**
  - Rapid urbanization and **motorization** since 1980s → Traffic congestion in SMA
  - Congestion is major economic and environmental challenge **reducing productivity**, **worsening air quality**, and **undermining urban livability**
- **Economic Impact**
  - Annual economic loss: **USD 25 billion** in SMA (2024)
  - Commuters in SMA spend **82 minutes a day** – among the highest in OECD countries
- **Evolution of Korea's Policy approach**
  - Supply expansion (1980s ~ early 1990s) : infrastructure solution
  - Demand management (mid 1990s ~ 2000s) : infrastructure solution + economic solution
  - Smart and sustainable transportation policy (2010s ~ present) : 3 types of solutions

02. Causes of Traffic Congestion

- **Excessive traffic demand**
  - **Economic solutions**: traffic demand management / investment in public transportation
- **Limited road capacity and improper design**
  - **Infrastructure solutions**: road expansion / bottleneck mitigation measures
- **Inefficient traffic operation + Accidents/incidents/construction**
  - **Engineering solutions**: improved traffic information systems / advanced traffic management strategies + real-time traffic monitoring / rapid accident response systems

03. Economic solutions

Why traffic demand management (TDM) despite political risks?

- **Past approach:** U.S. (1980s), U.K.(1990s) relied on road expansion to meet increased traffic demand
- **Policy shift:** Recognizing limits of supply-driven strategies
- **Key theories:** Downs(1977) & Mogridge/Williams(1985) – road expansion induces more traffic
- **Global awareness:** U.S. – "We can't build our way out of congestion." U.K. – "New Realism"
- **Seoul's strategy:** Adopted traffic demand management (TDM) to regulate excessive car use
- **Balancing Supply & Demand:** Developing nations must integrate infrastructure expansion with traffic demand management

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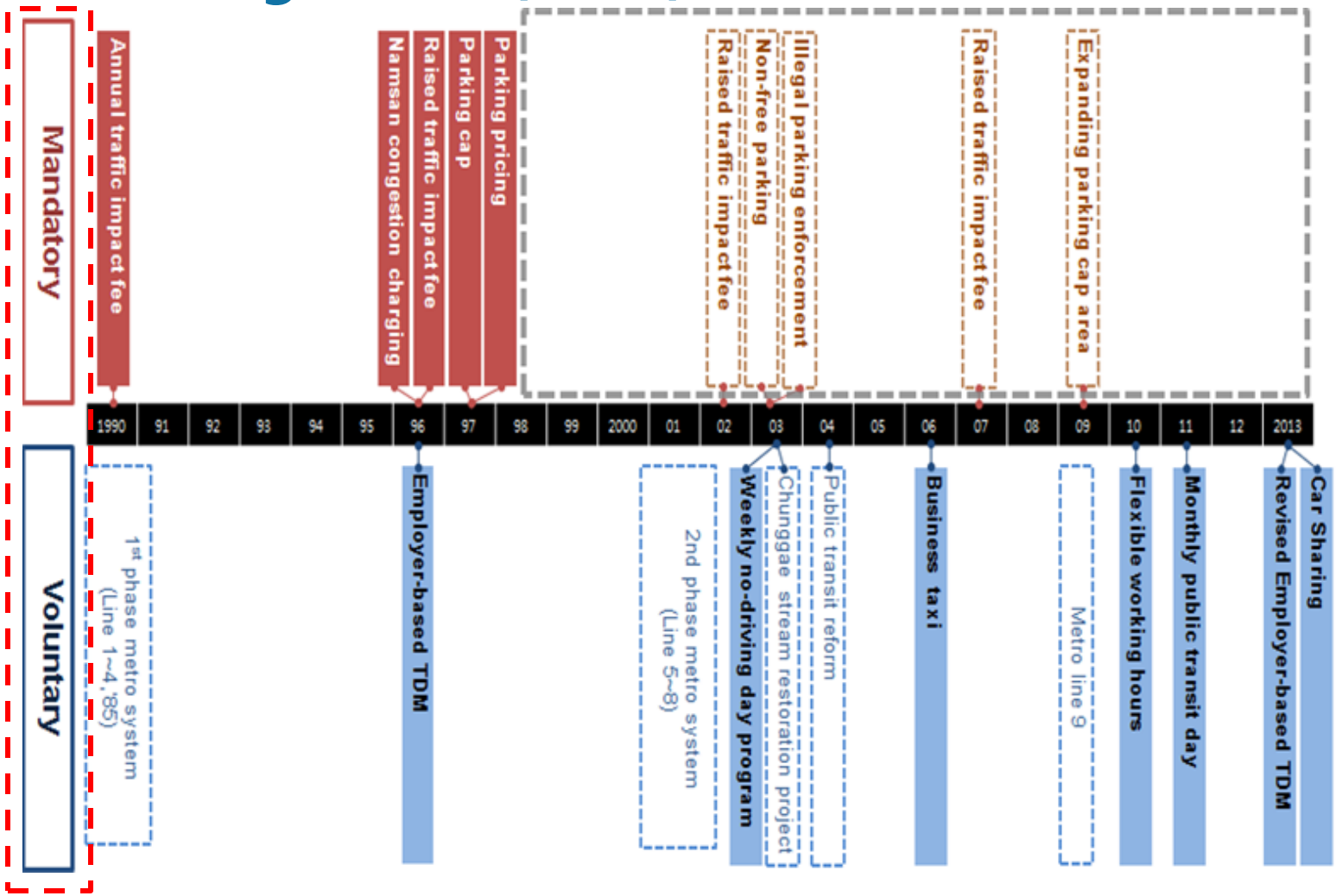
03. Economic solutions

