Korea Transport Mobility Report

Korea Transport DataBase

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Korea Transport Mobility Report

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Contents

PART 01 **Passenger Travel Status Index Book**

007 Chapter 1 Overview
015 Chapter 2 Current Status of Passenger Travel in Korea

PART 02 **Freight in Korea**

043 Chapter 1 Overview of the Nationwide Freight Transport Survey
047 Chapter 2 Current Status of Korea's Freight Transport

PART 03 **Transportation Network Map Book**

087 Chapter 1 Overview
095 Chapter 2 Transportation Network Infographics

PART 04 **Mobile Mobility Report**

133 Chapter 1 Overview of Mobile DB Establishment
147 Chapter 2 Analysis of Mobile DB-based Travel Characteristics

PART 05 **Vehicle Mobility Report**

221 Chapter 1 Overview of Vehicle Mobility Report
229 Chapter 2 National Transport in the Perspective of Vehicle Mobility

Passenger Travel Status Index Book

How Do Korean People Travel?

Chapter 1

Overview

01 I Overview of the Report
02 I National Passenger Travel Survey
03 I Passenger O/D

01 _ Overview of the Report

◎ **Purpose**

- To provide a guidebook on the status of Korea's passenger travel that the general public as well as transport officials and transport experts can easily access

◎ **Contents**

- Development of a major passenger travel index based on the National Passenger Travel Survey and the National Passenger O/D Survey

◎ **Reference Date**

- Statistics of the Report are drafted as of 2016.

◎ **Method**

- Statistics of this report are based on the National Passenger Travel Survey and informational materials produced by the statistics authorities at home and abroad. Each statistics table is tagged with reference sources.
- Statistics in this report are also available through other statistics portals such as the KTDB, MOLIT Statistics System and Korean Statistical Information Service (KOSIS).

◎ **No. of Sample**

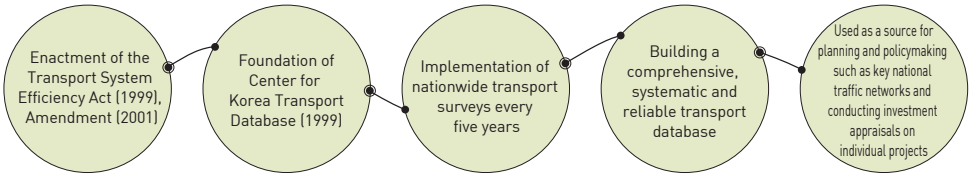
- Samples used for each in-depth survey of the National Passenger Travel Survey in the report are as below.

Name of the in-depth survey	Target groups	Number of Samples	Reference Period
Household Travel Survey	Households nationwide	224,883 households	May-December 2016
Weekend Travel Survey	Households nationwide	12,527 households	
Passenger Transport Facilities Usage Survey	Users of passenger transport facilities nationwide	77,952 persons (512 passenger transport facilities nationwide)	
Expressway Tollgate Survey	Cars using closed expressway tollgates	26,492 cars (323 expressway tollgates across the country)	
Chartered Bus Survey	Chartered buses nationwide	1,863 buses	
Traffic Volume Survey	Nationwide	744 cordon points to survey traffic volumes	

02 _ National Passenger Travel Survey

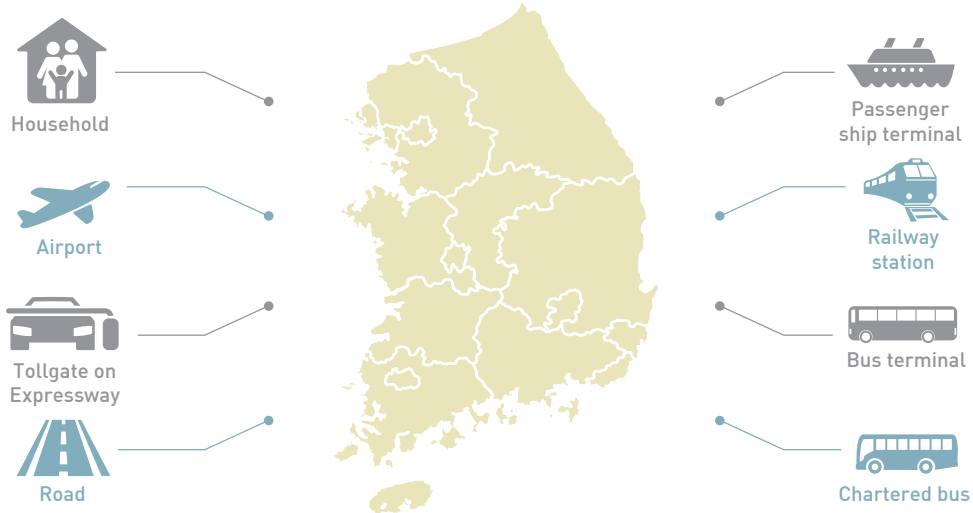
- The National Passenger Travel Survey is, a nationwide travel survey performed by the government for identifying changes in population structure, socio-economic status, and travel patterns caused by changes in the transportation system; and it is also used for building O/D travel databases that are used as the basic data to establish, implement and evaluate all aspects of the national transportation plans in Korea.

- With the public service project in 1998, the National Passenger Travel Survey has been conducted every five years based on the National Transport System Efficiency Act (1st: 1998, 2nd: 2005, 3rd: 2010, 4th: 2016)



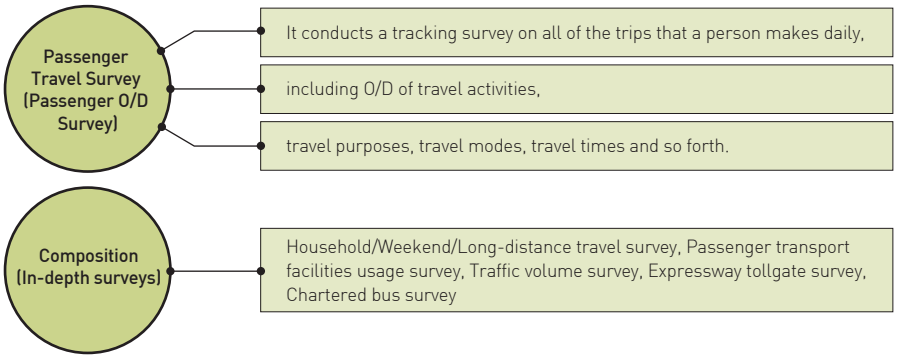
◎ Survey scope

- All households nationwide including Jeju Island, and transport facilities nationwide



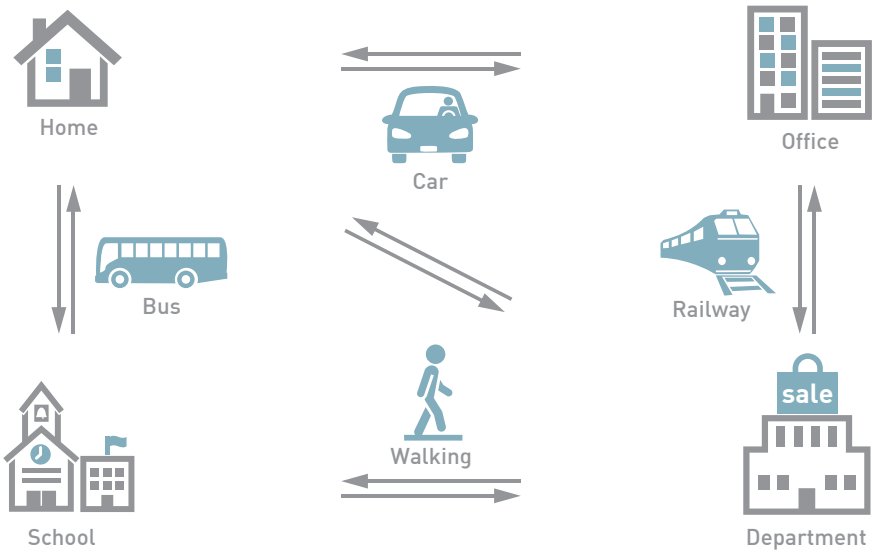
◎ Survey format

- The travel survey is implemented to analyze the movement characteristics of people.



03 _ Passenger Origin/Destination (O/D)

- Passenger travel is movement where a person with a particular purpose of activity moves from one place to another using a transportation mode.



• Passenger O/D travel volume is aggregate data that estimate persons' travels by O/D.

Destination

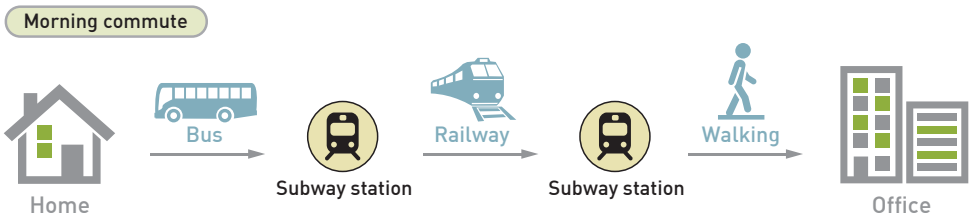
O \ D	Seoul	Busan	Daegu	Incheon	Gwangju	Daejeon	Ulsan
Seoul		500					
Busan							
Daegu							
Incheon							
Gwangju							
Daejeon							
Ulsan							

Origin

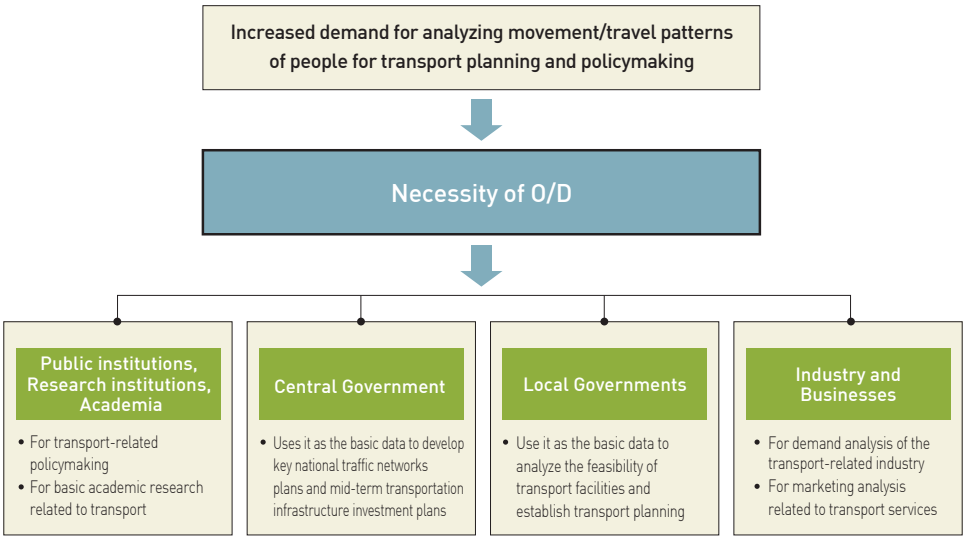
Indicates that there are 500 travels from Seoul to Busan.

• Travel is defined in two different concepts: linked trips and unlinked trips.
  - Linked trips are trips undertaken to achieve a purpose, incorporating the entire course of travel as a single trip.
  - Unlinked trips deal with different transport modes as separate trips.

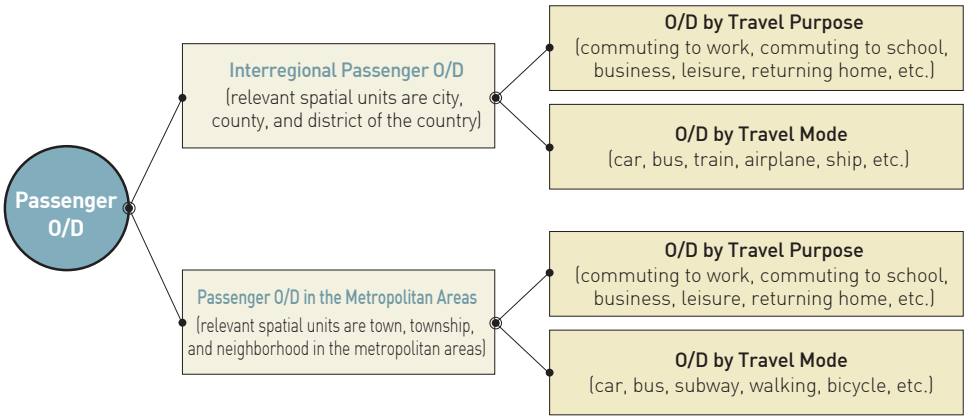
In the example below, there is a single trip for commuting of a linked trip; but there are a total of three trips including a bus trip, a subway trip and a walking trip, in terms of an unlinked trip.



◎ Necessity of passenger O/D and its application



◎ Combination of passenger O/D data



※ Metropolitan areas: Seoul metropolitan area, Busan·Ulsan area, Daegu metropolitan area, Daejeon metropolitan area(Daejeon-Chungcheong area), Gwangju metropolitan area, Jeju area

◎ Construction of yearly passenger O/D database

- Passenger O/D has been constructed using all sorts of statistics such as the Nationwide Passenger Travel Survey, socio-economic index, transported volumes by transport mode, and so forth (Expansion)
- For the years without survey, passenger O/D is yearly amended and renewed by reflecting changed statistical indicators on the baseline passenger O/D (Actualization).

Current status of passenger O/D database construction

Classification	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Survey	Interregional O/D Survey	Metropolitan Cities O/D Survey	Traffic Volume Survey	Supplementary Survey for O/D				Interregional O/D Survey	Metropolitan Cities O/D Survey	
Analysis		Expansion of Interregional O/D	Expansion of Metropolitan Cities O/D	Actualization of Interregional/ Metropolitan Area O/D	Actualization of Interregional O/D	Actualization of Interregional O/D	Actualization of Interregional/ Metropolitan Area O/D	Actualization of Interregional O/D	Expansion of Interregional O/D	Actualization of Interregional O/D, Expansion of Metropolitan Area O/D

Classification	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Survey	Supplementary Survey for Interregional O/D		Nationwide O/D Survey						Nationwide O/D Survey	
Analysis	Actualization of Interregional O/D	Actualization of Interregional O/D	Actualization of Interregional O/D	Expansion of Interregional/ Metropolitan Area O/D	Actualization of Interregional/ Metropolitan Area O/D	Actualization of Interregional/ Metropolitan Area O/D	Actualization of Interregional/ Metropolitan Area O/D	Actualization of Interregional/ Metropolitan Area O/D	Actualization of Interregional/ Metropolitan Area O/D	Expansion of Interregional/ Metropolitan Area O/D

Chapter 2

Current Status of Passenger Travel in Korea

01 I Changes in Travel Patterns

02 I Characteristics of the Nationwide Passenger Travel

03 I Characteristics of Passenger Travel in the Metropolitan Areas

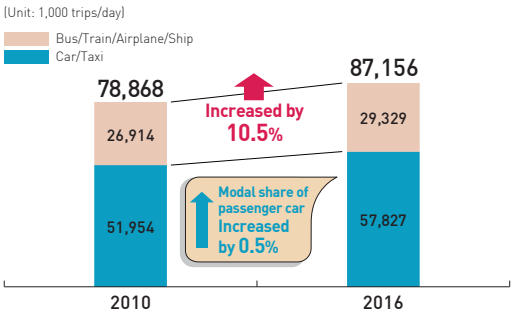
04 I Forecast for the Nationwide Passenger Travel Demands in the Future

05 I Findings from the National Passenger Travel Survey

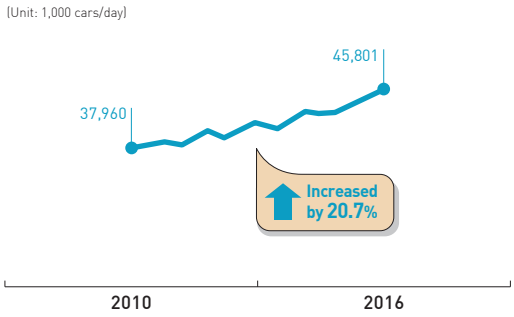
01 _ Changes in Travel Patterns

[Rapid increase in passenger car traffic volume with the increase of the country's total travels]

● Total travels (nationwide)

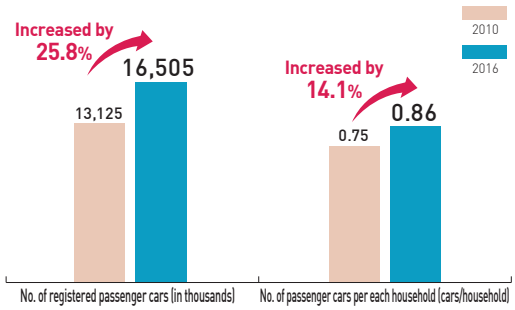


● Passenger car traffic volume (nationwide)

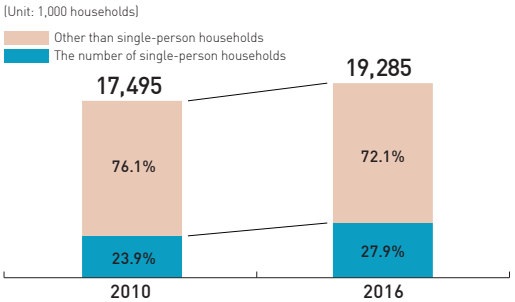


[An increase in passenger car traffic volume is the outcome of an increase in household car ownership and the number of single-person households.]

● Number of registered vehicles & number of passenger cars per household

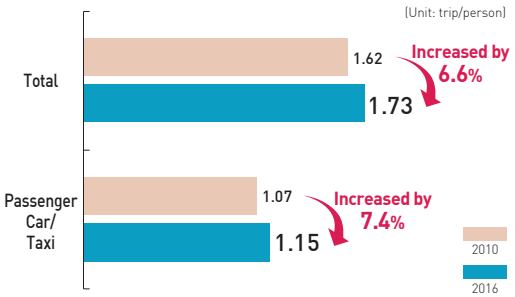


● Total number of households and the proportion of single-person households

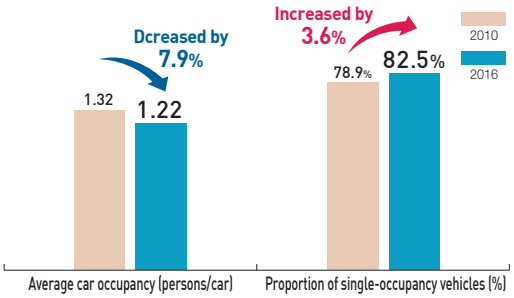


[Influence of an increase in the number of trips per person and a decrease in average occupancy of cars]

● No. of trips per person



● Average passenger car occupancy and the proportion of single-occupancy passenger car

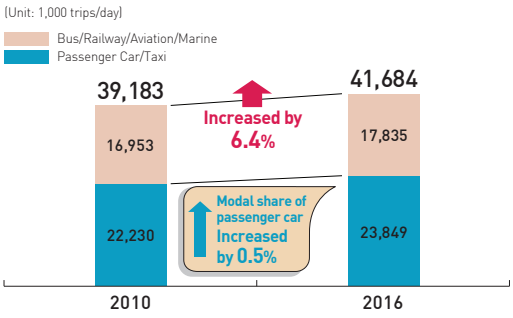


Source : 1) The National Transport DB Center, KOTI (https://www.ktdb.go.kr), Nationwide interregional main travel mode O/D, Household travel survey (2010, 2016) 2) Korean Statistical Information System, KOSTAT (http://kosis.kr), Household projections 3) MOLIT Statistics System (http://stat.molit.go.kr), Total registered moter vehicles
Note : Analysis of interregional travel generated by the travel modes other than walking, bicycle, and freight is analyzed.

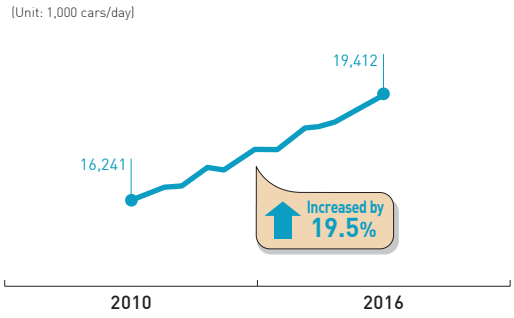
◎ Special/Metropolitan cities

[Due to increasing travels, the passenger cars traffic is sharply increasing]

- Total travels in the special/metropolitan cities

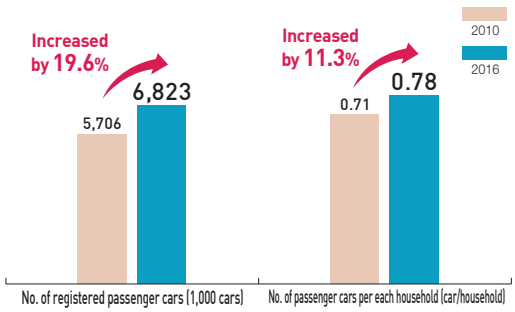


- Passenger-car traffic in the special/metropolitan cities

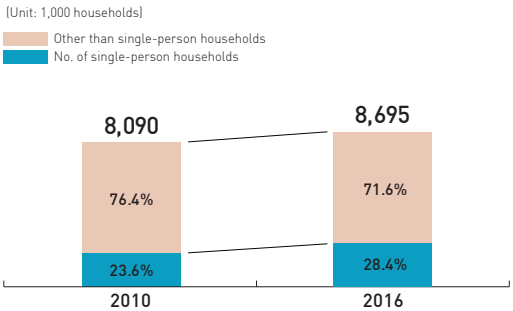


[A rapid increase in passenger car traffic is the outcome of an increase in the number of passenger cars per household and single person household]

- No. of registered vehicles & No. of passenger cars per household

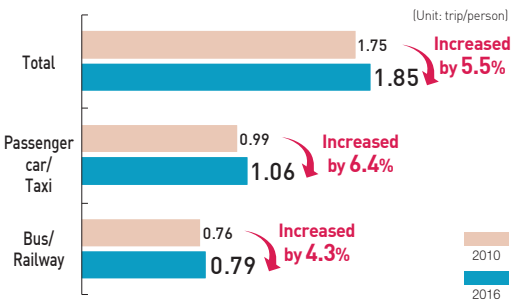


- No. of total households and ratio of single person households

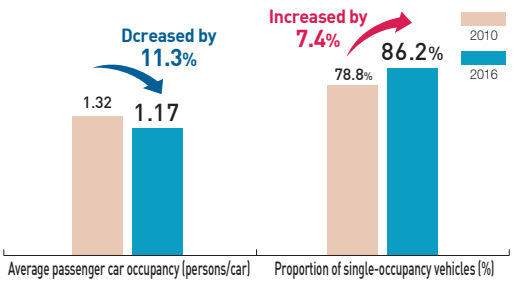


[An increase in passenger car traffic per person is influenced by a decrease in the average car occupancy rate]

- Number of trips per person



- Average passenger car occupancy and the proportion of single-occupancy passenger car

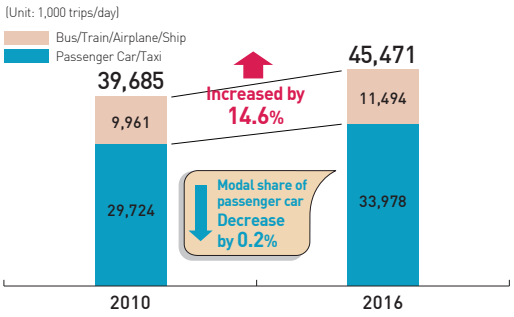


Source : 1) The National Transport DB Center, KOTI (https://www.ktdb.go.kr), Nationwide Interregional Main travel Mode O/D, Household Travel Survey (2010, 2016) 2) Korean Statistical Information System, KOSTAT (http://kosis.kr), Household Projections 3)MOLIT Statistics System (http://stat.molit.go.kr), Total Registered Moter Vehicles

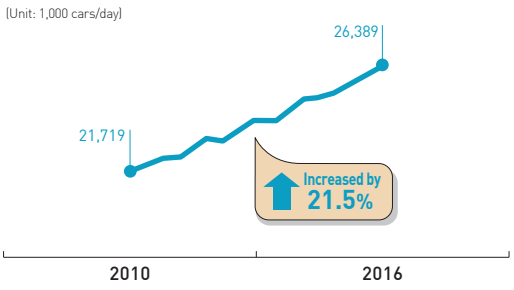
◎ Towns and townships other than special/metropolitan cities

[Due to increasing travels, the passenger car traffic is sharply increasing]

- Total travels of the other towns and townships

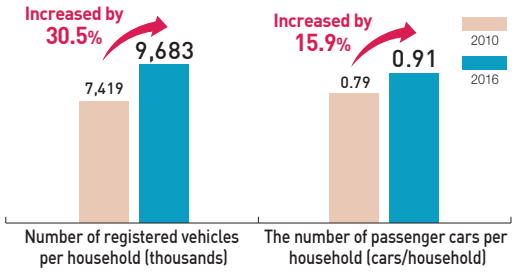


- Traffic volume of passenger cars in other towns and townships

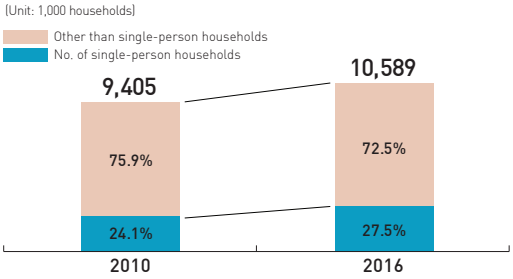


[A rapid increase in passenger car traffic is the outcome of the increase in the number of cars per household and single-person households.]

- Number of registered vehicles per household and the number of cars per household

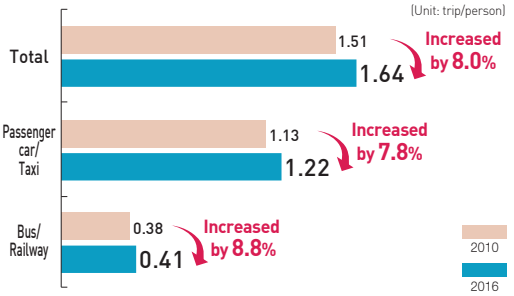


- Total households and the proportion of single-person households

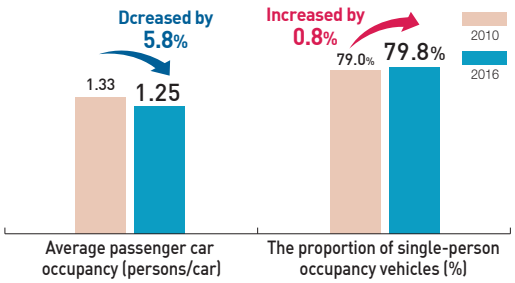


[An increase in passenger car traffic per person is influenced by a decrease in the average car occupancy rate]

- Number of trips per person



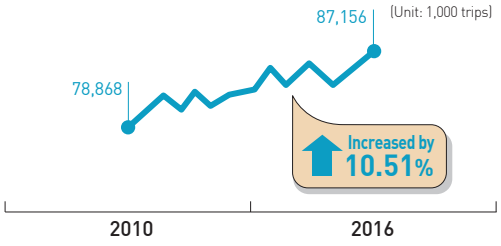
- Average passenger car occupancy and the proportion of single-person occupancy vehicles



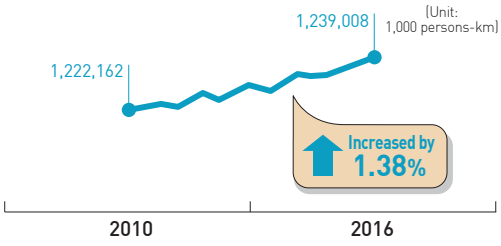
Source : 1) The National Transport DB Center, KOTI (https://www.ktdb.go.kr), Nationwide interregional Main travel Mode O/D, Household Travel Survey (2010, 2016) 2) Korean Statistical Information System, KOSTAT (http://kosis.kr), Household Projections 3) MOLIT Statistics System (http://stat.molit.go.kr), Total Registered Moter Vehicles

02 _ Characteristics of the Nationwide Passenger Travel

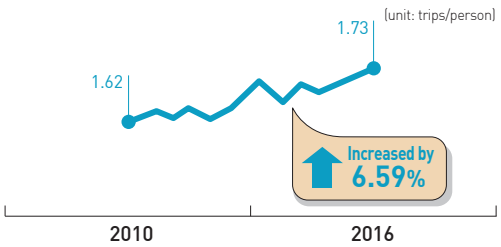
The national total travels



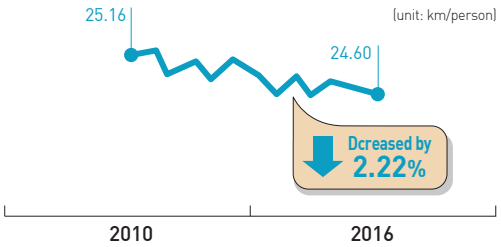
The nation's total travel distance



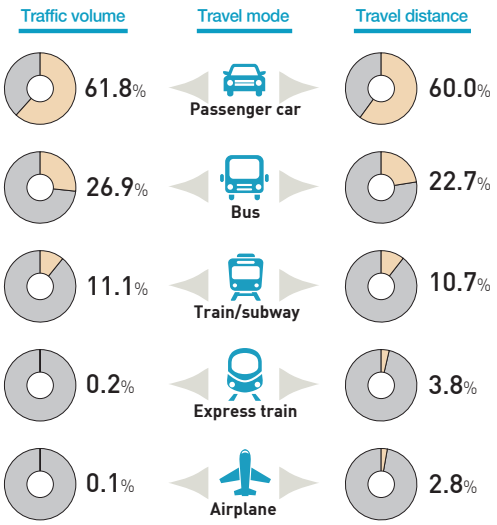
Daily number of trips per person



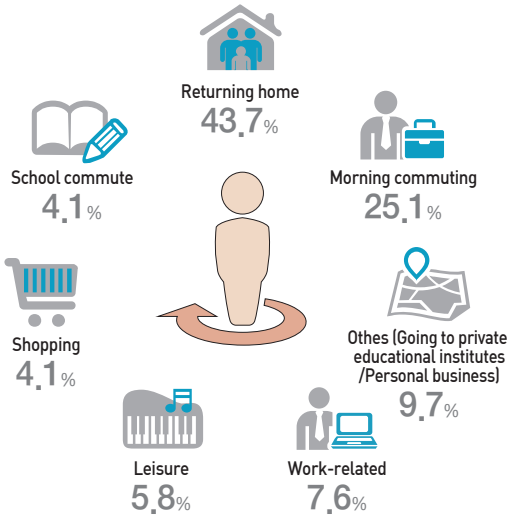
Travel distance per person



How do people travel? (2016)



Why do people travel? (2016)

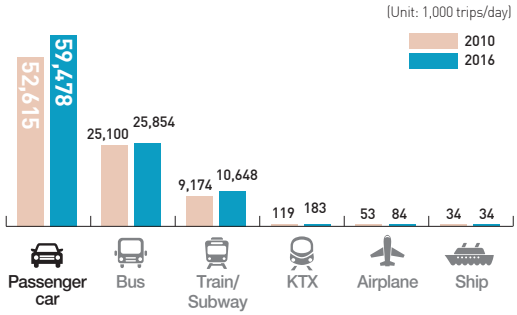


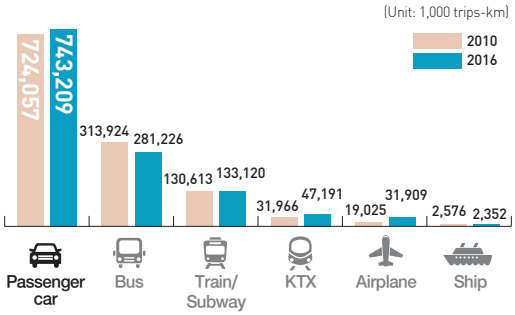
Sources : The National Transport DB Center (https://www.ktdb.go.kr), Nationwide interregional OD by trip purpose and mode type, Transport analysis network

◎ Characteristics of travel modes in nationwide passenger travel

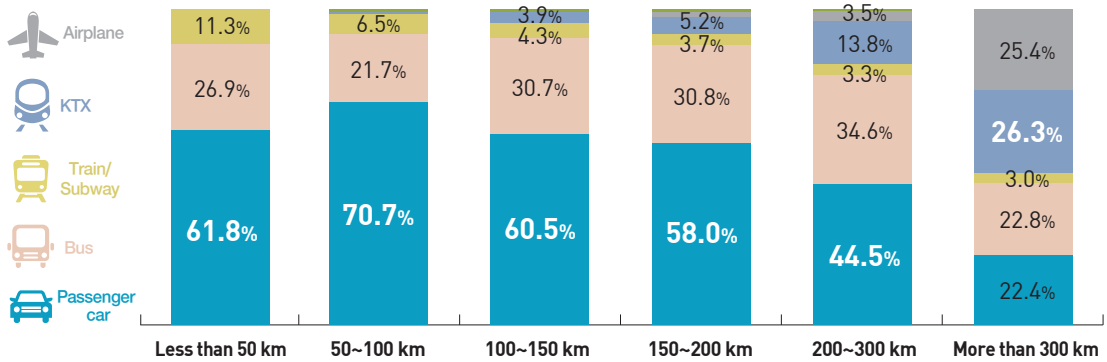
● What travel modes do people use?

● How many time do people use travel modes and how far do people travel?





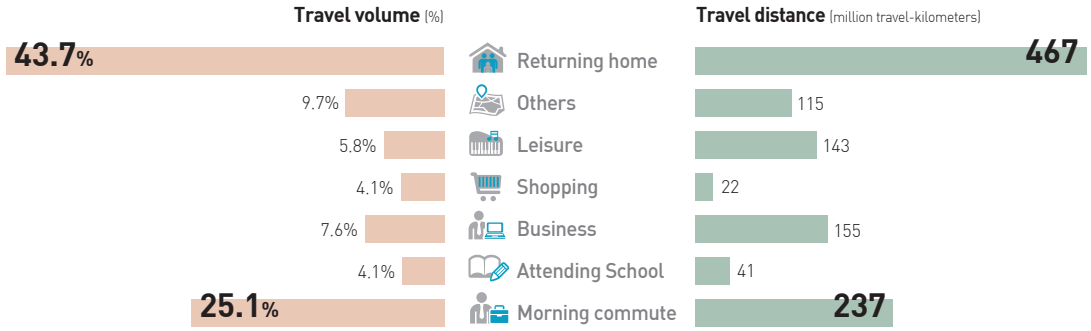
● What specific travel modes do people prefer according to the travel distance? (2016)



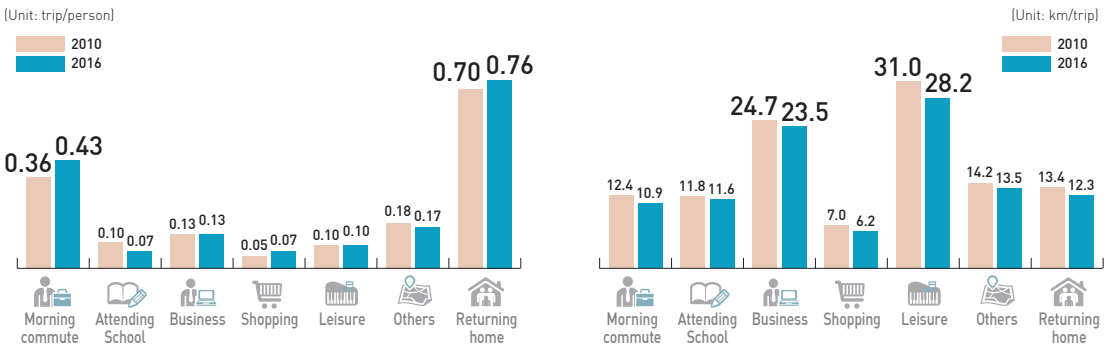
Sources : The National Transport DB Center (https://www.ktdb.go.kr), Nationwide Interregional OD by Trip Purpose and Mode Type, Transport Analysis Network

◎ Characteristics of the nation's passenger travel purposes

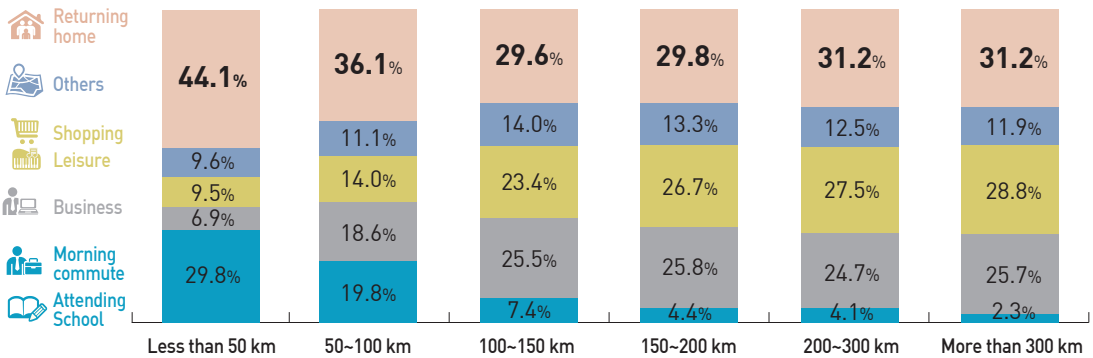
● For what purpose do people travel and how far? (2016)



● What types of trip chaining are presented per day and how far are they in average?



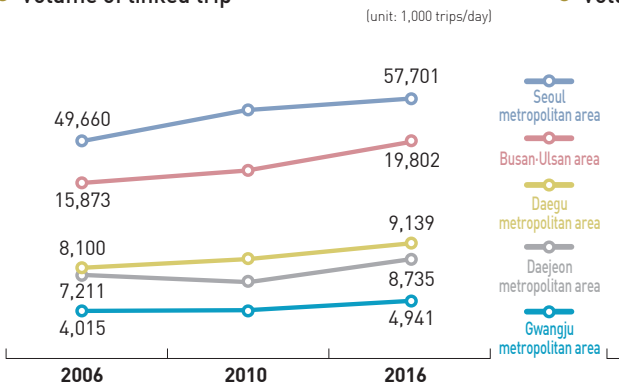
● What types of trips are taken according to the travel distance?



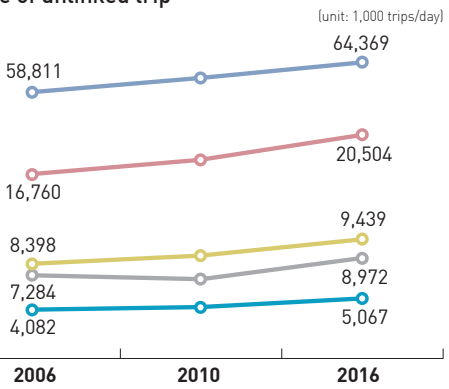
Sources : The National Transport DB Center (https://www.ktdb.go.kr), Nationwide Interregional OD by Trip Purpose and Mode Type, Transport Analysis Network

03 _ Characteristics of Passenger Travel in the Metropolitan Areas

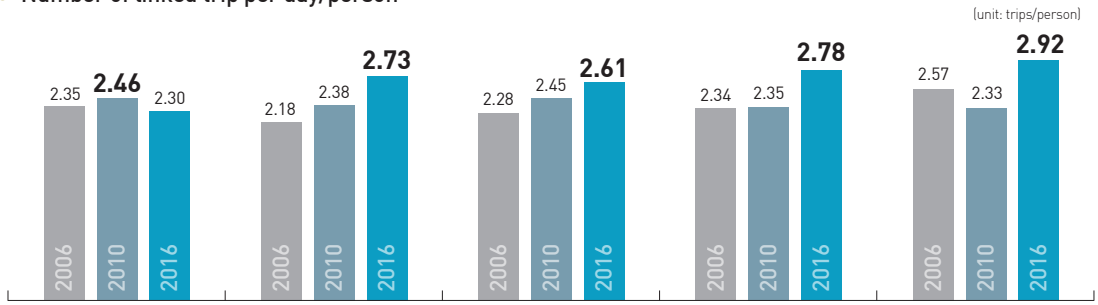
Volume of linked trip



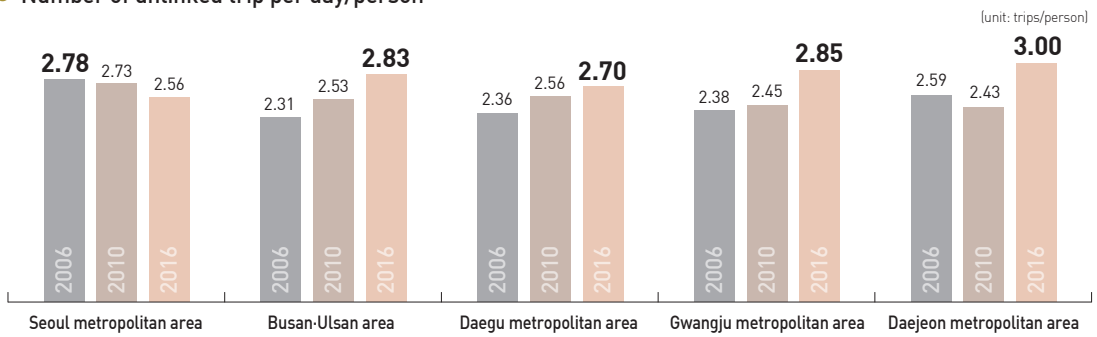
Volume of unlinked trip



Number of linked trip per day/person



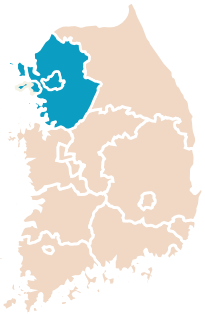
Number of unlinked trip per day/person



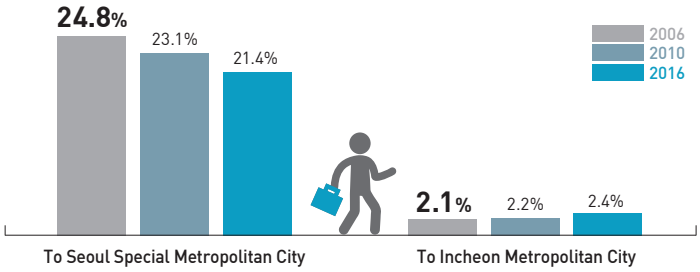
Source: The National Transport DB Center (https://www.ktdb.go.kr) at the Korea Transport Institute, OD by Trip Purpose and Mode Type in the Metropolitan Areas

Note: 1) These are the results of analyzing intra-zonal travel of the metropolitan areas. 2) Seoul Metropolitan area : Seoul special metropolitan city, Incheon metropolitan city, Every city/Gun in Gyeonggi-do (33 Municipalities) 3) Busan·Ulsan metropolitan area: Busan metropolitan city, Ulsan metropolitan city, Changwon city, Yangsan city, Gimhae city, Miryang city, Pohang city, Gyeongju city (8 Municipalities) 4) Daegu metropolitan area: Daegu metropolitan city, Gumi city, Yeongcheon city, Gyeongsan city, Gunwi-gun (county), Cheongdo-gun, Goryeong-gun, Seongju-gun, Chilgok-gun, Changnyeong-gun (10 Municipalities) 5) Gwangju metropolitan area: Gwangju metropolitan city, Naju city, Hwasun-gun (county), Damyang-gun, Jangseong-gun, Hampyeong-gun, Gokseong-gun (7 Municipalities) 6) Daejeon metropolitan area: Daejeon metropolitan city, Sejong Special Self-governing City, Cheongju city, Boeun-gun (county), Okcheon-gun, Yeongdong-gun, Gongju city, Nonsan city, Gyeryong city, Geumsan-gun (10 Municipalities)

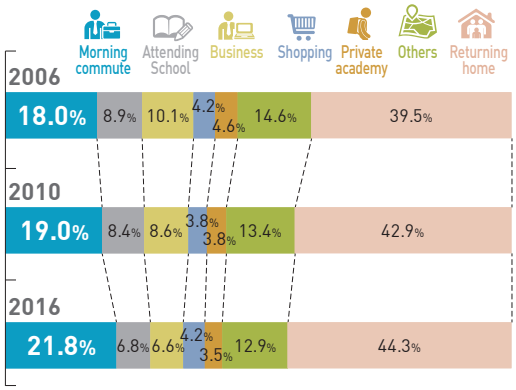
◎ Travel characteristics in the Seoul Metropolitan Area



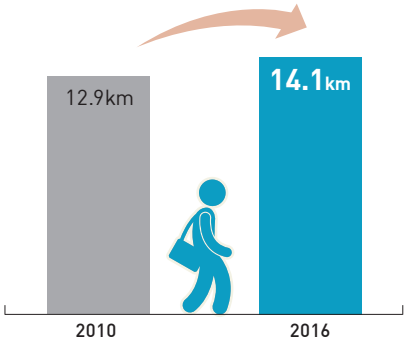
● The rates of commuting to Seoul and Incheon from neighborhood towns and townships



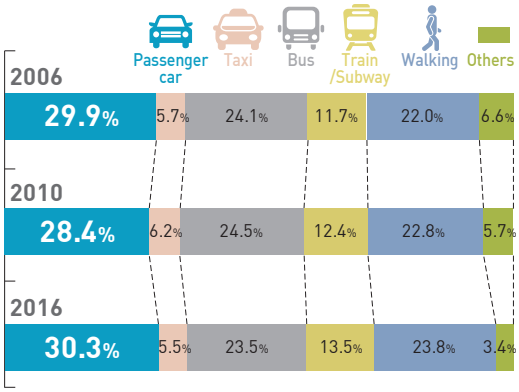
● Major purposes of trips



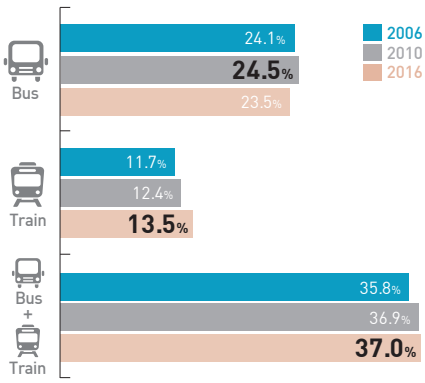
● Average distance of commuting



● Major modes of transport

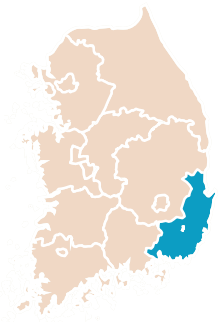


● Modal split of the public transportation (bus, train, etc.)