Traffic demand management (TDM) in Seoul

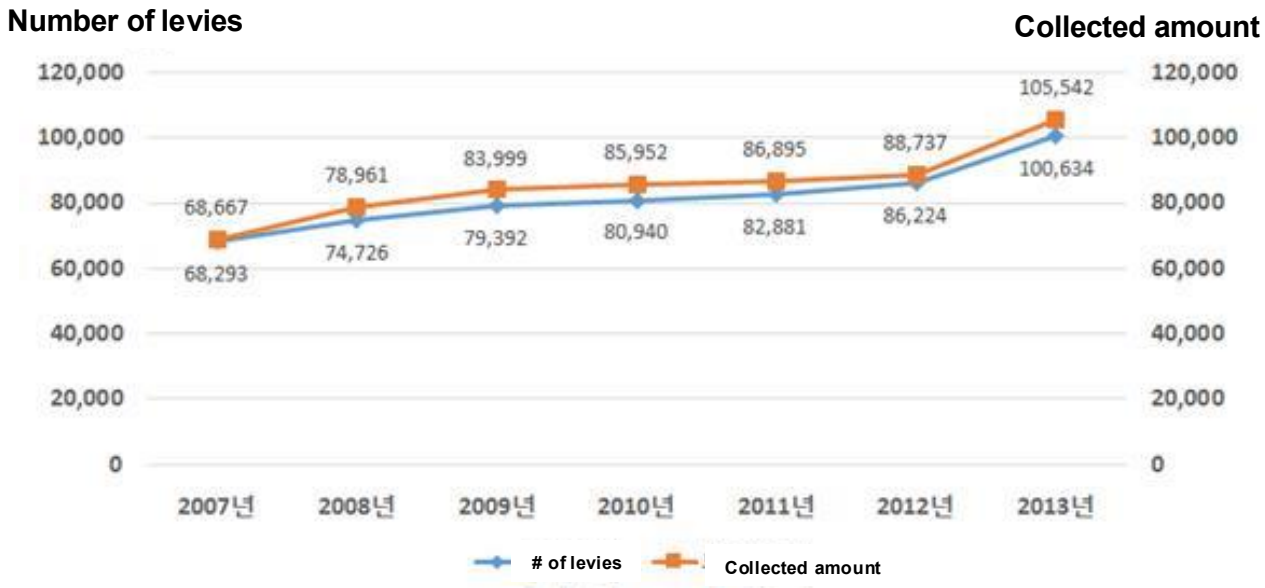
TDM: A policy to alleviate traffic congestion by reducing automobile traffic, promoting temporal and spatial dispersion of travel and encouraging modal shift to public transit



03. Traffic demand management (mandatory)

Annual traffic impact fee (1990)

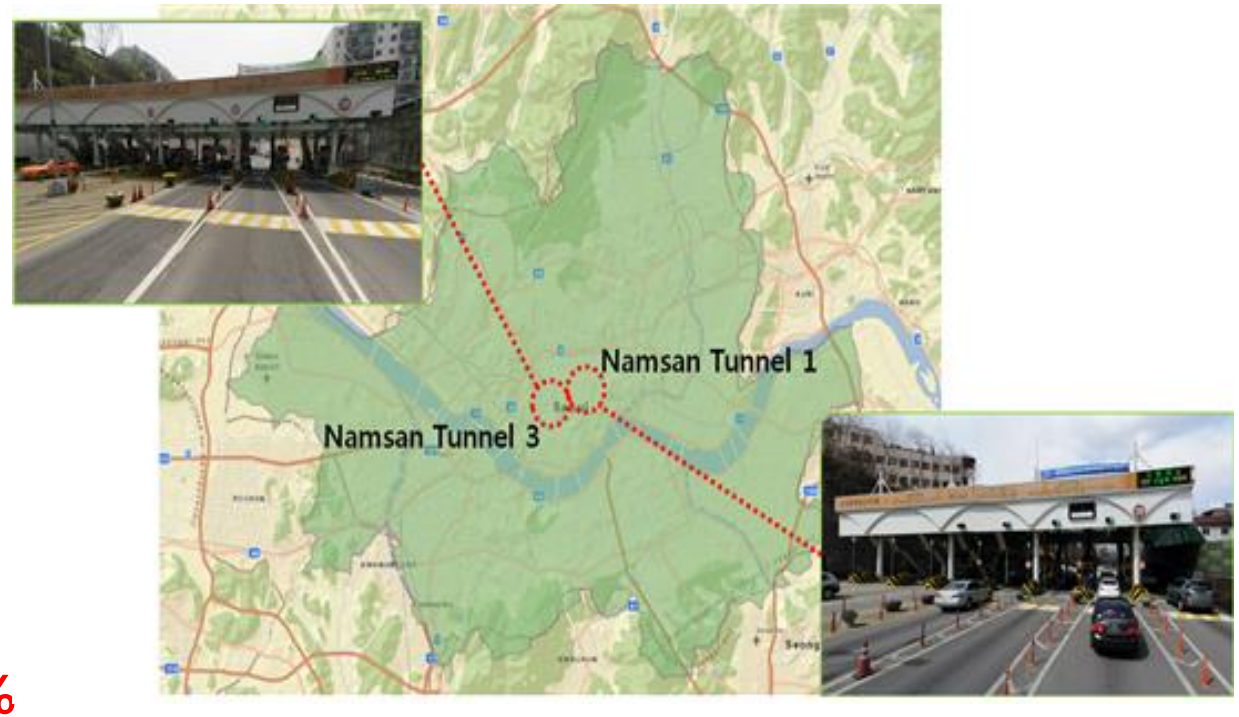
- Imposing financial burden on facilities generating large amount of traffic based on the principle of causality
- Mitigate the concentration of large traffic-generating facilities in urban centers and secure funding for urban transportation improvement project