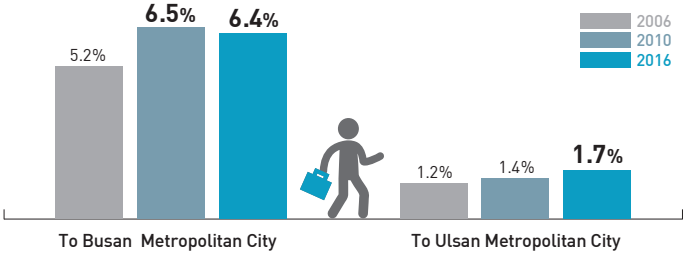


Source: KTDB (https://www.ktdb.go.kr), OD by Trip Purpose and Mode Type in the Seoul Metropolitan Area, Transport Analysis Network
Notes: 1) These are the results of analyzing intra-zonal travel of the Seoul Metropolitan Area 2) The metropolitan areas: Entire towns and townships in Seoul, Incheon, and Gyeonggi Province (33 towns and townships)

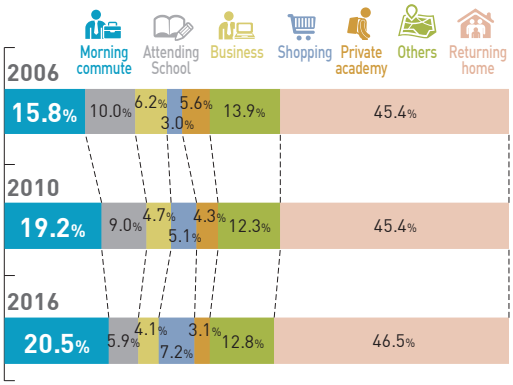
◎ Travel characteristics of the Busan-Ulsan Metropolitan area



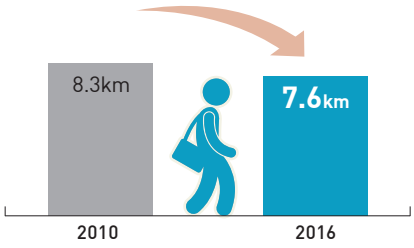
● The rates of commuting to Busan and Ulsan from neighborhood towns and townships



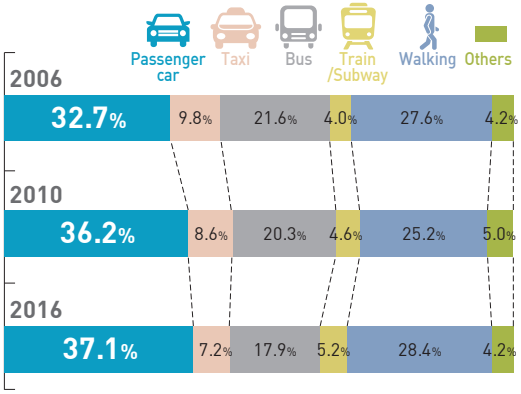
● Major purposes of trips



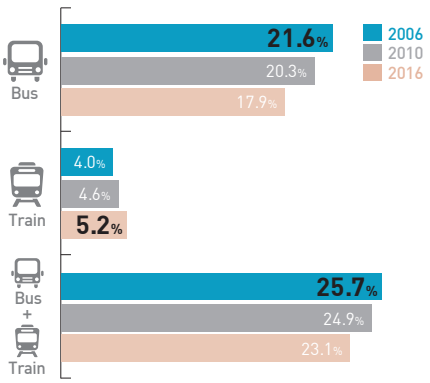
● Average distance of commuting



● Major modes of transport



● Modal split of the public transportation (bus, train, etc.)

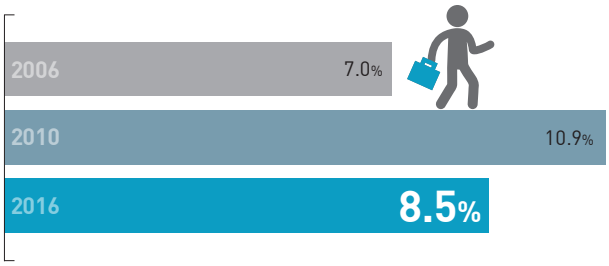


Source: The National Transport DB Center (https://www.ktdb.go.kr) at the Korea Transport Institute, OD by Trip Purpose and Mode Type in the Busan·Ulsan Metropolitan area, Transport Analysis Network

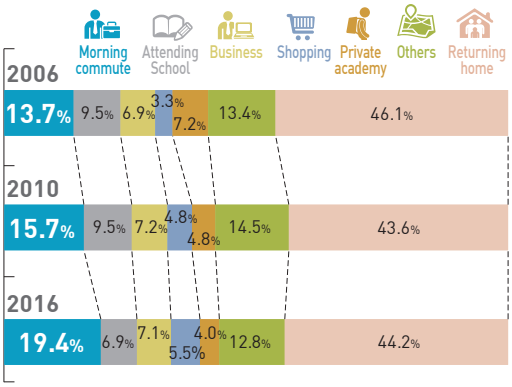
Notes: 1) These are the results of analyzing intra-zonal travel of the Busan·Ulsan area. 2) Busan·Ulsan Metropolitan area: Busan Metropolitan City, Ulsan Metropolitan City, Changwon City, Yangsan City, Gimhae City, Miryang City, Pohang City, Gyeongju City (8 towns and townships)

◎ Travel characteristics of the Daegu metropolitan area

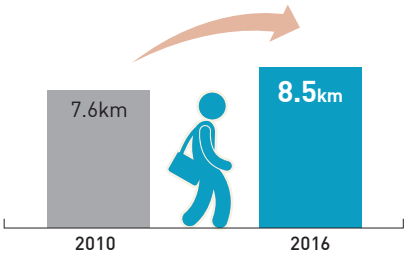
● The rates of commuting to Daegu from neighborhood towns and townships



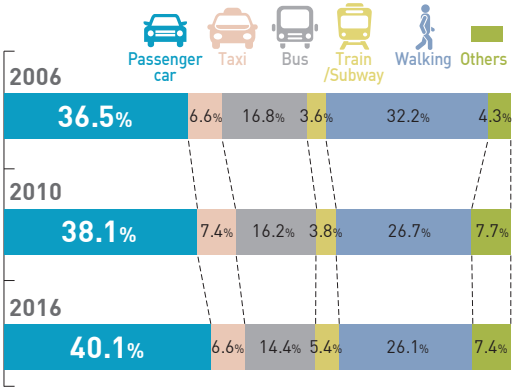
● Major purposes of trips



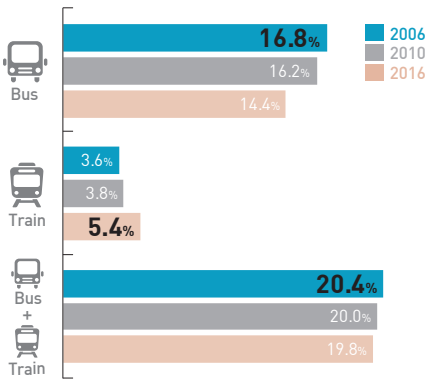
● Average distance of commuting



● Major modes of transport



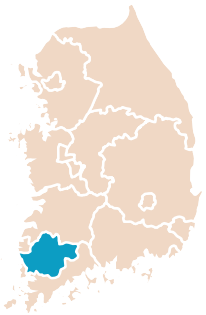
● Modal split of the public transportation (bus, train, etc.)



Source: The National Transport DB Center (https://www.ktdb.go.kr) at the Korea Transport Institute, OD by Trip Purpose and Mode Type in the Daegu metropolitan area, Transport Analysis Network

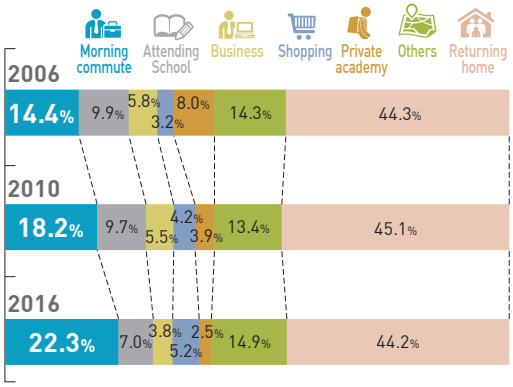
Notes: 1) These are the results of analyzing intra-zonal travel of the Daegu metropolitan area. 2) Daegu metropolitan area: Daegu metropolitan city, Gumi city, Yeongcheon city, Gyeongsan city, Gunwi-gun (county), Cheongdo-gun, Goryeong-gun, Seongju-gun, Chilgok-gun, Changnyeong-gun (10 towns and townships)

◎ Travel characteristics of the Gwangju metropolitan area

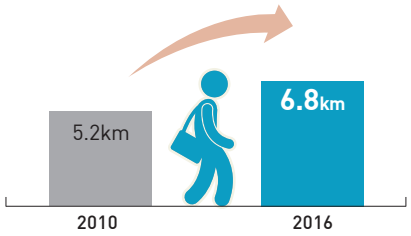


● The rates of commuting to Gwangju from neighborhood towns and townships

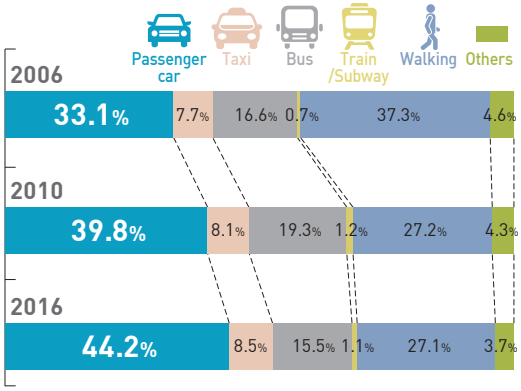
● Major purposes of trips



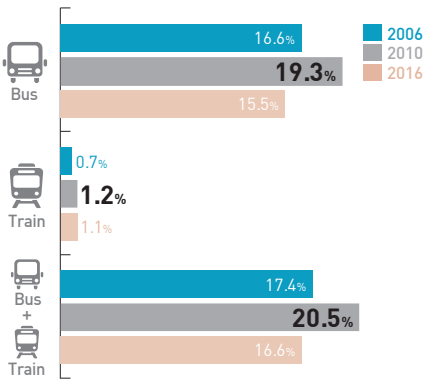
● Average distance of commuting



● Major modes of transport



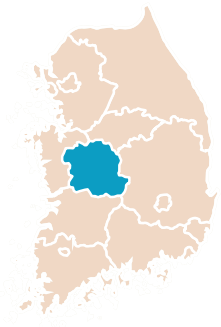
● Modal split of the public transportation (bus, rail, etc.)



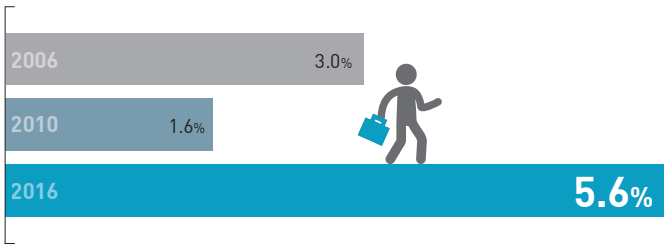
Source: The National Transport DB Center (https://www.ktdb.go.kr) at the Korea Transport Institute, OD by Trip Purpose and Mode Type in the Gwangju metropolitan area, Transport Analysis Network

Notes: 1) These are the results of analyzing intra-zonal travel of the Gwangju metropolitan area. 2) Gwangju metropolitan area: Gwangju metropolitan city, Naju city, Hwasun-gun (county), Damyang-gun, Jangseong-gun, Hampyeong-gun, Gokseong-gun (7 towns and townships)

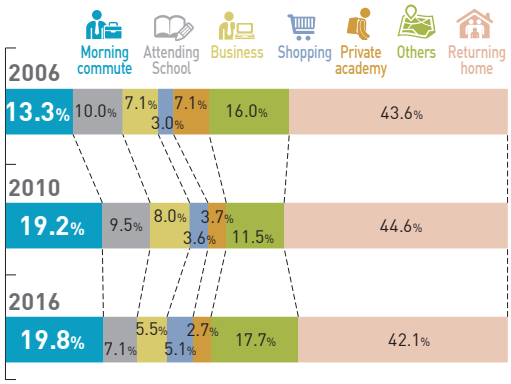
◎ Travel characteristics of the Dajeon metropolitan area



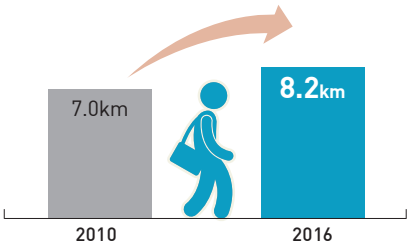
● The rates of commuting to Daejeon from neighborhood towns and townships



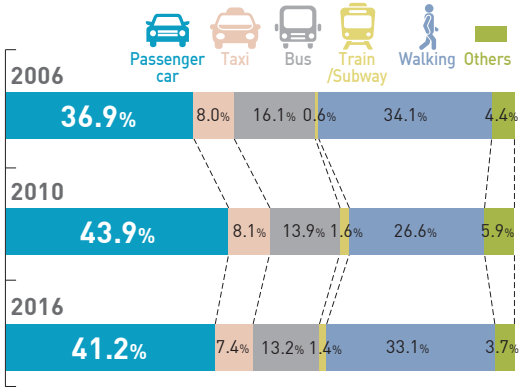
● Major purposes of trips



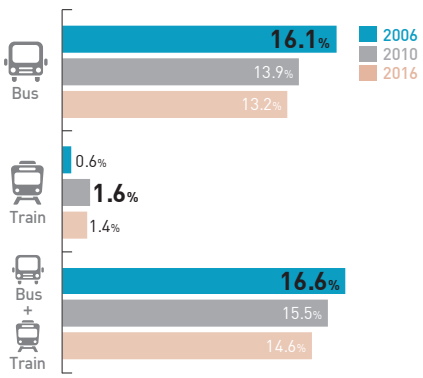
● Average distance of commuting



● Major modes of transport



● Modal split of the public transportation (bus, rail, etc.)

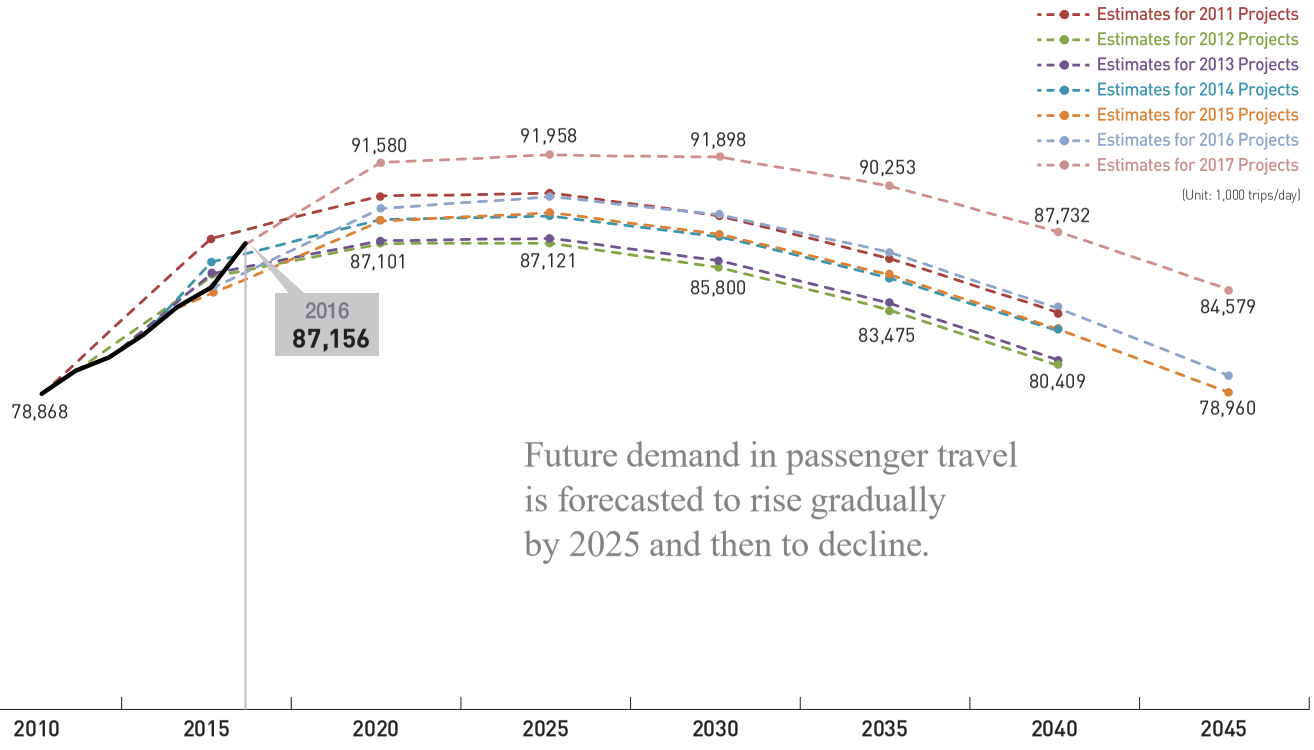


Source: The National Transport DB Center (https://www.ktdb.go.kr) at the Korea Transport Institute, OD by Trip Purpose and Mode Type in the Daejeon metropolitan area, Transport Analysis Network

Notes: 1) These are the results of analyzing intra-zonal travel of the Daejeon metropolitan area. 2) Daejeon metropolitan area: Daejeon metropolitan city, Sejong Special Self-governing City, Cheongju city, Boeun-gun (county), Okcheon-gun, Yeongdong-gun, Gongju city, Nonsan city, Gyeryong city, Geumsan-gun (10 towns and townships)

04 _ Forecast for the Nationwide Passenger Travel Demands in the Future

◎ Trends and forecasts of passenger travel

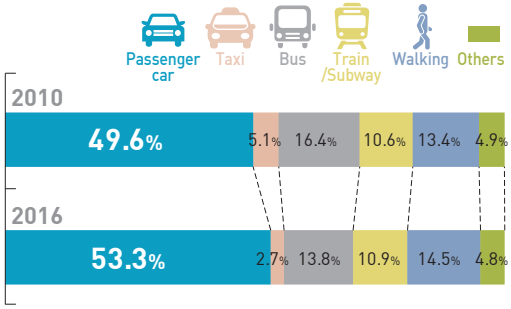


Source: The National Transport DB Center (https://www.ktdb.go.kr) at the Korea Transport Institute, Nationwide Interregional Future Travel Purpose OD
Note: 1) The dotted lines are the forecast results for future travel demands by business year and the solid lines are the passenger travel volume by year.
2) Interregional travel is analyzed based on the transport modes other than walking, bicycle, and freight.

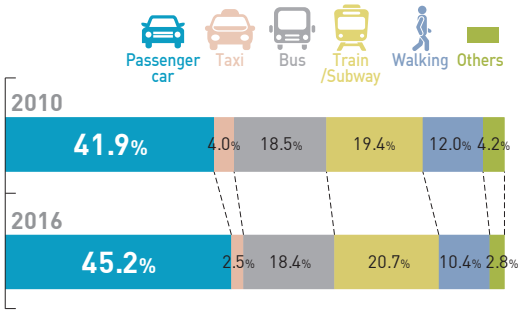
05 _ Findings from the Nationwide Passenger Travel Survey

◎ Commuting trips

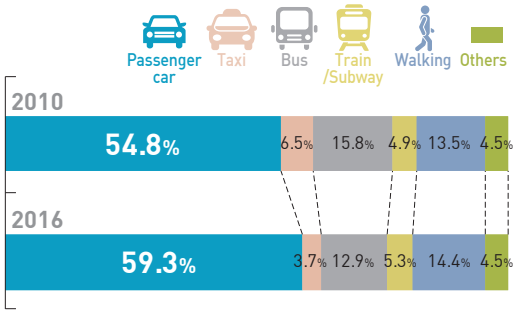
- (Nationwide) What are the major modes of transport for commuting?



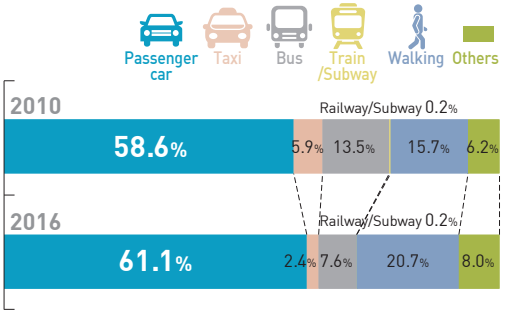
- (Seoul metropolitan area) What are the major modes of transport for commuting?



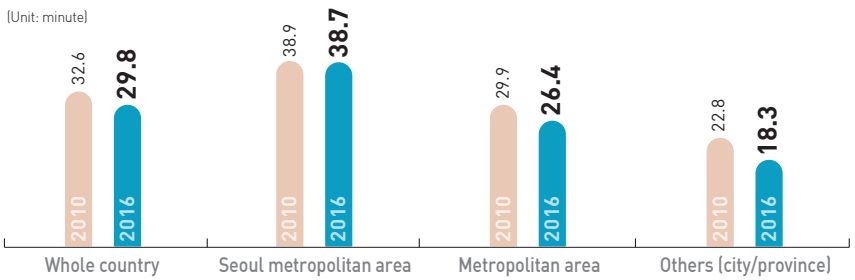
- (Other metropolitan areas) What are the major modes of transport for commuting?



- (Other cities) What are the major modes of transport for commuting?



- How long does it take for commuting on average?

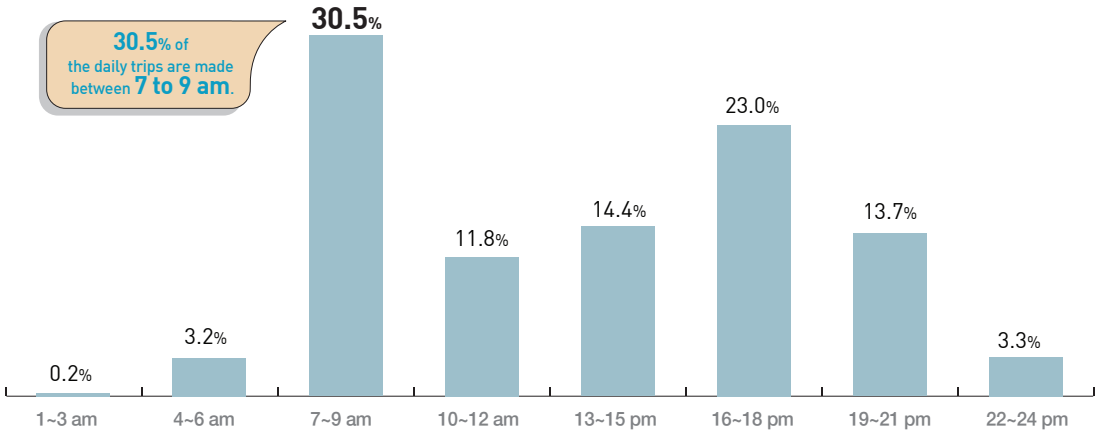


Source; 1) The National Transport DB Center (https://www.ktdb.go.kr) at the Korea Transport Institute, travel Purpose OD between regions in the nation and metropolitan areas
2) The National Transport DB Center (https://www.ktdb.go.kr) at the Korea Transport Institute, Household Travel Survey (2010, 2016)

Note: 1) Modal share for commuting is analyzed using the nationwide interregional and metropolitan area travel purpose OD 2) Average commuting times are calculated weighted populations according to age, and gender composition of different cities based on the samples of the National Household Travel Survey.

◎ Departure times by travel purpose

● When is the common time to start on a trip?



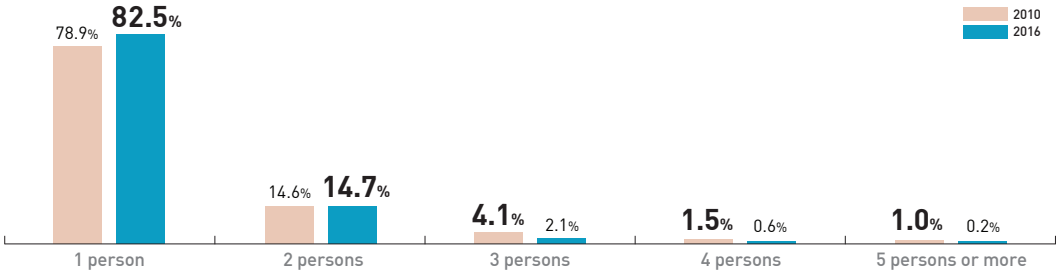
● What time are trips generated and for what purpose?

Time zone	Morning Commute	Attending school	Business	Shopping	Leisure	Others	Returning home
1-3 am	0.1%	0.0%	0.2%	0.2%	0.1%	0.0%	0.2%
4-6 am	12.0%	1.5%	1.9%	0.7%	2.0%	1.1%	0.1%
7-9 am	77.0%	93.5%	7.3%	5.5%	12.9%	26.4%	1.8%
10-12 am	6.8%	3.7%	21.3%	33.2%	37.1%	18.6%	8.7%
13-15 pm	2.4%	1.1%	43.4%	32.2%	15.9%	27.7%	16.5%
16-18 pm	1.2%	0.3%	16.7%	21.7%	17.7%	21.2%	39.8%
19-21 pm	0.3%	0.0%	6.2%	5.9%	13.5%	4.2%	25.9%
22-24 pm	0.0%	0.0%	3.1%	0.5%	0.6%	0.5%	6.9%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

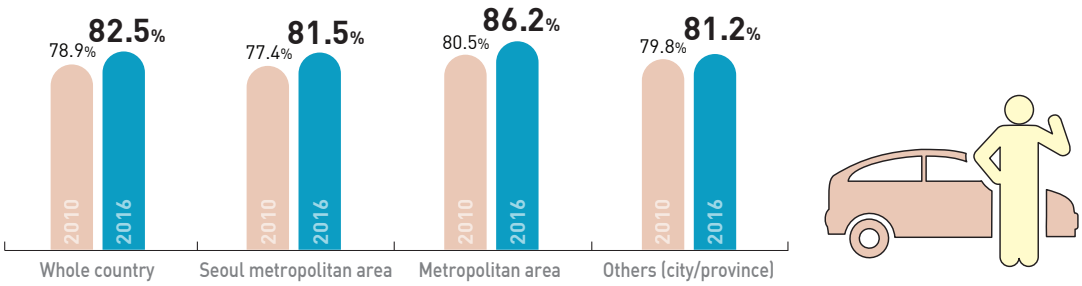
Source: The National Transport DB Center (https://www.ktdb.go.kr), National Household Travel Survey (2016)
Note: 1) It is calculated weighting populations according to age, and gender composition of different cities based on the sample data.
2) Other purposes = send-off, private lessons, personal business, etc.

◎ Average number of passengers per car

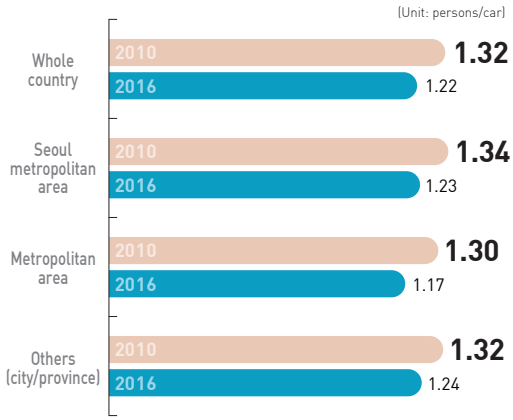
● (Nationwide) How many passengers are in a car?



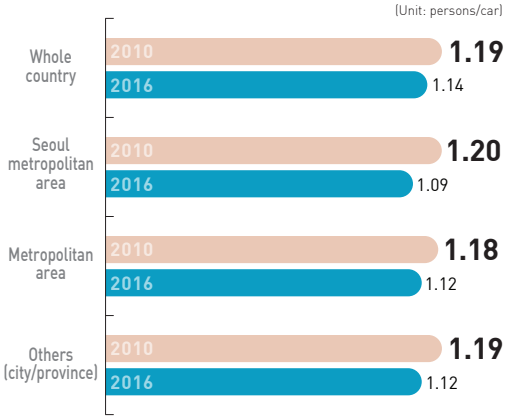
● How many people use single occupancy cars?



● Average number of passengers in a car



● Average number of passengers in a car for commuting trip

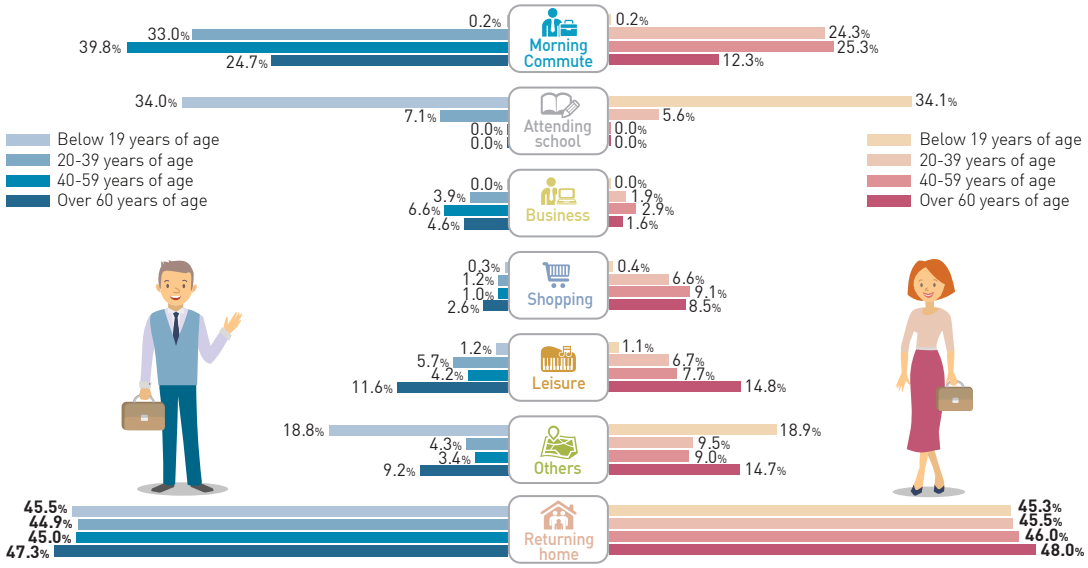


Source: The National Transport DB Center (https://www.ktdb.go.kr), National Household Travel Survey (2016)
Note: 1) It is calculated weighting populations according to age, and gender composition of different cities based on the sample data.

◎ Travel characteristics by gender and age

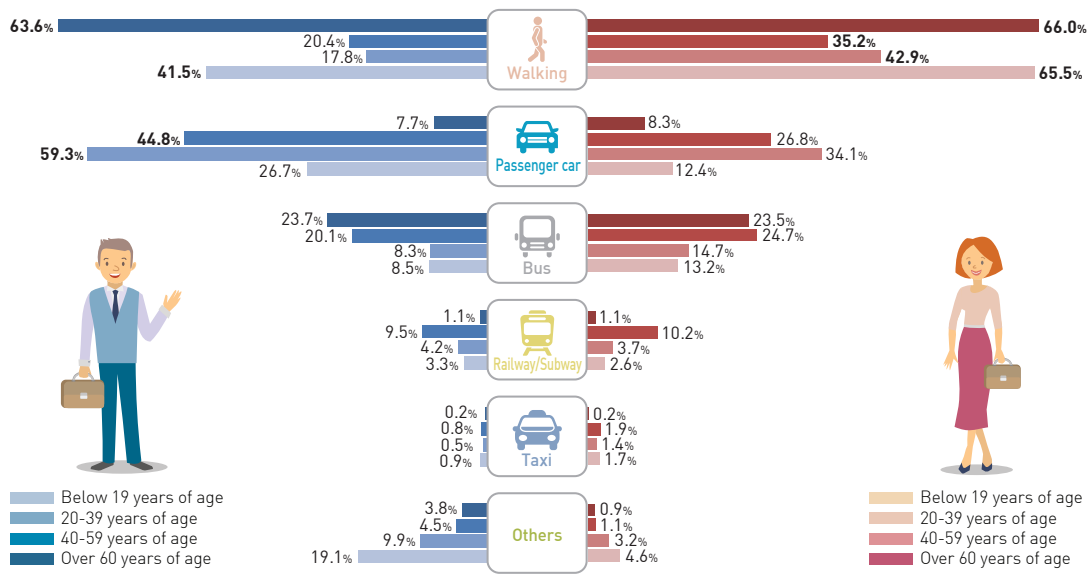
● What are the most common purpose of trips for males?

● What are the most common purposes of trips for females?



● What are the most common travel modes for males?

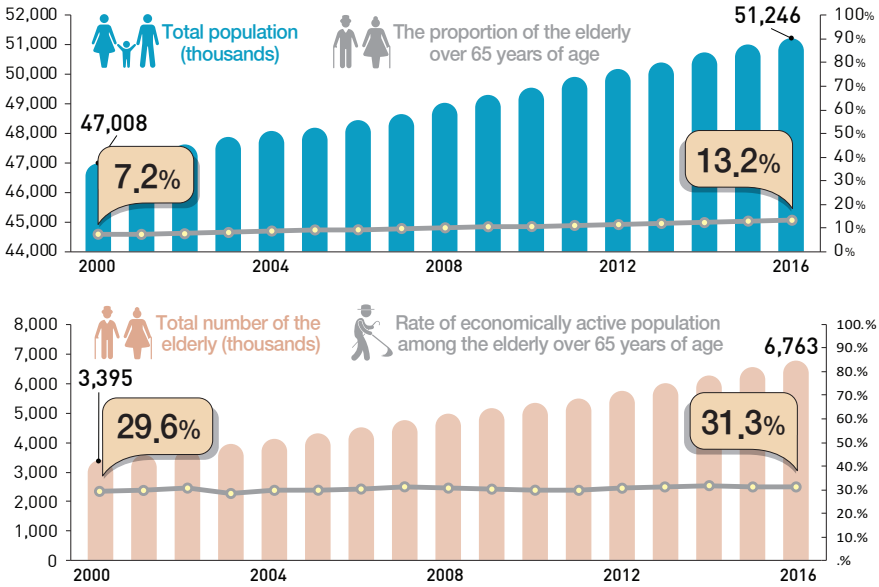
● What are the most common travel modes for females?



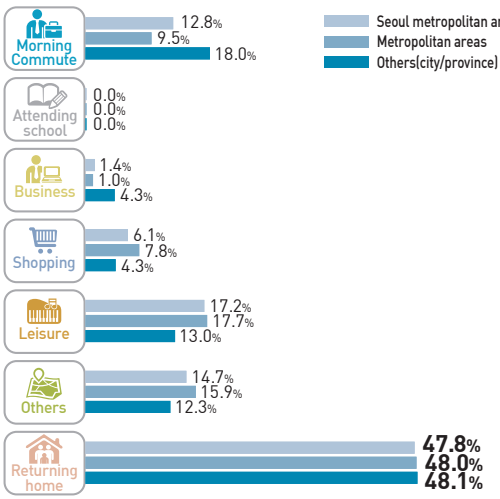
Source: The National Transport DB Center (https://www.ktdb.go.kr), Nationwide Household Travel Survey (2016)
Note: 1) It is calculated weighting populations according to age, and gender composition of different cities based on the samples of the National Household Travel Survey.
2) Other purposes = send-off, private lessons, personal business, etc.

◎ Travels of the elderly over 65

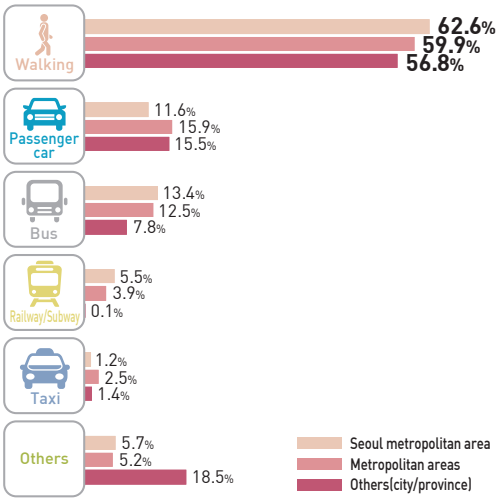
● How has the proportion of the elderly changed among the total population?
How have economic activity rates changed among the elderly?



● What are the most common purposes of trips for the elderly?



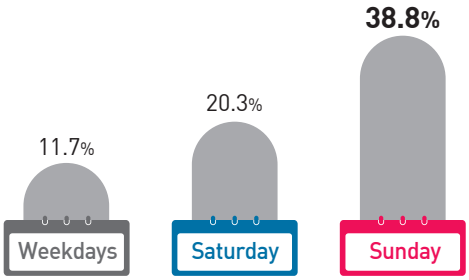
● What are the most common travel modes for the elderly?



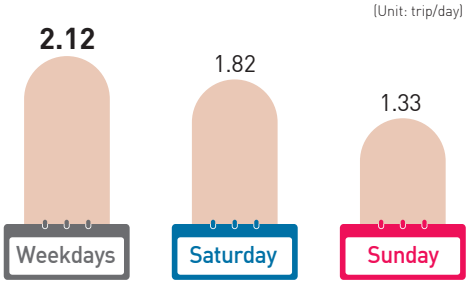
Source: 1) KOSIS (KOrean Statistical Information Service) website (http://kosis.kr), Population Projections of Korea 2) KOSIS (KOrean Statistical Information Service) website (http://kosis.kr), Economically Active Population Survey 3) The National Transport DB Center (https://www.ktdb.go.kr), National Household Travel Survey (2016)
Note: This is calculated on the basis of weighting populations according to age, and gender composition of different cities based on the samples of the National Household Travel Survey.

Weekend travel

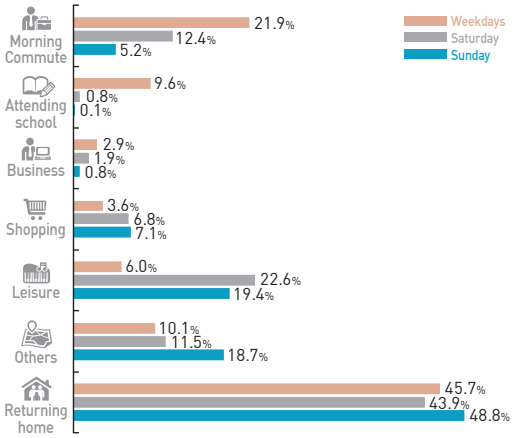
- How many people do not travel during weekdays and weekends?



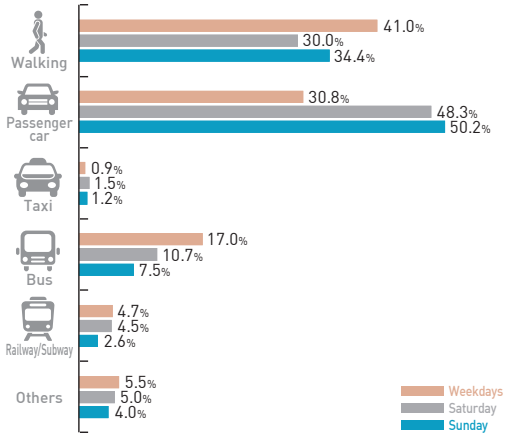
- How many trips do people make during weekdays and weekends?



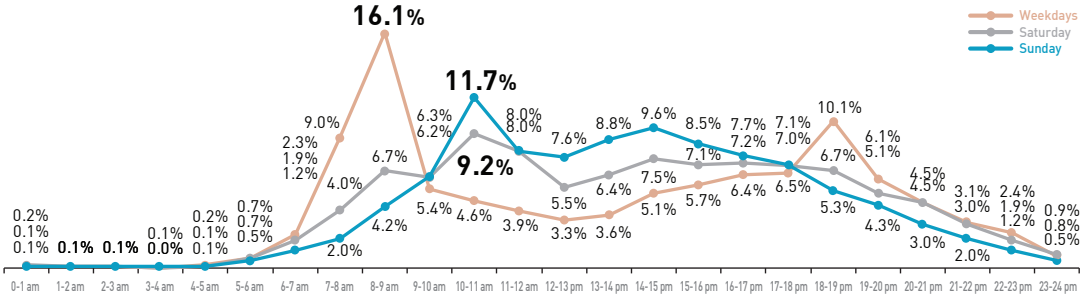
- For what purpose, do people travel during weekdays and weekends?



- What are the prioritized modes of transport during weekdays and weekends?



- At what time of day, do people usually travel during weekdays and weekends?

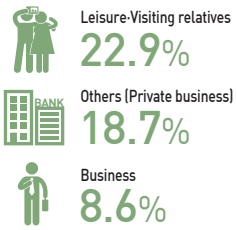


Source: The National Transport DB Center (https://www.ktdb.go.kr), Weekend traffic status (2010, 2016)
Note: This is calculated by weighting populations according to age, and gender composition of different cities based on the sample data.

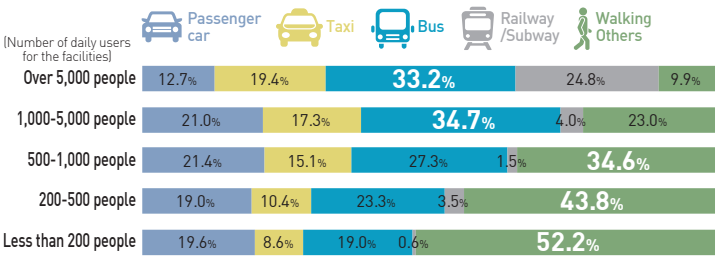
◎ Characteristic of using passenger facilities (Bus terminals)

Intercity bus terminal/ Express bus terminal

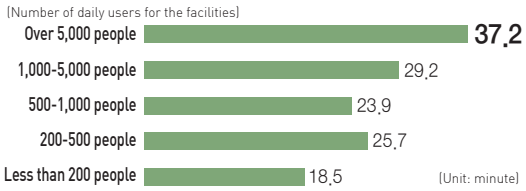
● For what purpose, do people use bus terminals?



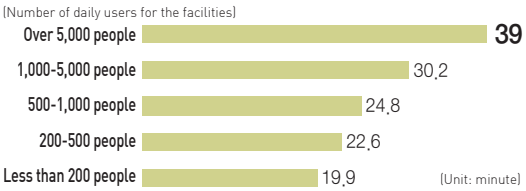
● With what transport modes do people access bus terminals?



● How long does it take to access the bus terminals?

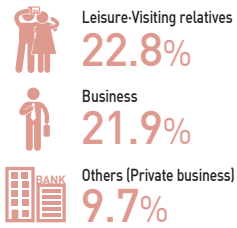


● How long do people wait for a bus in bus terminals ?

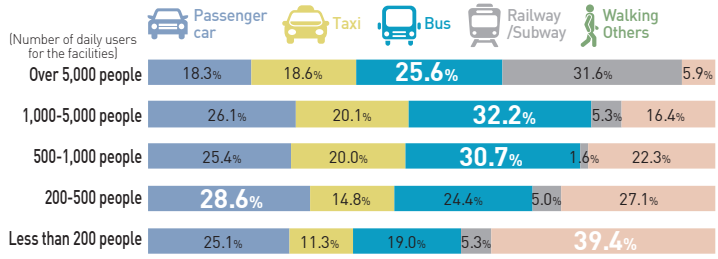


Railway station

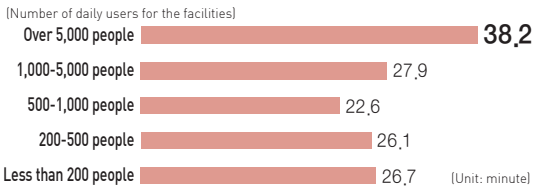
● For what purpose, do people use railway stations?



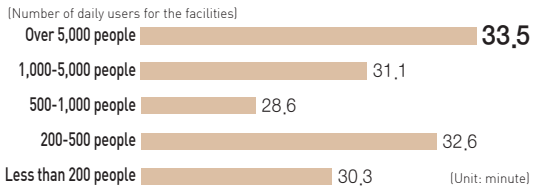
● With what transport modes do people access railway stations?



● How long does it take to access the railway stations?



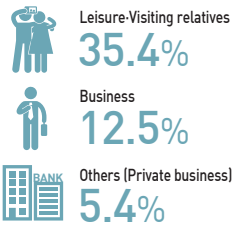
● How long is do people wait for a train?



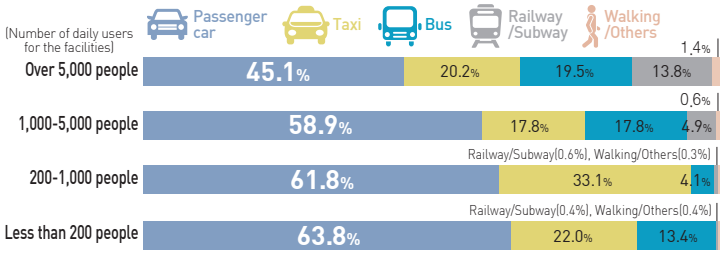
Source: The National Transport DB Center (https://www.ktdb.go.kr), Passenger transport facilities usage survey (2016)
Note: It is calculated by weighting the volume of passengers transported by facility on the sample data.

Airport terminal (domestic)

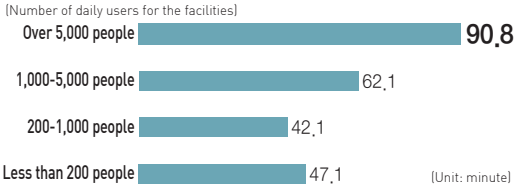
For what purpose, do people use airport terminals?



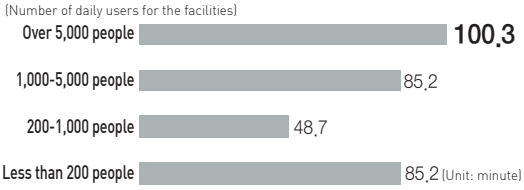
With what transport modes do people access airport terminals?



How long does it take to access the airport terminals?

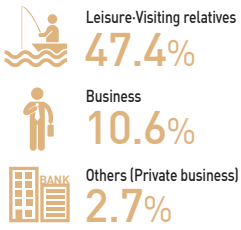


How long do people wait for an airplane?

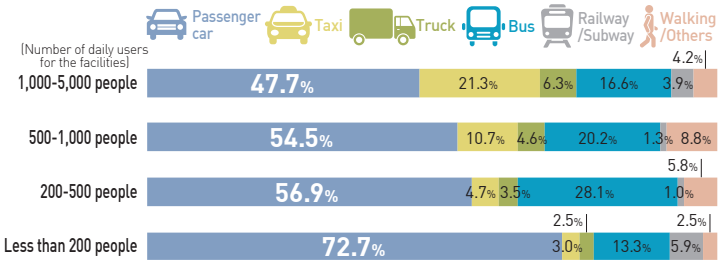


Passenger ferry terminal

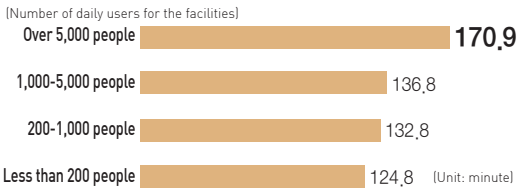
For what purpose, do people use passenger ferry terminals?



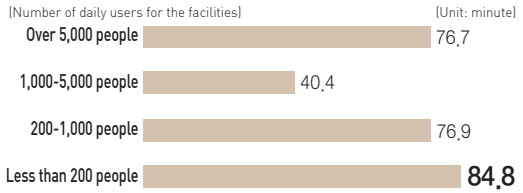
With what transport modes do people access passenger ferry terminals?



How long does it take to access the passenger ferry terminals?



How long do people wait for a passenger ferry?

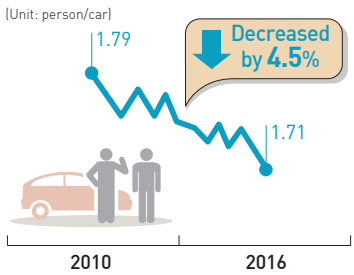


Source: The National Transport DB Center (https://www.ktdb.go.kr), Passenger transport facilities usage survey (2016)
Note: It is calculated by weighting the volume of passengers transported by facility on the sample data.

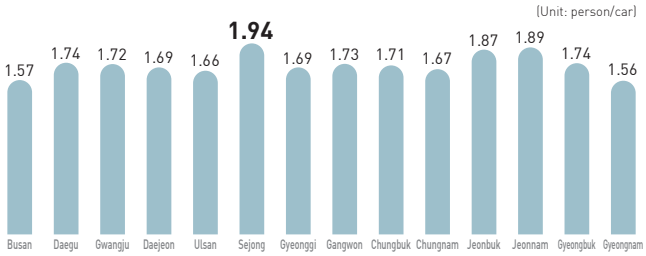
◎ Passenger cars characteristic using expressways

● How many people on average take a ride in cars using expressways?