03. Traffic demand management (mandatory)

Congestion toll charging(1994)

- The surge in private car ownership has intensified the need for measures to control personal vehicle use
- Weekdays: 07:00~21:00, Saturday: 07:00~15:00 ($1.50/veh)
- 30% Traffic reduction during peak hours, modal shift to public transportation
- Temporary suspension of congestion toll: 13% traffic increase, 9% speed decrease (2023)



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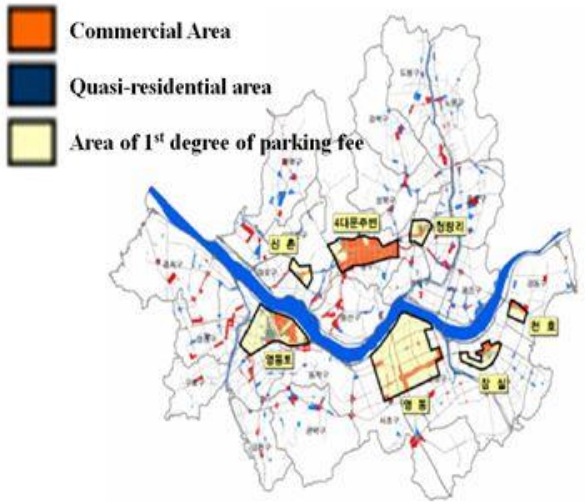
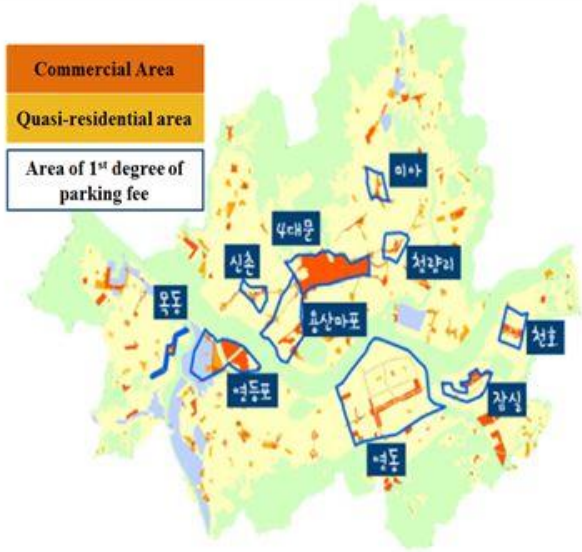
03. Traffic demand management (mandatory)

Parking cap and pricing(1997)

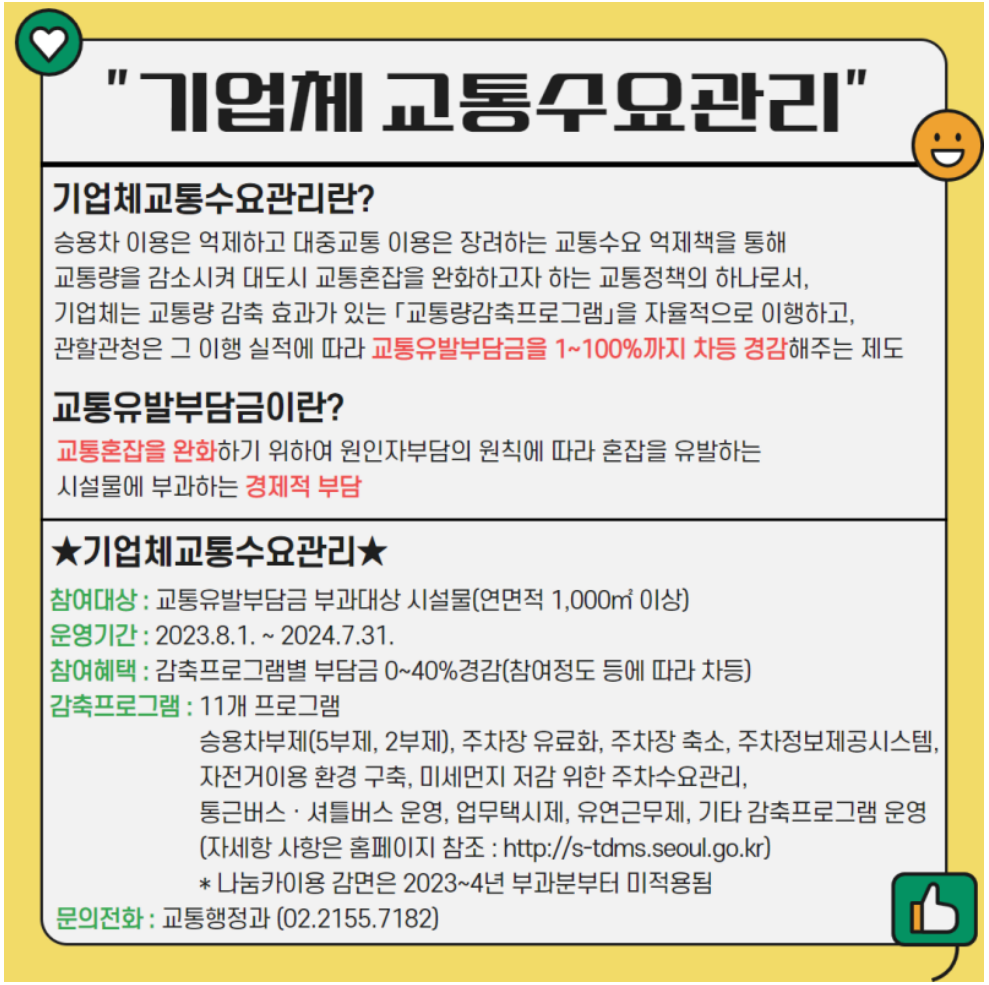
- Transition in Parking Policy: from expanding parking spaces to downsizing them
- Parking cap in Seoul: Commercial and office facilities in congested traffic area is restricted to 50% of the standard parking requirements for general areas

시행초기(1997~2008)	현재(2009~)
· 공영주차장 주차요금 1급지인 7개 지역 중 상업지역	· 공영주차장 주차요금 1급지인 10개 지역 중 상업 및 준주거지역 · 대중교통이 편리한 교통혼잡 특별관리구역
	
· 13.8km² - 서울시 전체의 2.3% - 서울시 전체 상업지역의 60%	· 16.2km² - 서울시 전체의 2.7% - 서울시 전체 상업지역의 58.7%

03. Traffic demand management (voluntary)

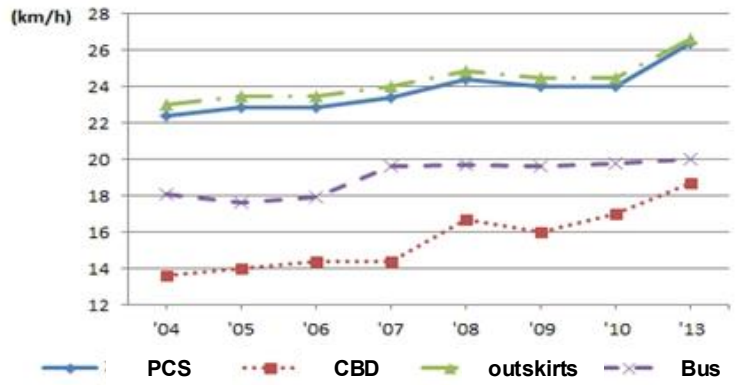
Corporate TDM program(1996)

- A voluntary traffic reduction program with incentives (reduction of annual traffic impact fee) tied to implementation performance
- Measures: license plate rationing, paid parking, commuter bus operation, car sharing, business taxi, flexible working hours

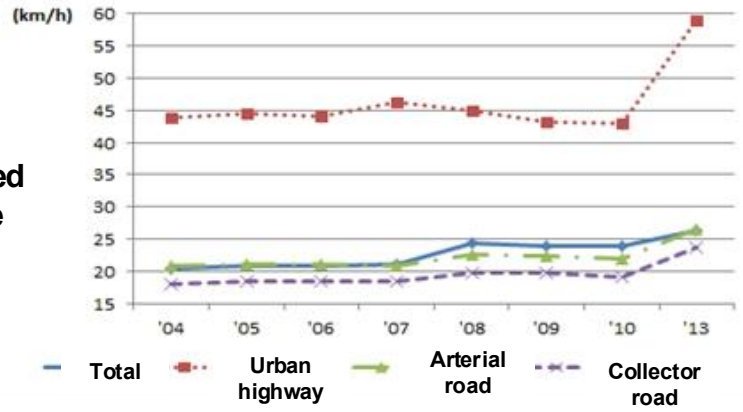


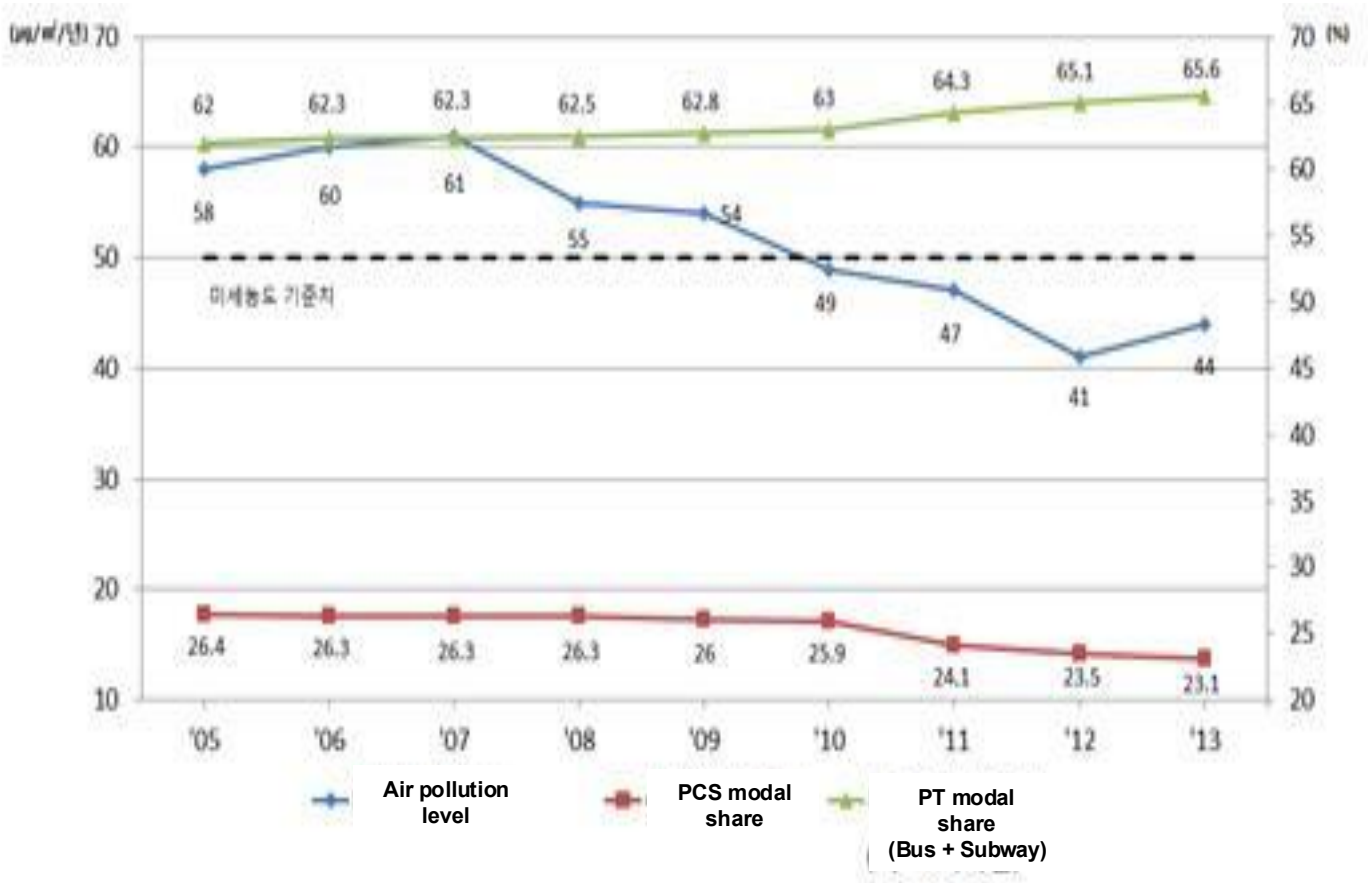
03. Effects of traffic demand management in Seoul