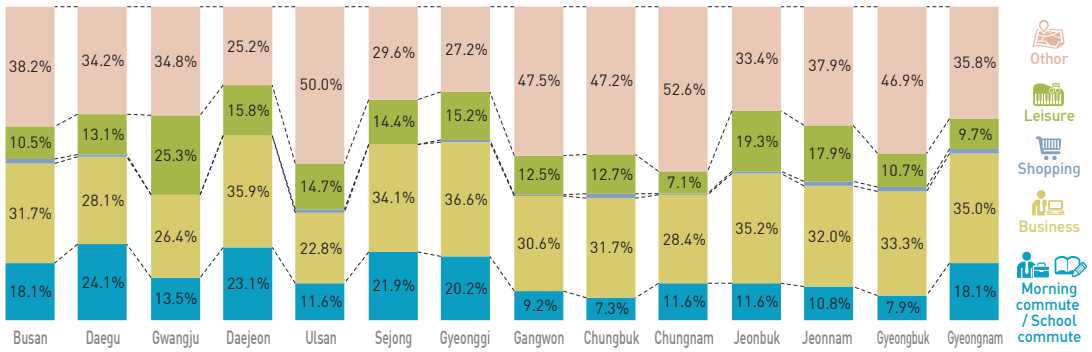
Nationwide average



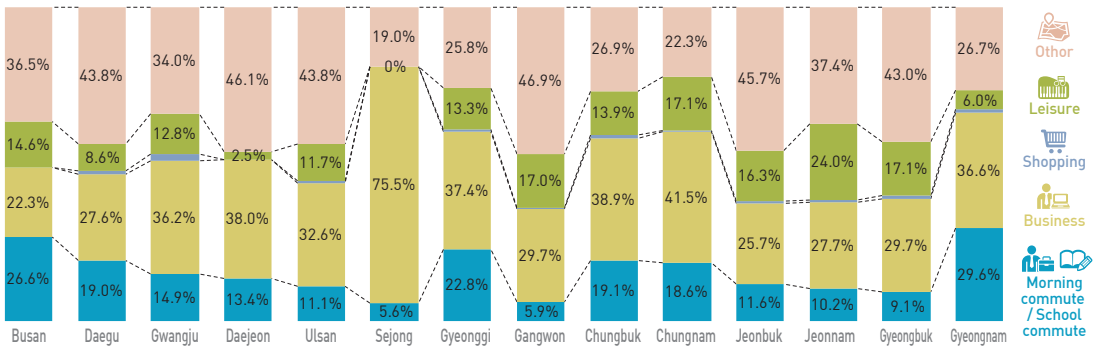
Average by region with expressway tollgates



● For what purpose, do car passengers use expressway? (For entry tollgate)



● For what purpose, do car passengers use expressway? (For exit tollgate)



Source: The National Transport DB Center (https://www.ktdb.go.kr), Mailing survey on expressway toll gates (2016)
Note: It is calculated by weighting the volume of passenger cars by tollgate based on the sample data.

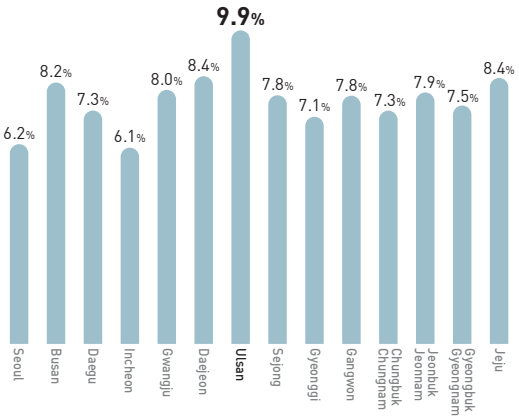
◎ Traffic volumes between towns and townships

● What are the types of cars passing through interregional roads between towns and townships?

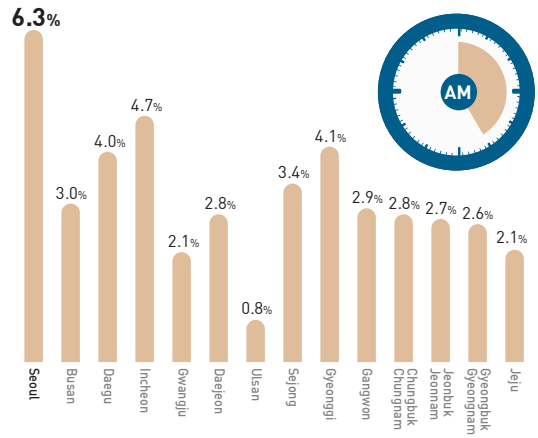
(Unit: %)

	Whole country	Seoul	Busan	Daegu	Incheon	Gwangju	Daejeon	Ulsan	Sejong	Gyeonggi	Gangwon	Chungbuk Chungnam	Jeonbuk Jeonnam	Gyeongbuk Gyeongnam	Jeju
Passenger car/Van	75.0	76.4	73.1	75.1	74.7	71.5	79.7	71.8	77.0	75.7	71.4	70.4	72.9	70.2	74.3
Taxi	3.0	4.8	2.3	2.2	2.4	0.8	1.2	0.6	1.3	2.3	1.8	1.7	1.4	1.3	1.8
Bus	2.8	3.3	2.5	3.4	2.5	1.0	1.3	3.4	1.8	2.8	3.4	1.8	1.9	1.6	4.6
Truck/ Others	19.2	15.5	22.1	19.3	20.5	26.6	17.8	24.1	19.9	19.3	23.4	26.0	23.7	26.9	19.4

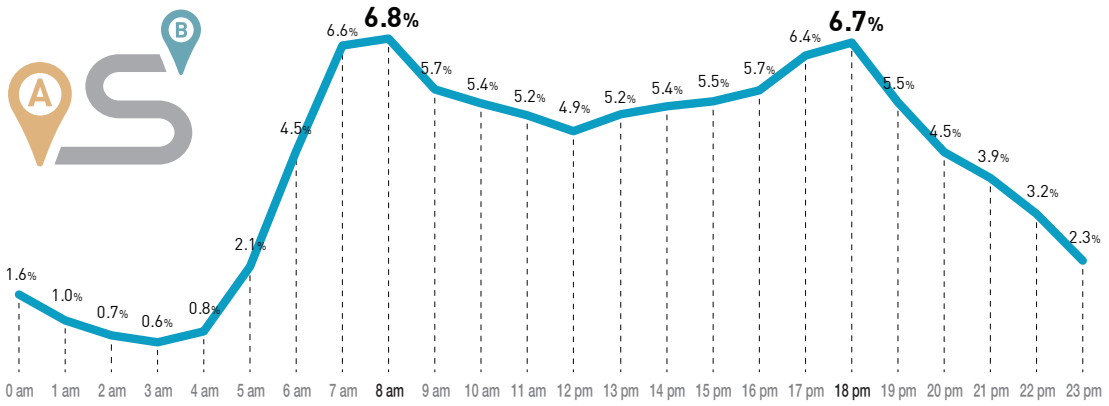
● Peak hour traffic rate



● Early hours traffic rate (midnight-5 am)



● How do traffic volumes of interregional roads vary according to the time of day?



Source: The National Transport DB Center (https://www.ktdb.go.kr), Traffic Volume Survey (2016)

Freight in Korea

Current Status of Korea's Freight Transportation in 2017

Chapter 1

Overview of the Nationwide Freight Transportation Survey

01 I Legal Basis

02 I Purposes of the Survey

03 I Survey Items

04 I Survey Targets

05 I Survey Period

06 I Utilization of Survey Results

07 I Implementation System

01 _ Legal Basis

◎ Article 12 National Transportation Survey, National Integrated Transportation System Efficiency Act (National Statistics No. 11627)
◎ Article 7 Logistics Survey, Framework Act on Logistics Policies

02 _ Purposes of the Survey

◎ To identify logistics types and transportation features of domestic businesses; to identify vehicle types and transportation features of freight vehicles; and to calculate the volume of freight transportation
◎ To establish baseline data including the population, OD traffic volume, and so forth, which are essential for the effective establishment and implementation of transportation plans and logistics plans
◎ To update major indexes in the feasibility appraisal guidelines for transportation and logistics facilities investment

03 _ Survey Items

◎ Number of survey questionnaires: Four (Three for businesses, and one for freight vehicles)
◎ Survey items
- Commodity flow survey of businesses (Mining industry; manufacturing industry; wholesale industry)
  - Overview of businesses: Name of business; number of employees; annual sales; produced and sold commodities, etc.
  - Logistics facilities and transportation modes: Main land-area in use; status of logistics facilities; utilization status of freight vehicles, etc.
  - Logistics utilization status: Use of 3rd Party Logistics (3PL) company, 3PL using pattern type; freight volume transported by using 3PL
  - Freight shipment volume: Monthly shipment days; freight shipment volume for the top-five commodities; shipment volume trends for the past 12 months
  - Three-day freight shipment status: shipping frequencies for three days; shipping dates; shipping commodities; freight transportation modes at points of origin and destination, etc.

- Commodity flow survey of businesses (warehouse industry)
  - General status: Facilities; total site area; warehouse building area; number of warehouses, etc.
  - Warehouse status: Warehouse area; effective story height; number of stories of warehouse; ownership type; warehouse type, etc.
  - Warehouse use status: Ownership type (owned or rented), utilization ratio
  - Operation status: Average operation days per month; warehouse type; rack type; warehouse equipment; warehouse operating rate, etc.

- Commodity flow survey of businesses (companies dealing with hazardous materials)

- Shipment/transportation status: Shipment volume of hazardous materials, accident prevention and post- accident measures; transportation types/routes, etc.
- Ratio of hazardous materials by supply-type and shipment-type
- Daily shipment and transportation status: Shipping date; volume of shipments/number of shipping cases, shipment commodity/hazardous material, export status, etc.

- Truck trip diary survey for drivers
- Vehicle features: Vehicles for business purposes; vehicle types; vibration free status; tonnage classification; tonnage capacity; vehicle model year, etc.
- Trip features: Place of registration; key areas of logistics activity; average days of logistics activities
- Trip log: Transportation type, information of origin/destination; characteristics of cargo on board; empty/loaded vehicle status; expressway use, etc.

- Surveys on traffic volume at distribution hubs
- 24-hour traffic volume collection: Traffic volume by vehicle type; inflow and outflow traffic volumes; inflow and outflow traffic volumes by detailed vehicle type; traffic volumes by day of the week and time band; traffic volumes by hub
- One-week traffic volume collection: Traffic volumes by vehicle type and day of the week; traffic volumes by detailed vehicle type and day of the week; traffic volumes by day of the week and time band; traffic volumes by day of the week and survey point

04 _ Survey Targets

◎ Businesses in the manufacturing/wholesale/warehouse industry, freight vehicle drivers, and logistics hubs in Korea

Survey names		Survey targets	Samples
For businesses	Survey on logistics for the manufacturing and the wholesale business	Business with more than 5 employees	About 19,000 businesses
	Survey on logistics for the warehouse business	Warehouse businesses and logistics businesses	About 750 businesses
	Survey on logistics for businesses dealing with hazardous materials	Businesses dealing with hazardous materials nationwide	About 500 businesses
For freight vehicles	Truck trip diary survey for drivers	Freight truck drivers for non-business and business purposes	About 50,000 vehicles
	Survey on entry/exit traffic volumes at distribution hubs	Entry and exit vehicles at logistics hub facilities	100 hubs

05 _ Survey Period

◎ Reference date: Weekdays of May and June 2017

◎ Survey implementation

- Survey period: May 2017 – Nov. 2017

06 _ Utilization of Survey Results

Survey names		Use of survey results
For businesses	Commodity flow survey of businesses (Manufacturing industry, wholesale industry)	- Calculation of shipment volumes from origin to destination by cargo commodity - Analysis of domestic freight transportation status by commodity and transportation mode
	Commodity flow survey of businesses (Warehousing business)	- Assessing freight index in feasibility appraisal guidelines for transportation facilities - Using them as feasibility appraisal indexes for logistics facilities construction
	Commodity flow survey of businesses (Businesses dealing with hazardous materials)	- Calculation of traffic volumes from origin to destination by hazardous material - Analysis of freight transportation status by hazardous material and transportation mode
For freight vehicles	Truck trip diary survey for drivers	- Calculation of freight volumes transported by freight vehicles - Establishment of policies related to freight vehicles
	Surveys on entry/exit traffic volumes at distribution hubs	- Identification of freight vehicles accessing logistics hubs such as industrial complexes, integrated logistics terminals, logistics complexes, ports, and so forth

07 _ Implementation System

◎ Managing organization: Ministry of Land, Infrastructure and Transport

◎ Implementation organization: Department of National Transportation Big Data at the Korea Transport Institute

Chapter 2

Current Status of Korea's Freight Transportation

01 I Nationwide Freight Transportation Survey

02 I Freight Transportation

03 I Freight Transportation System

04 I Freight Economy and Industry

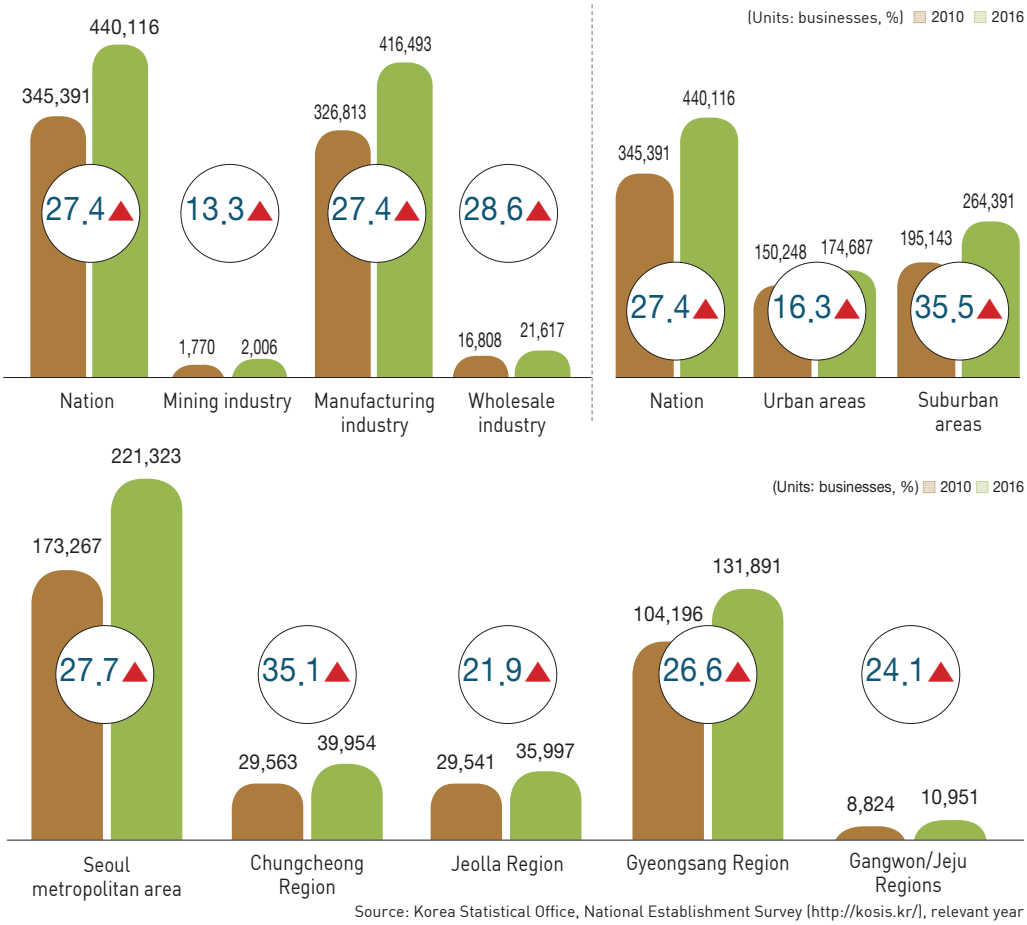
05 I Freight Safety, Energy and Environment

01_Nationwide Freight Transportation Survey

① Changes in Businesses' Logistics Status (mining industry, manufacturing industry, wholesale industry)

- The freight volume growth rate in the mining industry, which accounts for large parts of the traffic volume, has slowed down. The growth rates in the manufacturing industry and the wholesale industry have continued to rise. And the number of businesses in suburban areas, particularly in Chungcheong Region, has increased more than in urban areas.
- The growth rate in the manufacturing industry of lumber, refined products of oil, and non-metallic minerals, whose traffic volumes run high in the manufacturing industry, has slowed down, and the growth rate in the manufacturing industry of electronic parts and medical precision instruments, whose traffic volumes run low, has continued to rise.

Changes in businesses distribution by region and industry

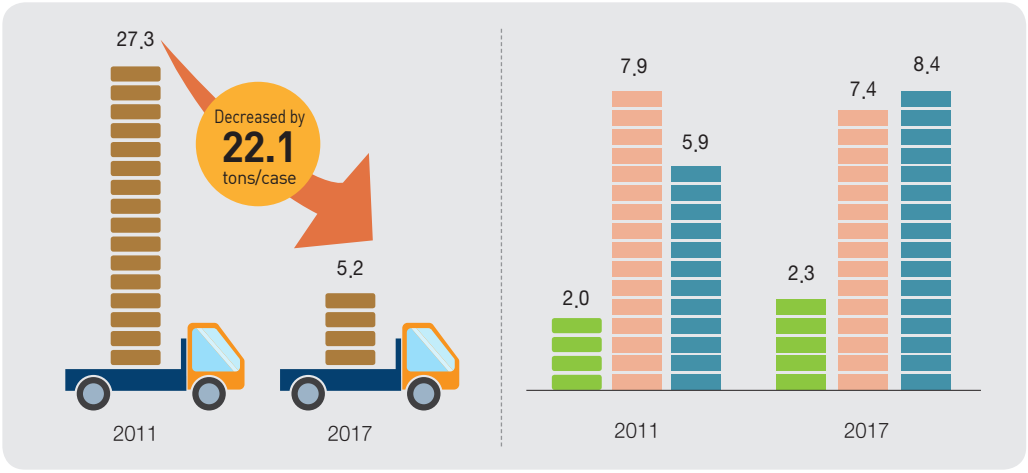


Source: Korea Statistical Office, National Establishment Survey (http://kosis.kr/), relevant year

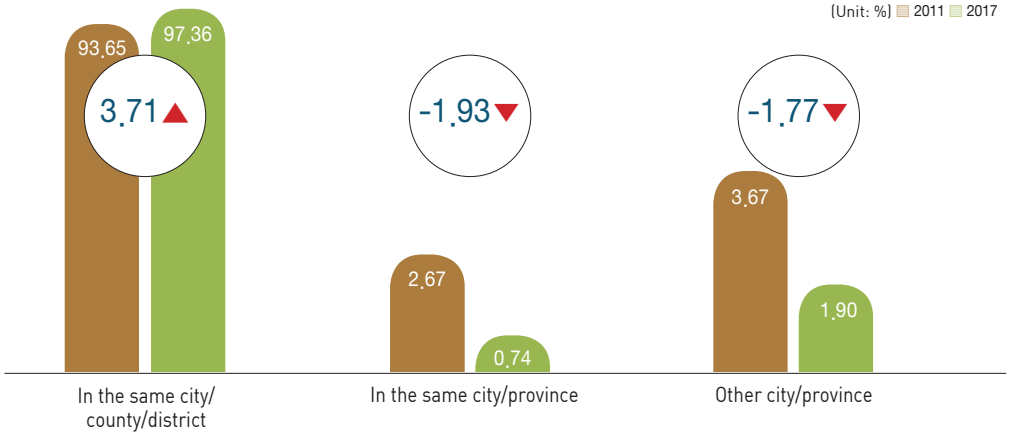
- The shipment volume per case has decreased, and the utilization rate of freight vehicles for business purposes has increased.
- The distribution rate of business logistics facilities located within the same city, county or district has increased, and the rate of stopping by logistics facilities in the same city/province has increased.

Changes in logistics characteristics and facilities distribution including locations and stops

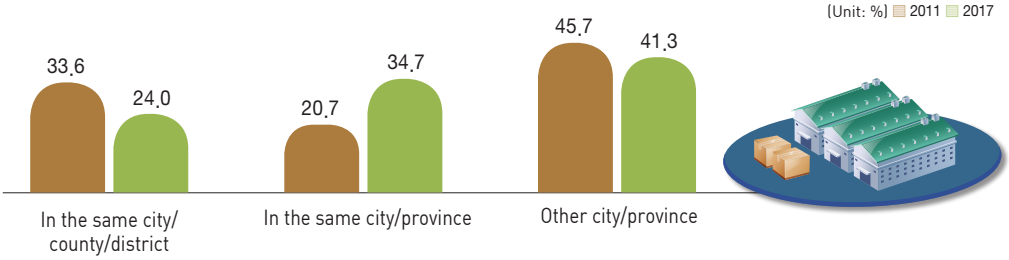
(Units: tons/case, vehicles) non-business long-term (business) short-term (business)



(Unit: %) 2011 2017



(Unit: %) 2011 2017



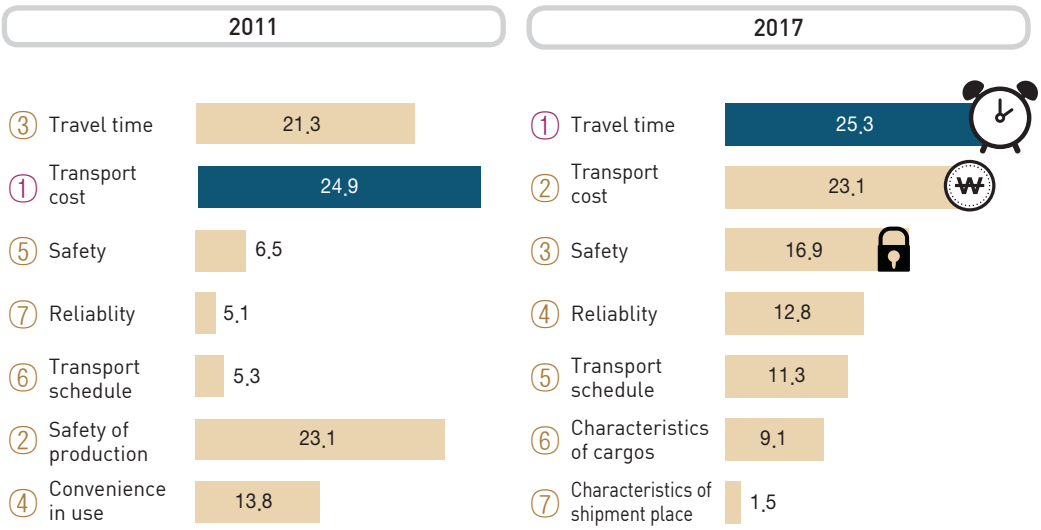
Intermediate stop (distribution center)

Source: The Korea Transport Institute, Korea Transport Survey and Database Building Project, Each year

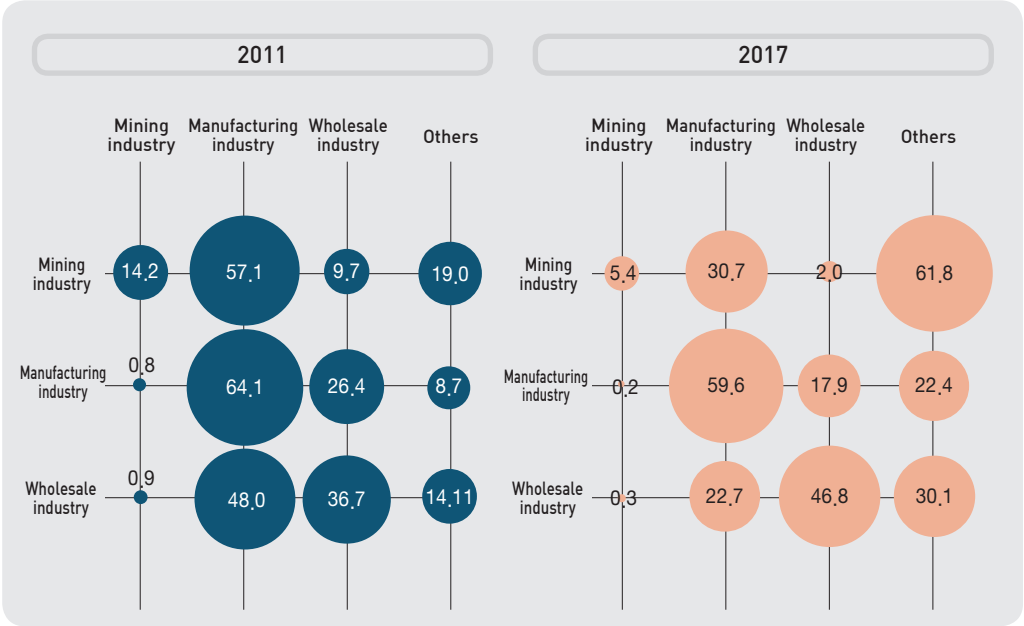
- The main reason for choosing transportation modes have changed from expenses to quality of service.
- When it comes to the freight volume transported between businesses, the transportation between different industries is more active than within the same industries.

Changes in main factors involved in selection of transportation modes and in transportation rates between different industries

(Unit: %)



(Unit: %)

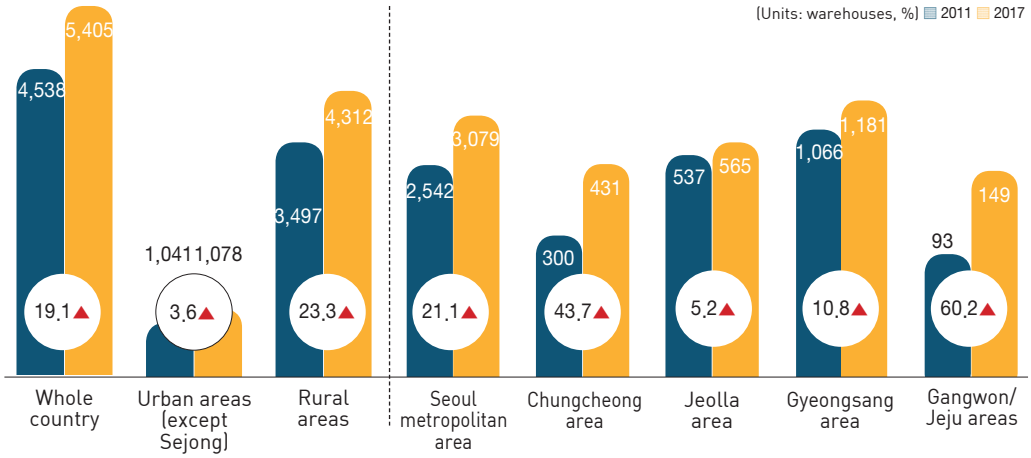


Source: The Korea Transport Institute, Korea Transport Survey and Database Building Project, Each year

② Changes in Businesses' Logistics Status (warehousing business)

- The number of warehouses has increased sharply in Gangwon/Jeju Regions (60.2%) and Chungcheong Region (43.7%), followed by total suburban areas (23.3%) and urban areas (3.6%).
- The rate of long-distance goods receipts and shipments within the nation has increased, and the rate of goods receipts and shipments within metropolitan cities has decreased.

Changes in the number of warehouses by region and the rate of receipt places to shipment places for domestic consumption

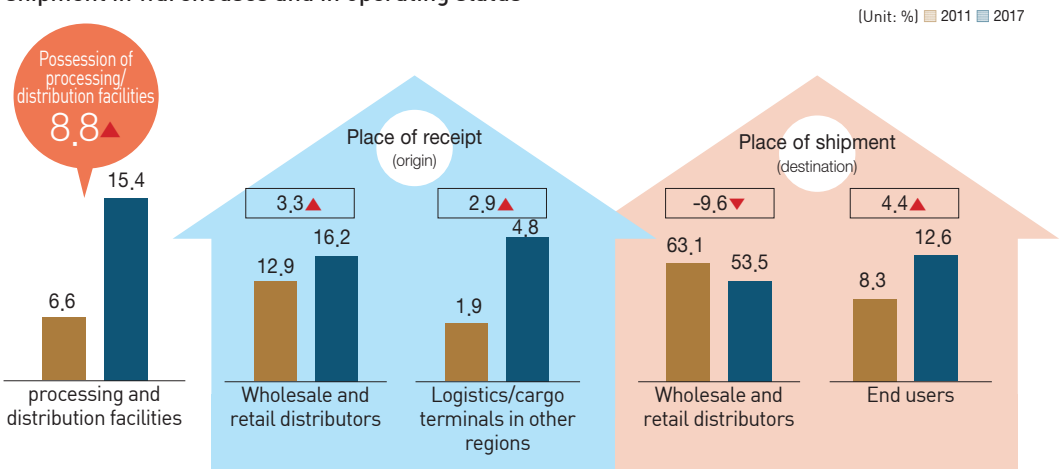


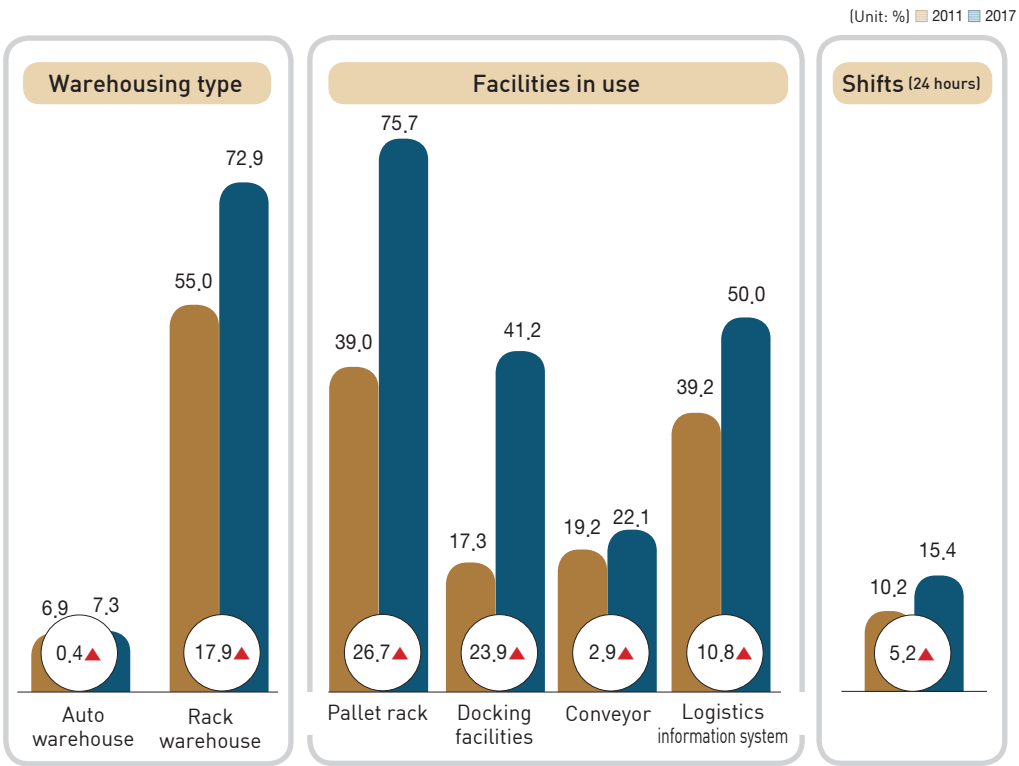
Source: Statistics Korea, The Census on Establishment (http://kosis.kr), Each year

Source: The Korea Transport Institute, Korea Transport Survey and Database Building Project, Each year

- With the development of IT technologies, warehouses have more advanced and automated. Increasing numbers of the warehouses now operate 24 hours per day.
- The holding rate of processing and distribution facilities within the warehouses has increased; the places of receipt/shipment have changed.
  · The rate of using logistics/cargo terminals in other regions as places of receipt has increased.
  · The number of end-users in the shipment locations has increased.

Changes in types of the places of receipt and shipment in warehouses and in operating status



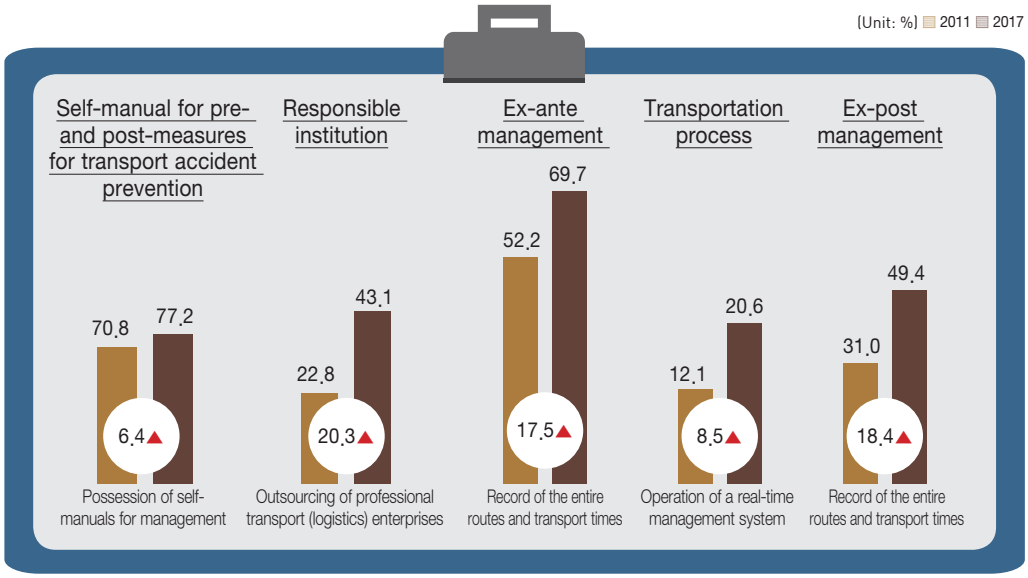


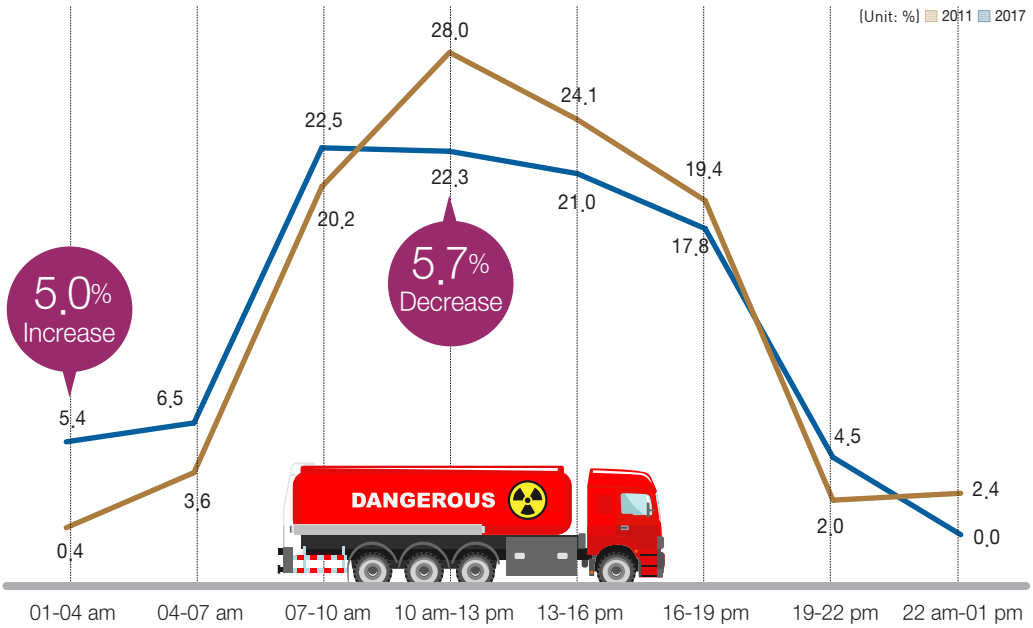
Source: The Korea Transport Institute, Korea Transport Survey and Database Building Project, Each year

③ Changes in Businesses' Logistics Status (businesses dealing with hazardous materials)

- Safety consciousness has enhanced, and safety management in the process of transportation has been strengthened.
- The rate of night and owl time transportation for hazardous materials has increased.

Changes in the sense of safety of businesses dealing with hazardous materials and the distribution status of transport time



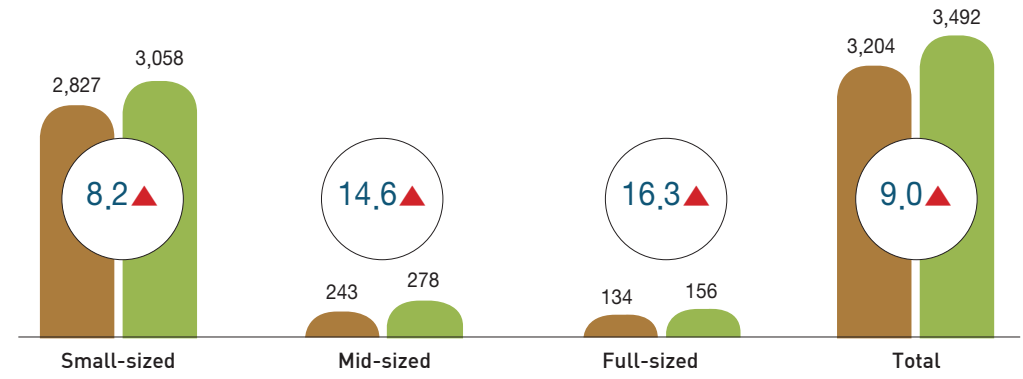


Source: The Korea Transport Institute, Korea Transport Survey and Database Building Project, Each year

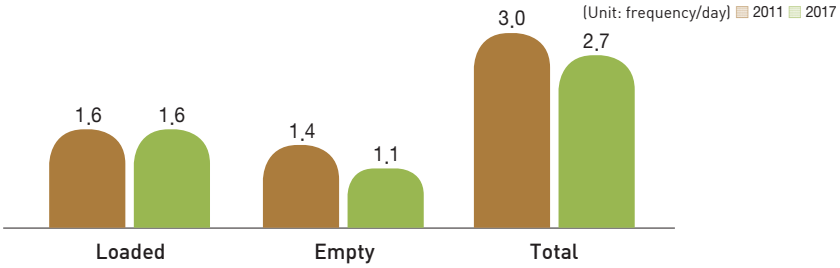
④ Changes in the Trip Patterns of Freight Vehicles

- The number of registered freight vehicles has increased by 9.0% (small-sized car 8.2%; mid-sized car 14.6%; full-sized car 16.3%).
- The total number of trips (3.0 → 2.7) and the number of empty vehicle trips (1.4 → 1.1) have decreased.
- The capacity tonnage has slightly increased (2.6 tons → 2.7 tons), and the capacity tonnage in small-sized freight vehicles (1.3 tons → 1.0 tons) and mid-sized freight vehicles (5.8 tons → 5.3 tons) have decreased.

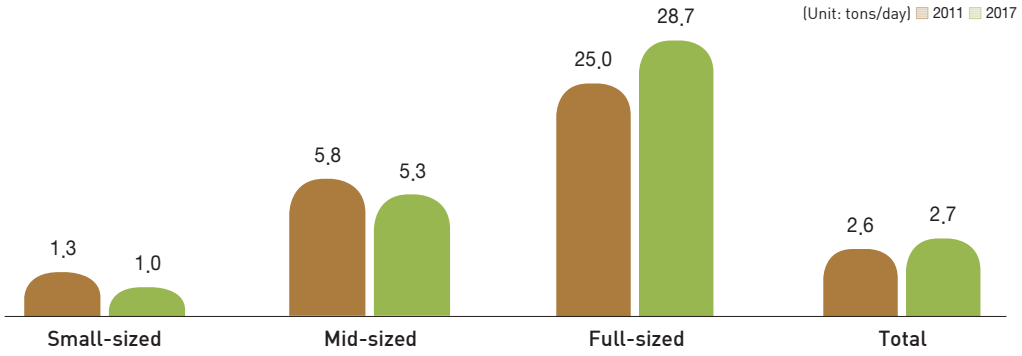
Registered number of freight trucks by capacity tonnage and changes in daily average number of trips/capacity tonnage



Source: MOLIT, MOLIT Statistics System (http://stat.molit.go.kr)



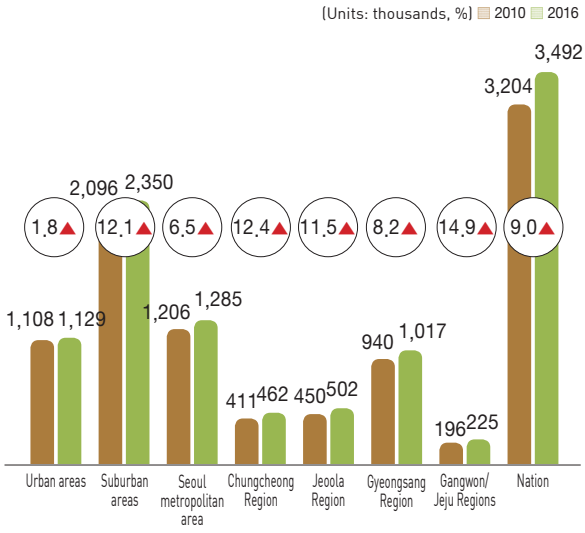
Source: The Korea Transport Institute, Korea Transport Survey and Database Building Project, Each year



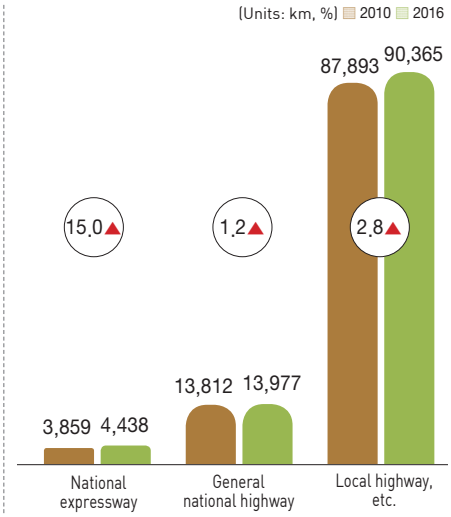
Source: The Korea Transport Institute, Korea Transport Survey and Database Building Project, Each year

- The number of registered freight vehicles increased sharply in suburban regions (12.1%), compared to urban regions (1.8%), particularly in Gangwon/Jeju Regions, and Jeolla Region.
- Vehicle travel kilometers have increased, with multiple trips decreased and round trips increased.
- Due to the expansion of SOC, travel time has decreased but the utilization rate of expressways has increased.

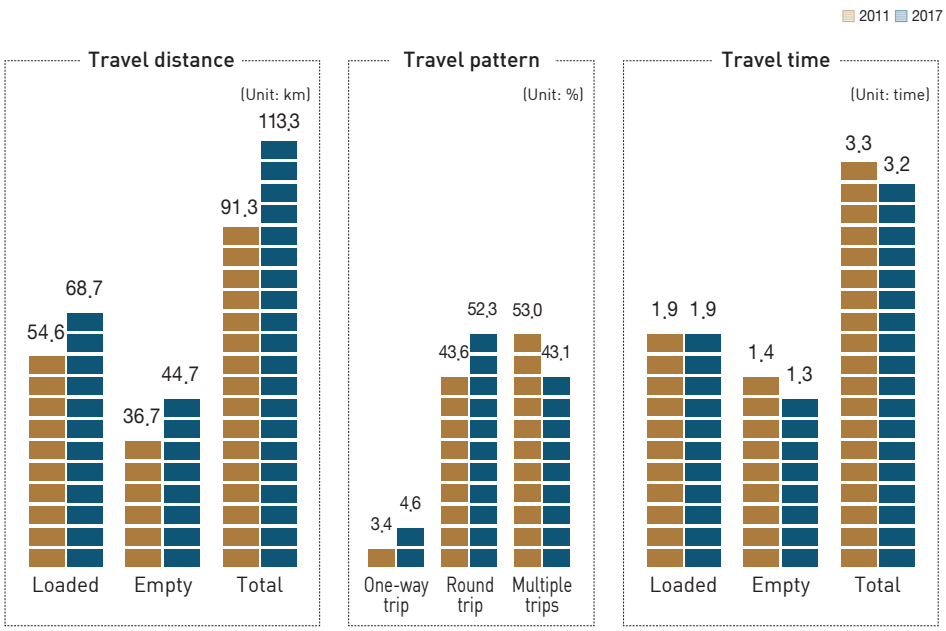
Changes in the number of registered freight vehicles by zone/SOC status/travel characteristics



Source: MOLIT, MOLIT Statistics System (http://stat.molit.go.kr)



Source: The Korea Transport Institute, 2016 National Transportation Statistics, 2017

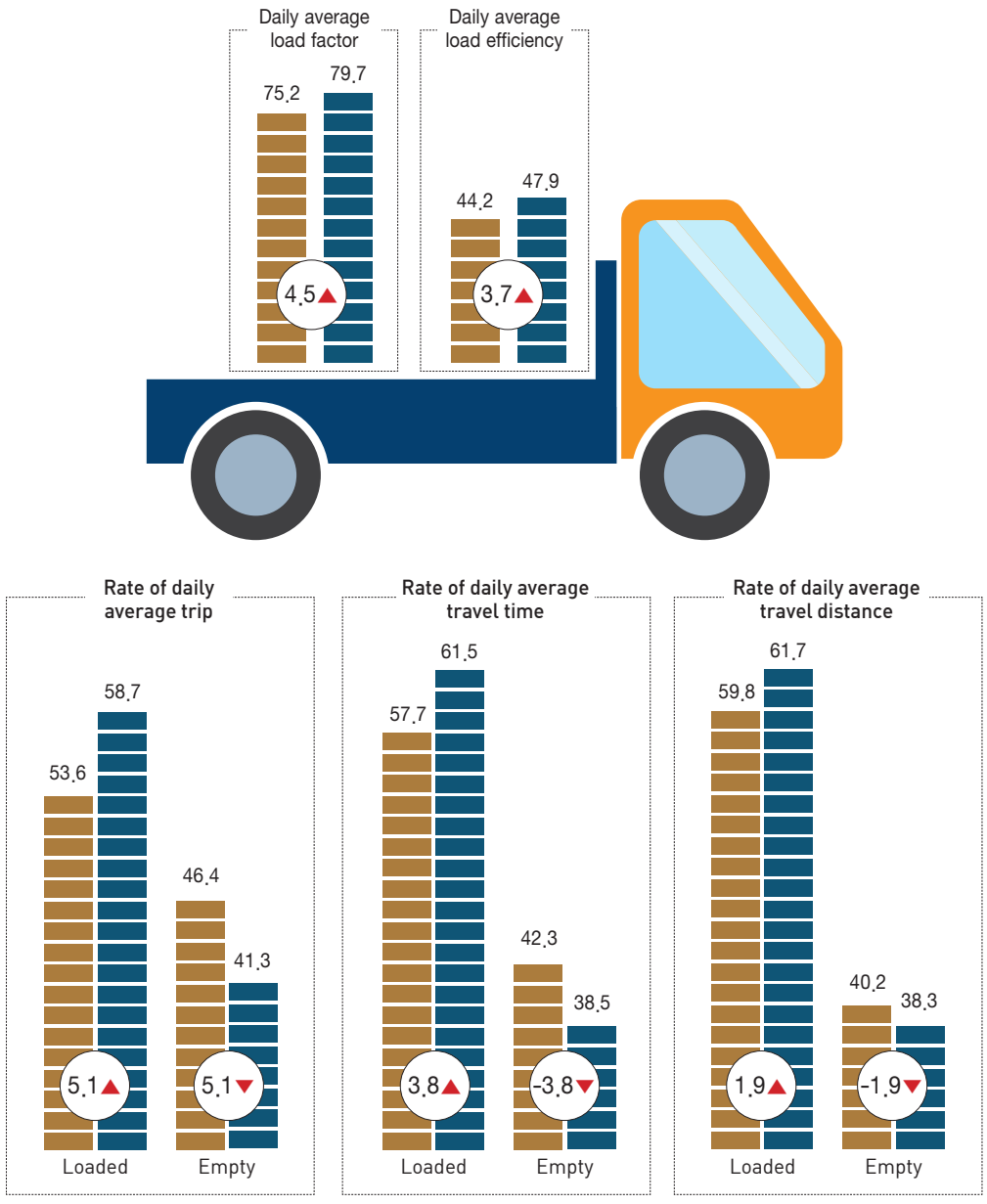


Source: The Korea Transport Institute, Korea Transport Survey and Database Building Project, Each year

- Both load factor and load efficiency have increased by 4.5% and 3.7%, respectively, compared to 2011.
- In general, the operation index related to loaded trips has grown, compared to 2011, and loaded travel-time rate and loaded travel-distance rate have increased by 3.8% and 1.9%, respectively.

Changes in daily operation characteristics index of freight vehicles

(Unit: %) 2011 2017

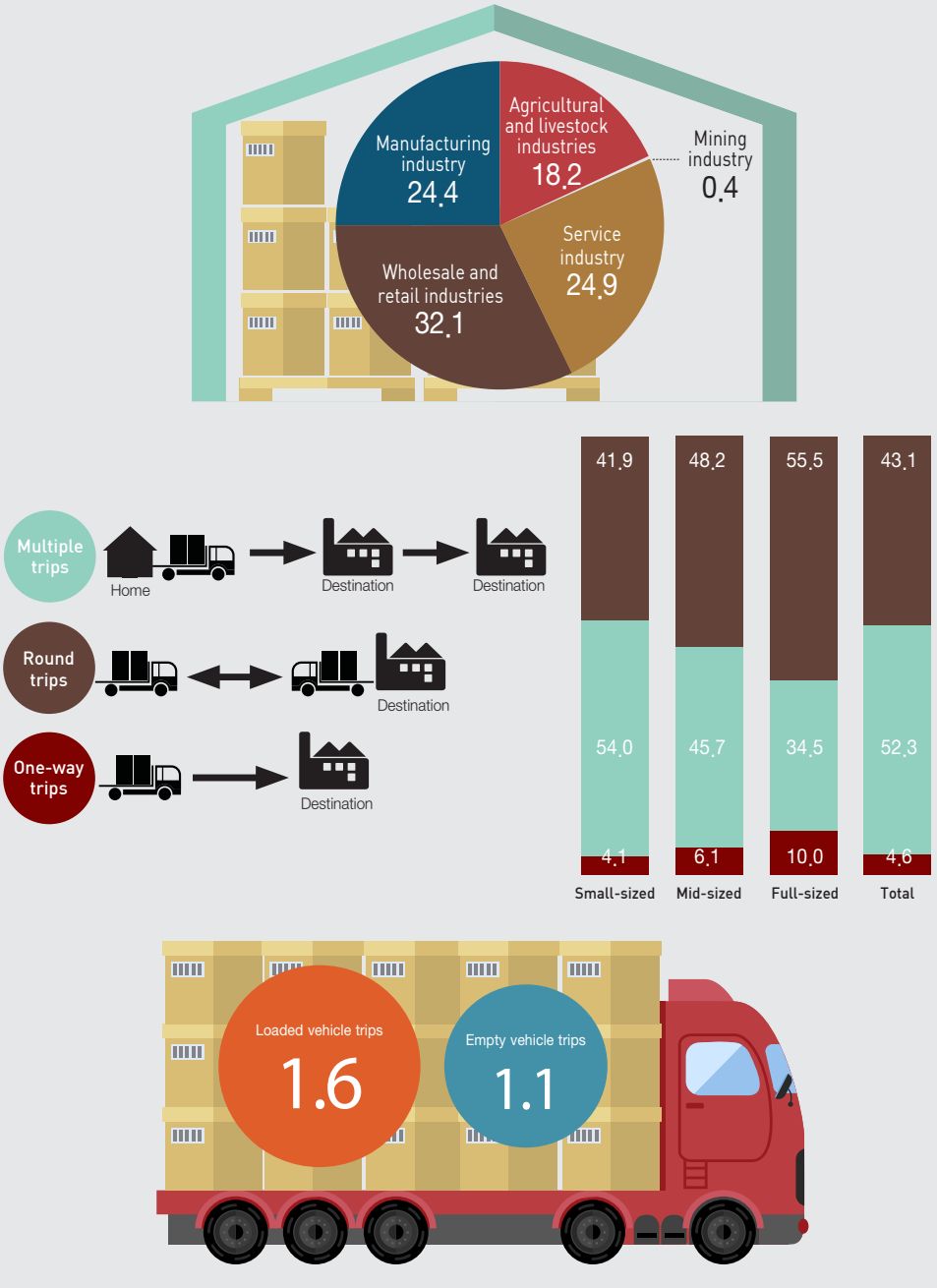


Source: The Korea Transport Institute, Korea Transport Survey and Database Building Project, Each year

⑤ Daily Operation Characteristics of Freight Vehicles

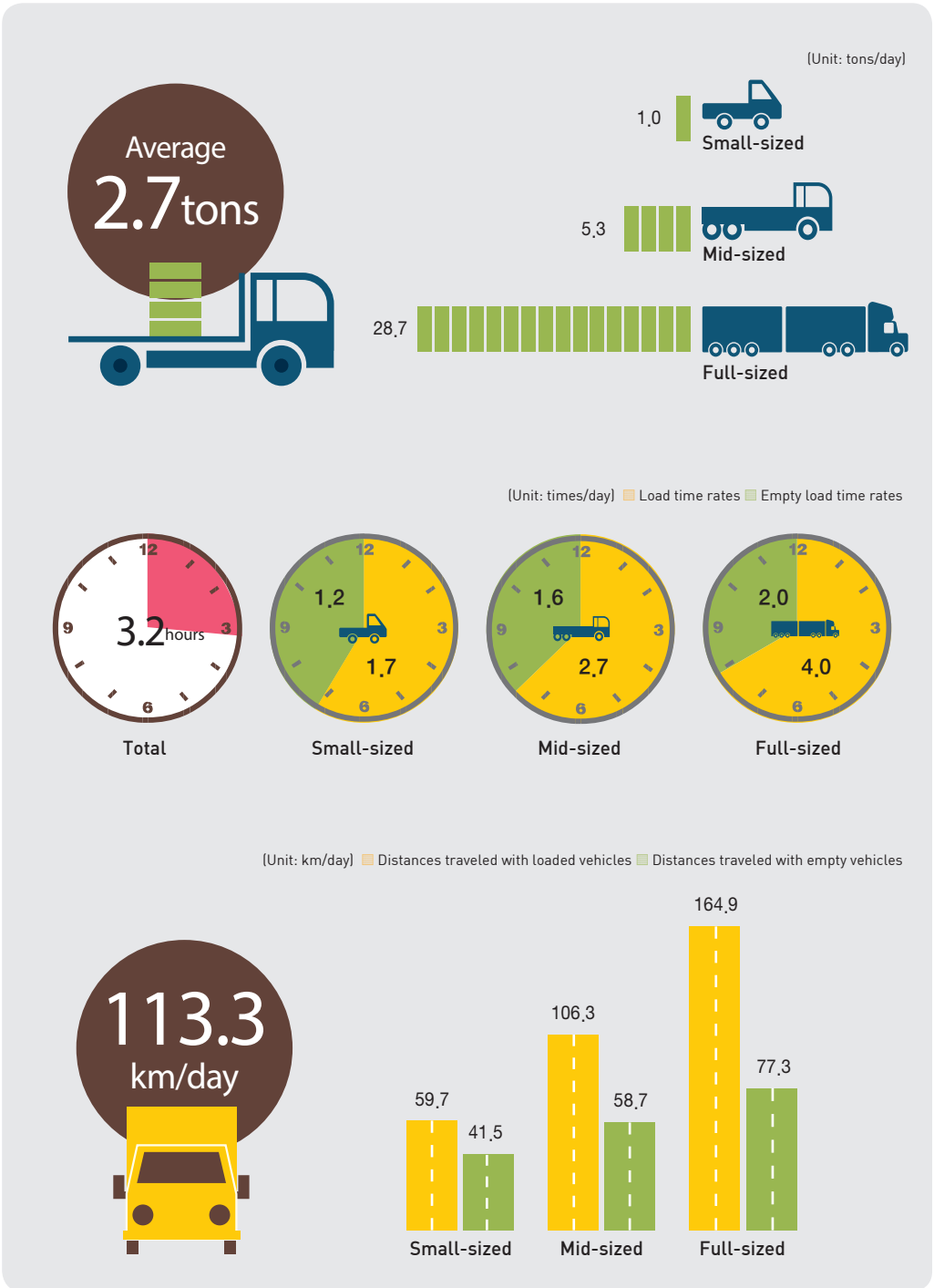
Mainly engaged industries, travel patterns, and the number of loaded and empty vehicle trips for freight vehicles

(Unit: %)



Source: The Korea Transport Institute, 2017 Korea Transport Survey and Database Building Project, 2018

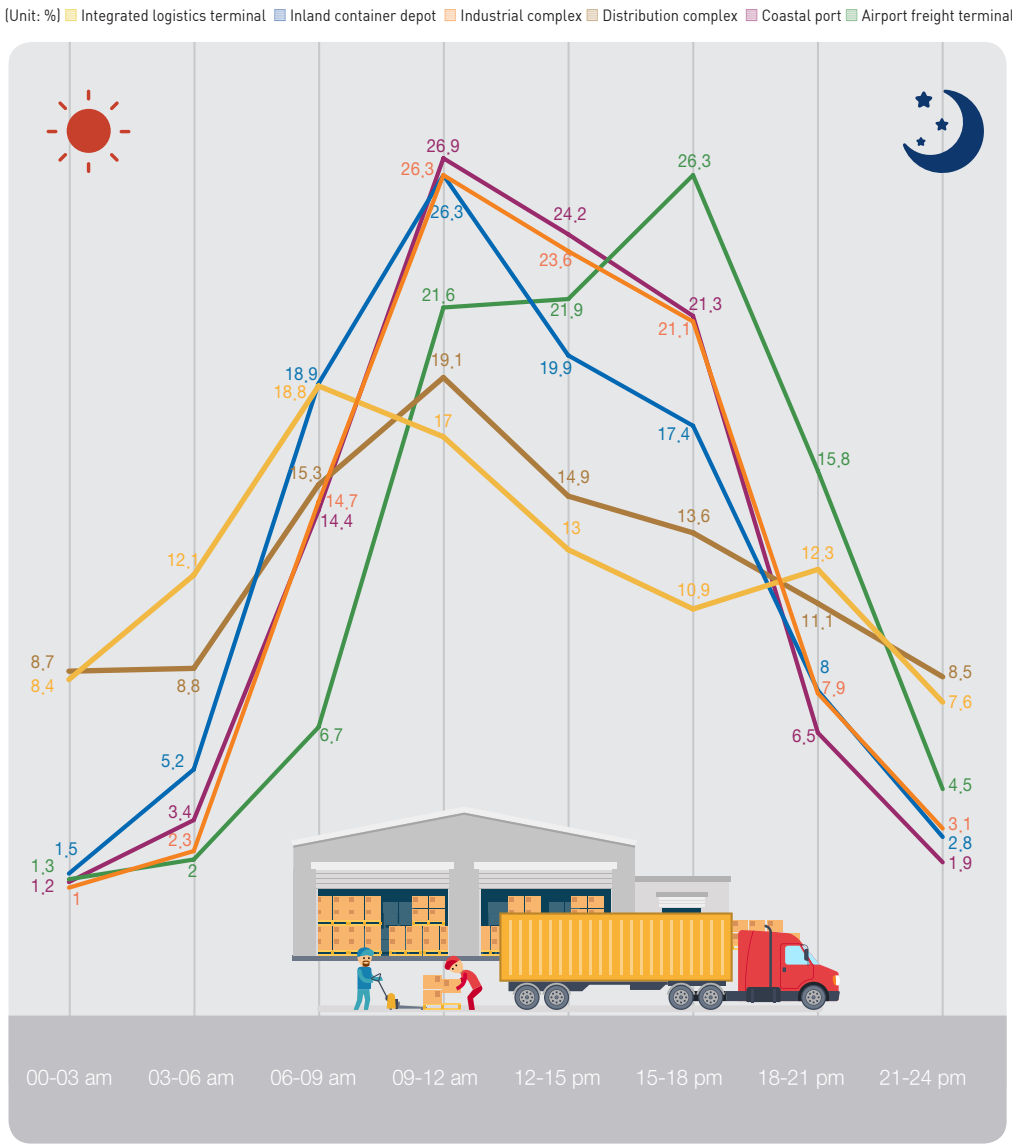
Daily average capacity tonnage, travel time and travel distance by capacity tonnage



Source: The Korea Transport Institute, 2017 Korea Transport Survey and Database Building Project, 2018

- Travel time bands of freight vehicles differ with the characteristics of logistics hubs.
- Traffic rates are high in daytime at industrial complexes and coastal ports, in evening and dawn at national logistics hubs such as inland container depots and integrated logistics terminals, and in evening time at airport freight terminals.

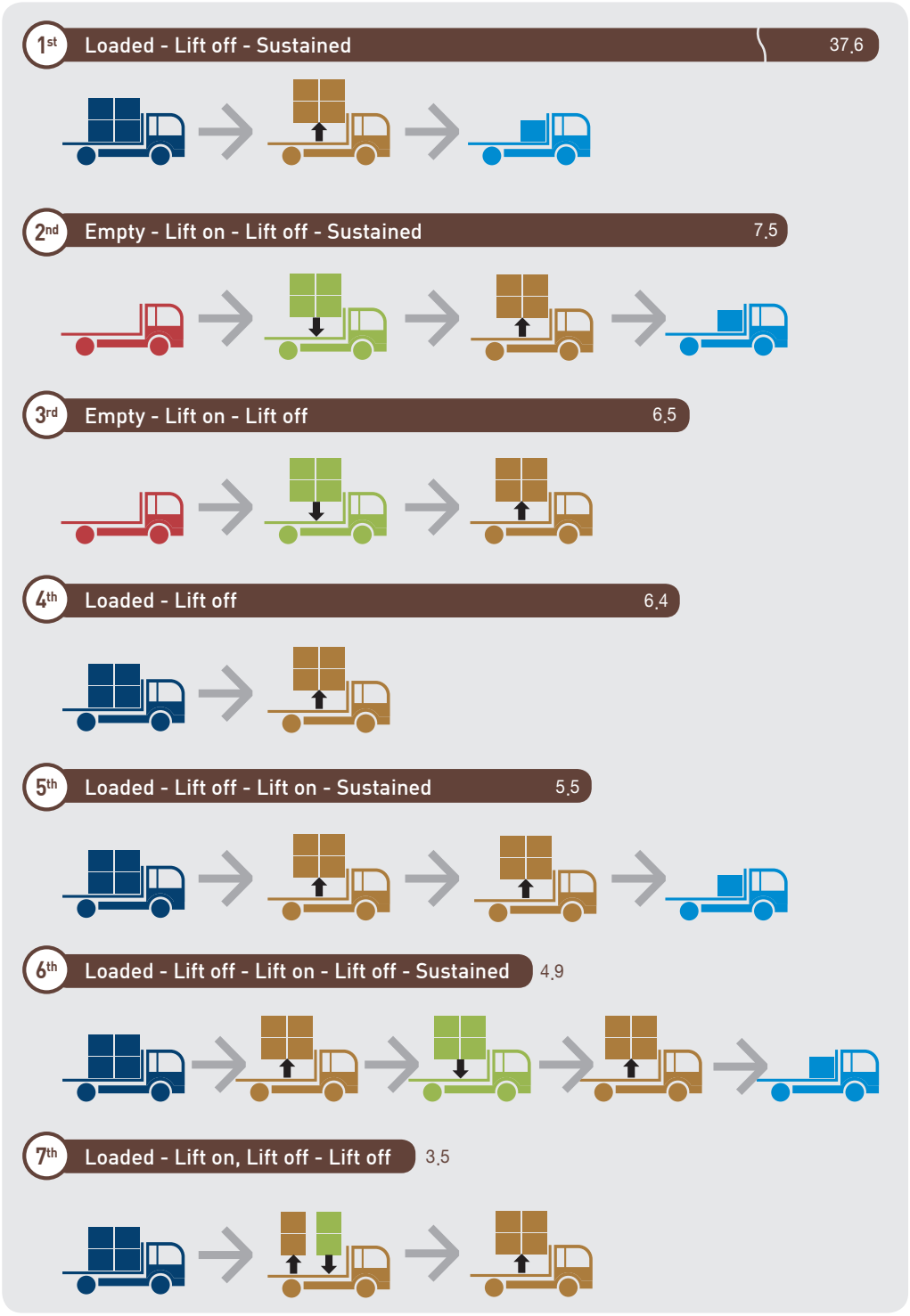
Travel time distribution of freight vehicles by logistics hub



Source: The Korea Transport Institute, 2017 Korea Transport Survey and Database Building Project, 2018

Freight-vehicle travel patterns

(Unit: %)



Source: The Korea Transport Institute, 2017 Korea Transport Survey and Database Building Project, 2018

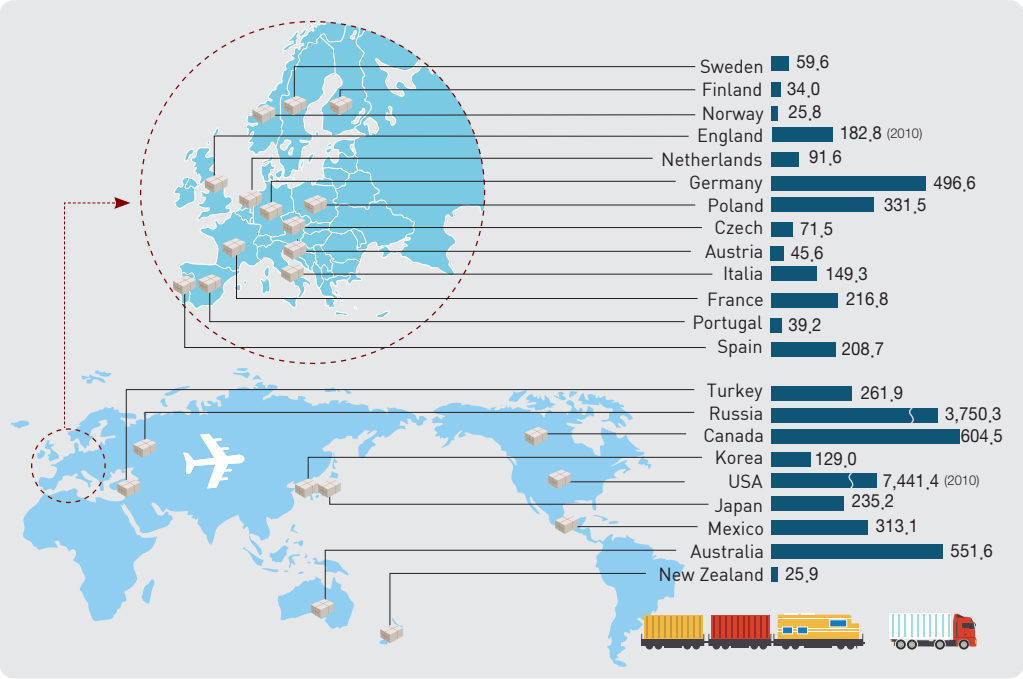
02_Freight Transportation

① Trends in Transport Performance by OECD Countries

- The freight volume transported in Korea is 129 (billion ton-km) which is similar to Italy's and one half of France's and Japan's.
- In the past 10 years, there has been a huge increase in the freight volumes transported in Poland, Australia, Canada, and Russia compared with those of other countries.

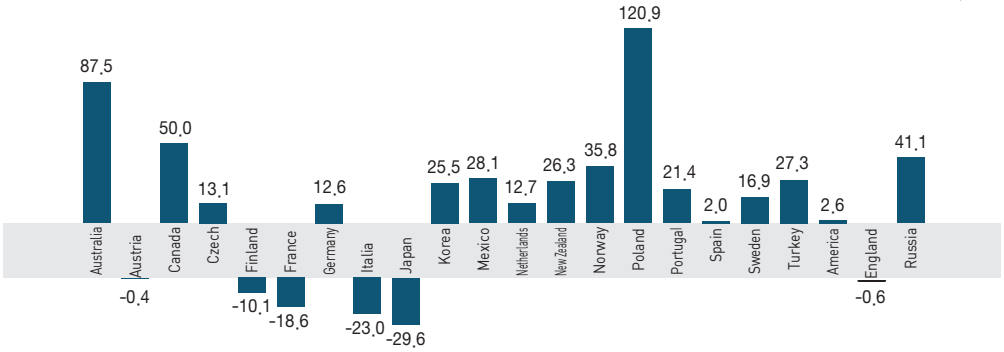
Freight volume transported by nation (in 2013)

(Unit: billion ton-km/year)



Changes in the freight volume transported by nation (2002-2013)

(Unit: %)

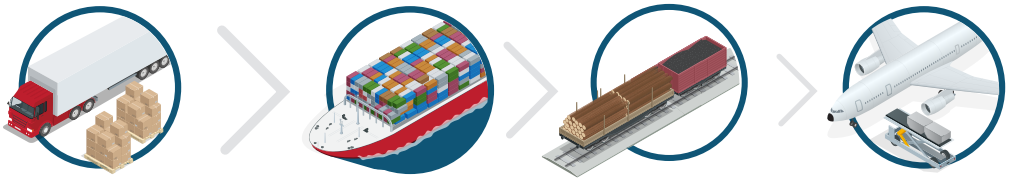


Sources : OECD, OECD fact book(2015~2016, 2016)

② Domestic Freight Volumes by Transportation Mode

- In 2016, the domestic freight volume transported is about 1.97 billion tons and the highest modal share is shown in road with about 91%, followed by maritime, rail, and aviation.

Modal split and freight volume by transportation mode (in 2016)



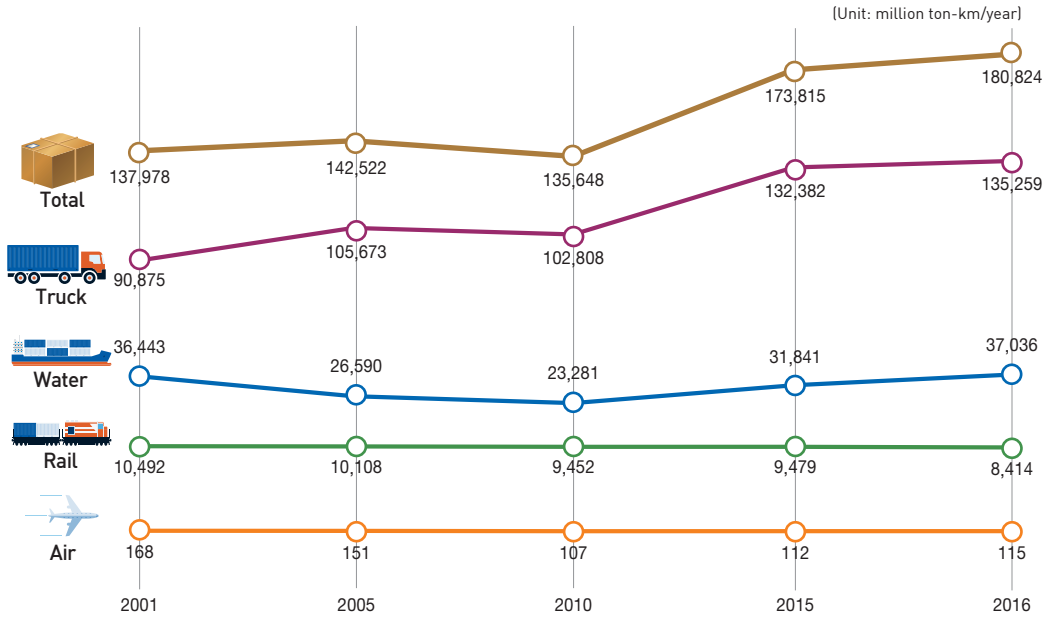
Truck	Water	Rail	Air
91.09%	7.25%	1.65%	0.01%
1,799,565 thousand tons	143,227 thousand tons	32,555 thousand tons	293 thousand tons

Source: The Korea Transport Institute, 2016 Korea Transport Survey and Database Building Project, 2017
Note: Domestic maritime freight includes the freight volume transported between coastal ports

③ Trends in Domestic Freight Volume

- The domestic freight volume (Unit: ton-km) has increased by about 30% over the past 15 years; the road sector has seen an increasing trend, while the opposite is the case for the rail and aviation sectors.

Trends in domestic freight volume by transportation mode



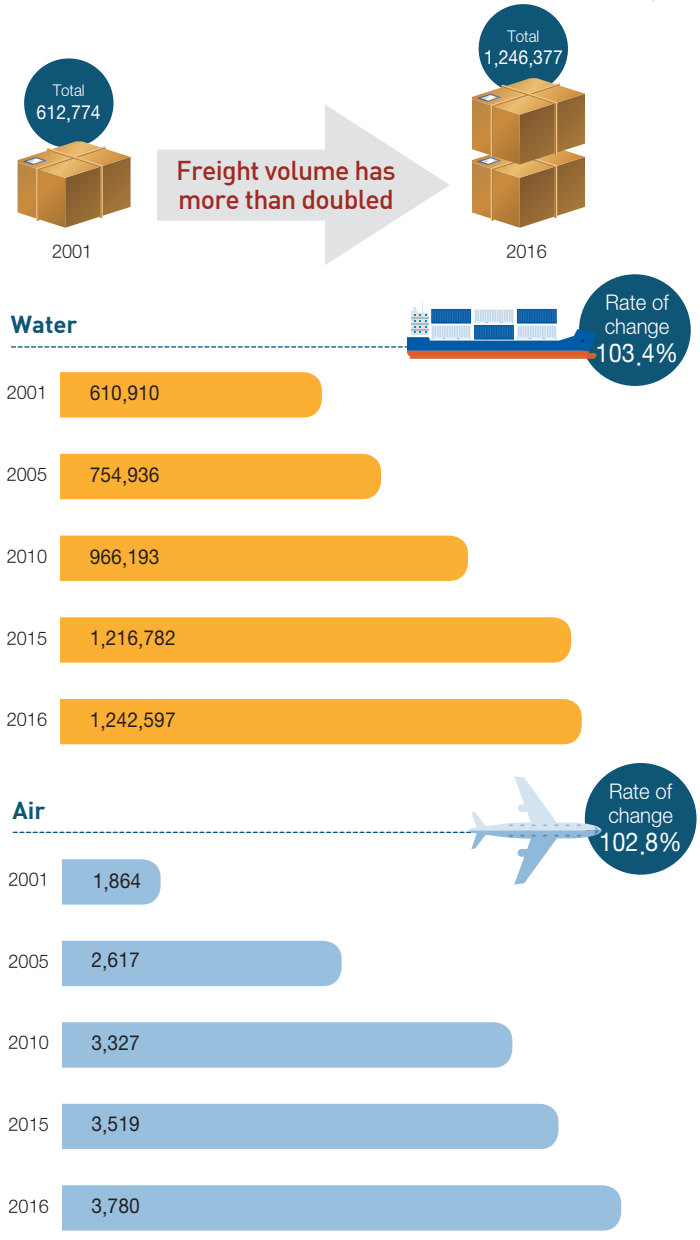
Source: The Korea Transport Institute, The National Transport DB Center (http://www.ktdb.go.kr/)
Note: Index refers to the quarterly average in 2000 (100 index).

④ Trends in International Freight Volume (maritime, aviation)

- The freight imported and exported are mostly transported by maritime shipping, and the international freight volume has almost doubled over the past 15 years.

International freight volume by transportation mode and modal split

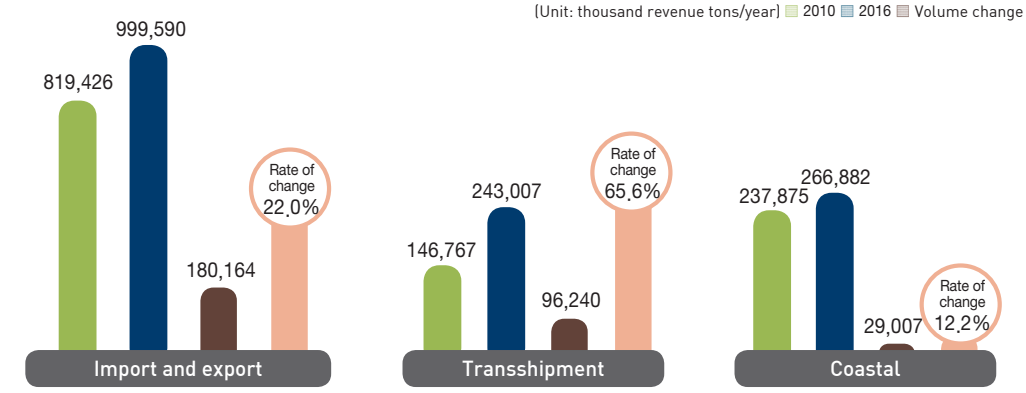
(unit: thousand tons/year)



Source: 1) Ministry of Land, Infrastructure and Transport, Statistical Yearbook of MOLIT, 2017
2) Ministry of Oceans and Fisheries, Statistical Yearbook of MOF, 2017
3) Ministry of Land, Infrastructure and Transport, Airportal (http://www.airportal.go.kr)

- The import and export shipment volume of the nation has increased by 22.0% compared to 2010. Transshipment volume and coastal shipment volume have increased by 65.6% and 12.2%, respectively, during the same period.

Changes in the nation's marine freight (2010-2016)

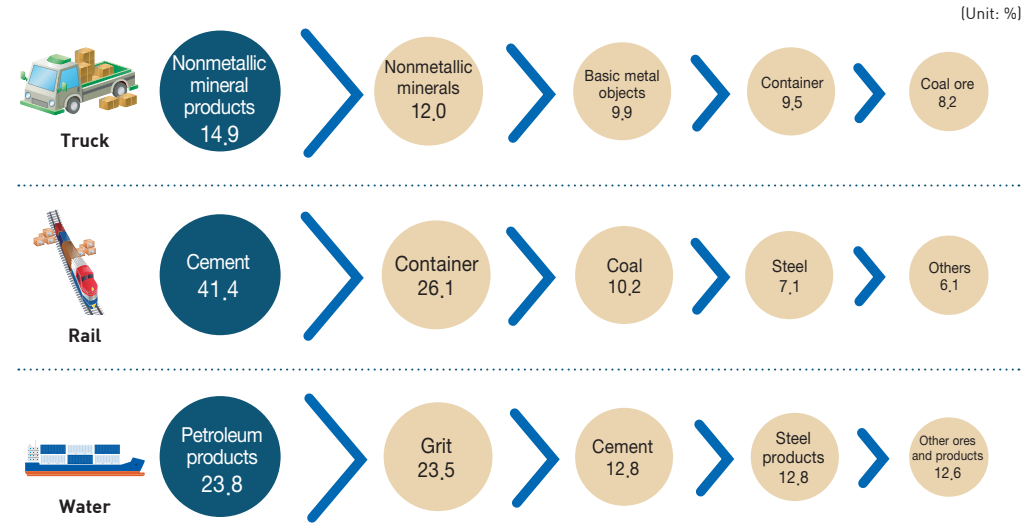


Source: Ministry of Maritime Affairs and Fisheries, Shipping & Port Logistics Internet Data Center (http://www.spidc.go.kr)
Note: Coastal freight includes both inbound shipment volume and outbound shipment volume.

⑤ Cargo Commodities Delivered by Transportation Mode

- Roads, which account for the largest delivery of domestic freight volume, have delivered nonmetallic minerals the most, while railways have mainly delivered cement, and coastal shipping has mainly delivered petroleum products.

Top-five commodities delivered by transportation mode



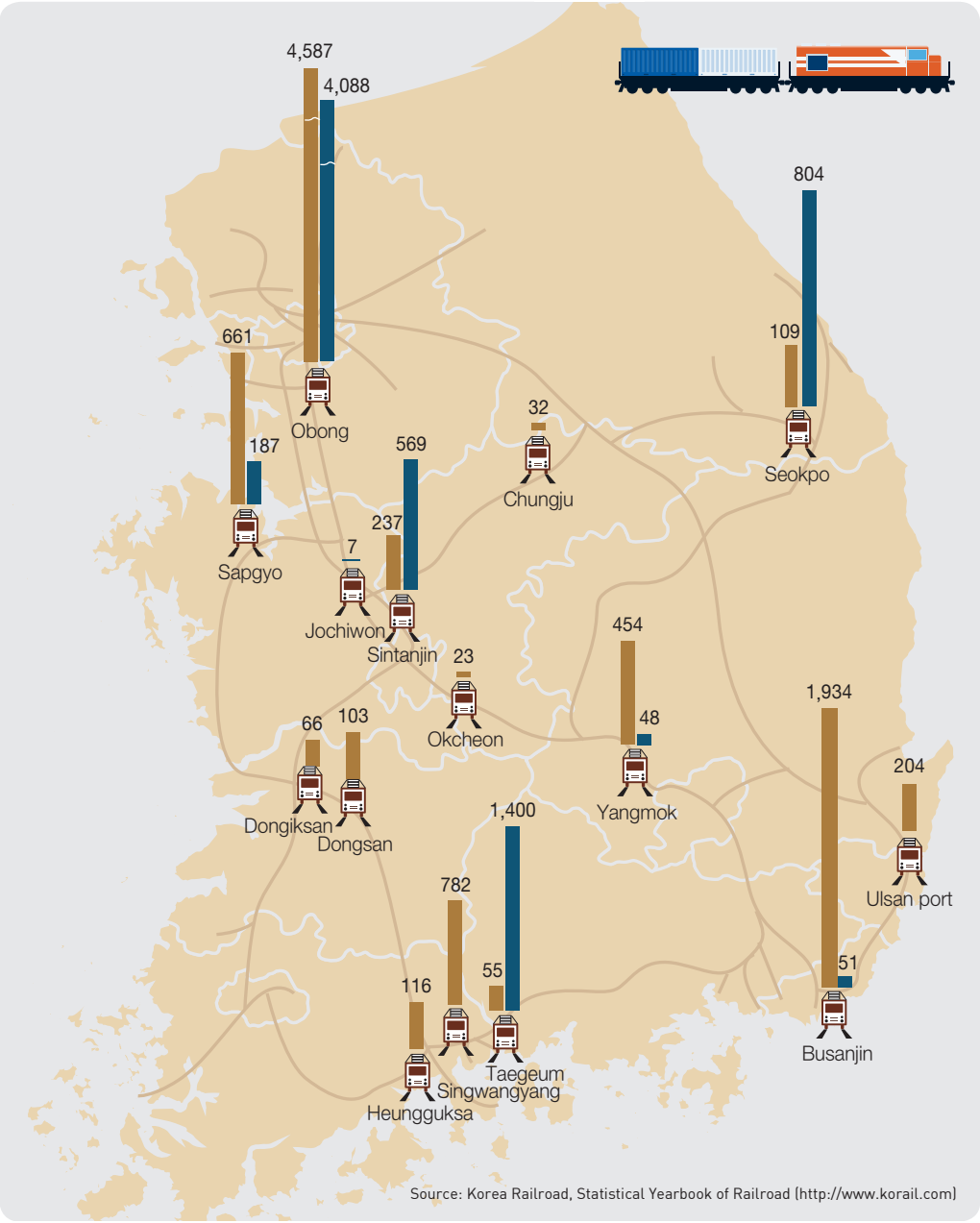
Source: 1) The Korea Transport Institute, 2015 Korea Transport Survey and Database Building Project, 2016
2) Korea Railroad, Statistical Yearbook of Railroad, 2016
3) Ministry of Maritime Affairs and Fisheries, Shipping & Port Logistics Internet Data Center (http://www.spidc.go.kr)
Note: Coastal freight includes inbound shipment volume of coastal cargo ships

⑥ Freight-handling Performance by Major Rail Stations

- Rail stations that are high in handling container freights are Obong, Busanjin, Singwangyang, Sapgyo, and Yangmok station in sequence; rail stations that are high in handling bulk carriers are Obong, Taegeum, Seokpo, and Sintanjin station in sequence.

Freight volume by major rail stations (in 2016)

(Unit: thousand tons/year) Container Bulk



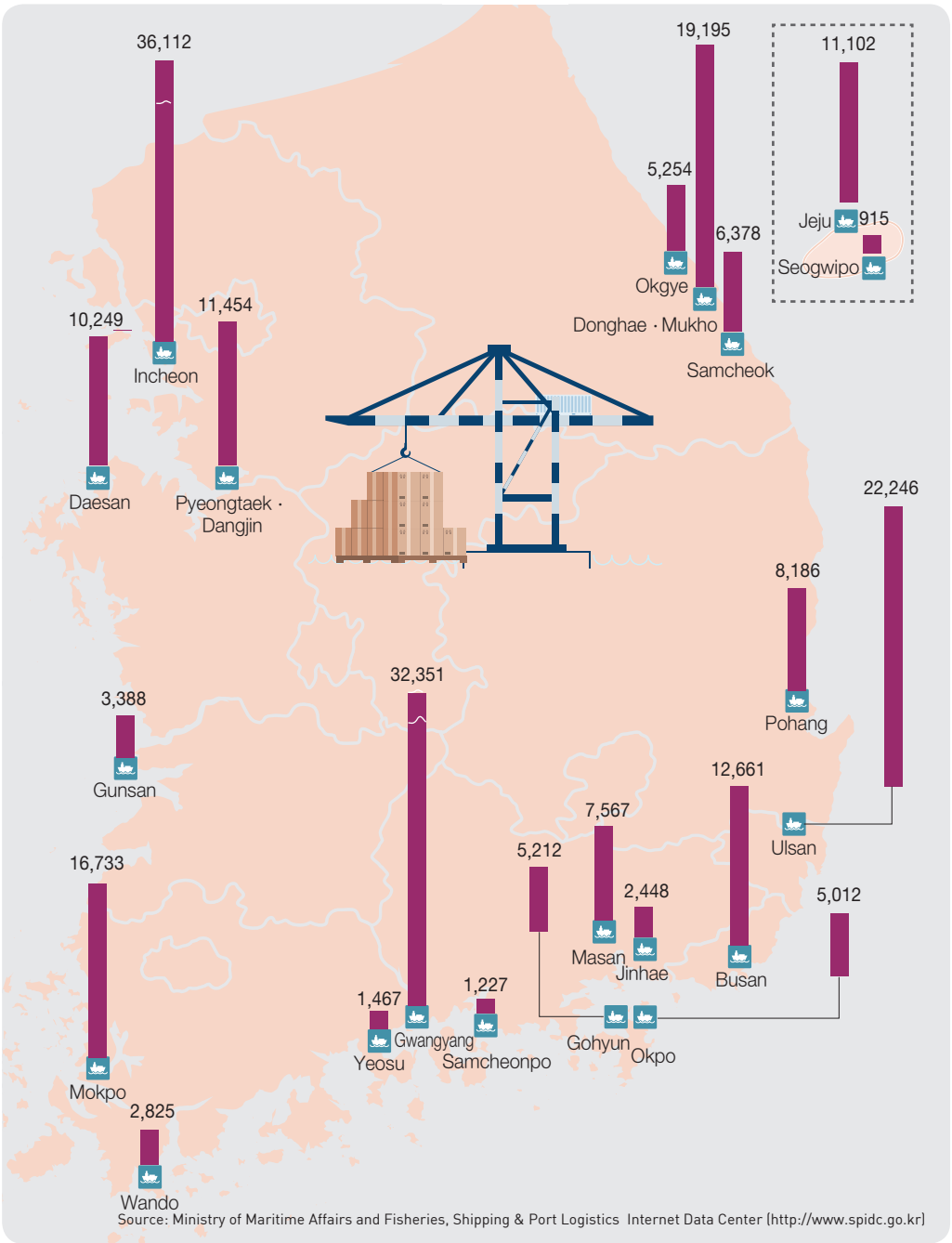
Source: Korea Railroad, Statistical Yearbook of Railroad (http://www.korail.com)

⑦ Freight-handling Performance by Major Water Ports

- Of major ports, Incheon port handled the largest coastal freight volume of about 36,000 RTs in 2016, followed by Gwangyang port, Ulsan port, Donghae port, Mukho port and Mokpo port.

Coastal freight volumes by major ports (in 2016)

(Unit: thousand R/T)



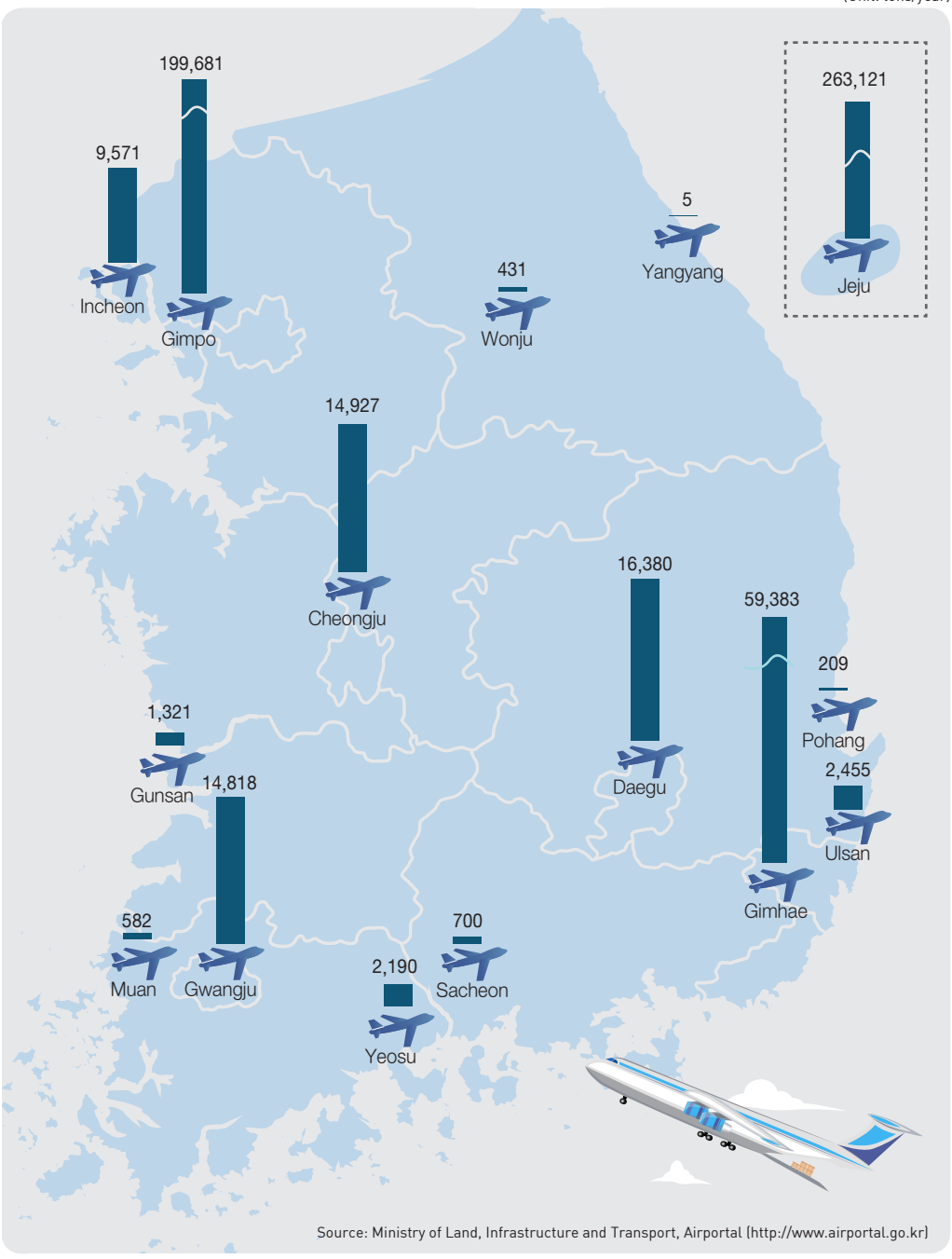
Source: Ministry of Maritime Affairs and Fisheries, Shipping & Port Logistics Internet Data Center (http://www.spidc.go.kr)

⑧ Freight-handling Performance by Major Domestic Airports

- Of major domestic airports, Jeju airport has handled the largest freight volume of about 260,000 tons a year, followed by Gimpo airport, Gimhae airport, Daegu airport and Cheongju airport.

Domestic airlines' freight volumes by major airports (in 2016)

(Unit: tons/year)

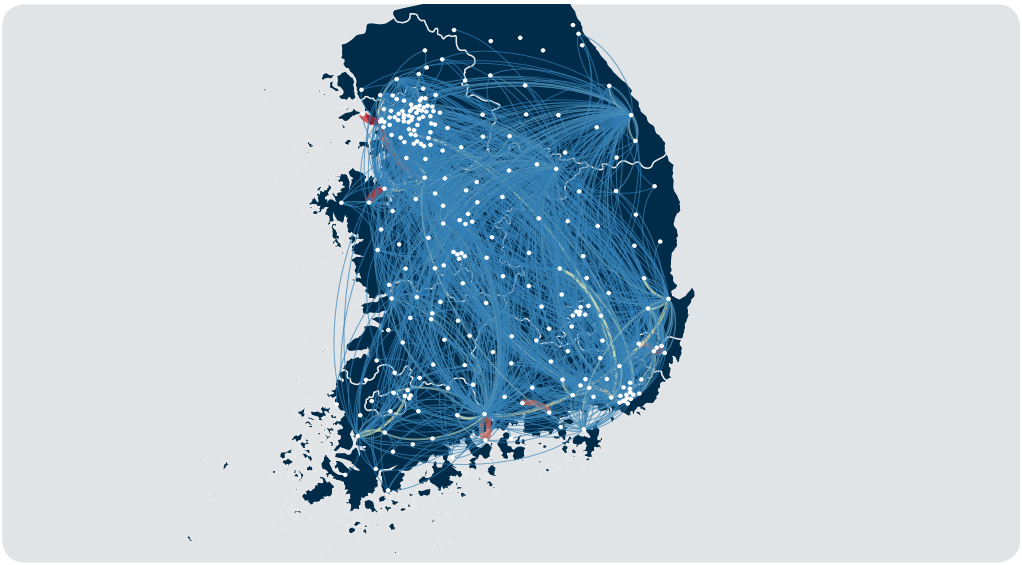


Source: Ministry of Land, Infrastructure and Transport, Airportal (http://www.airportal.go.kr)

⑨ National Freight OD Traffic Volumes

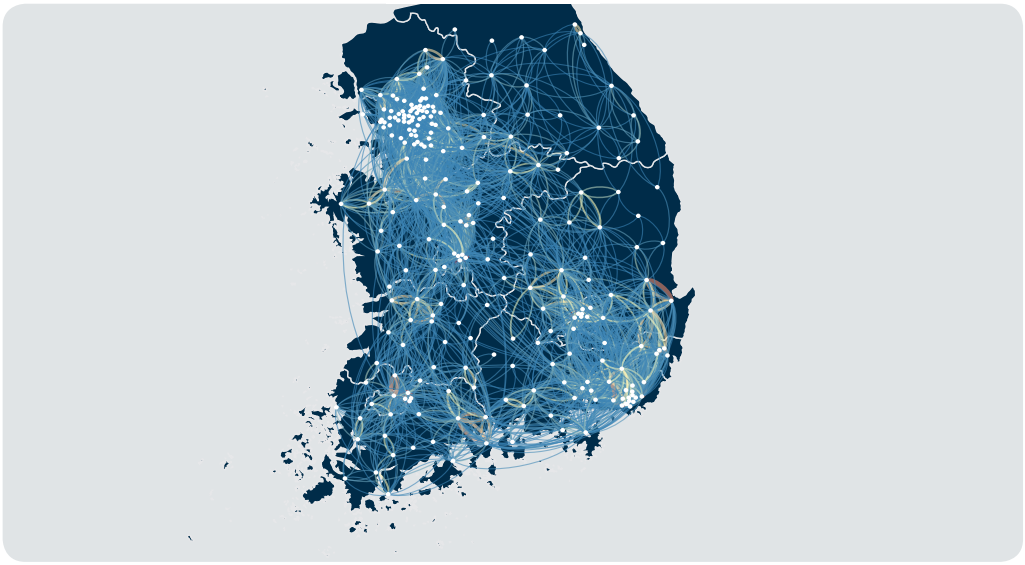
- In 2015, it is in the Seoul metropolitan area and major ports that freight OD traffic volumes by commodity run high.