Average travel speed



Average travel speed over the road type





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04. Public transportation

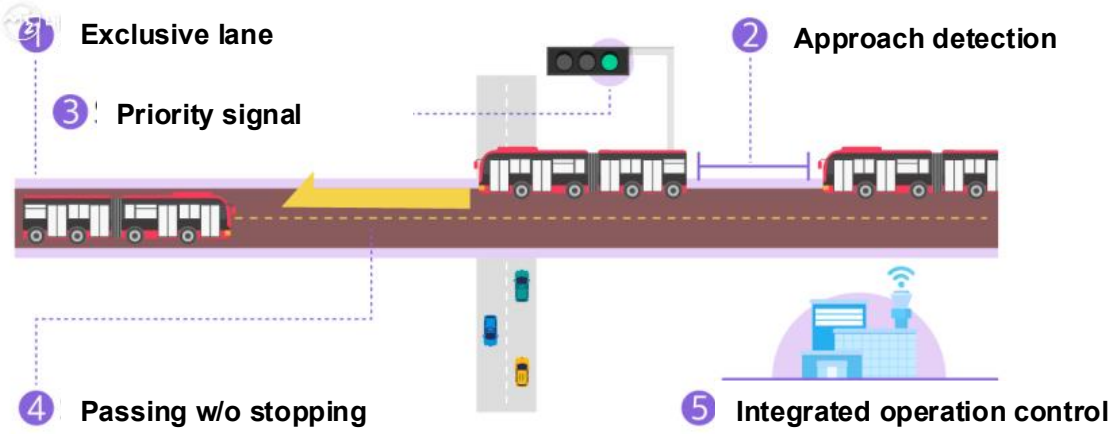
Bus exclusive lane

- Relieves severe traffic congestion caused by the surge of private car usage
- A low cost, effective solution for managing traffic demand and improving road utilization (30% speed increase, 10% passenger increase)
- Significantly lower investment while achieving the similar capacity with LRT
- Easy modification/restoration during operation
- Encourage a modal shift from private cars to public transportation

04. Public transportation

Bus rapid transit(BRT)

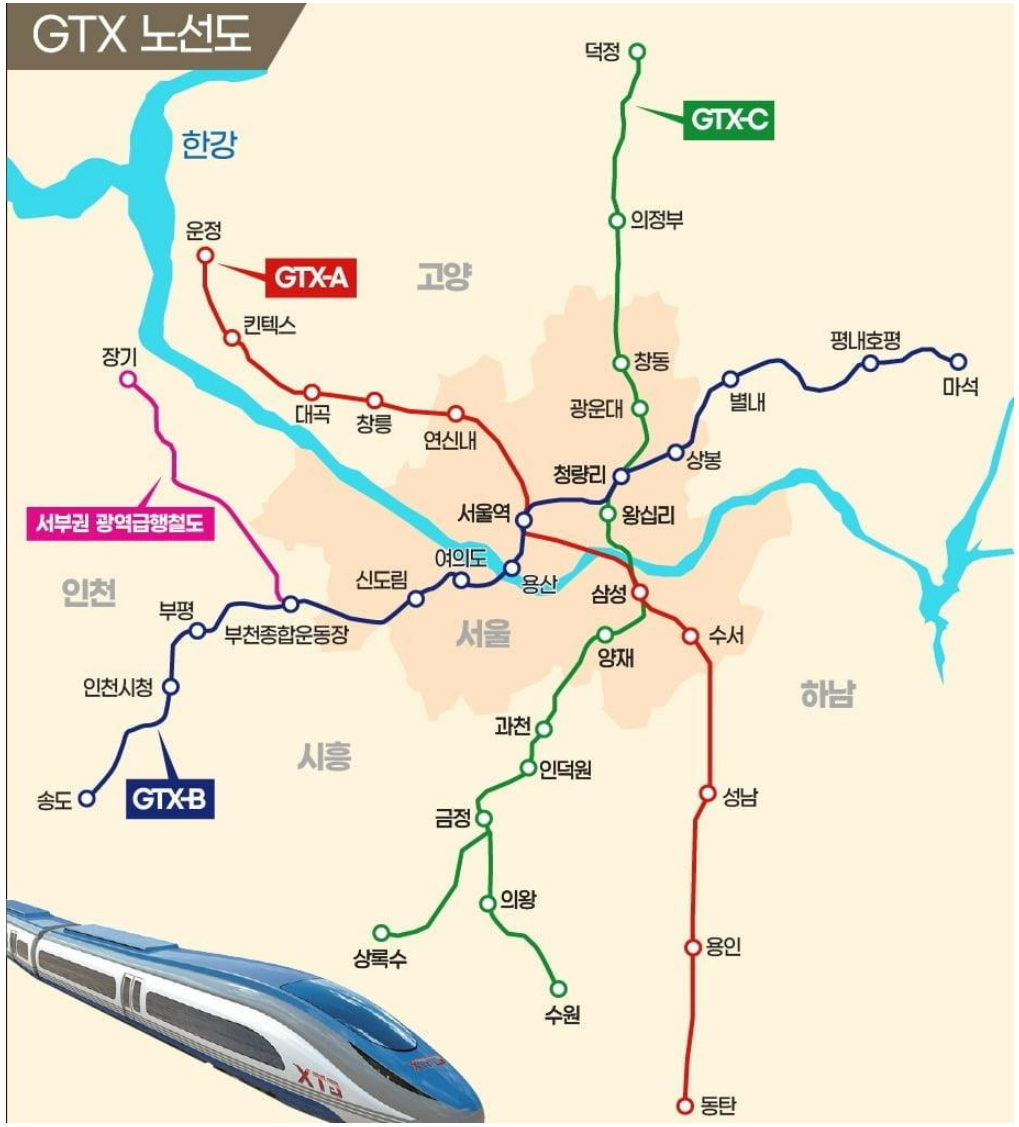
- Dedicated median bus exclusive lane
- Convenient transfer facilities (air-conditioned enclosed bus stops, multimodal transit hub)
- Intersection priority signals
- Exclusive high-quality vehicles (Electric or Hydrogen bus)
- Advanced operations and control system



04. Public transportation

Great Train eXpress(GTX: 2024.3)

- Aiming to reduce traffic congestion in the greater Seoul area and ensure a **30-min travel time from suburban regions to the city center (3~4 times faster than subway*)**
- Enhanced **connectivity** to key locations, increasing convenience for commuters
- Expansion of infrastructure and services around GTX stations: **regional growth**
- The GTX A line is partially open: 9,500,000 accumulated passengers as of May 5, 2025



* commercial speed: 100km/h

05. Infrastructure solutions

Undergrounding of expressway

- Reduces existing road congestion and improve traffic flow
- Transforms surface area into parks, cultural complexes
- Reduces noise and fine dust pollution, creating a more livable environment
- Develops commercial and business zones and boost local economies
- Raises real estate values in surrounding areas

<Source:https://m.ecomedia.co.kr/news/news view.php?ncode=1065609505981363>

05. Finetuning of Infrastructure

Freeway exit guidance lines

- Guides drivers toward the correct exit and provides visual cues to adjust speed, minimizing confusion
- Facilitates smoother lane change and reduces congestion near exit
- Effects
  - Accidents prevention
  - Enhanced driver convenience
  - Traffic efficiency improvement

<source: https://www.hankookilbo.com/News/Read/A20200922102700059 47>

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05. Finetuning of Infrastructure

Climbing lane

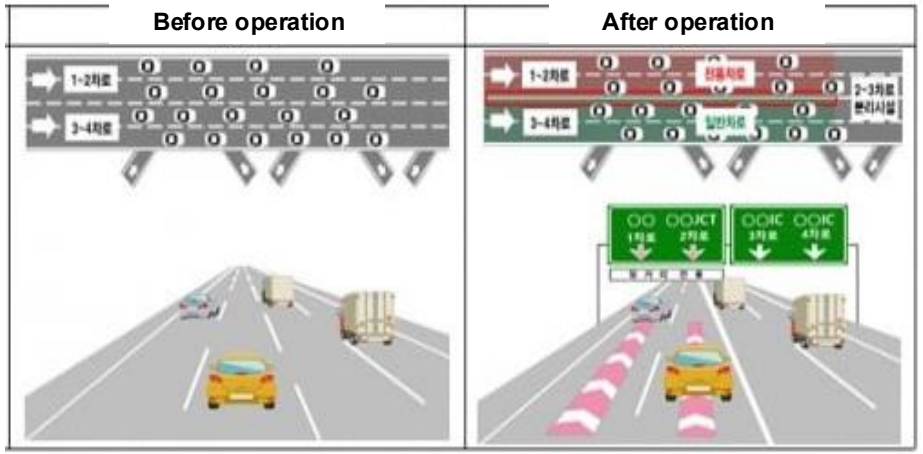
- **Guides heavy vehicles into dedicated lanes, allowing regular traffic to move smoothly**
- **Effects**
  - Separating slow-moving vehicles from faster ones, reducing sudden lane changes and congestion
  - Minimizes delays caused by speed differences, optimizing overall road efficiency
  - Helps large vehicle drivers maintain steady speeds, reducing fatigue and improving efficiency

<source: https://m.blog.naver.com/dhxk32/221326148379>

05. Finetuning of Infrastructure

Long-distance express lane (2025. 09)