Freight OD traffic volumes by commodity (in 2015)



- Freight OD traffic volumes are relatively high in Seoul metropolitan area and Youngnam region compared to other regions.

Freight vehicle OD traffic volumes (in 2015)



Source: The Korea Transport Institute, 2015 Korea Transport Survey and Database Building Project, 2016
Note: 252 zone system

① Status of Major Logistics Hubs Related to Roads

- Inland logistics hub: A large scale logistics hub composed of Integrated Freight Terminal (IFT) and Inland Container Depot (ICD)
- Integrated Freight Terminal (IFT): Greater logistics facilities wherein a series of logistics activities are conducted from storage of diverse products to product packaging and classification for freight collection and delivery
- Inland Container Depot (ICD): Inland container depot that supports container storage and handling services equipped with customs clearance facilities that are equivalent to the ports
- Logistics complex (previously, distribution complex): A complex created with distribution facilities (freight terminal, collection and distribution complex, retail and wholesale complex, etc.) and supporting facilities (processing and production facilities, data processing facilities, etc.) all together

Status of major logistics hubs related to roads (in 2016)

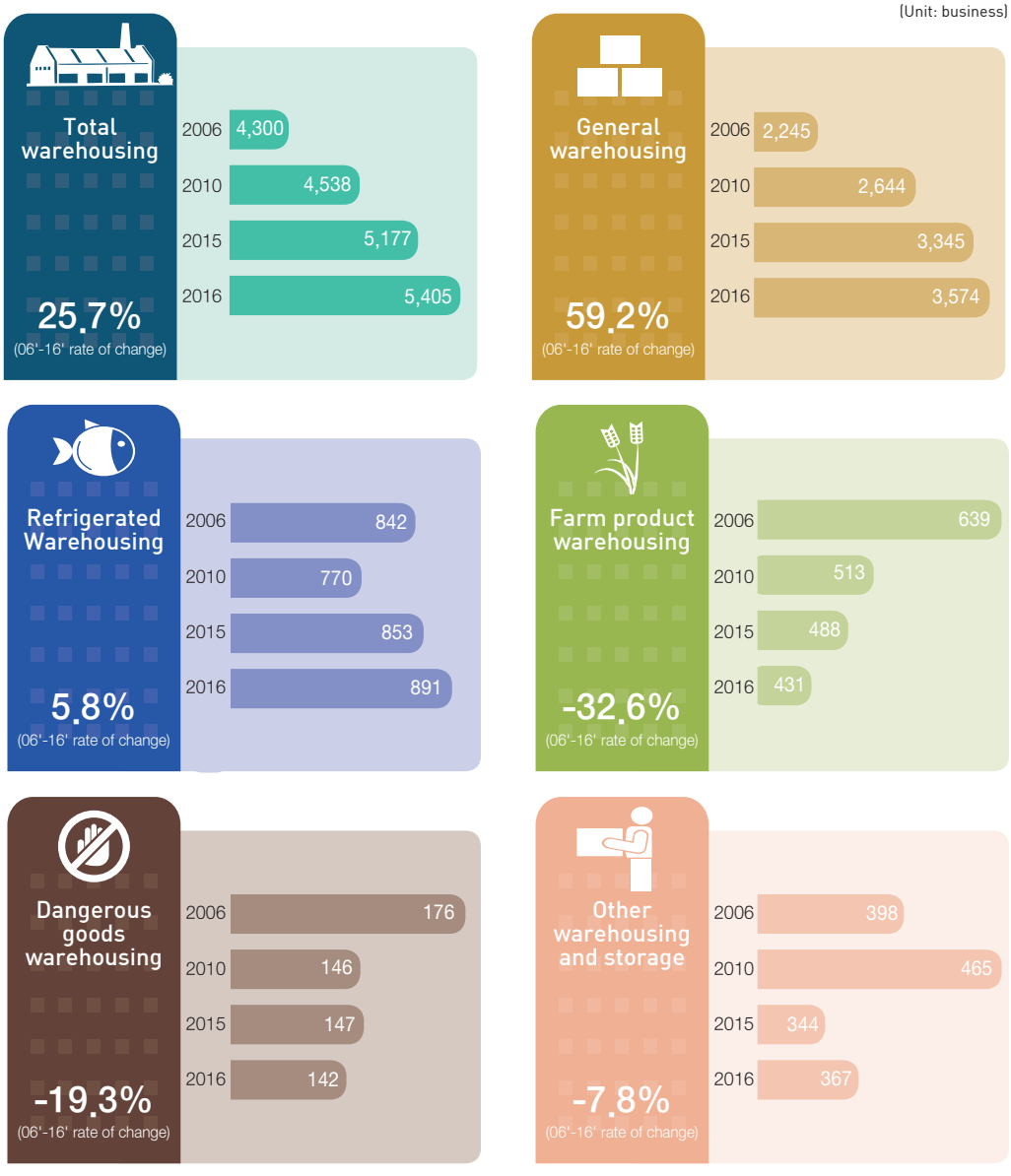
Source: Ministry of Land, Infrastructure and Transport, The 3rd Logistics Facilities Development Plan, 2017

② Trends in Domestic Warehouses

- According to Statistics Korea, the number of warehousing businesses in 2016 was about 5,400, most of which comprised general warehouses and cold & frozen warehouses.
- The number of warehouses has increased by about 26% over the past 10 years; general warehouses and cold & frozen warehouses are on a rising trend and farm product warehouses and hazardous material warehouses are on a declining trend.

Changes in the number of domestic warehousing businesses

(Unit: business)

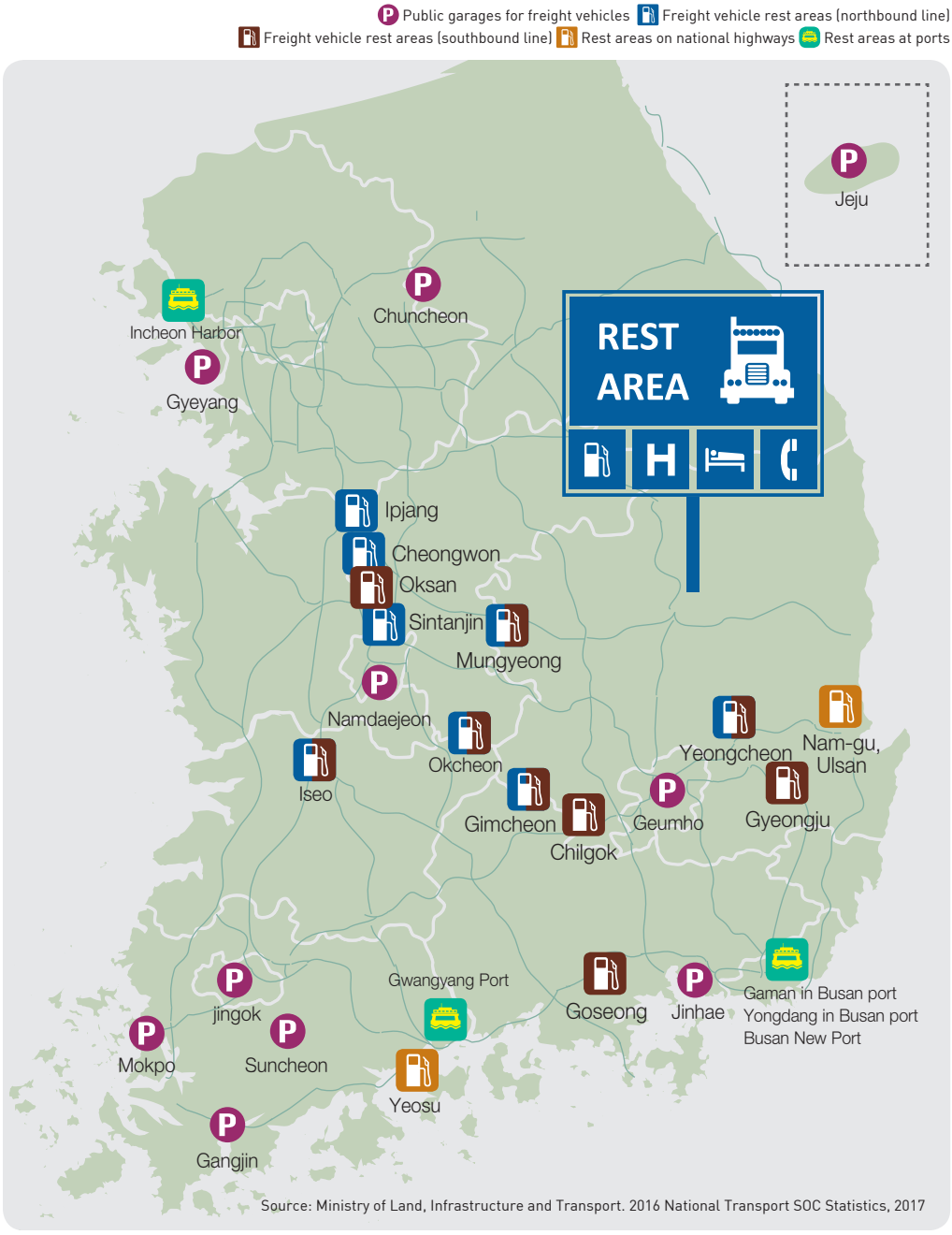


Source: Statistics Korea, The Census on Establishments (http://kosis.kr), Each year

③ Status of Freight Vehicle Rest Areas and Public Garages

- In 2016, the total number of freight vehicle rest areas being operated is 24 including 17 on highways, 2 on national highways, and 5 at ports; and public garages numbered 10 in total.

Status of freight vehicle rest areas and public garages

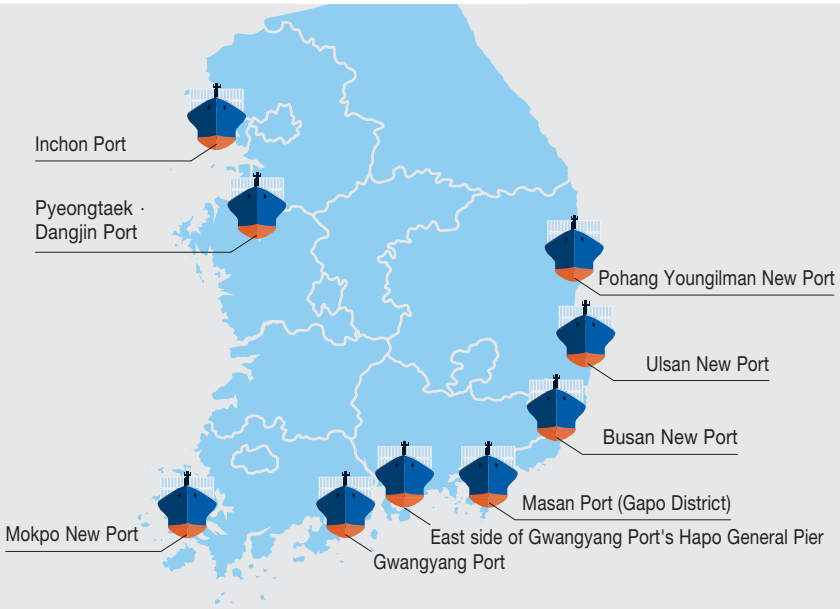


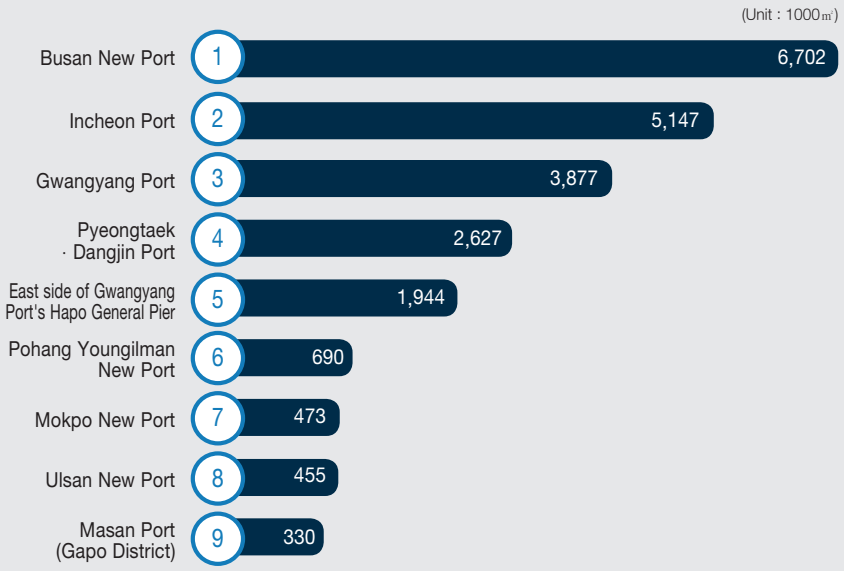
Source: Ministry of Land, Infrastructure and Transport. 2016 National Transport SOC Statistics, 2017

④ Current Status of Port Hinterland

- Port hinterlands across the nation number a total of nine, comprising about 22.24 million square meters of land area.
- The hinterland of Busan new port is noted to be the largest one with about 6.7 million square meters of land area (30.1%).

Current status of port hinterland (in 2016)





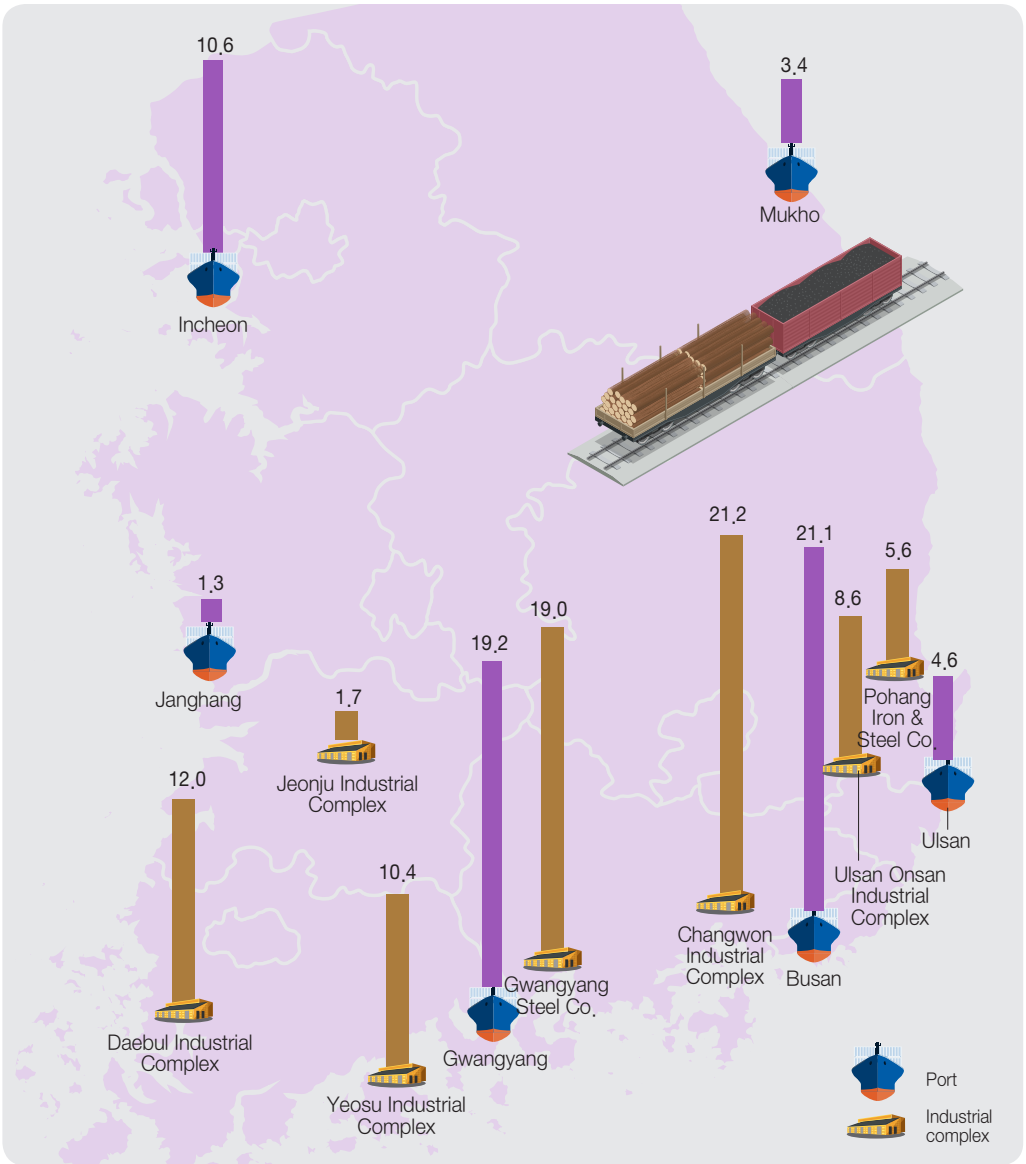
Source: Ministry of Land, Infrastructure and Transport, 2016 Key Statistics of National Transport and SOC, 2017

⑤ Status of Industrial Rail Tracks for Ports and Industrial Complexes

- Total lengths of industrial rail tracks for ports and industrial complexes are 60.4 km and 78.5 km, respectively.
- Industrial rail tracks for ports are mainly connected to trade ports such as Busan port, Busan new port, Incheon port, and Gwangyang port and industrial lines for industrial complexes are mainly connected to the national industrial complexes nearby the ports.

Status of industrial rail tracks for ports and industrial complexes (in 2016)

(Unit: km)



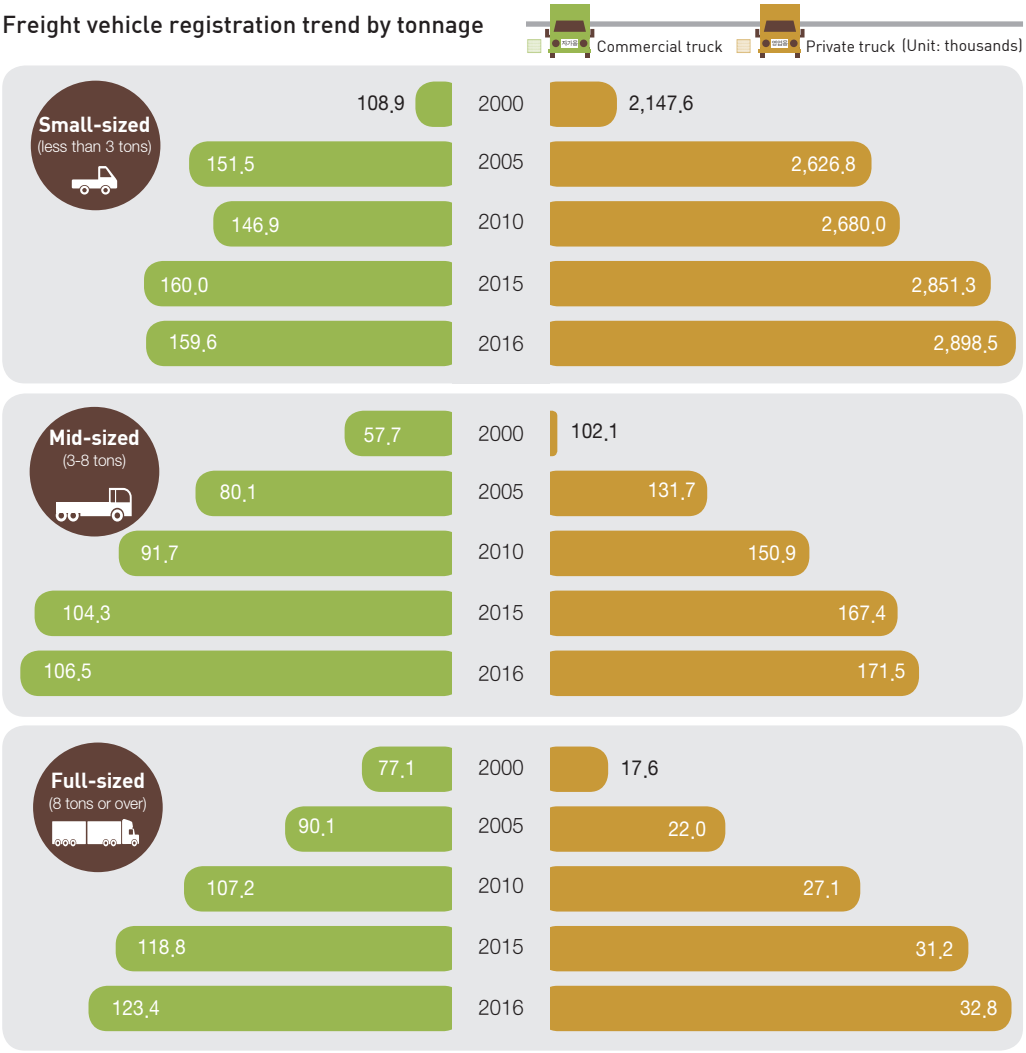
Sources : Korea Railroad Corporation, 2017

Note: Connected by the Taean suspension bridge, Gwangyang Steel Works and Gwangyang industrial complex are regarded as one industrial complex.

⑥ Freight Vehicle Registration Trend in Korea

- Registered freight vehicles are as many as about 3.5 million in 2016, among which freight vehicles for businesses are 11.2% (about 390,000), and private trucks (for non-business) are about 88.8% (about 310,000).
- About 88% of the freight vehicles are small freight vehicles of less than three tons; about 93% of the private trucks for a non-business purpose are small freight vehicles, and about 60% of the freight vehicles for business purposes are mid- or full-sized freight vehicles of more than three tons.
- Increasing ratios of newly registered mid- and full-sized vehicles are relatively high compared to those of newly registered small-sized vehicles.

Freight vehicle registration trend by tonnage



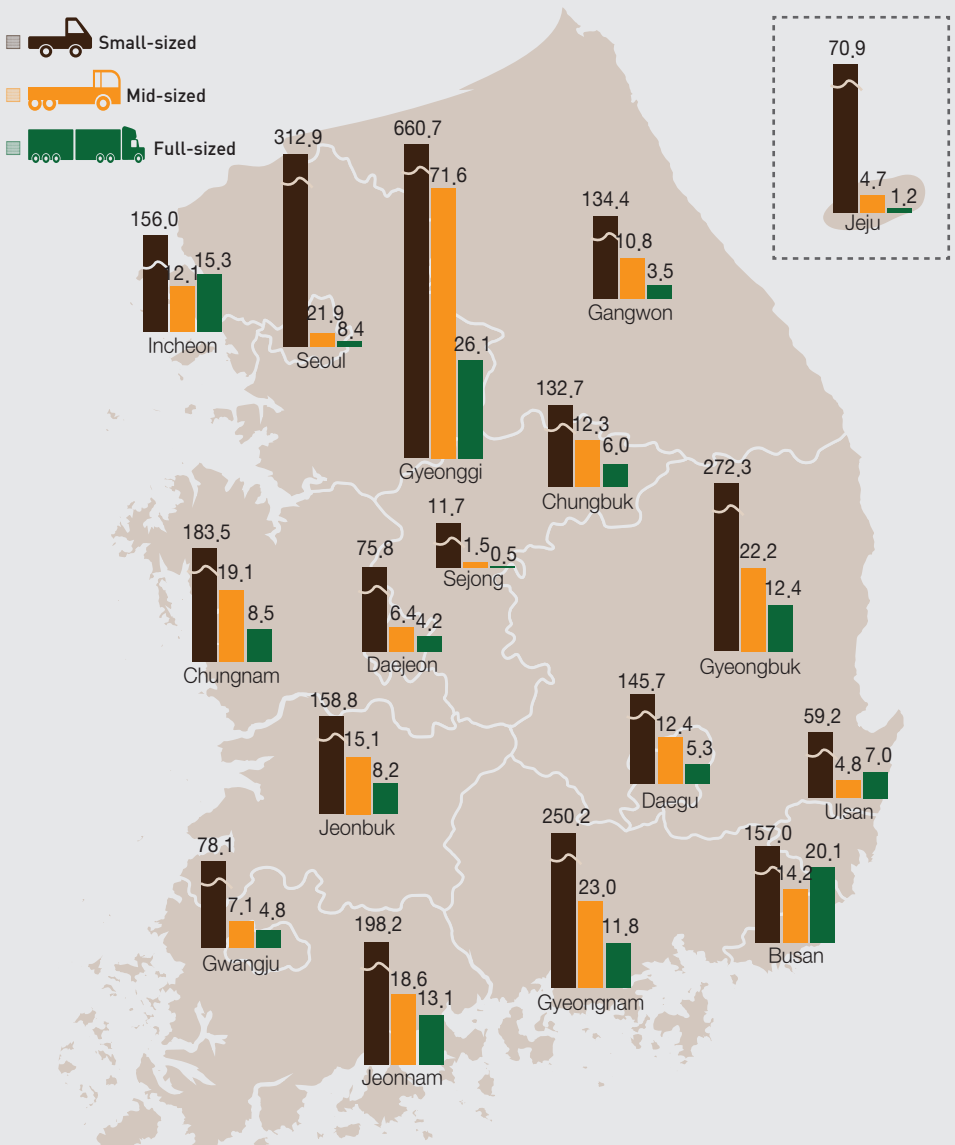
Source: Ministry of Land, Infrastructure and Transport (MOLIT), MOLIT Statistics System (http://stat.molit.go.kr)
Note: Classification of freight vehicle tonnage has been changed. (Small-sized: Freight vehicle less than three-ton trucks, Mid-sized: Freight vehicle more than three-ton to less than eight-ton trucks, Full-sized: Freight vehicle more than eight-tons trucks)

⑦ Status of Freight Vehicle Registration by City/Province

- Ratios of small-sized vehicle registration are relatively high in Gyeongbuk province, Gyeongnam province, Jeonbuk province, Jeonnam province, Chungbuk province and Chungnam province, respectively.
- Ratios of full-sized freight vehicle registration are high in port cities like Busan, Incheon and Ulsan.

Number of registered freight vehicles by region/tonnage (in 2016)

(Unit: thousands)



Source: Ministry of Land, Infrastructure and Transport (MOLIT), MOLIT Statistics System (http://stat.molit.go.kr)
Note: Classification of freight vehicle tonnage has been changed. (Small-sized: Freight vehicle less than three-ton trucks, Mid-sized: Freight vehicle more than three-ton to less than eight-ton trucks, Full-sized: Freight vehicle more than eight-tons trucks)

⑧ Nationwide Expressway Freight Vehicle Traffic Volumes

- Freight vehicle traffic is busy on expressways, such as the Gyeongbu expressway, the Chungbu expressway, the Jungbu Naeryuk expressway, the Seoul Beltway, the Daegu Busan expressway and the West Coast expressway.
- Freight vehicle traffic is relatively busy in Seoul Metropolitan Region, Chungcheong Region, and Youngnam Region compared to Gangwon Region, and Jeolla Region.

Nationwide freight vehicle traffic volume distribution on expressways (in 2016)

(Unit: vehicles/day)

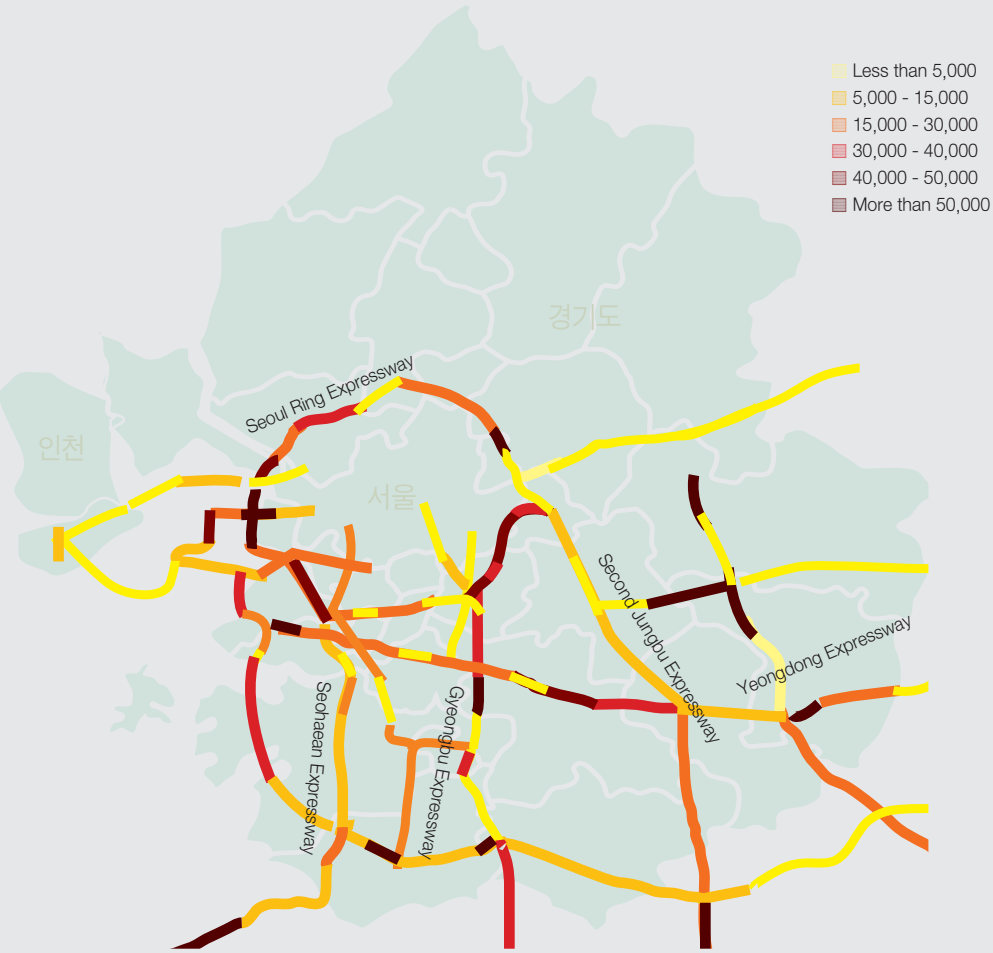
Source: Ministry of Land, Infrastructure and Transport, Annual Traffic Volume Report, 2017

⑨ Freight Vehicle Traffic Volumes on the Expressways around the Seoul Metropolitan Area

- In the Seoul metropolitan area, freight vehicle traffic is busy on such expressways as the Gyeongbu Expressway, the West Coast Expressway, the Youngdong Expressway and the Seoul Beltway.
- Freight vehicle traffic volumes on privately financed expressways, such as the Incheon International Airport Expressway, the Yongin-Seoul Expressway, the Seoul-Chuncheon Highway, and so forth, are relatively low.

Freight vehicle traffic volume distribution on the expressways around the Seoul metropolitan area (in 2016)

(Unit: vehicles/day)



Source: Ministry of Land, Infrastructure and Transport, Annual Traffic Volume Report, 2017

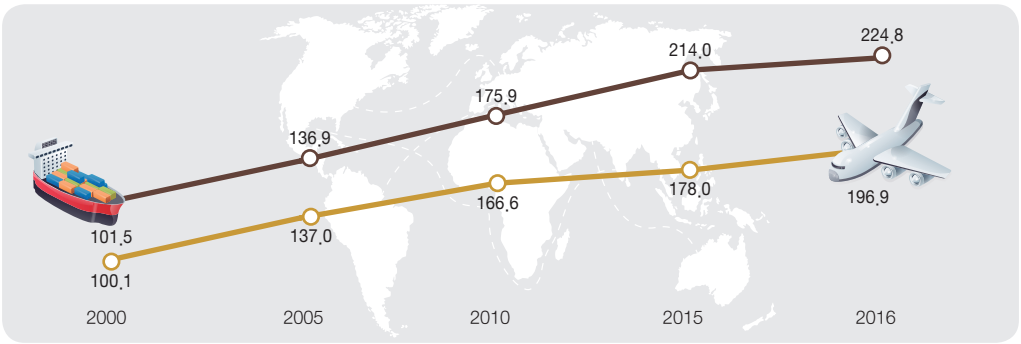
04_Freight Economy and Industry

① Trends in Transportation Service Indexes

- The domestic freight index is declining, while the international freight index is rising continuously.
- When the domestic freight index of the fourth quarter of 2016 is compared to that of 2000, the maritime index shows a similar level but the rail index and aviation index has declined by about one half.
- If the international freight index of the fourth quarter of 2016 is compared to that of 2000, both the aviation index and the maritime index have almost doubled.

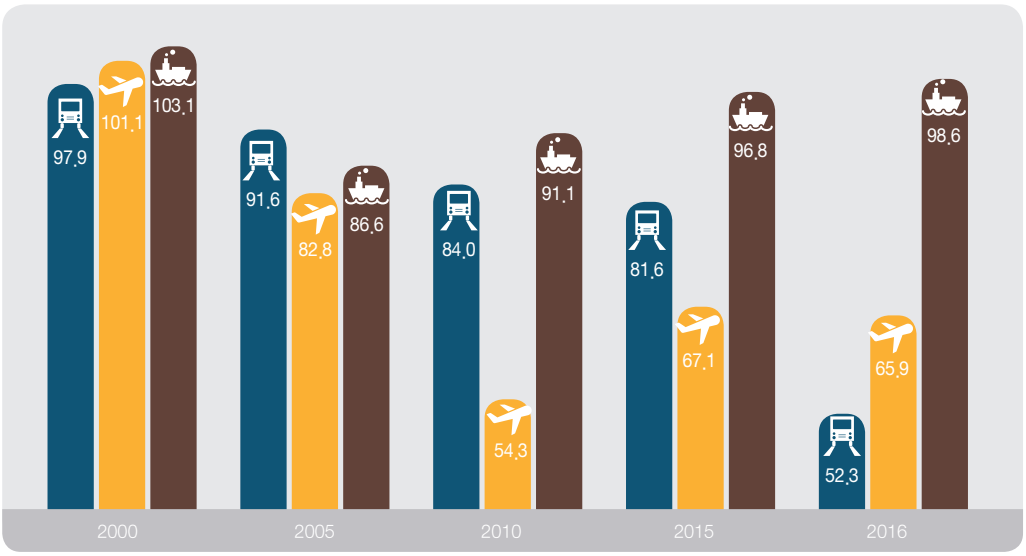
International freight indexes

(Unit : %) Air Water



Domestic freight indexes

(Unit : %) Rail Air Water

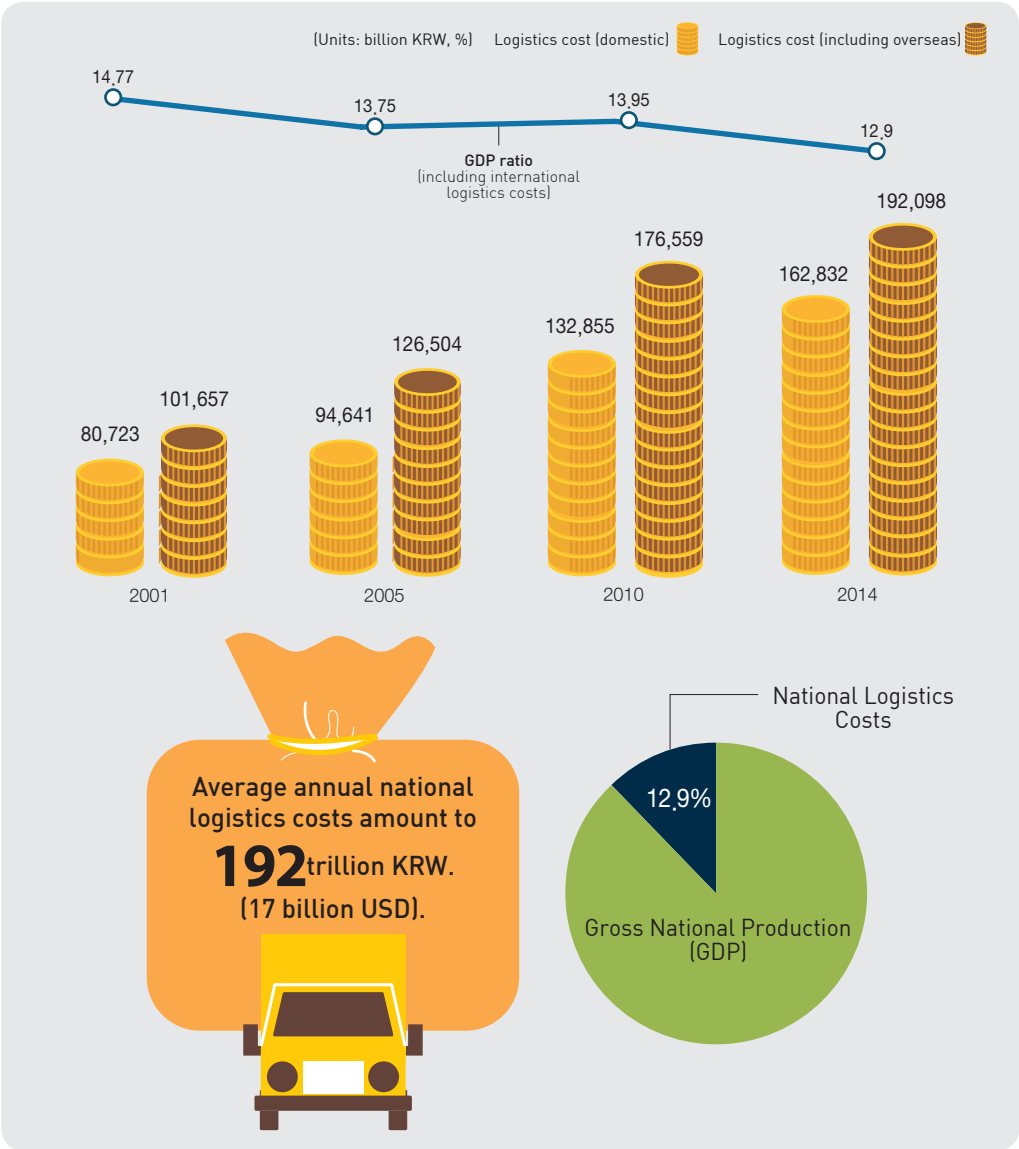


Source: The Korea Transport Institute, The Korea Transport Database Center (http://www.ktdb.go.kr/)
Note: Index refers to the annual average of 2000 (index 100).

② Trends in National Logistics Costs

- National logistics costs total about 192 trillion KRW (17 billion USD) when both domestic logistics costs and international logistics costs are taken into account and domestic logistics costs rose to about 163 trillion KRW (14.44 billion USD) in 2014 and are increasing continuously every year.
- National logistics costs account for about 13% (11% for domestic) of GDP.

National logistics cost trends

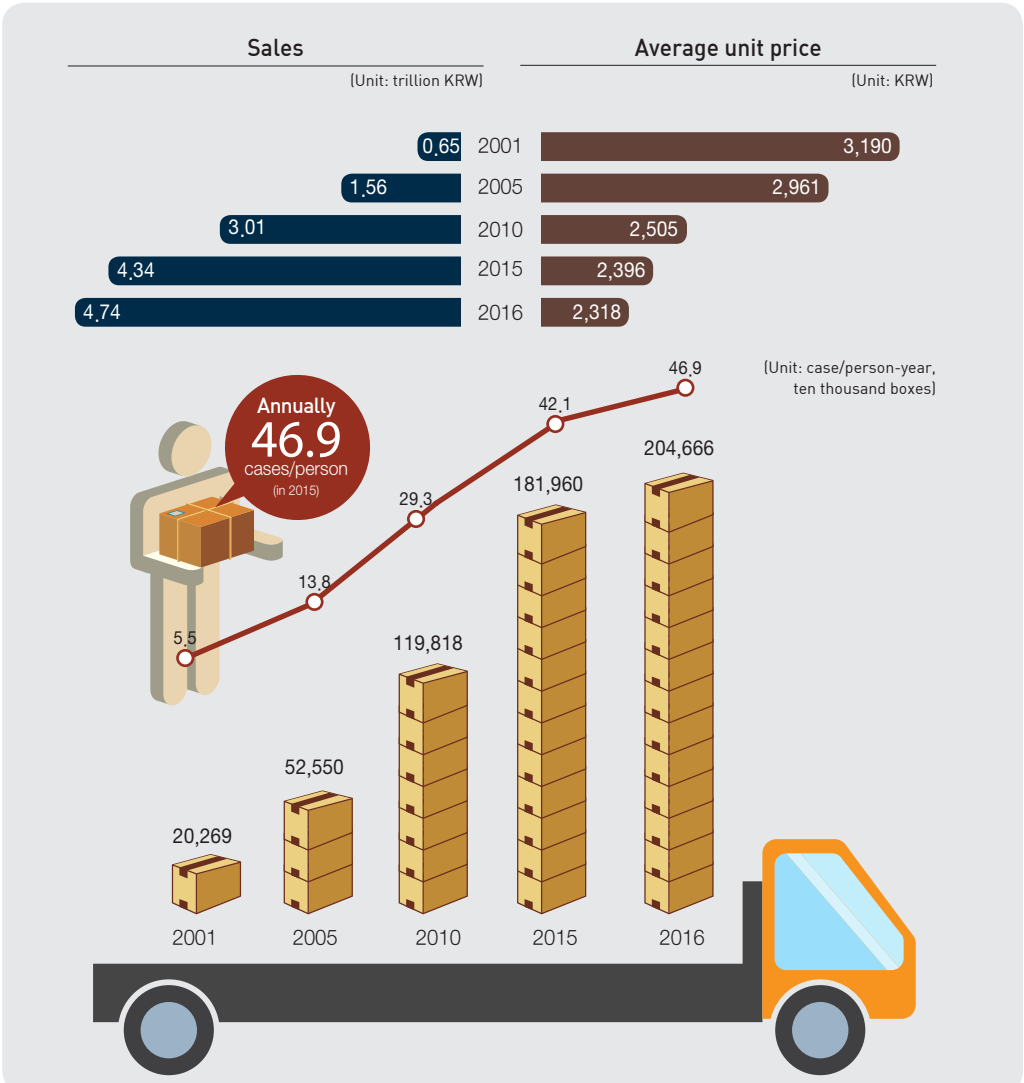


Source: The Korea Transport Institute, Korean National Logistics Costs in 2015, 2017

③ Traffic Volume & Sales Trends of Packages by Domestic Parcel Delivery Services

- Traffic volumes of packages by parcel delivery services and their sales have increased about three-fold over the past 10 years and average unit price has decreased by about a quarter.
- The annual volume of packages that a person sends and receives by parcel delivery services is about 47 per capita in 2016, which shows a continuous growth.

Annual volume of packages by parcel delivery services and sales trends



Source: Korea Logistics News, Korea Logistics Business Directory, 2016

Note: Referring to the freight volume of 16 parcel delivery service companies(CJ Logistics, Lotte Global Logistics, Hanjin Express, KG Logistics, Logen corporation, KGB Logistics Co. Ltd., Ilyang Express, YongMa Logis Co. Ltd., Korea Logistics Co. Ltd., Sung-hwa Logistics, Dongjin Logistics Co., Ltd., Chunil Parcel Co., LTD., Daesin International Transport Co. Ltd., Kyongdong R&D, Hapdong Express, Korea Delivery Business Corporative) and the post office

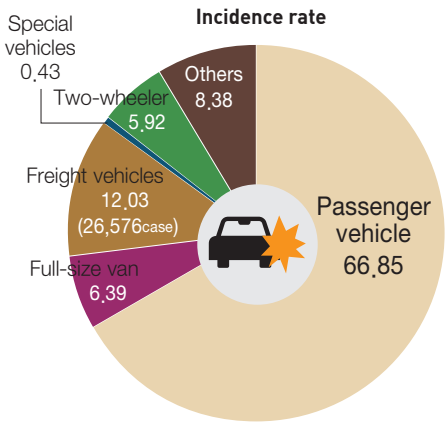
05_Freight Safety, Energy and Environment

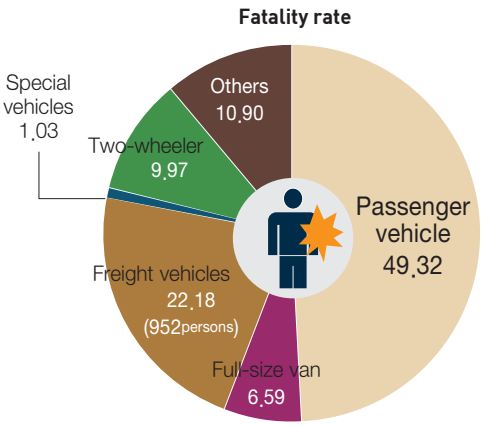
① Traffic Accidents by Vehicle Type

- The number of freight accidents is one-fifth of the number of passenger car accidents, but fatalities from freight accidents are quite high, being about one half of fatalities from passenger car accidents.
- The fatality rate of traffic accidents is high when they involve special vehicles, freight vehicles or two-wheel vehicles; and the fatality rate of freight accidents is about twice as high as the fatality rate of passenger car accidents.

Incidence rate and death rate of traffic accidents by vehicle type (in 2016)

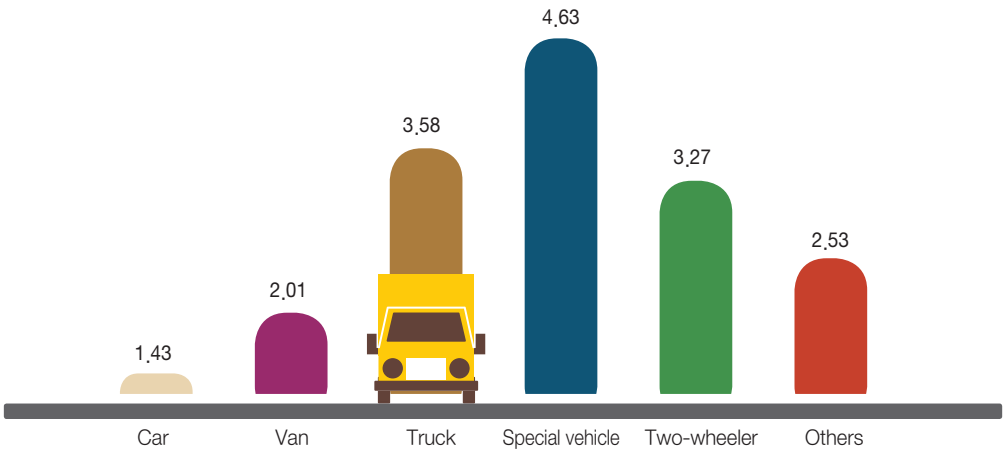
(Unit: %)





Mortality rate of traffic accidents by vehicle type (in 2016)

(Unit: %)

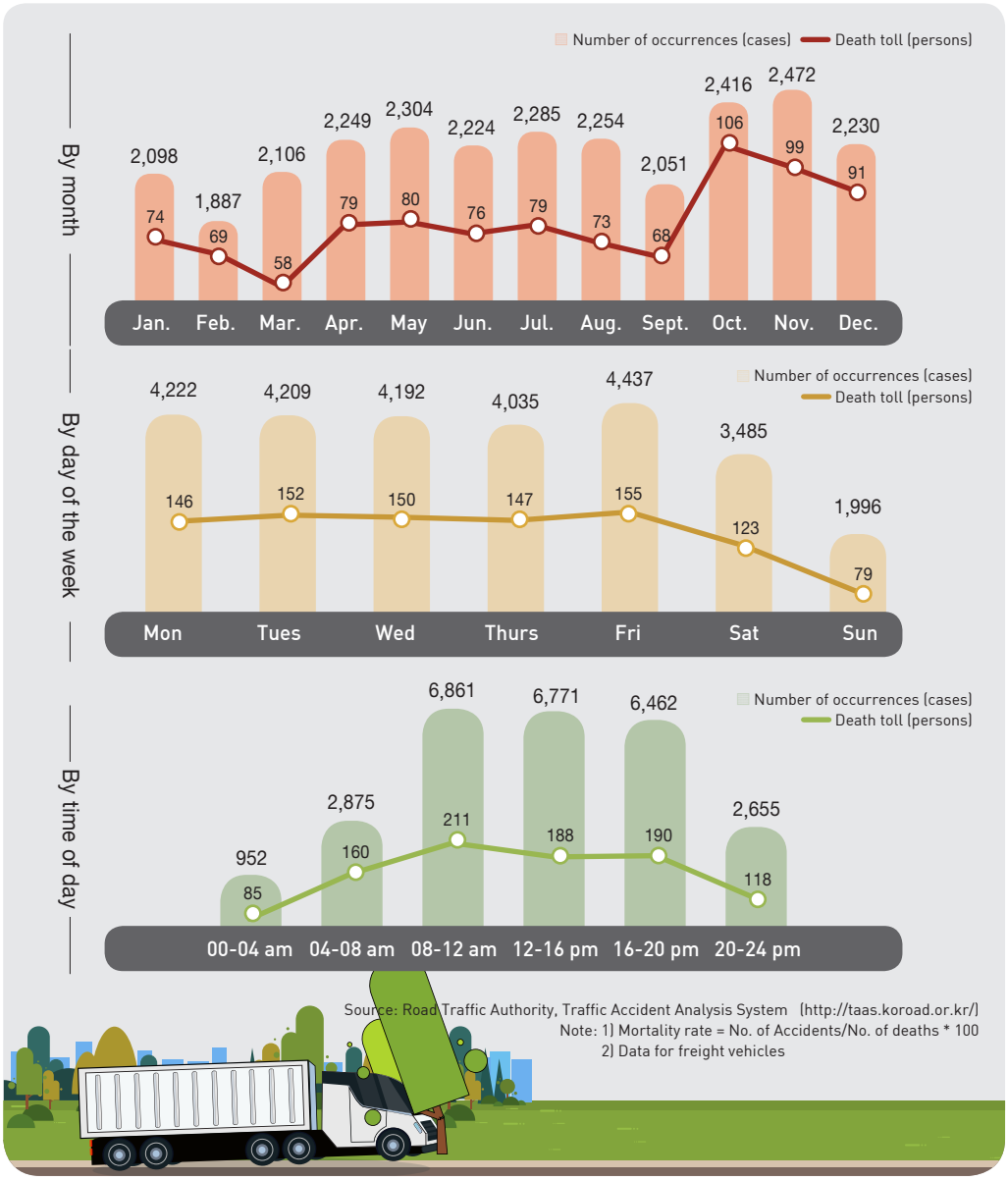


Source: Road Traffic Authority, Traffic Accident Analysis System (http://taas.koroad.or.kr/)
Note: Others include motor bicycles, bicycles, construction equipment, agriculture machines, and so forth.

② Traffic Accidents of Freight Vehicle by Month, Day of the Week and Time Band

- October and November are noted to have a relatively high level of frequencies and fatalities of monthly freight vehicle accidents.
- It is noted that Friday has the highest level of freight accidents among days of the week, while Monday through Thursday have similar levels of freight vehicle accidents.
- From midnight to 8 a.m., the number of freight accident mortalities is relatively high compared to the number of freight vehicle accidents that occurred during the time band.

Number of freight vehicle accidents and deaths (in 2016)



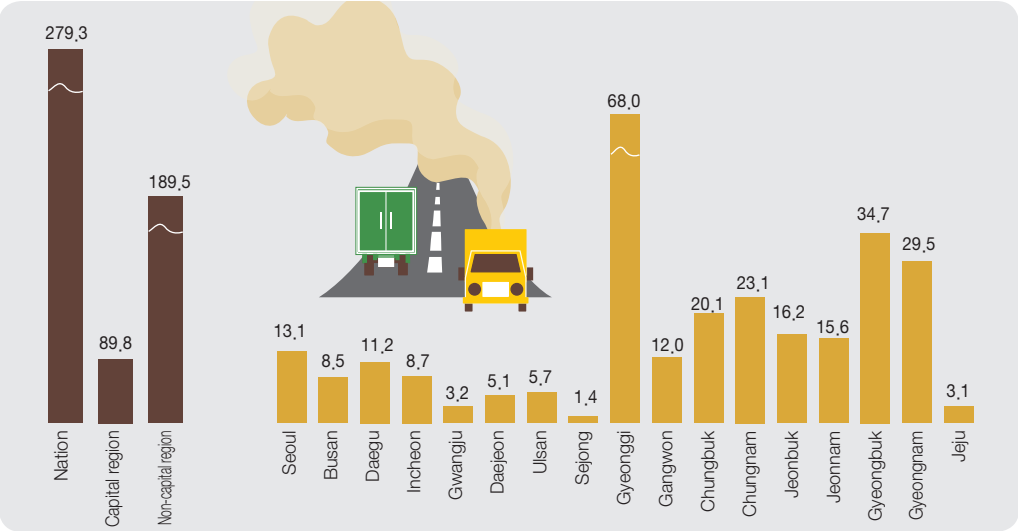
Source: Road Traffic Authority, Traffic Accident Analysis System (http://taas.koroad.or.kr/)
Note: 1) Mortality rate = No. of Accidents/No. of deaths * 100
2) Data for freight vehicles

③ Freight Vehicles' Air Pollutant and Particulate Matter Emission by Region

- The emission of air pollutants and particulate matters in non-Seoul metropolitan areas is twice as large as those in Seoul metropolitan areas.
- Gyeonggi province has produced the highest levels of emissions, followed by Gyeongbuk, Gyeongnam, Chungnam and Chungbuk.

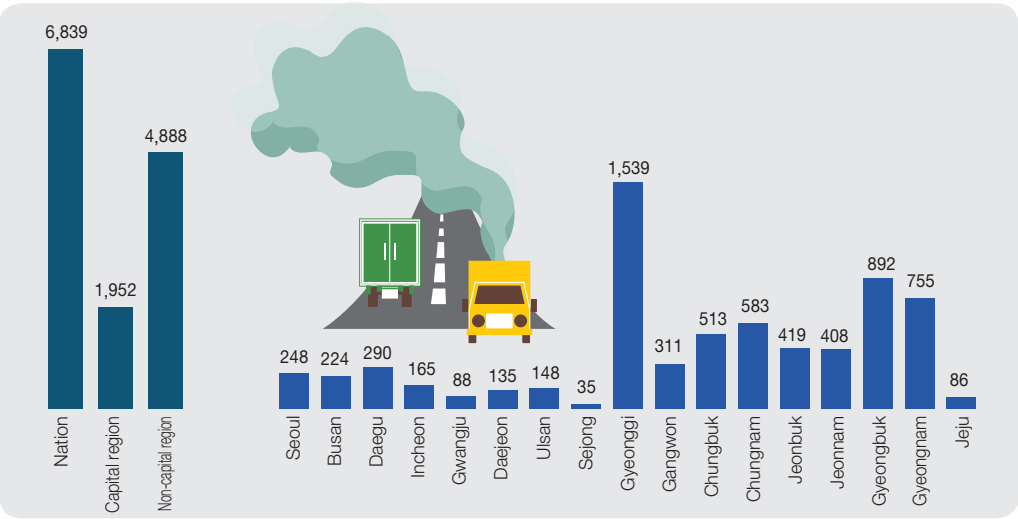
Air pollutant emission from trucks by region (2016)

(Unit: thousand tons/year)



Particulate matter emission from trucks by region (2016)

(Unit: tons/year)



Source: National Institute of Environmental Research, National Air Pollutants Emission Service (http://airemiss.nier.go.kr)
Note: Except fugitive dust and vegetation

Transportation Network Map Book

Chapter 1

Overview

01 I Overview of the Transportation Network

02 I Methods and Outcomes of Transportation Network

03 I Major Achievements

01_Overview of the Transportation Network

■ **Scope of establishment**
- 2014, 2015, 2016 (as of Dec. 31), nationwide (roads, railways)

■ **To use the transportation network as the basic and essential data to integrate and analyze transportation and spatial information**
- To use it as the basic data for transport problem diagnosis, solution development and policy establishment incorporating diverse transport information

■ **With the growing applicability and importance of GIS-based transport DB, there is a need to build precise and highly usable data sets**
- It is necessary to use cutting-edge transport data such as big data to build trustworthy GIS-based transportation network DB.
- It is necessary to establish a base map that serves as a transportation Network information platform to discard the existing convention of simply building a transportation network and expand its applicability.

■ **To establish a trustworthy transportation network using railway operation information including numerical maps, TAGO, and so forth.**
- It is necessary to accumulate information related to road transport such as road facilities, traffic signals, and traffic controls and railway such as railway stations, lines and operation status

■ **To enhance its applicability by establishing a transportation network that is connectable with transport information and spatial information**
- It is possible to develop new technologies and support policies in the comprehensive transport field such as transport demand, operation, and so forth, as it is used for transport-related big data platform (KTDB platform).

02_Methods and Outcomes of Transportation Network

Transportation network establishment methods

■ **To establish a GIS-based transportation network by standardizing the navigation numeric maps based on field surveys and railway operation information**

· The road network, which is comprised of nodes, links and turn penalties, is established for the paved roads with more than two lanes.

※ Exclusion rules

- Roads on islands are excluded.
- Roads without a centerline are excluded

· The railway network, which is comprised of nodes, links, and stations by line and train schedules, is established for lines related to passenger service.

■ **To establish a multi-layer system that allows intermodal connectivity by combining the road transportation network and the railway transportation network**

· To establish intermodal transfer network between access networks from road to railway stations and trains

Transportation network establishment results

Structures and characteristics of transportation network were analyzed and standardized to establish a total of 52 types of information.

Node		Established information
Road network	Node	Essential transport facility, turn penalty type, administrative border, traffic signal information, traffic regulation, etc.
	Link	Road name, road hierarchy, length, number of lane lines, traffic lights, traffic survey points, etc.
	Turn penalty	Permitted left-turn, permitted going straight, permitted right-turn, etc.
Railway network	Intersection points	Railway stations, railway transfer types, service types, etc.
	Center line	Name of railroad centerline, section length, number of tracks, electrification of railroads, etc.
	Node	X/Y coordination, station name and type, number of operation, etc.
	Route	Name of route, average vehicle kilometers traveled, average vehicle times traveled, number of operations, etc
	Stations by line	Origin/stops/destination by route, stations in order, etc.
	Timetable	Departure times by line, trains in operation, total number of operations, operation day of the week, etc.

Results of road network establishment

Link information

Items	Contents
Number of lanes	Two-way, eight-lane road
Maximum speed limit	60 km
One-way status	No one-way roads
Road number	-
Road name	Teheran-ro
Road class	Special metropolitan city roads and metropolitan city roads
Exclusive bus lane	No bus-only lanes
Exclusive road for motor vehicle	Not a motorway
Type of road appurtenances	General road
Pavement status	Paved road
Length	74 m
Number of traffic signals	0
Road width	14 m
Type of median strip	Flower bed

Node information

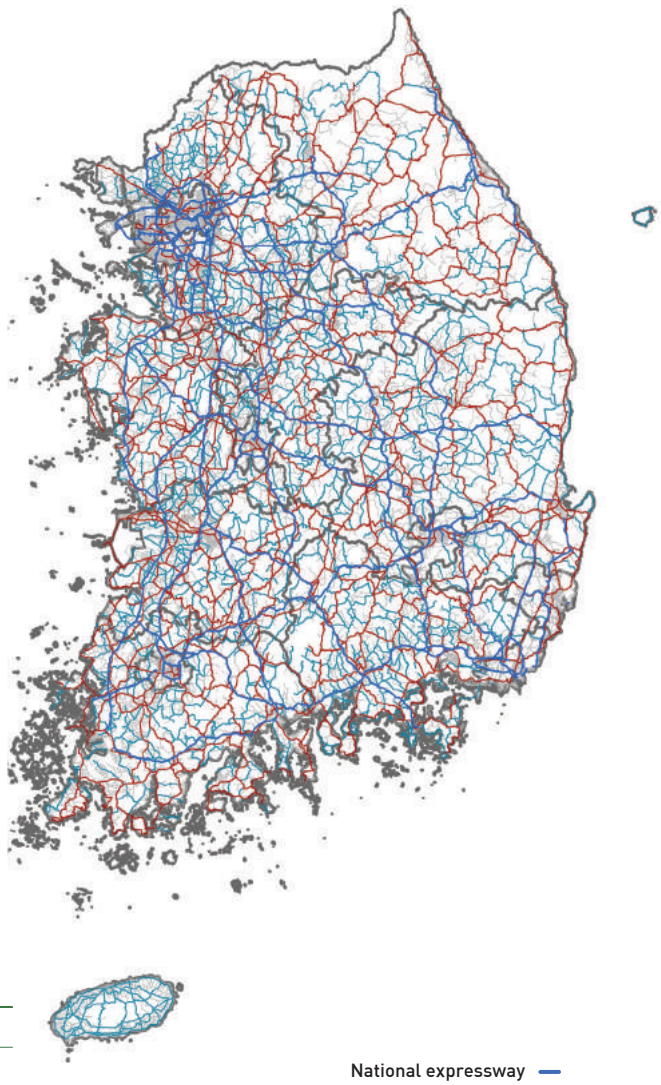
Items	Contents
Node type	Road intersection
Name of facility	Yeoksam Station intersection
Turn information	yes
Types of traffic signal	Three-color traffic signal
Number of access links	4
Coordination (X)	315044.67
Coordination (Y)	544730.14

Turn information

Items	Contents
Type of turn information	Permitted left-turn, permitted going straight, permitted right-turn

Administrative boundary information

Items	Contents
Town, Township, Neighborhood/City, County, District/City, Province	Yeoksamdong, Gangnam-gu, Seoul Special Metropolitan City



Results of railway network establishment

Railway facility (stations) information

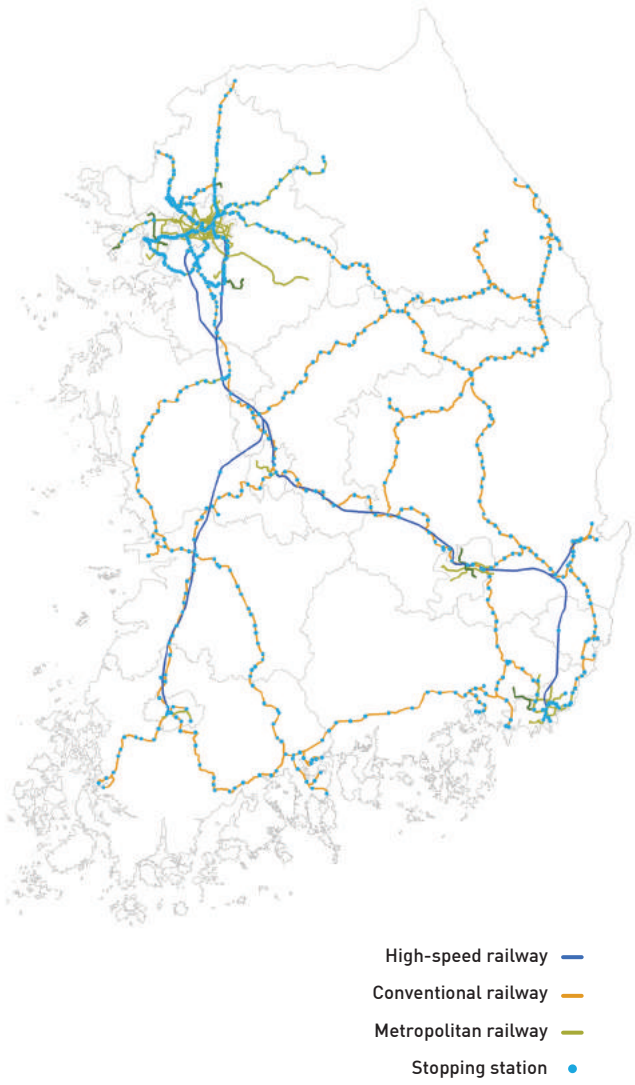
Items	Contents
Name of railway station	Yongsan
Type of railway station	High-speed railway, conventional railway and metropolitan railway
X-coordination	308603.5
Y-coordination	547974.2
Administrative district	Yongsangu

Railway lines information

Items	Contents
Name of line	KTX Gyeongbu line Busan station → Seoul station
Type of operation	High-speed railway
Average vehicle traveled	407.4 km
Origin station	Busan station
Destination station	Seoul station
Average time traveled	179 minutes
Number of operations	2
Date of reference	Dec. 31, 2016

Stopping stations by line

Name of line	Stopping stations (in order)
KTX Gyeongbu Line Busan Station → Seoul Station	Busan
	Gupo
	Miryang
	Dongdaegu
	Daejeon
	Osong
	Seoul



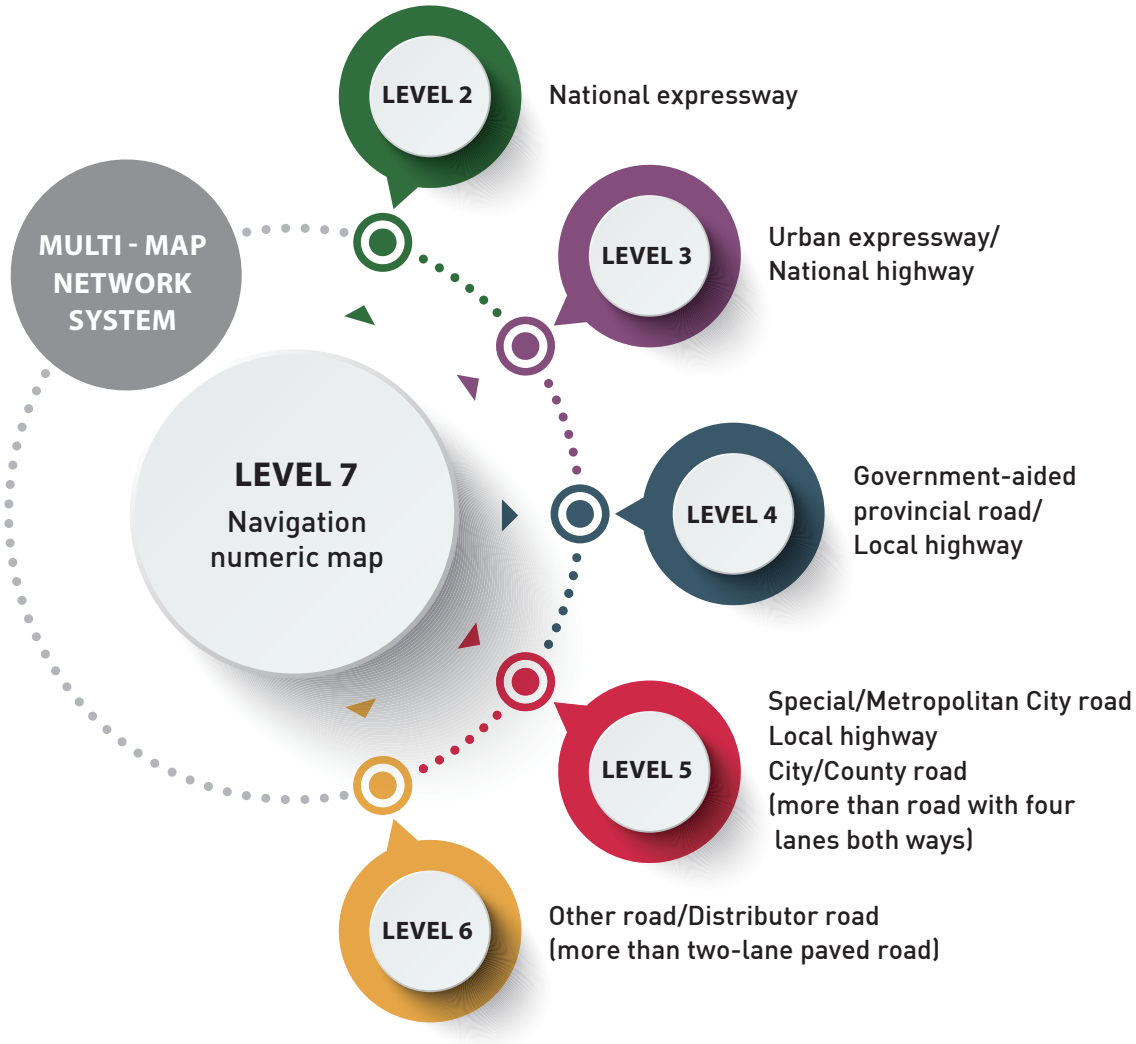
Timetable by Line

Name of line	Total number of operations	The order of train operation	Departure time	Operation day of the week
KTX Gyeongbu Line	2	1	820	weekdays/weekends
Busan Station → Seoul Station	2	2	1445	weekdays/weekends

03_Major Achievements

Multi-level transportation network establishment

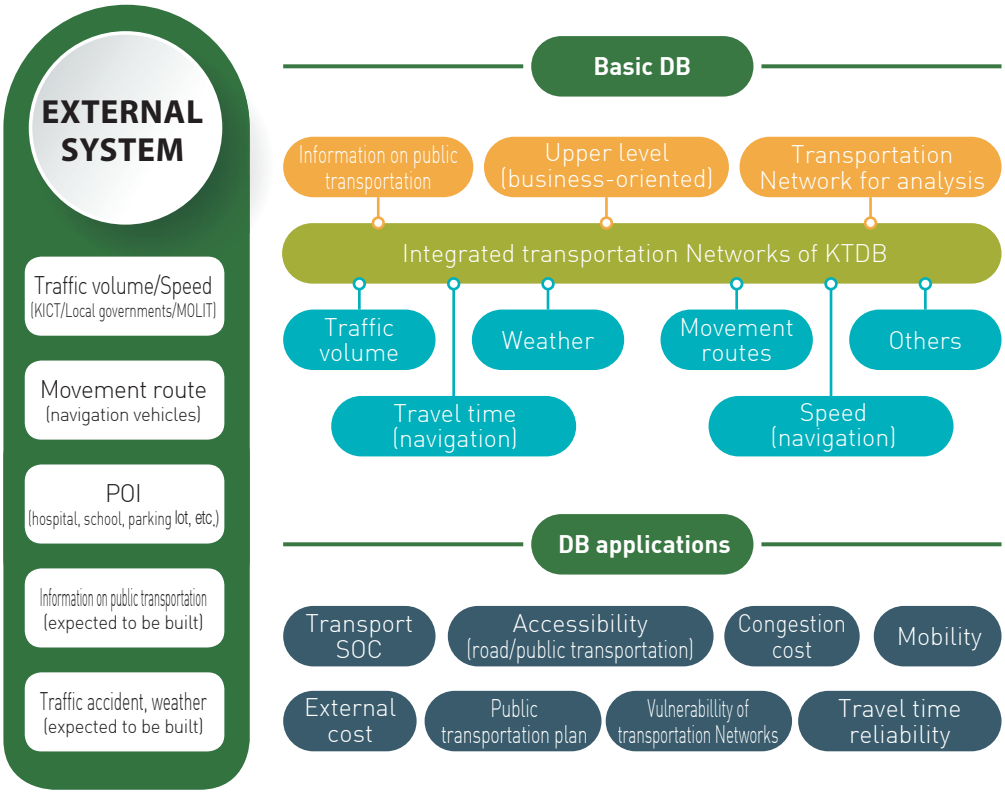
To establish a multi-level system composed of detailed levels of road networks using the navigation numeric map and prepare a foundation to support purpose-specific analyses on each level.



Archiving of diverse transport-related data

01 To analyze road transport, archive features of road network links, such as road facility, traffic signal, traffic regulation, etc.
- Establish information on expressway rest facilities, traffic signals, the national transport survey and so forth

02 To avoid the conventional way of establishing transportation network for its own sake and expand its use by preparing a system that serves as a platform of transportation network information
- Support for transport problem diagnosis and solution development through the integration of transportation and spatial information such as vehicle route data, land use related information and so forth



Note: Applied DB indicates a database which is possible to build using basic DB.

Securing efficiency and accuracy in establishment

To secure convenience and efficiency from transportation network establishment by building an integrated transportation network management system that manages, establishes, edits and validates transportation network related data

Establishment of an integrated transportation network management system

The integrated transportation network system is comprised of several functions of managing, editing, validating, and outputting data for the road and public transportation network

Establishment

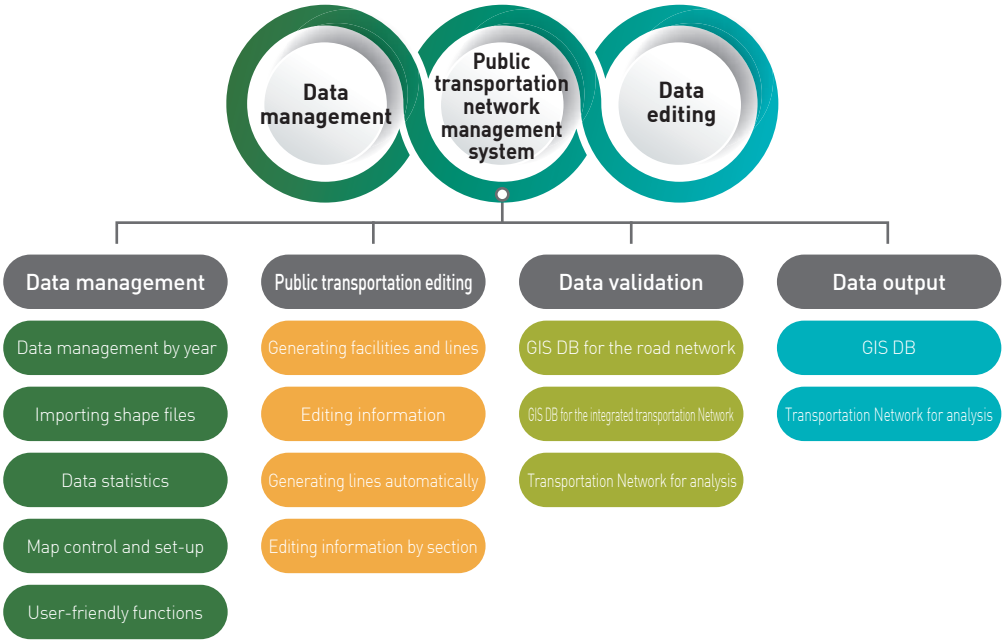
- Input and output functions for road and public transportation networks
- Data editing and validation function

Functions

- Multiple user-convenience functions
- Network environment based on GIS

Statistics

- To provide information and search functions for the road and public transportation network statistics
- To provide an analysis environment for road and public transport services such as traffic signal density by region, lines by region and station, the number of operations by region and station, and so forth.



Chapter 2

Transportation Network Infographics

01 | Highway Part

02 | Transit Part

Note: The transportation network (road, railway) statistics of the KTDB are calculated by using navigation numeric maps based on field surveys and railway operation information. So, they could possibly differ from the figures suggested by the statistical yearbooks of the central and regional governments.

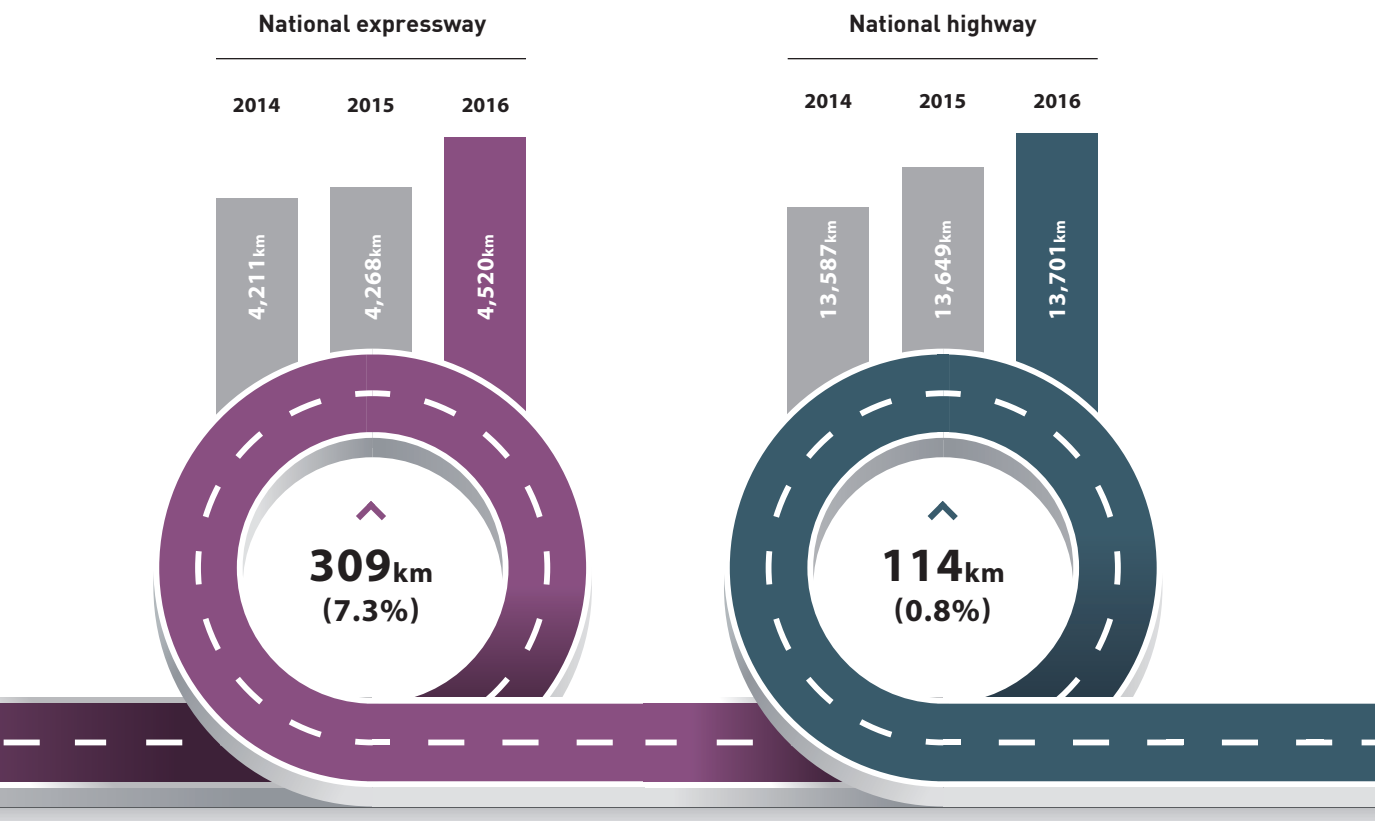
01_Highway Part

What Roads Have Been Constructed Over the Past Three Years?

Road length reported over the past three years

Over the past three years, the total road length of the nation has increased by 3.4% from 101,173 km in 2014 to 104,631 km in 2016.

- National expressways have increased in length by 7.3% from 4,211 km in 2014 to 4,520 km in 2016.
- Special/Metropolitan City roads, City/County roads and District roads have increased in length by 4.3% from 66,953 km in 2014 to 69,821 km in 2016.
- Local highways and Government-aided provincial roads have increased in length by 1.0% from 16,422 km in 2014 to 16,589 km in 2016.
- National highways have been increased by 0.8% from 13,587 km in 2014 to 13,701 km in 2016

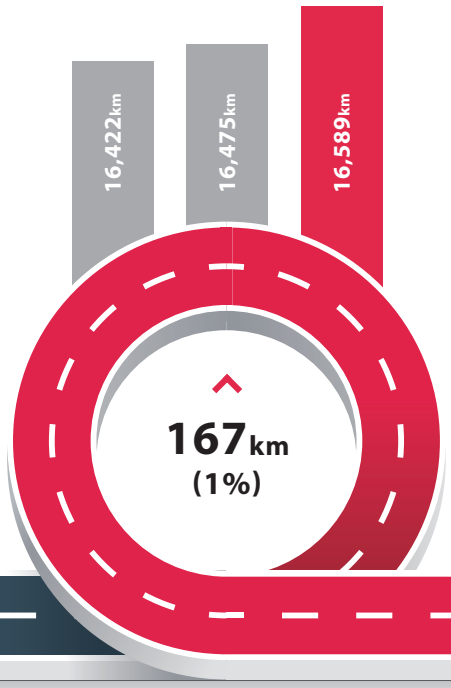


Road length reported for the past 3 years

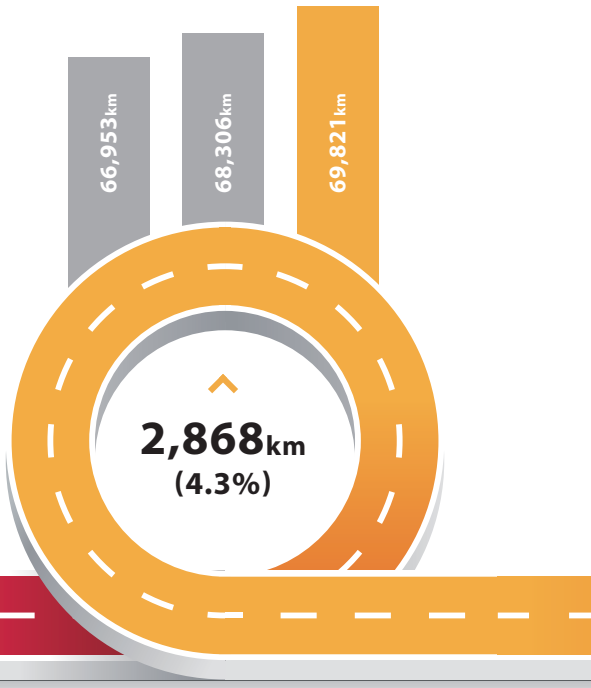
2014	2015	2016
101,173km	102,698km	104,631km

^ 3,458km (3.4%)

Local highway
Government-aided provincial road



Special/Metropolitan City road
City/County road
District road

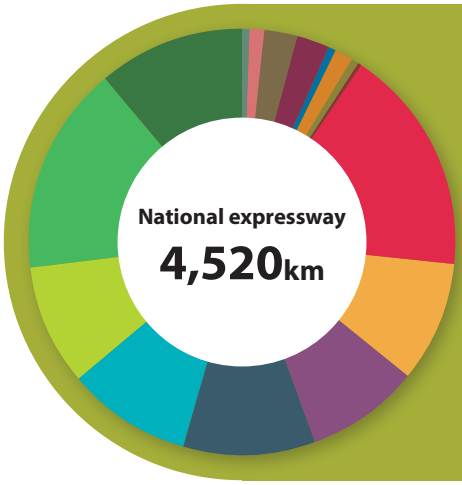


(단위 : km)

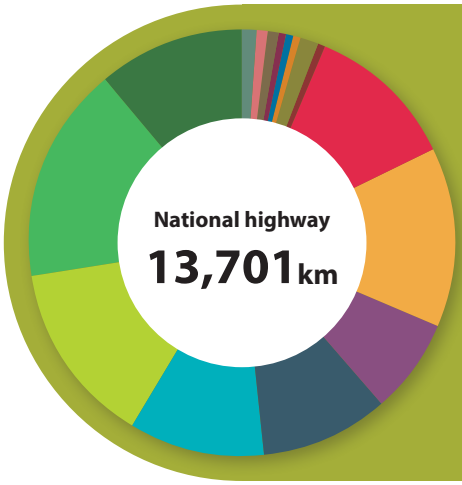
Road length by region and road hierarchy

Total road length of Gyeonggi in 2016 is 15,690 km, which accounts for 15.0% of the nation's entire roads and that of Sejong City is 724 km, 0.7% of the nation's roads.

- There was 15,690 km of major road in Gyeonggi consisting of:
  1) 758 km of national expressway; 2) 1,566 km of national highway; 3) 2,298 km of local highway and government-aided provincial road; 4) roads of 11,069 km belonging to special/metropolitan cities/cities/counties and districts.
- There was 724 km of major road in Sejong City consisting of:
  1) 15 km of national expressway; 2) 66 km of national highway; 3) 124 km of local highway and government-aided provincial road; 4) roads of 520 km belonging to special/metropolitan cities/cities/counties and districts.



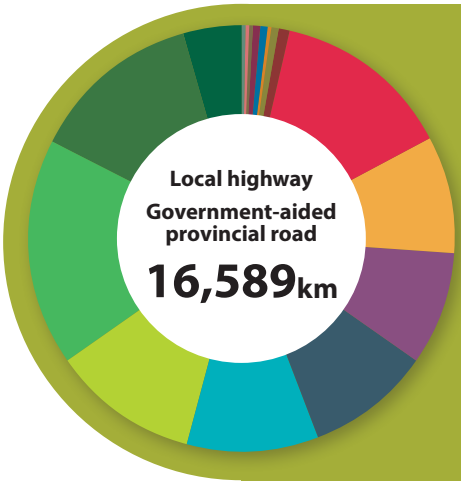
Seoul	28km(0.6%)	Gyeonggi	758km(16.8%)
Busan	52km(1.2%)	Gangwon	410km(9.1%)
Daegu	108km(2.4%)	Chungbuk	385km(8.5%)
Incheon	107km(2.4%)	Chungnam	454km(10.0%)
Gwangju	27km(0.6%)	Jeonbuk	425km(9.4%)
Daejeon	74km(1.6%)	Jeonnam	416km(9.2%)
Ulsan	69km(1.5%)	Gyeongbuk	700km(15.5%)
Sejong	15km(0.3%)	Gyeongnam	492km(10.9%)
		Jeju	0km(0.0%)



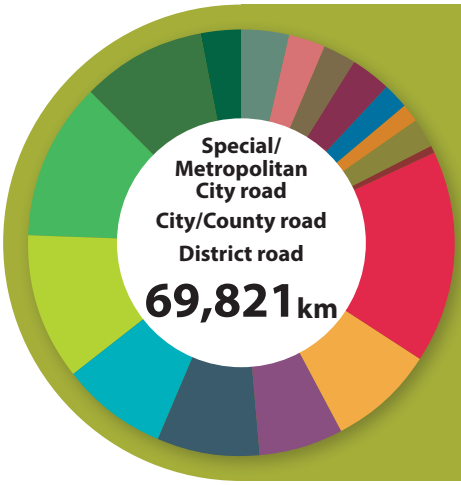
Seoul	180km(1.3%)	Gyeonggi	1,566km(11.4%)
Busan	120km(0.9%)	Gangwon	1,868km(13.6%)
Daegu	101km(0.7%)	Chungbuk	990km(7.2%)
Incheon	72km(0.5%)	Chungnam	1,327km(9.7%)
Gwangju	94km(0.7%)	Jeonbuk	1,409km(10.3%)
Daejeon	80km(0.6%)	Jeonnam	1,896km(13.8%)
Ulsan	180km(1.3%)	Gyeongbuk	2,258km(16.5%)
Sejong	66km(0.5%)	Gyeongnam	1,494km(10.9%)
		Jeju	0km(0.0%)

Seoul Busan Daegu Incheon Gwangju Daejeon
Ulsan Sejong Gyeonggi Gangwon Chungbuk Chungnam
Jeonbuk Jeonnam Gyeongbuk Gyeongnam Jeju

(Unit: km)



Seoul	15km(0.1%)	Gyeonggi	2,298km(13.9%)
Busan	37km(0.2%)	Gangwon	1,504km(9.1%)
Daegu	20km(0.1%)	Chungbuk	1,466km(8.8%)
Incheon	44km(0.3%)	Chungnam	1,593km(9.6%)
Gwangju	44km(0.3%)	Jeonbuk	1,693km(10.2%)
Daejeon	36km(0.2%)	Jeonnam	1,857km(11.2%)
Ulsan	44km(0.3%)	Gyeongbuk	2,887km(17.4%)
Sejong	124km(0.7%)	Gyeongnam	2,228km(13.4%)
		Jeju	700km(4.2%)

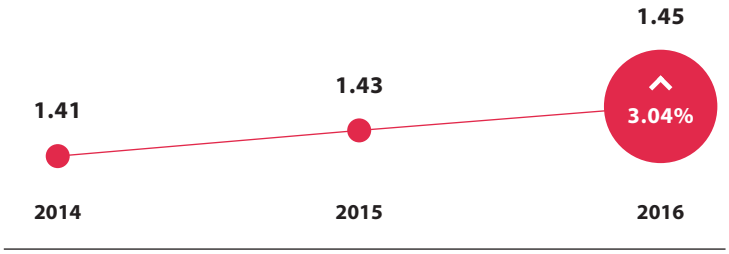


Seoul	2,605km(3.7%)	Gyeonggi	11,069km(15.9%)
Busan	1,999km(2.9%)	Gangwon	5,743km(8.2%)
Daegu	1,709km(2.4%)	Chungbuk	4,385km(6.3%)
Incheon	2,093km(3.0%)	Chungnam	5,548km(7.9%)
Gwangju	1,311km(1.9%)	Jeonbuk	5,669km(8.1%)
Daejeon	1,099km(1.6%)	Jeonnam	7,766km(11.1%)
Ulsan	1,462km(2.1%)	Gyeongbuk	8,140km(11.7%)
Sejong	520km(0.7%)	Gyeongnam	6,756km(9.7%)
		Jeju	1,946km(2.8%)

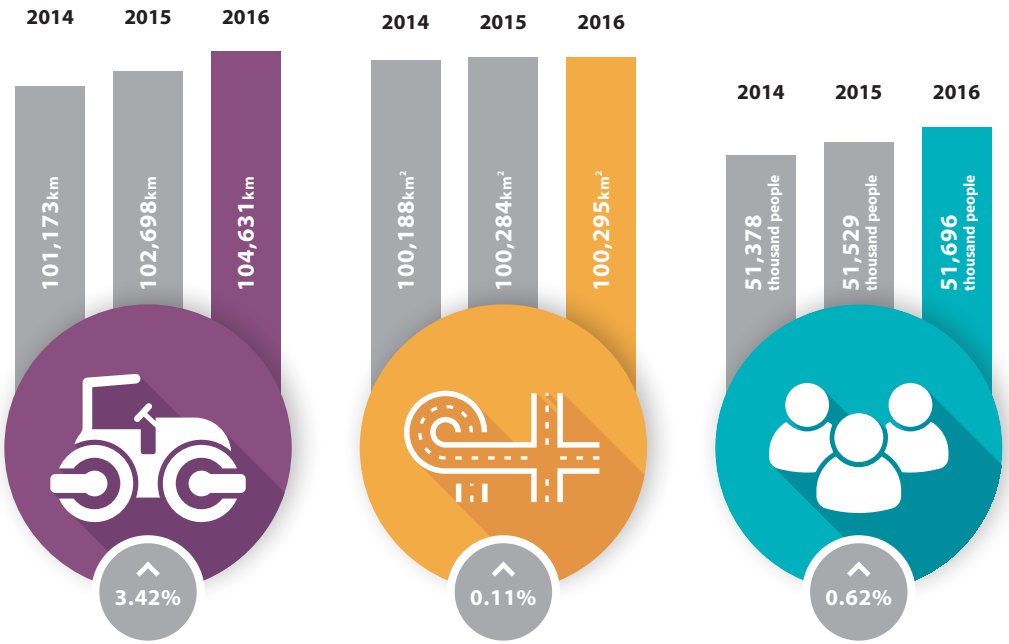
Is the Road Supply Rate Enough for the Nation?

Road supply rate reported for the past three years

Road supply rate has continued to rise for the past three years.
- It has increased by 3.04% from 1.41 in 2014 to 1.45 in 2016.