- **Separates long-distance travelers by providing limited/restricted access, reducing disruptions and optimizing traffic flow**
- **Effects**
  - Minimizes bottlenecks caused by vehicles merging from ICs
  - Allows long-distance travelers to maintain a steady speed without frequent lane changes
  - Reduces sudden lane changes and heavy congestion
  - Separates local and long-distance traffic, maximizing road capacity and expressway efficiency



<source: https://www.hankyung.com/article/202507301644i>

05. Finetuning of Infrastructure

Shoulder lane operation

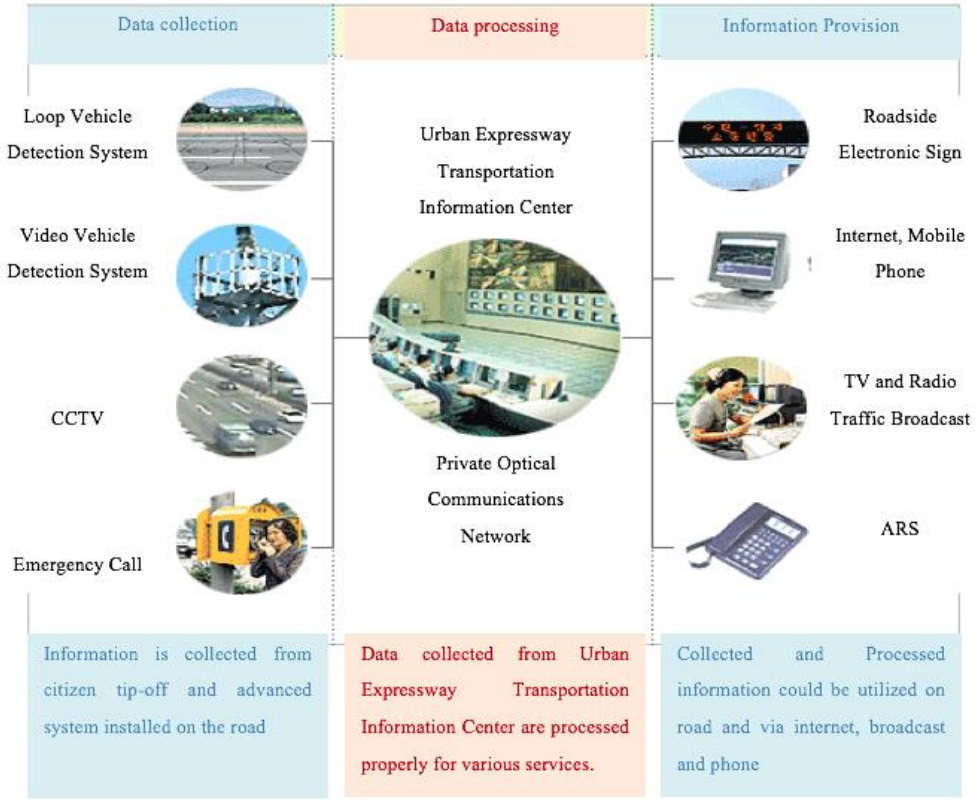
- **Effects**
  - Increases capacity without road expansion
  - Allows temporary operation while keeping the lane available
- **Drawbacks**
  - Regular traffic may increase accident risks
  - Only operates during specific hours, reducing long-term effectiveness
  - Drivers my be confused with usage rules

<source: https://www.yna.co.kr/view/AKR20150211063900004>

06. Engineering solutions

ITS on Freeway in Seoul (2003 ~ 2010)

- **Objectgives**
  - Maintain a minmum average speed of 40km/h
  - Zero traffic fatalities
- **Features**
  - Real time traffic monitoring and management
  - Automatic incident detection and rapid response
  - Traffic information dissemination
- **Effects (2003~2007)**
  - USD 150 Mil. travel time saving benefit
  - USD 23 Mil. Energy savings, USD 25 Mil. Incident response time saving

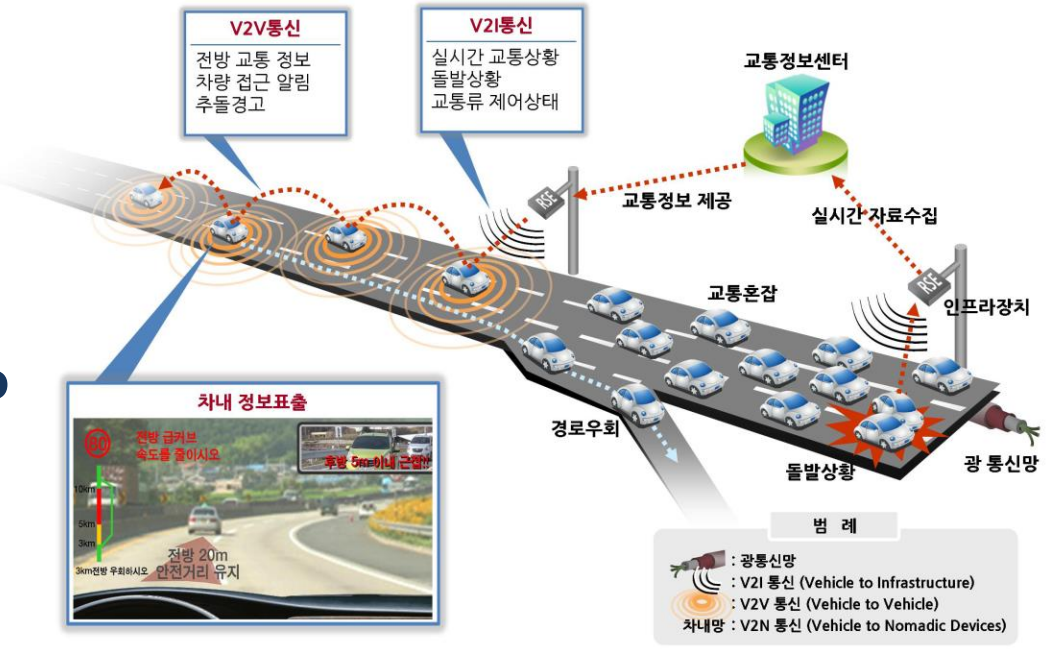


<source: Seoul Metropolitan Government, 2013>

06. Engineering solutions

C-ITS in Korea (2013 ~)