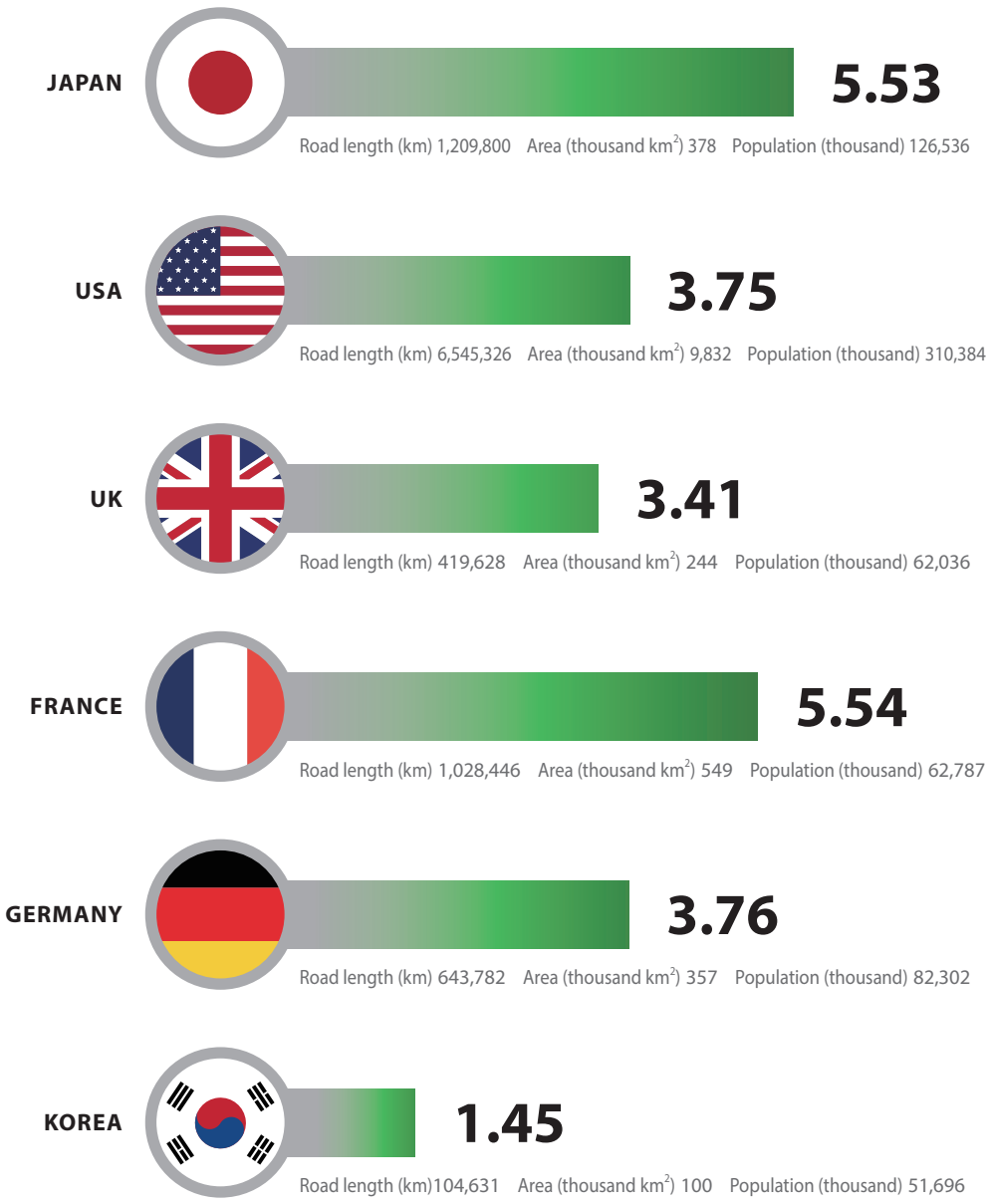
Road supply rate per land coherent



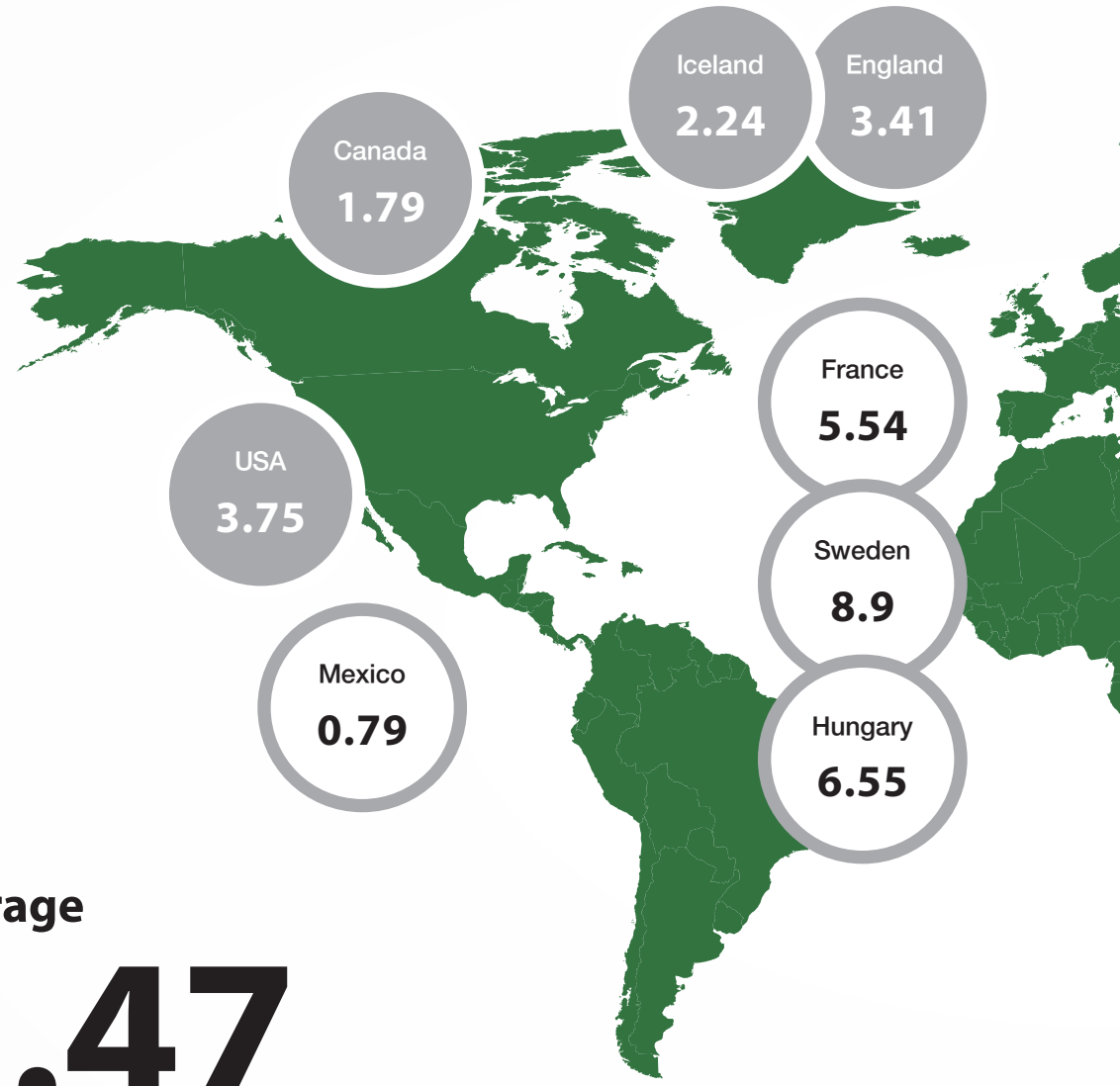
Road supply rate by nation

The road supply rate of Korea is one of the lowest among the 30 OECD countries.

- Road supply rate per land coherent that measures road supply rate corresponding to the nation's total land area and population is 2.47 on average for the 30 OECD countries.
- Korea is ranked the lowest, even below Mexico.



Road supply rate by nation

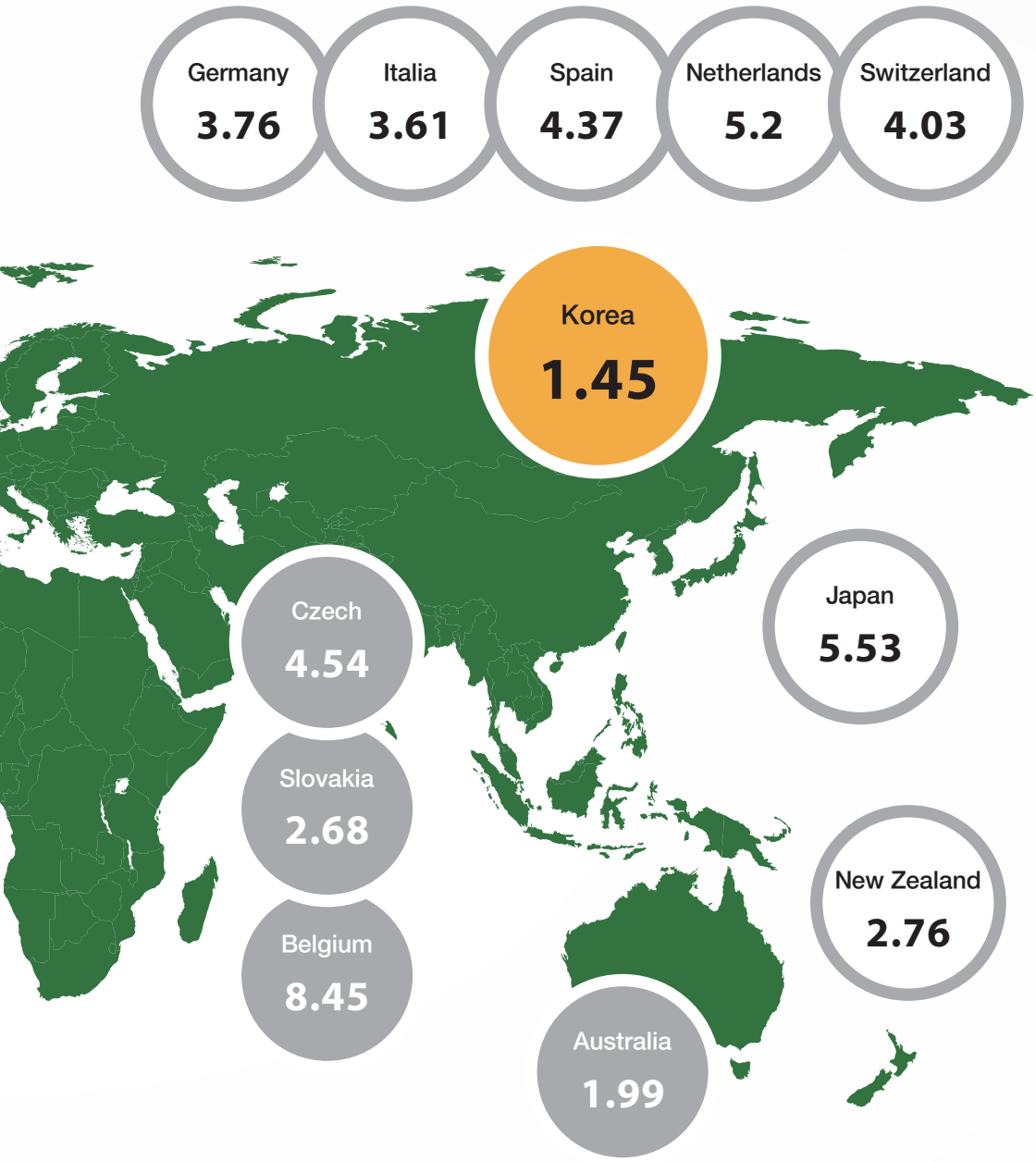


Average

2.47

Source: National Traffic Survey and DB Construction Project, KOTI, 2017.

Note: Road length, land area, population, and road supply rate per land coherent of overseas countries are referred to the base year of 2012 and use the data provided by Statistics Korea.


Germany
3.76
Italia
3.61
Spain
4.37
Netherlands
5.2
Switzerland
4.03
Korea
1.45
Japan
5.53
Czech
4.54
Slovakia
2.68
Belgium
8.45
New Zealand
2.76
Australia
1.99

Road supply rate by region

Road supply rate for regions is presented in decreasing order of Jeonnam with 2.46, Jeju with 2.43 and Jeonbuk with 2.37.

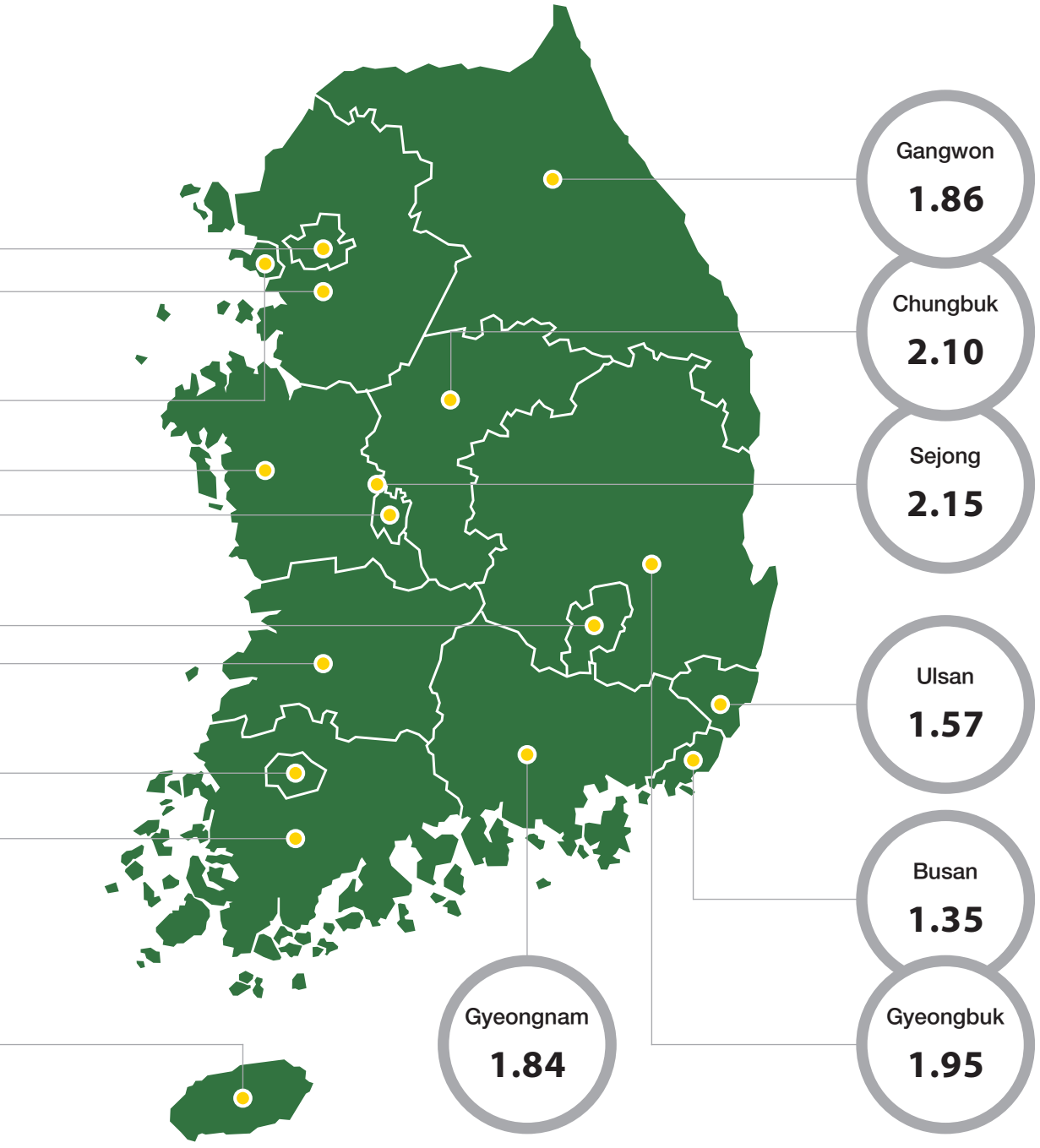
- Road supply rate of the Seoul metropolitan area (Seoul, Incheon and Gyeonggi) is ranked at the lowest level despite the fact that it is the most congested area of the nation.
- The road supply rate of Jeonnam is on the highest side.

Average

Road supply rate index per land coherent (for the whole country)

1.45

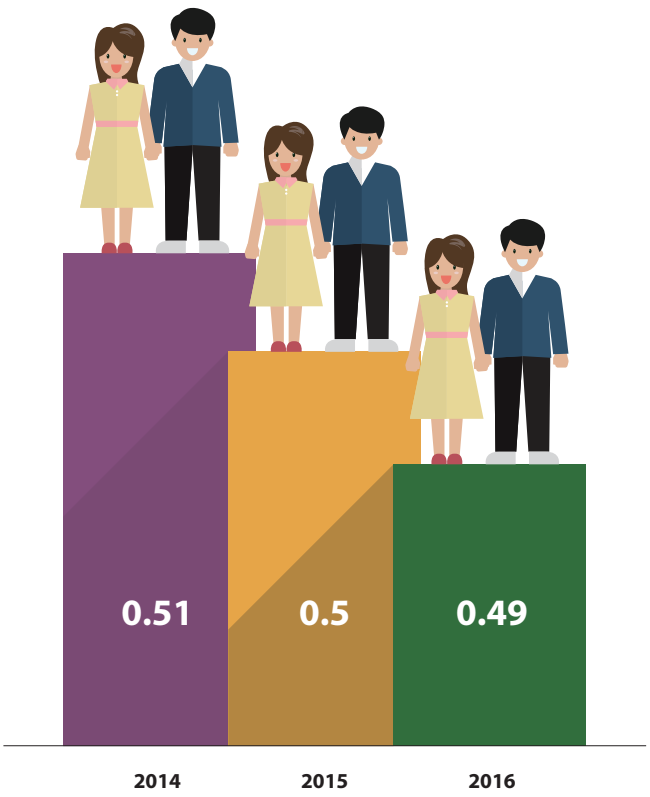
Source: 1) National Traffic Survey and DB Construction Project, KOTI, 2017.
2) Yearbook of road statistics, MOLIT, 2017.


Gangwon
1.86
Chungbuk
2.10
Sejong
2.15
Ulsan
1.57
Busan
1.35
Gyeongbuk
1.95
Gyeongnam
1.84

What Are the Total Number of People on the Roads?

Population load on road for the past 3 years

- Population load on road has been in decline, decreasing from 0.51 in 2014 to 0.49 in 2016.



-2.71%

2016 population load on road by region

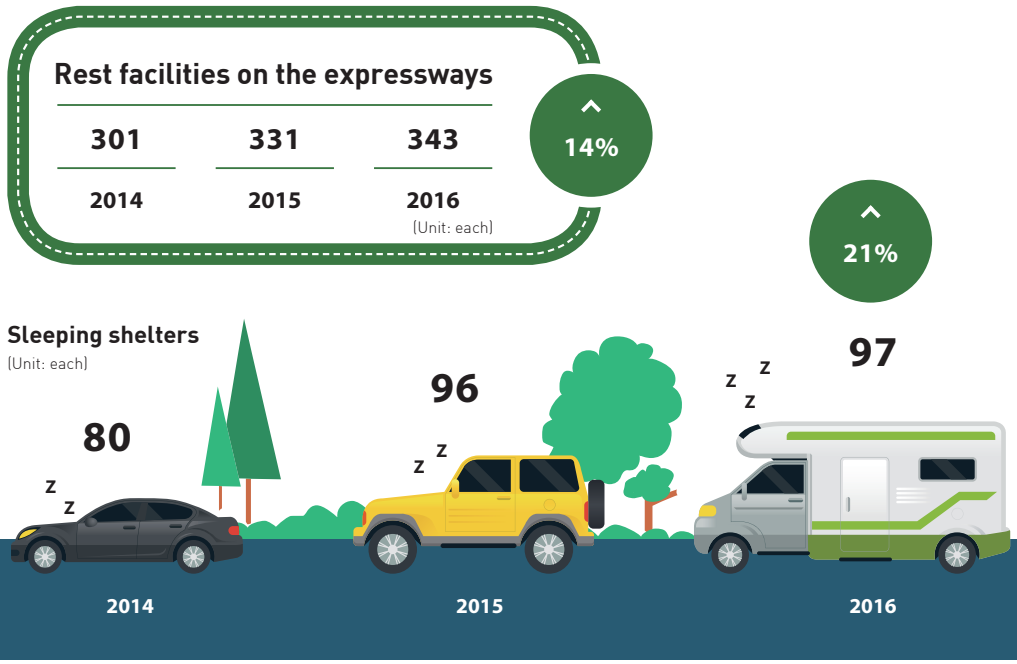
- Population load on road is presented in decreasing order of Seoul with 3.51, Busan with 1.58, and Daegu with 1.28.
- Population load on road of Jeonnam is ranked the lowest as 0.16.

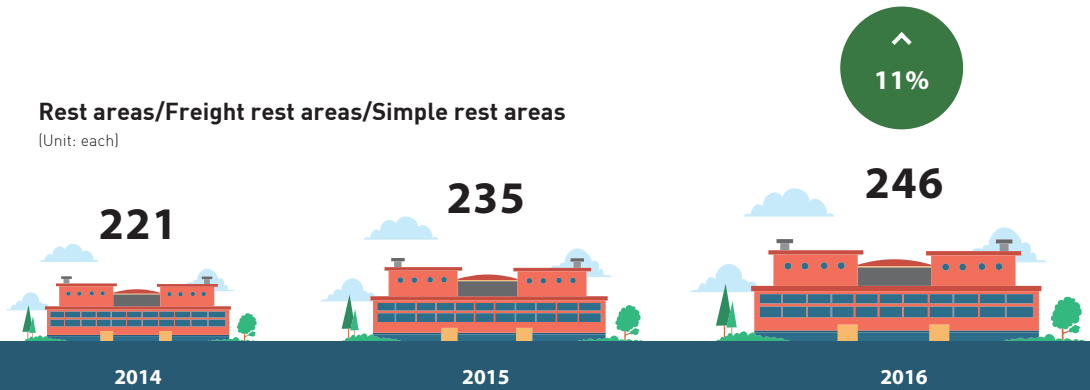
	Population load on road	Road lenth (km)	Population (thousand)
Seoul	3.51	2,828	9,930.6
Busan	1.58	2,209	3,498.5
Daegu	1.28	1,939	2,484.6
Incheon	1.27	2,316	2,943.1
Gwangju	1.00	1,476	1,469.2
Daejeon	1.17	1,289	1,514.4
Ulsan	0.67	1,755	1,172.3
Sejong	0.34	724	243.0
Gyeonggi	0.81	15,690	12,716.8
Gangwon	0.16	9,525	1,550.8
Chungbuk	0.22	7,226	1,591.6
Chungnam	0.24	8,922	2,096.7
Jeonbuk	0.20	9,196	1,864.8
Jeonnam	0.16	11,934	1,903.9
Gyeongbuk	0.19	13,985	2,700.4
Gyeongnam	0.31	10,970	3,373.9
Jeju	0.24	2,645	641.6

How Far Are the Rest Facilities Placed Apart on the Expressways?

Current status of expressway rest facilities

The rest facilities on expressway including sleeping shelters and simple rest areas have been increasing every year for the past three years.
- It has been increased by 14% with 301 in 2014, 331 in 2015, and 343 in 2016, respectivey.

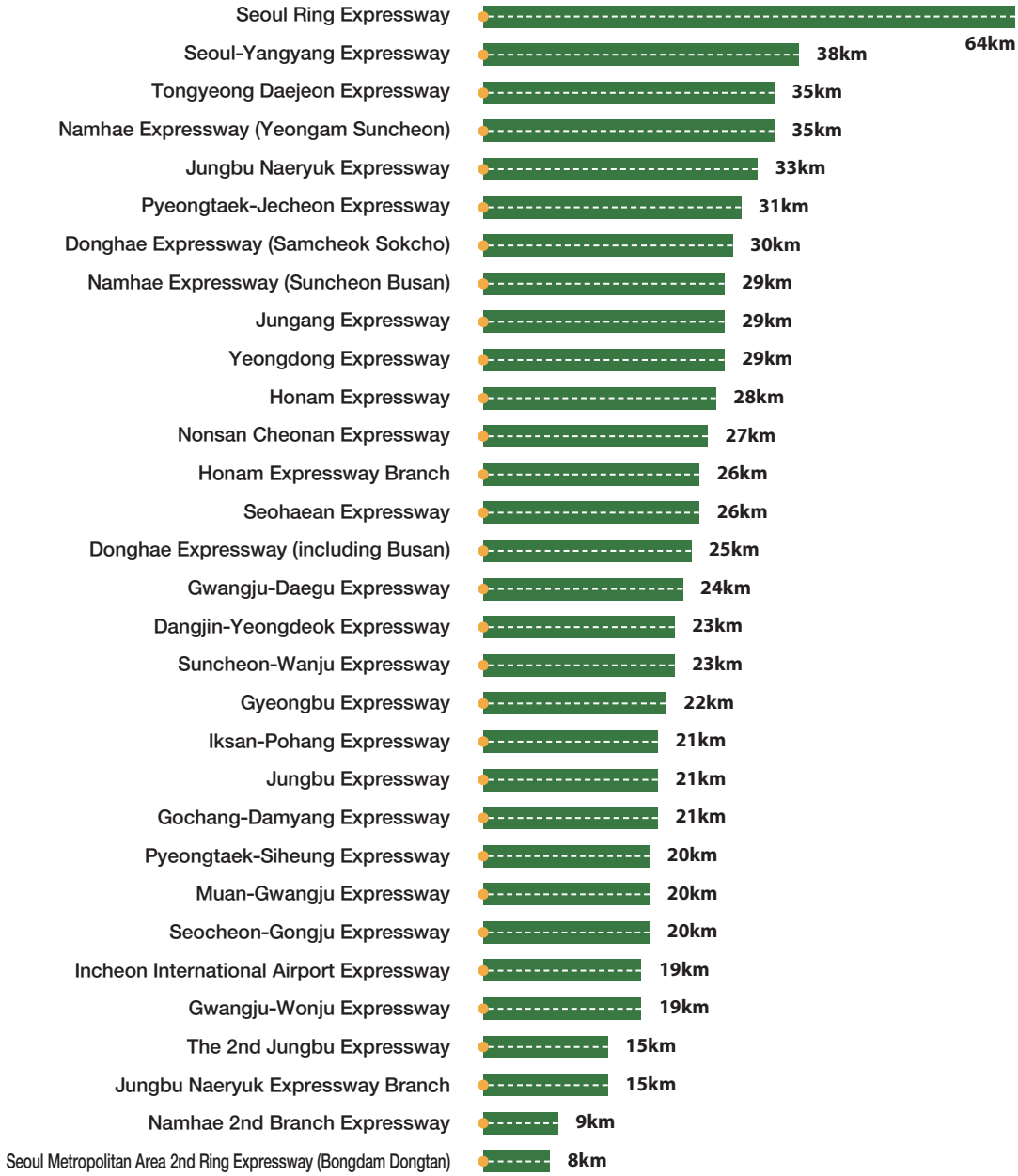




Spacing between rest facilities on the expressways

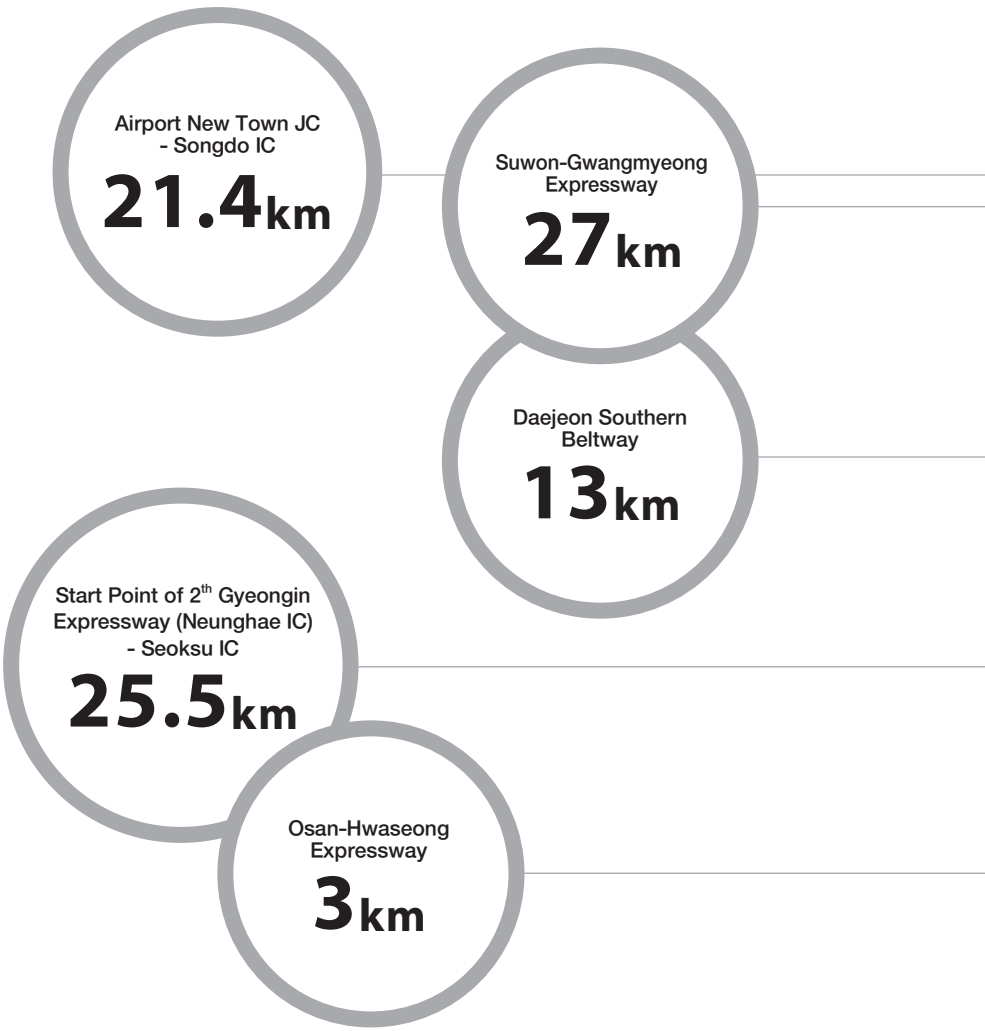
The line with the farthest spacing between rest facilities in 2016 is the Seoul Ring Expressway.

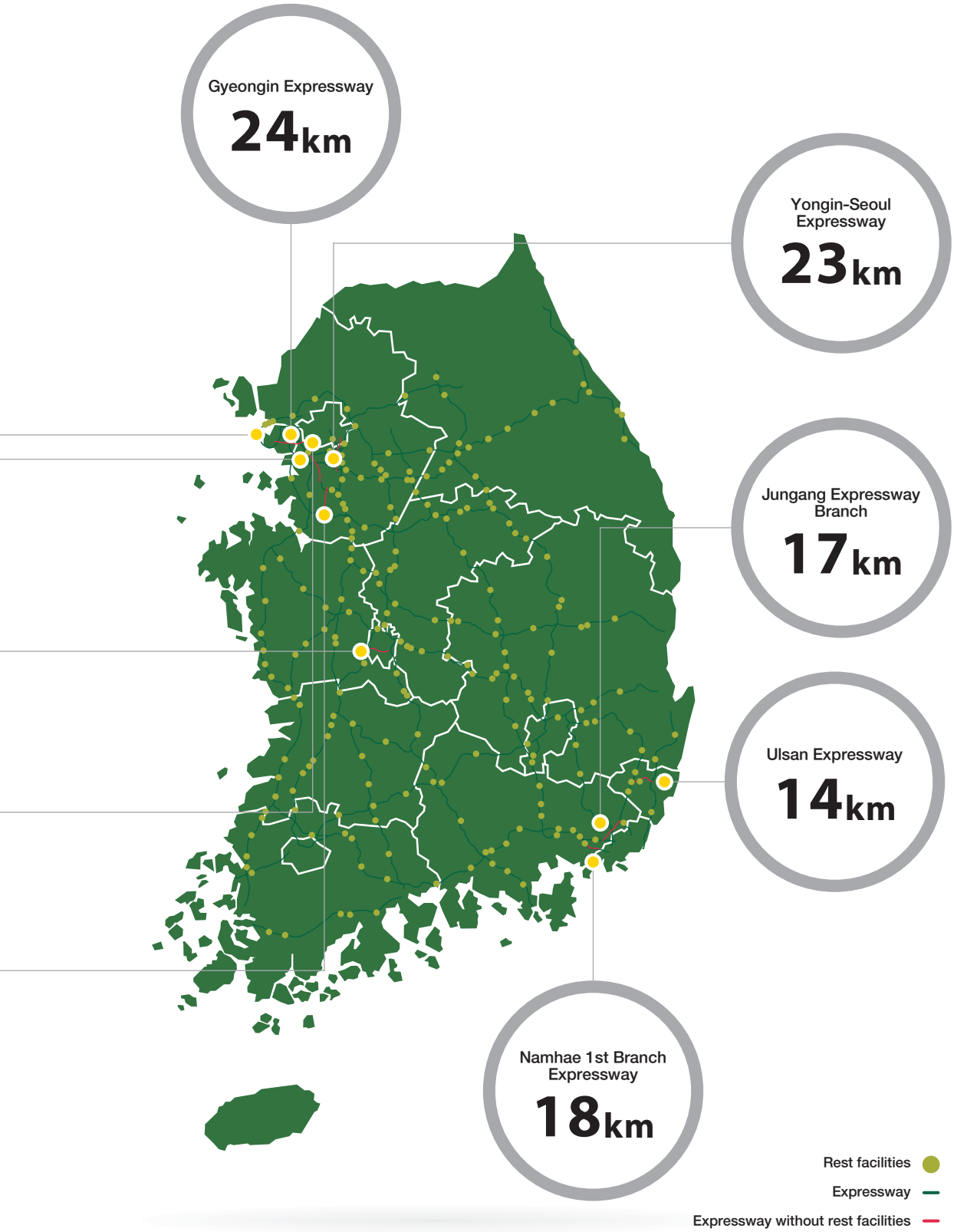
- Rest facilities are located at about every 64 km on the Seoul Ring Expressway.
- The line with the shortest spacing between rest facilities is the Seoul Metropolitan Area 2nd Ring Expressway, which is 8 km.



Expressway routes without rest facilities

- Expressway routes such as the Gyeongin Expressway, Yongin-Seoul Expressway, the 2nd Gyeongin Expressway and so forth are without rest facilities.



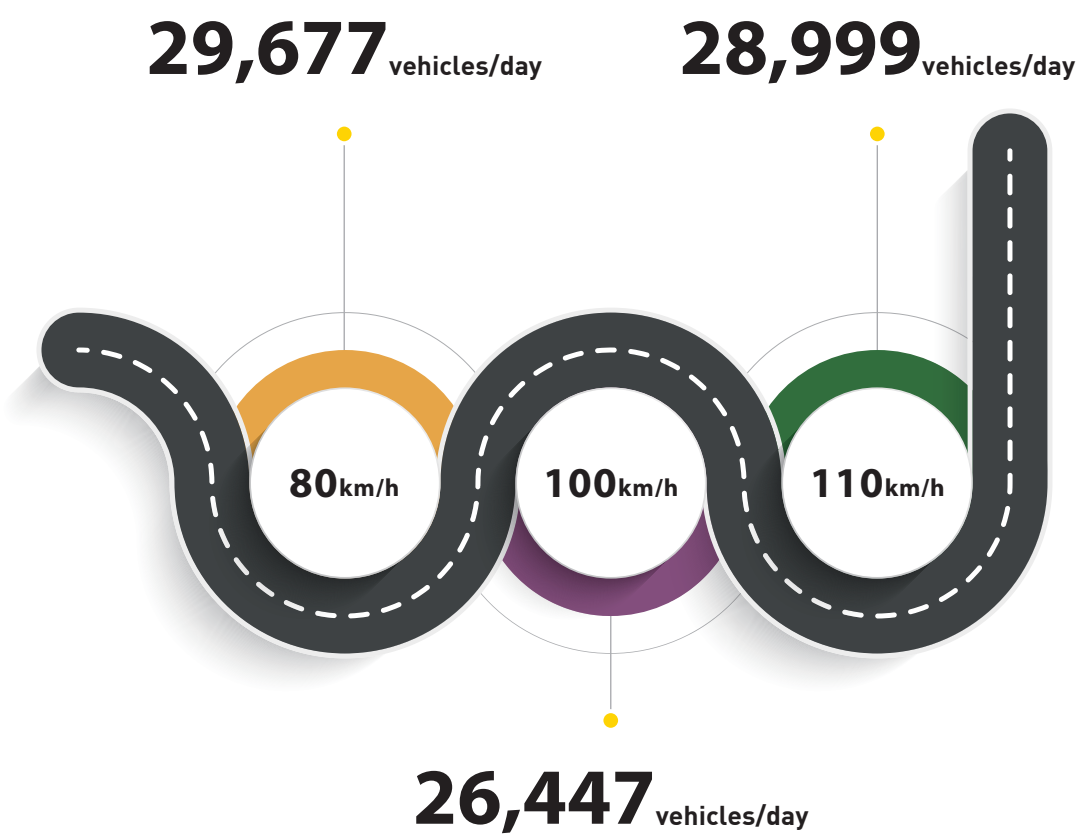

Gyeongin Expressway
24km
Yongin-Seoul Expressway
23km
Jungang Expressway Branch
17km
Ulsan Expressway
14km
Namhae 1st Branch Expressway
18km
Rest facilities
Expressway
Expressway without rest facilities

How Much Traffic Is There on Expressways Corresponding to the Speed Limit?

Average traffic volume by section of expressway

Average daily traffic volume estimated by section of expressway is about 28.374 vehicles/day.

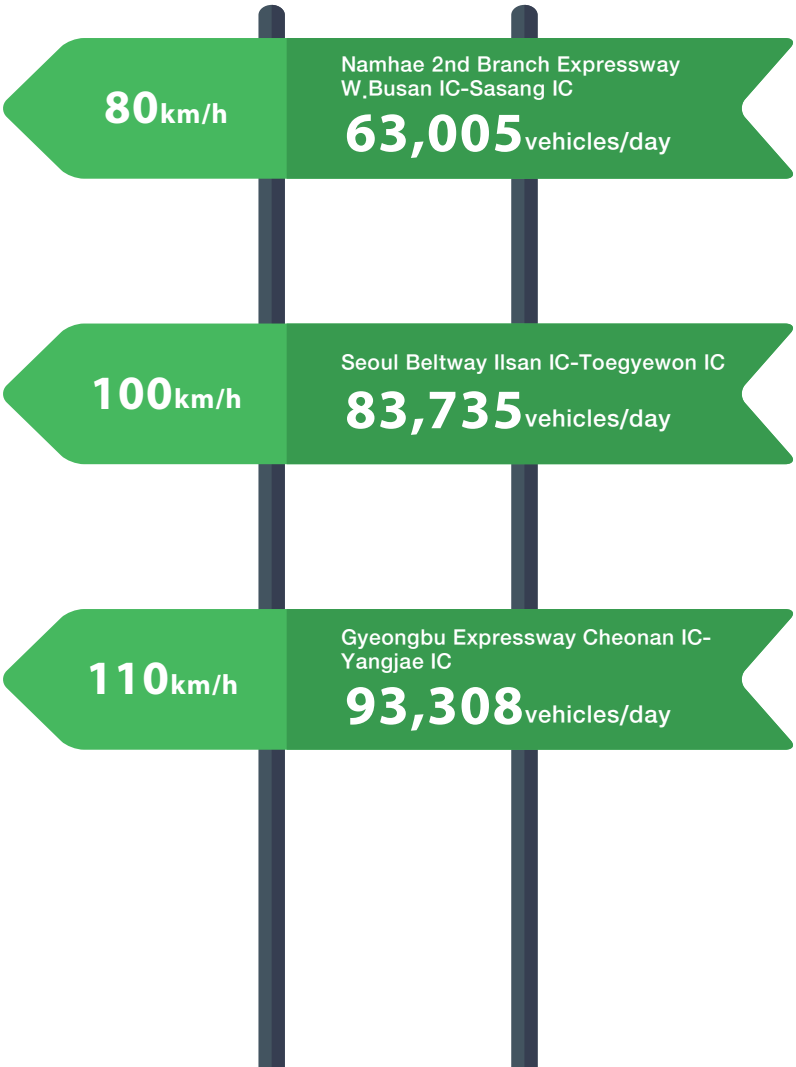
- Average traffic volume for the section with speed limit of 80 km/h: 29,677 vehicles/day
- Average traffic volume for the section with speed limit of 100 km/h: 26,447 vehicles/day
- Average traffic volume for the section with speed limit of 110 km/h: 28,999 vehicles/day



The section with the highest level of traffic volume

The section with the highest level of traffic volume is from Cheonan IC to Yangjae IC of the Gyeongbu Expressway.

- For the expressways with speed limit of 80 km/h, the section with the highest level of traffic volume is from W.Busan IC to Sasang IC of the Namhae 2nd Branch Expressway (The average daily traffic is 63,005 vehicles/day).
- For the expressway s with speed limit of 100 km/h, the section with the highest level of traffic volume is from Ilsan IC to Toegyewon IC of the Seoul Outer Ring Road (The average daily traffic is 83,735 vehicles/day).
- For the expressways with speed limit of 110 km/h, the section with the highest level of traffic volume is from Cheonan IC to Yangjae IC of the Gyeongbu Expressway (The average daily traffic is 93,308 vehicles/day).

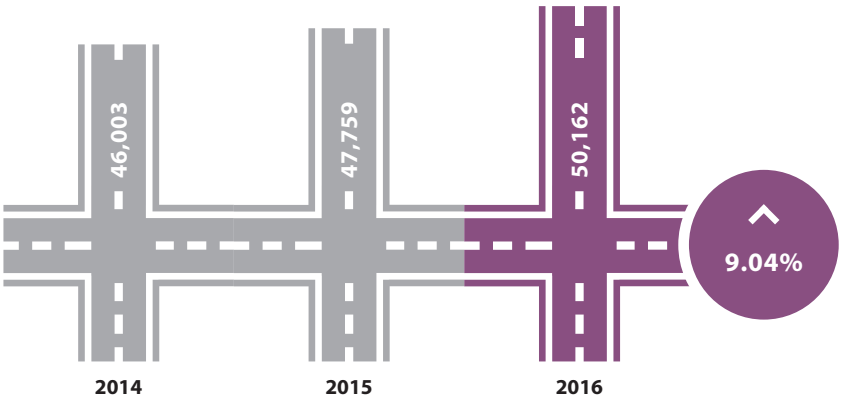


How Well Are Intersections Constructed by Region?

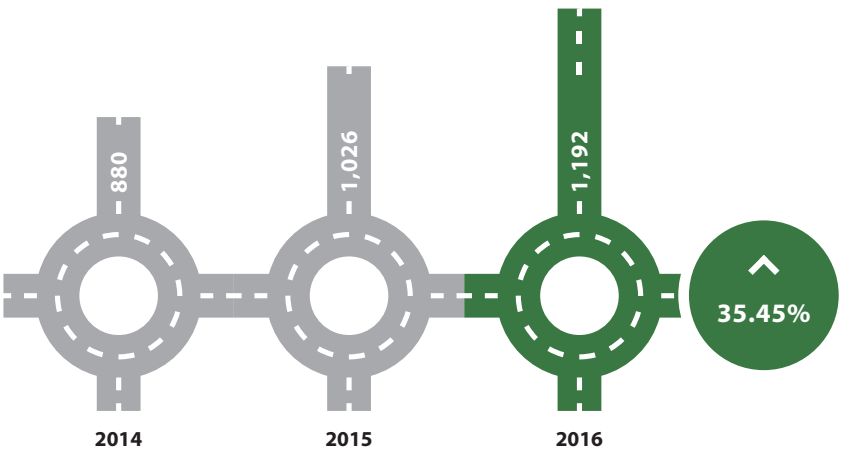
Intersection construction status over the past three years

The number of intersections has been increased by 9.5% from 46,883 in 2014 to 51,354 in 2016.

- The number of signal intersections has been increased by 9% from 46,003 in 2014 to 50,162 in 2016.
- The number of roundabouts has been increased by 35.5% from 880 in 2014 to 1,192 in 2016.



Intersection (Unit: each)

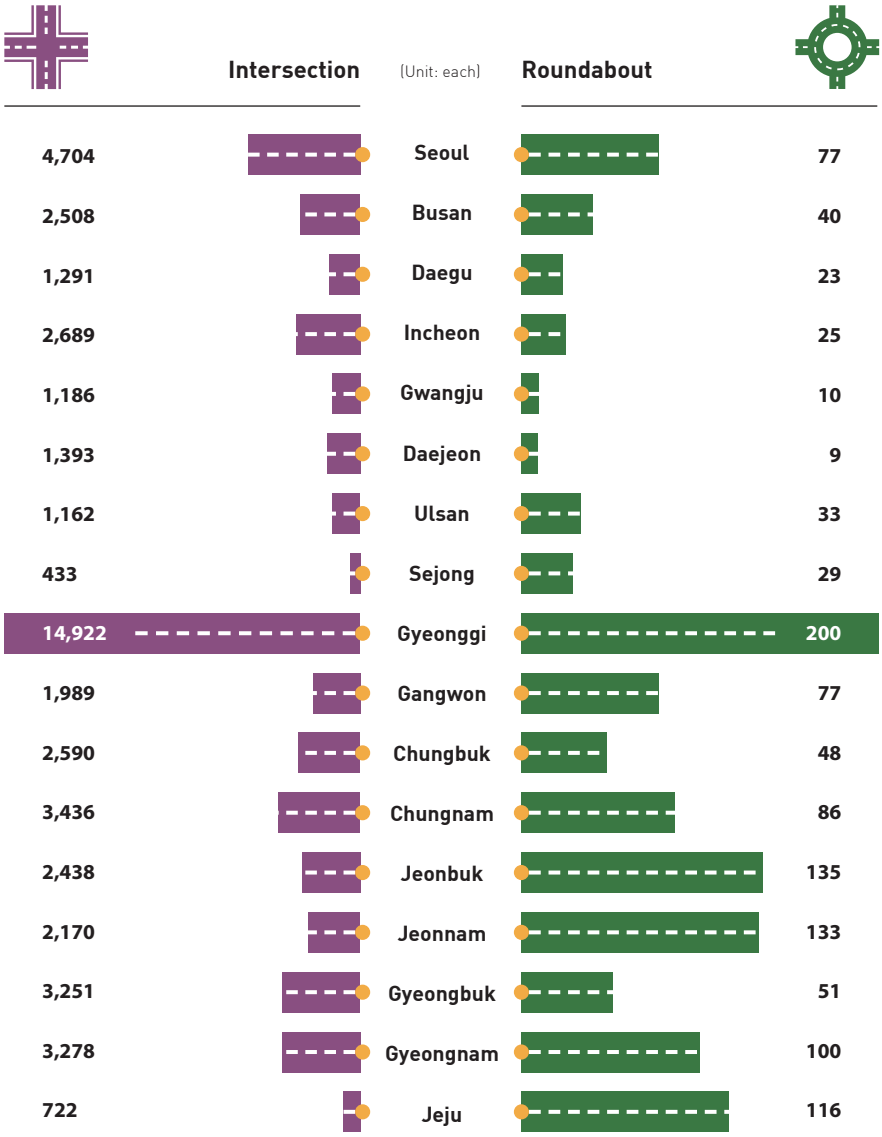


Roundabout (Unit: each)

Intersection and roundabout construction status by region

In 2016, intersections constructed in Gyeonggido was as many as 15,122, followed by Seoul with 4,781 and Chungcheongnam-do with 3,522.

- Roundabouts constructed for Gyeonggi-do was 200, followed by Jeollabuk-do with 135 and Jeollanam-do with 133.
- Intersections constructed for Gyeonggido was 14,922, followed by Seoul with 4,704 and Chungcheongnam-do with 3,436.

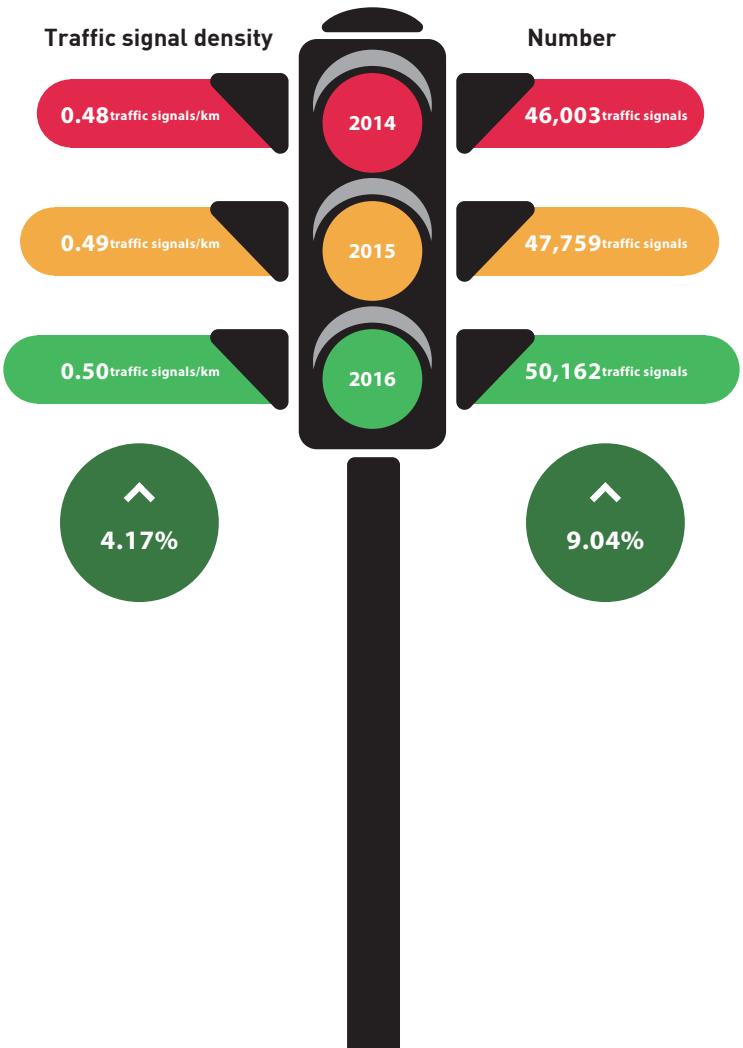


In Which Areas Does Traffic Signal Congestion Occur Most Frequently?

Traffic signal density over the past three years

With the construction of roads over the past three years increasing the density of traffic signals, traffic signal congestion has been on the rise.

- It has increased by 6% from 0.48 traffic signals/km in 2014 to 0.50 traffic signals/km in 2016.



2016 traffic signal density by region

Traffic signal density in the Seoul metropolitan area (Seoul, Incheon, Gyeonggi) and five other metropolitan cities (Busan, Daegu, Gwangju, Daejeon, Ulsan) are higher than the national average while that of the other regions is lower than the national average.