- Collection of real-time traffic and environmental information based on V2V and V2I technology like RSU, RWIS, ETC, AIDS
- Provision of traffic updates and detour guidance to individual road users using OBU (On-Board units)
- Effects
  - Avoiding potential collisions by early alerts
  - Route dispersion reducing vehicle concentration on any single route
  - Localized congestion reduction



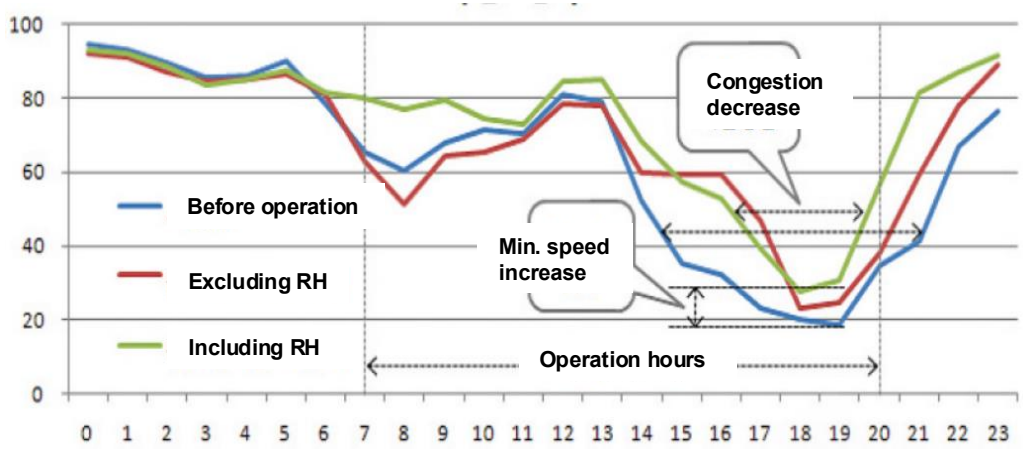
<source: MOLIT, Current status of C-ITS in Korea>

06. Engineering solutions

Ramp metering system (2010)

- **Ramp metering signals implemented on a 4.4km section of Seoul Metropolitan Expressway**
- **Effects**
  - Driver compliance rate: 95%
  - 30% Speed increase: 37-> 48km/h
  - Annual Benefit: USD 2 million in travel time saving, 7,000 tons of C02 emission reduction
  - the system was later extended to cover 8.7km section

<Ramp metering signals implemented on the expressway>



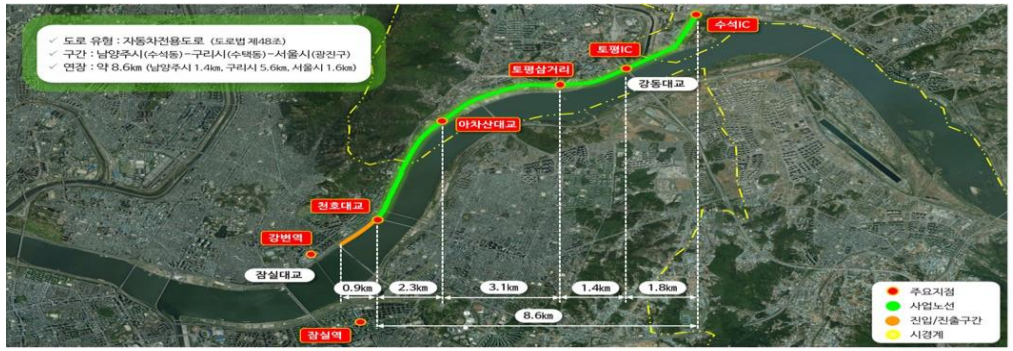
<Effectiveness of the ramp metering system>

<source: https://www.si.re.kr/sites/default/files/2020-BR-19.pdf>

06. Engineering solutions

Review of movable barrier implementation (2019~2022)

- **Provides an additional lane for inbound traffic during morning peak and for outbound traffic during evening peak – not implemented in Seoul**
- **Precondition**
  - Significant difference in traffic volume between morning and evening commute times
  - Sufficient number of lanes (at least 6 lanes in total)
  - A dedicated waiting area for the BTM
  - Sufficient lane width to secure lateral clearance when relocating median barriers



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07. Lessons and insights from Korea's experience

- **Key Lessons**
  - Road expansion alone cannot solve congestion
  - Success requires an integrated approach combining TDM, public transport, and ITS
  - Policy consistency and data-driven management ensured long-term effectiveness
- **Future Directions**
  - Sustainability: Combine congestion relief with energy saving, GHG reduction, urban livability
  - Integrated mobility: Connect GTX, BRT, DRT, ITS into one smart network
  - Regional Balance: Link transport accessibility to innovation cluster growth and local economies
- **Global Relevance**
  - Developing countries must shift from supply-driven to demand-management policies
  - Korea shows the value of combining policy, technology, and financing
  - KSP and technical partnerships with the WB can create tailored and sustainable solutions

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