- Of special note, Seoul is estimated to have heavy traffic signal congestion as its traffic signal density is relatively higher than that of the other regions.
- Jeollanam-do is estimated to have the lowest level of traffic congestion traffic as its traffic signal density is lower than that of the other regions.

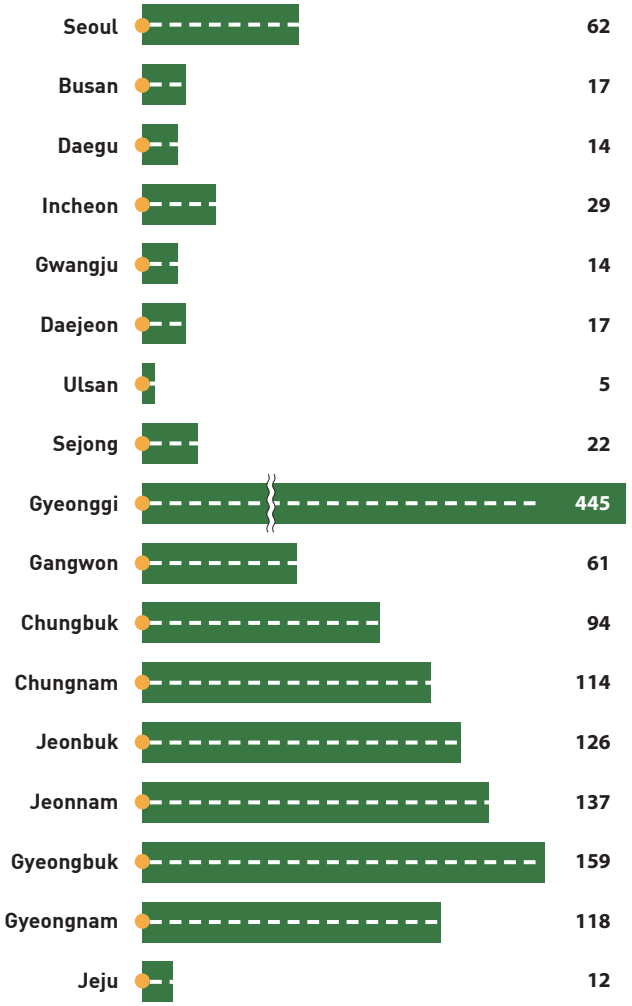
Road length	Number		Traffic signal density
2,635km	4,704	Seoul	1.79
2,108km	2,508	Busan	1.19
1,811km	1,291	Daegu	0.71
2,208km	2,689	Incheon	1.22
1,423km	1,186	Gwangju	0.83
1,206km	1,393	Daejeon	1.16
1,686km	1,162	Ulsan	0.69
710km	433	Sejong	0.61
14,757km	14,922	Gyeonggi	1.01
9,115km	1,989	Gangwon	0.22
6,841km	2,590	Chungbuk	0.38
8,468km	3,436	Chungnam	0.41
8,771km	2,438	Jeonbuk	0.28
11,519km	2,170	Jeonnam	0.19
13,285km	3,251	Gyeongbuk	0.24
10,478km	3,278	Gyeongnam	0.31
2,645km	722	Jeju	0.27

How Much Does Traffic Move in and out of the City Boundaries?

The 2016 survey points for intercity inflow and outflow traffic volume

The 2016 survey points for intercity inflow and outflow traffic volume (except national expressway and urban expressway) total 1,466.

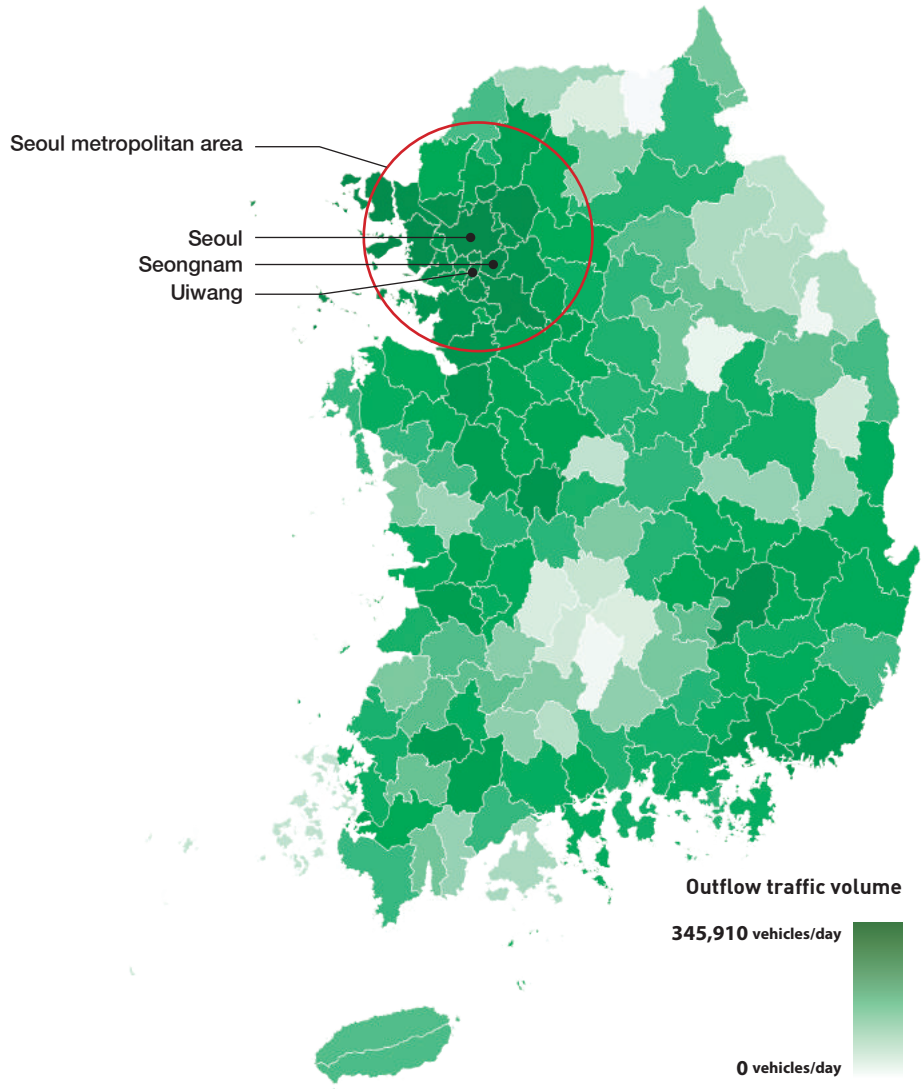
- Totals of 62 for Seoul, 17 for Busan, 14 for Daegu, 29 for Incheon, 14 for Gwangju, 17 for Daejeon, 5 for Ulsan, and 22 for Sejong



Average daily intercity inflow and outflow traffic volume

Average daily intercity inflow and outflow traffic volume of the Seoul metropolitan area is relatively high compared to that of the other regions.

- Intercity outflow traffic volume of Seoul city is 345,910 vehicles/day and its intercity inflow traffic volume is 342,985 vehicles/day.
- Intercity outflow traffic volume of Uiwang is 163,765 vehicles/day and its intercity inflow traffic volume is 166,480 vehicles/day.
- Intercity outflow traffic volume of Seongnam is 122,865 vehicles/day and its intercity inflow traffic volume is 120,644 vehicles/day.

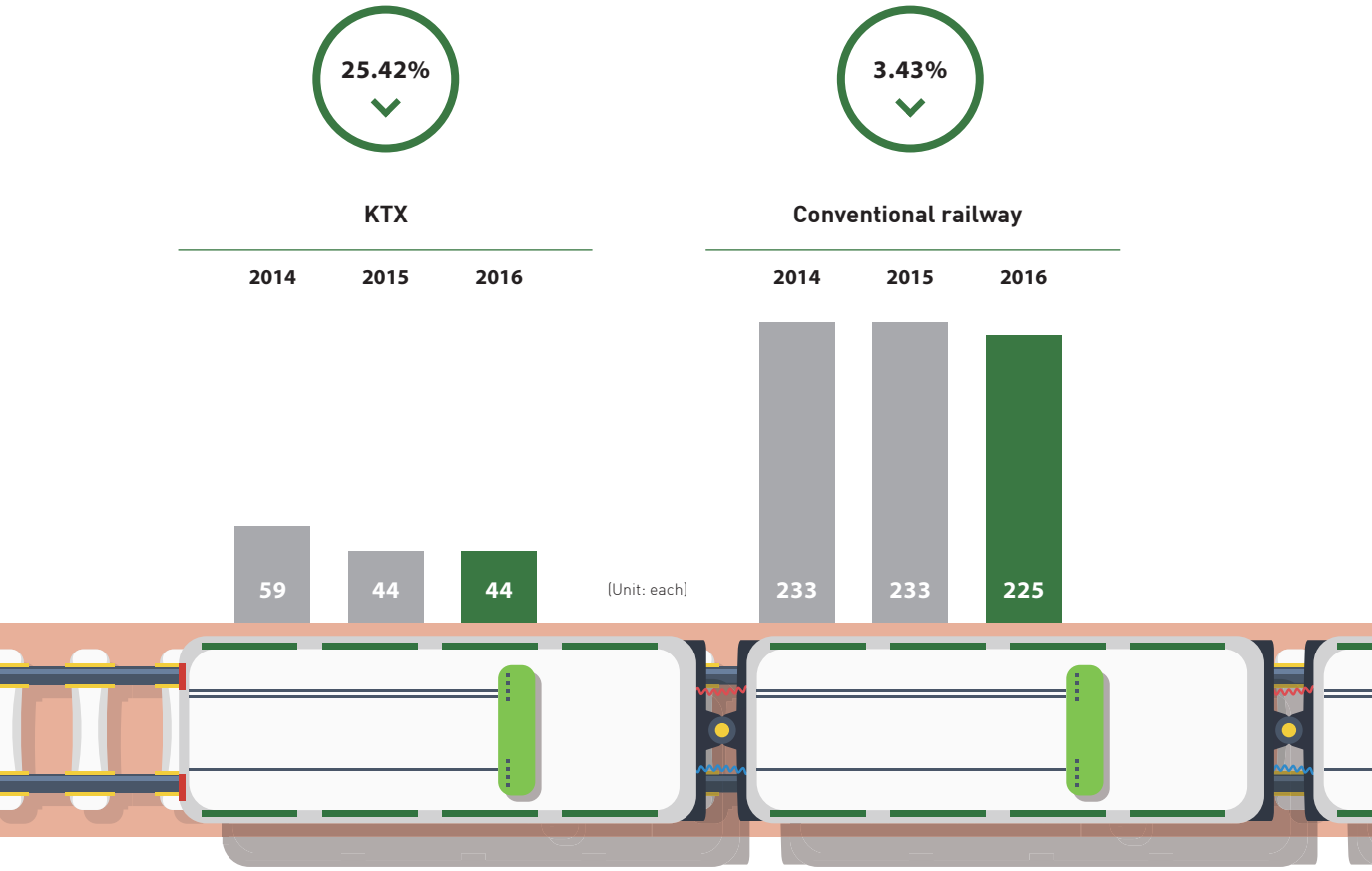


Which Are Regions Without Railway Stations?

Railway stations over the past three years

Railway stations (KTX, conventional railways, metropolitan railways, urban railways, and light rail transits) have increased by 7.74% over the past three years.

- While KTX stations and conventional railway stations have decreased by 25.42% and 3.43% respectively, metropolitan and urban railway stations and light rail transit (LRT) stations have increased by 10.10% and 64.71%, respectively.



Total

(Unit: each)

2014	2015	2016
1,046	1,073	1,127

7.74%

10.1%

Metropolitan railway · Urban railway

2014	2015	2016
703	745	774

64.71%

Light rail transit (LRT)

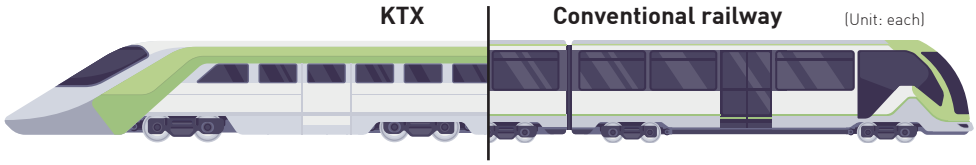
2014	2015	2016
51	51	84

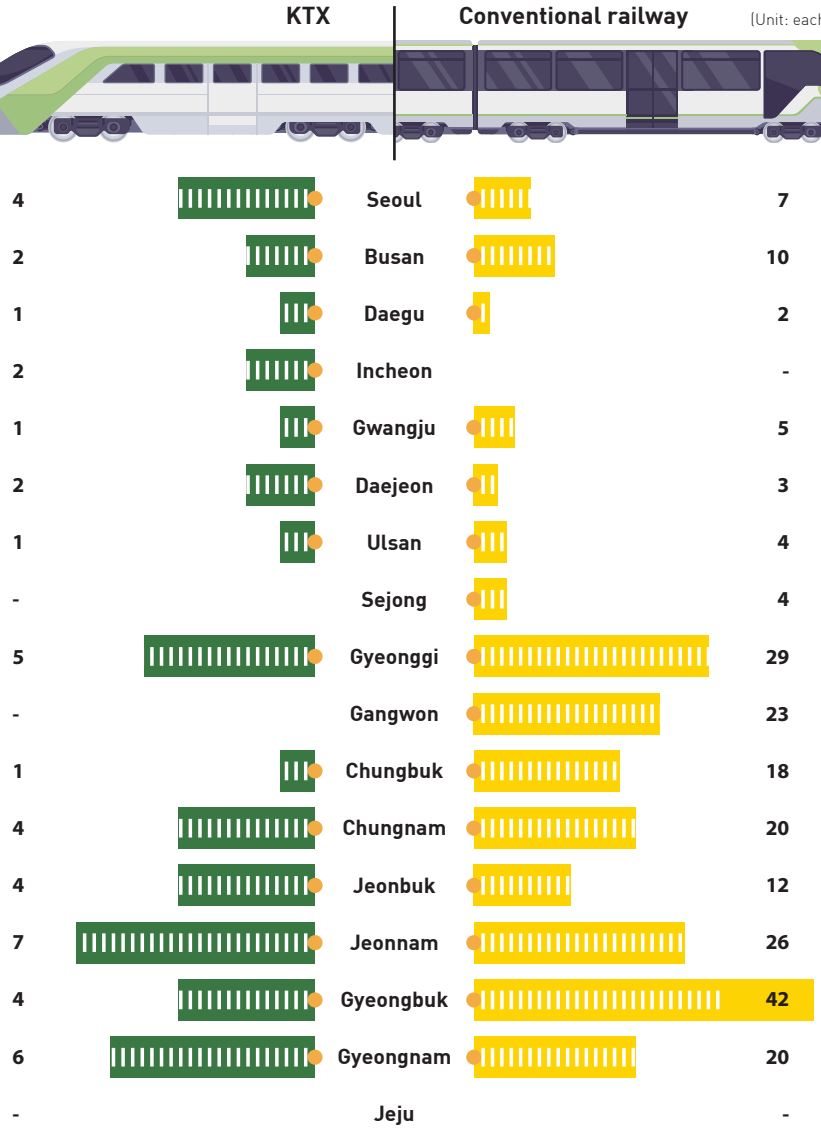
(Unit: each)

Railway stations status as of 2016

Referring to the 2016 railway station status, there are no KTX stations in the Sejong region.

- KTX stations in Jeollanam-do numbered seven in 2016, followed by Gyengsangnam-do with six, and Gyeonggi-do with five.
- The region where the conventional railway runs the most is Gyeongsangbuk-do with 42 stations; and the region where metropolitan railway and urban railway run the most is Seoul with 287 stations; and the region where light rail transit (LRT) runs the most is Incheon with 33 stations.





Total stations

44	225	774	84
KTX	Conventional railway	Metropolitan railway · Urban railway	LRT

(Unit: each)

Metropolitan railway · Urban railway		LRT
287	Seoul	-
110	Busan	9
85	Daegu	-
56	Incheon	33
20	Gwangju	-
22	Daejeon	-
-	Ulsan	-
-	Sejong	-
170	Gyeonggi	30
6	Gangwon	-
-	Chungbuk	-
10	Chungnam	-
-	Jeonbuk	-
-	Jeonnam	-
3	Gyeongbuk	-
5	Gyeongnam	12
-	Jeju	-

What Railway Lines Are Available by Region for Interregional Travel?

Railway lines status in 2016

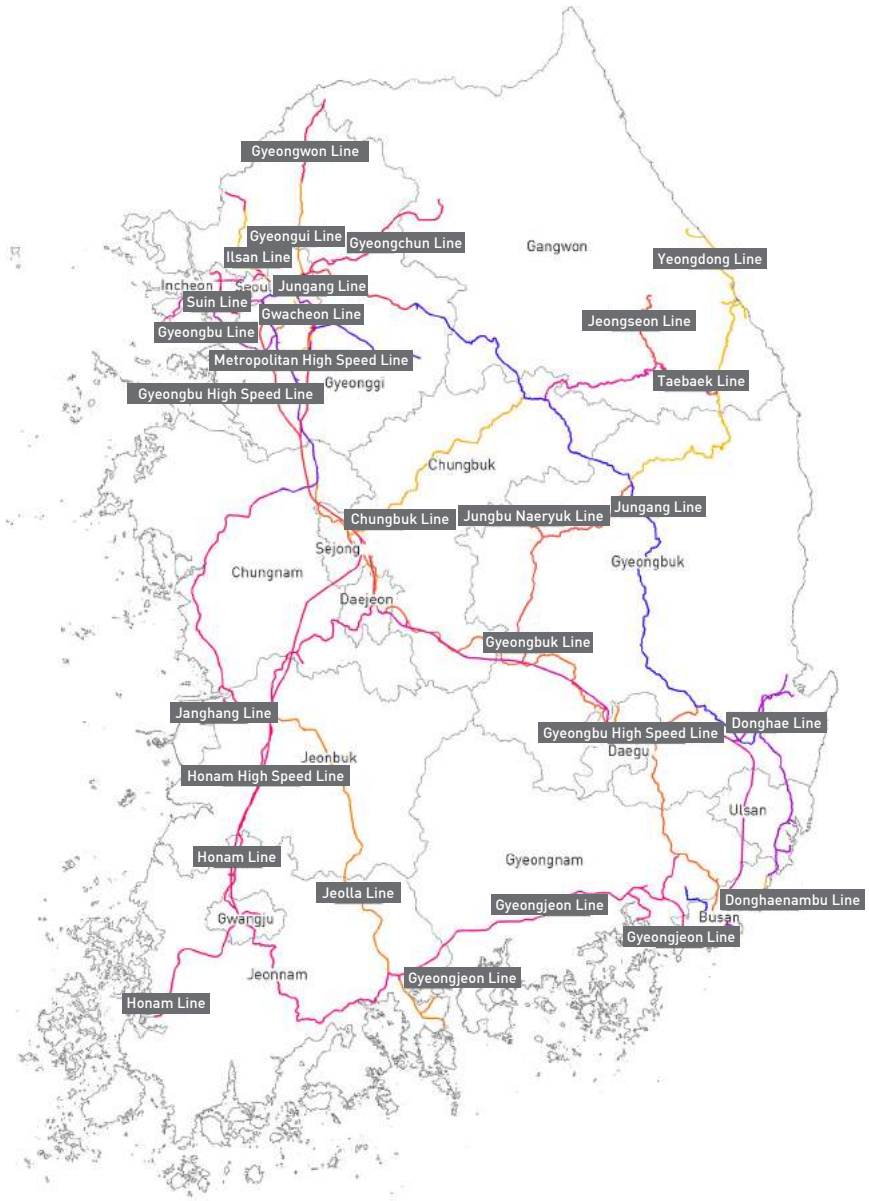
In Seoul and Gyeonggi province there is the largest number of railway lines, and in Gwangju there are the minimum railway lines.

- Available railway lines in Seoul and Gyeonggi province : KTX Gyeongbu Line, KTX Gyeongjeon Line, KTX Donghae Line, KTX Jeolla Line, KTX Honam Line, SRT Gyeongbu Line, SRT Honam Line, ITX Cheongchun Line, Gyeongbu Line, Gyeongui Line, Gyeongui-jungang Line, Gyeongjeon Line, Gyeongchun Line, Donghaenambu Line, Bundang Line, Airport Express, Janghang Line, Jeolla Line, Jungang Line, Chungbuk Line, Taebaek Line, Honam Line
- Available railway lines in Gwangju : KTX Honam Line, SRT Honam Line, Gyeongjeon Line, Honam Line

Region	KTX	Conventional railway
Seoul	KTX Gyeongbu Line, KTX Gyeongjeon Line, KTX Donghae Line, KTX Jeolla Line, KTX Honam, SRT Gyeongbu Line, SRT Honam Line	ITX Cheongchun Line, Gyeongbu Line, Gyeongui Line, Gyeongui-jungang Line, Gyeongjeon Line, Gyeongchun Line, Donghaenambu Line, Bundang Line, Airport Express, Janghang Line, Jeolla Line, Jungang Line, Chungbuk Line, Taebaek Line, Honam Line
Busan	KTX Gyeongbu Line, SRT Gyeongbu Line	Gyeongbu Line, Gyeongbuk Line, Gyeongjeon Line, Daegu Line, Donghaenambu Line, Donghae Line, Yeongdong Line, Jungang Line, Honam Line
Daegu	KTX Gyeongbu Line, KTX Gyeongjeon Line, KTX Donghae Line, SRT Gyeongbu Line	Gyeongbu Line, Gyeongbuk Line, Gyeongjeon Line, Daegu Line, Donghaenambu Line, Yeongdong Line
Incheon	KTX Gyeongbu Line, KTX Gyeongjeon Line, KTX Donghae Line, KTX Jeolla Line, KTX Honam Line	Suin Line, Airport Express
Gwangju	KTX Honam Line, SRT Honam Line	Gyeongjeon Line, Honam Line
Daejeon	KTX Gyeongbu Line, KTX Gyeongjeon Line, KTX Donghae Line, KTX Jeolla Line, KTX Honam Line, SRT Gyeongbu Line	Gyeongbu Line, Gyeongjeon Line, Donghaenambu Line, Jeolla Line, Chungbuk Line, Honam Line
Ulsan	KTX Gyeongbu Line, SRT Gyeongbu Line	Gyeongjeon Line, Daegu Line, Donghaenambu Line, Yeongdong Line, Jungang Line
Sejong		Gyeongbu Line, Gyeongjeon Line, Donghaenambu Line, Jeolla Line, Chungbuk Line, Honam Line
Gyeonggi	ITX Cheongchun Line, KTX Gyeongbu Line, KTX Gyeongjeon Line, KTX Donghae Line, KTX Jeolla Line, KTX Honam Line, SRT Gyeongbu Line, SRT Honam Line	Gyeonggang Line, Gyeongbu, Gyeongwon Line, Gyeongui Line, Gyeongui-jungang Line, Gyeongjeon Line, Gyeongchun Line, Gwangmyeong Shuttle, Donghaenambu Line, Bundang Line, Suin Line, Yongln Everline, Uijeongbu Line, Janghang Line, Jeolla Line, Jungang Line, Chungbuk Line, Taebaek Line, Honam Line
Gangwon		ITX Cheongchun Line, Gyeongwon Line, Gyeongchun Line, Daegu Line, Donghaenambu Line, Yeongdong Line, Jungang Line, Taebaek Line
Chungbuk	KTX Gyeongbu Line, KTX Gyeongjeon Line, KTX Donghae Line, KTX Jeolla Line, KTX Honam Line, SRT Gyeongbu Line, SRT Honam Line	Gyeongbu Line, Gyeongjeon Line, Donghaenambu Line, Jungang Line, Chungbuk Line, Taebaek Line
Chungnam	KTX Gyeongbu Line, KTX Gyeongjeon Line, KTX Donghae Line, KTX Jeolla Line, KTX Honam Line, SRT Gyeongbu Line, SRT Honam Line	Gyeongbu Line, Gyeongjeon Line, Donghaenambu Line, Janghang Line, Jeolla Line, Chungbuk Line, Honam Line
Jeonbuk	KTX Jeolla Line, KTX Honam Line, SRT Honam Line	Gyeongbu Line, Gyeongjeon Line, Janghang Line, Jeolla Line, Honam Line
Jeonnam	KTX Jeolla Line, KTX Honam Line, SRT Honam Line	Gyeongjeon Line, Daegu Line, Jeolla Line, Honam Line
Gyeongbuk	KTX Gyeongbu Line, KTX Gyeongjeon Line, KTX Donghae Line, SRT Gyeongbu Line	Gyeongbu Line, Gyeongbuk Line, Gyeongjeon Line, Daegu Line, Donghaenambu Line, Yeongdong Line, Jungang Line
Gyeongnam	KTX Gyeongbu Line, KTX Gyeongjeon Line	Gyeongbu Line, Gyeongbuk Line, Gyeongjeon Line, Daegu Line, Donghaenambu Line, Honam Line

Source: National Traffic Survey and DB Construction Project, KOTI, 2017.

Railway lines available by region

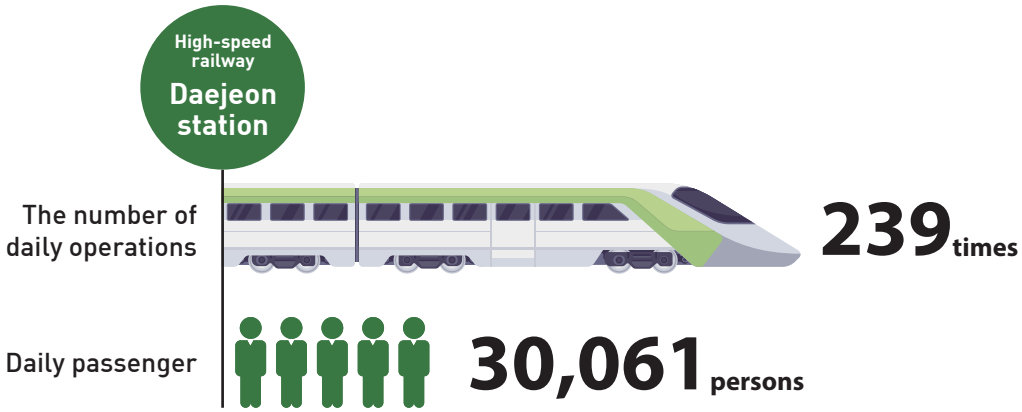


How Often Do Trains Operate to Meet Ridership?

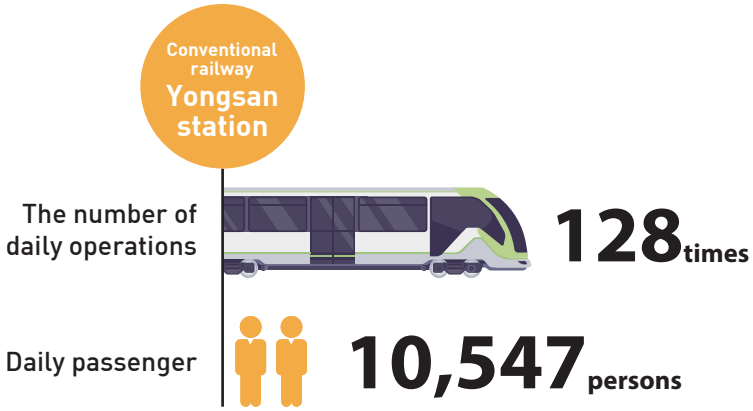
The number of users by station

The station with the most frequent number of high-speed railway (HSR) operation is Daejeon station and the station with the most frequent number of conventional railway is Yongsan station.

- The number of daily operations of Daejeon station is 239 and ridership is 30,061.
- The number of daily operations of Yongsan station is 128 and ridership is 10,547.

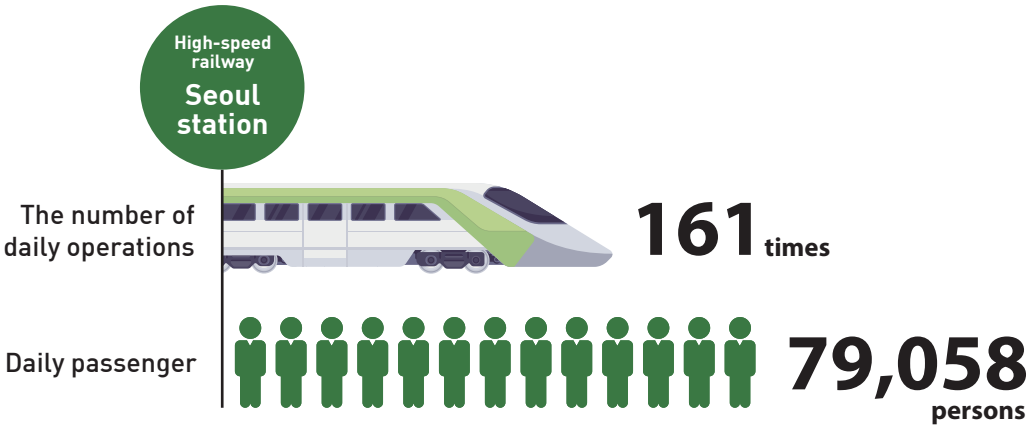


• High-speed railway: KTX, SRT

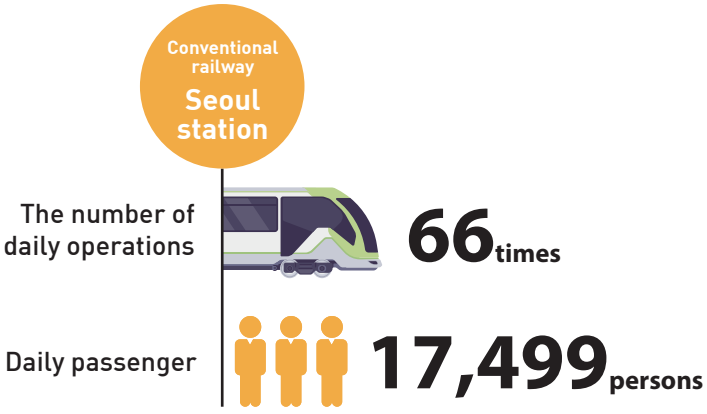


The station with the highest ridership for High-speed railway and conventional railway is Seoul station.

- HSR ridership in Seoul station is 79,058 and daily number of operation is 161.
- Conventional railway ridership in Seoul station is 17,499 and daily number of operation is 66.



• High-speed railway: KTX, SRT

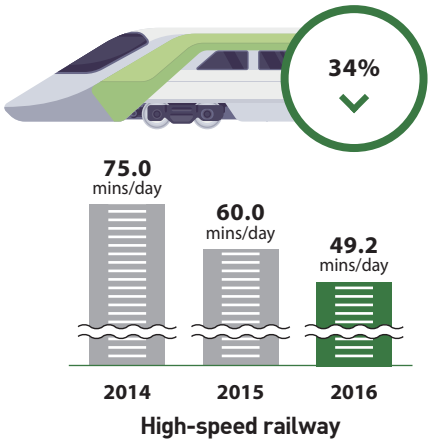


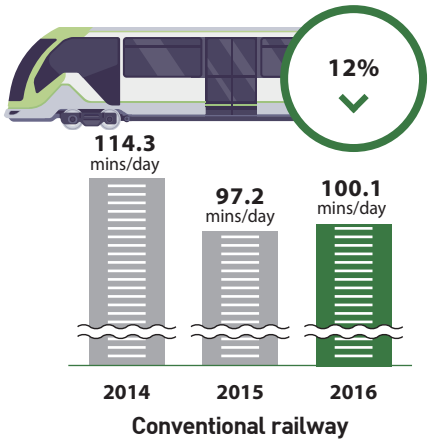
How Long Is the Headway Between Trains?

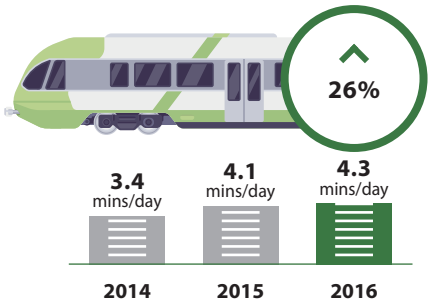
Headway between trains for the past 3 years

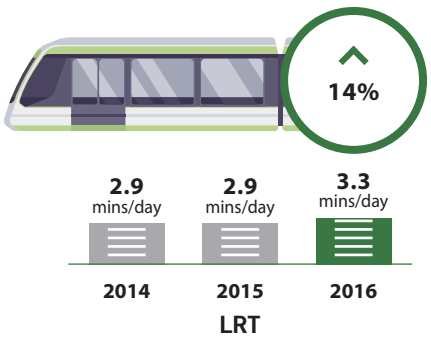
While the headway between trains of high-speed railway and conventional railway has decreased over the past three years (2014, 2015, 2016), the headway between trains of metropolitan railway and urban railway has increased.

- Average headway between trains of high-speed railway has decreased by 34% from 75 minutes in 2014 to 49.2 minutes in 2016 and that of conventional railway has decreased by 12% from 114.3 minutes in 2014 to 100.1 minutes in 2016.
- Average headway between trains of metropolitan railway and urban railway had increased by 26% from 3.4 minutes for 4.3 minutes in 2016, and that of light rail transit (LRT) had increased by 14% from 2.9 minutes in 2014 to 3.3 minutes in 2016.





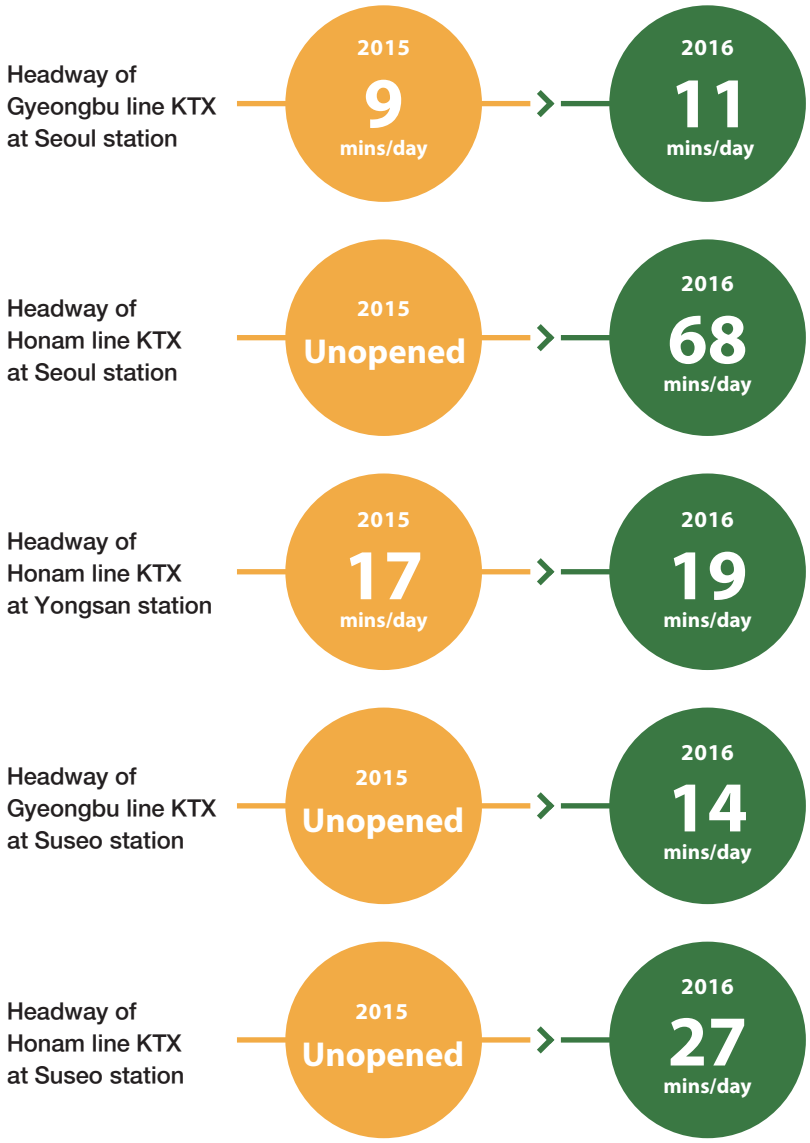




Changes in headways at Seoul station and Yongsan station

With the increase in SRT lines, changes arrived in headways at Seoul station and Yongsan station.

- Headway of the KTX Gyeonbu line at Seoul station 9 mins/day in 2015 → 11 mins/day in 2016
- Headway of the KTX Honam line at Seoul station (Unopened in 2015) → 68 mins/day in 2016
- Headway of the KTX Honam line at Yongsan station 17 mins/day in 2015 → 19 mins/day in 2016
- Headway of the KTX Gyeonbu line at Suseo station (Unopened in 2015) → 14 mins/day in 2016
- Headway of the KTX Honam line at Suseo station (Unopened in 2015) → 27 mins/day in 2016



Mobile Mobility Report

Human Mobility Observations

Chapter 1

Overview of Mobile DB Establishment

01 I Understanding Mobile Data
02 I Digitalization of Mobile Data

01_Understanding Mobile Data

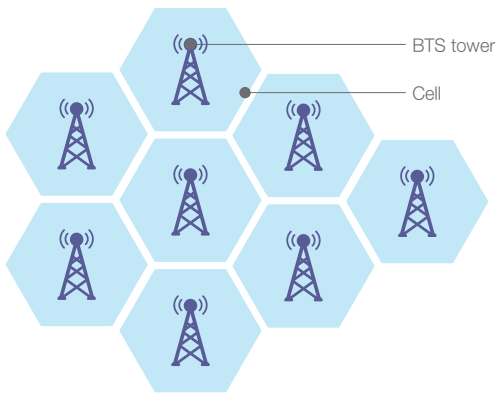
Definition and Type

- Mobile data refers to a mobile phone signal that has been transmitted to a nearby base transceiver station (BTS) and accumulated as data.
- According to domestic and overseas references, mobile data is divided into CDR (Call Detail Record), The CDR gets recorded when a mobile phone is used; for text messaging, conversation and the Internet, whereas the sighting data gets recorded at regular time intervals, even if a mobile phone is not used.

Principles of Generation

- Mobile data used in this project refers to the mobile phone signaling data. Accumulated transmissions and receptions between devices and a BTS tower, the data generation occurs when a device with power on is located within the cell coverage of a BTS tower.

When the device is within the cell coverage of a BTS tower, the receiving BTS detects the signal of the device at a regular time interval and has a tracking history. However, when the device is out of the cell coverage, the recording is stopped.



Source: Cited from p. 24, Racciato et al, 2015

Figure 1 | **Example of cell coverage**

1) Distance between BTS towers differs depending on the regional characteristics, and cell coverage also varies depending on physical interference, signal strength, etc.

2) Transmission/reception cycles between device and BTS tower differs among each BTS tower.

Type

- Following information will be given: date of generation, identification number that can distinguish various devices, location information (x-coordinate, y-coordinate) of the BTS tower receiving the signal of the device, time where the signal of the device is detected (start time and end time of data recording, corresponding total data recording time)

Table 1 | **Mobile Phone Signaling Data Type (base station)**

Date of Generation (yyyymmdd)	ID Number	Base station		Start time (hhmm)	End time (hhmm)	Total time
		X coordinate	Y coordinate			
20160520	1843030	127.132	36.475	1247	1248	2
20160520	1843030	127.132	36.475	1300	1300	1
20160520	1843030	127.132	36.475	1528	1528	1

02_Digitalization of Mobile Data

Purpose of processing

- Utilizing the mobile data, to identify the information on human characteristics and record human locations in detail, for identifying demand for moving

The existing transportation sector research conducted and analyzed a household travel survey in order to understand the demand for individual movements, the transportation sector calculated weights based on the annual average movements to generate related information, such as the weekday and weekend traffic.

Recently, key traffic information such as an accurate linked traffic volume and speed, based on big data like navigation, DSRC, GPS, DTG, etc., are under the process of research, but there is still a limitation in understanding the total demand.

-In particular, when using public transportation, there are limitations on assessing the traffic demand of passengers.

3) This means a newly assigned number for each terminal after non-identifica tion process so that a specific individual cannot be identified.

- The purpose of the project, "Development of Indicators related to Mobile Data-based Transport Plan" conducted during the National Traffic Survey in 2017, is to establish high-resolution traffic volume at the start/end terminals considering human characteristics as the first step of utilizing mobile data and its plan.

Scope of Processing

- Mobile phone signaling data generated at KT corp. from March 7, 2016 to March 2017

Point-type data recorded on a scale of milliseconds for each BTS tower is grouped every one minute for each terminal to provide information on the stay start time and the stay end time of the relevant customers population.

Using BTS tower location information and the time series information of each customer, the mobile phone signaling data can identify the traffic trajectory of an individual. (Refer to [Figure 2])

Processing Process

1st Stage Data preprocessing

– Removal of outliers

- Null value

- The coordinate information is indicated in the form of '\N'

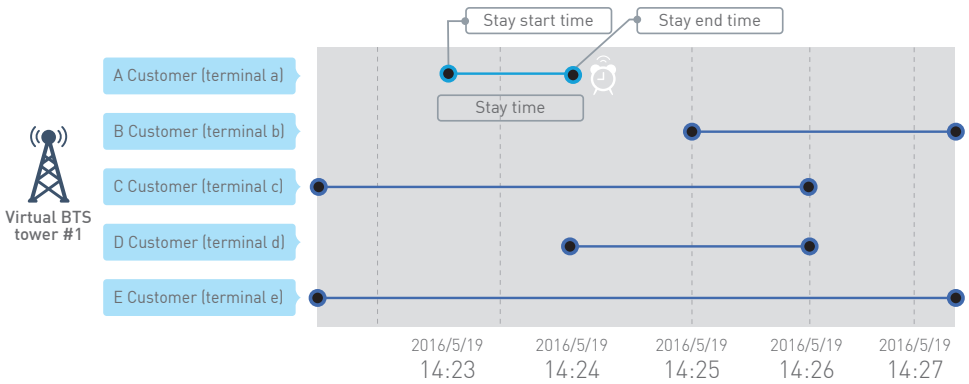


Figure 2 | **Conversion to Line History of Mobile Phone Signaling Date to Check Traffic Patterns of Individuals**

Table 2 | **Outlier (BTS tower or administrative code is null value)**

Date of Generation (yyyymmdd)	Identification number	Base station		Start time (hhmm)	End time (hhmm)	Age	Total time	Administrative District
		X-coordinate	Y-coordinate					
20160525	16027050	\N	\N	1037	1037	65	1	-
20160525	16027050	\N	\N	1037	1037	65	1	-

- Data generated at the BTS tower where the administrative district information is missed.

· As the telecommunication company subdivides the spatial division of the Korean territory into squares, only the BTS tower within this area has the administrative code.

If the BTS tower is located outside the boundaries of the square, the administrative code 'NA' is assigned.

Table 3 | **Outlier ((BTS tower or administrative code is null value)**

Date of Generation (yyyymmdd)	Identification number	Base station		Start time (hhmm)	End time (hhmm)	Age	Total time	Administrative District
		X-coordinate	Y-coordinate					
201605 Incheon	4867381	126.266	33.115	1213	1213	35	1	NA
20160526	6563051	126.269	33.117	1035	1035	45	1	NA
20160526	10579125	131.870	37.239	1348	1353	20	6	NA

Correction of distorted data

· While tracking, if the BTS tower is out of the reception range, the signal may be weakened or out of service. To prevent this, the devices continuously search for the signal of the nearest BTS tower to "handover" the signal to the appropriate base state.

· In such cases, the following distortion in data occurs in the process of handover due to the distance between BTS towers and the difference in the transmission setting.

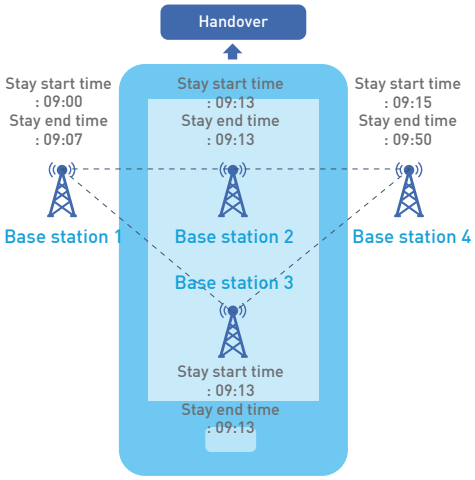
- Data due to unnecessary handovers

· Data with the same log-recording start time (the 'Stay start time') and log recording end time (the 'Stay end time')in one terminal at(two or more) different BTS towers.

When traveling by using transportation means (KTX, passenger car, etc.), the handover speed between the BTS tower becomes faster, and the data is displayed on a scale of milliseconds. However, it is expressed in minutes, so the same time is displayed.·

· The data is collected as if one device is at two locations at the same time. Two or more moving trajectories are formed, distorting the actual movement trajectory.

The best trajectory will remain, and the rest will be removed. The # of records of individual movements (repeated or not) and the distance information will be utilized.



Note: Directlyschematic

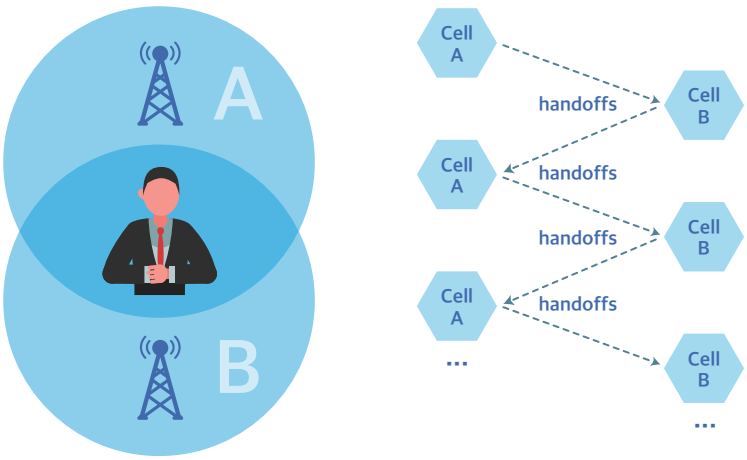
Figure 3 I **Unnecessary Handover Concept**

- Data due to ping-pong handover

· Data that repeatedly shows two or more different BTS tower coordinates at short time intervals (one minute)

It happens frequently when the signal level between BTS towers becomes similar or the towers are too close to each other, during the night time (when the tower signal intensity is adjusted)

· If Stay start time and Stay end time of the BTS tower with a ping pong handover



note : https://www.researchgate.net/figure/Noise-of-Ping-pong-Effects_fig1_261024524

Figure 4 I **Concept of Pin-Pong Handover**

phenomenon are compared, the time difference is very short. So it can NOT be seen as the data recorded when a mobile phone user was moving.

- Therefore, the data in which a ping-pong handover phenomenon occurs is corrected for the Stay time in the personal movement trajectory according to the following conditions:

√ Detect ping-pong handover phenomenon among individual movement trajectory data

√ Check the start and end points of each phenomenon

√ Consider data with the longest Stay time as resident in the actual BTS tower and delete the remaining data

√ If the Stay time is the same, set the BTS tower whose frequency of recording at BTS tower is high as the main BTS tower and delete the data at other BTS towers that showed the ping-pong phenomenon

√ In order to prevent the Stay time from being distorted, Stay start time and Stay end time should be corrected by the Stay start time of the data firstly generated in the data checked due to the ping-pong phenomenon occurring before the deleting the data and the Stay end time of the last data generated.

2nd Stage Classification of 'Movement' and 'Stay' by log

▪ Condition 1

Case where, based on the BTS tower coordinates (x, y) which are currently recorded when data is listed in the order of data recording, the BTS tower coordinates (X0, y0) recorded immediately before, coincide with the coordinates recorded immediately after. This can be expressed as (x0=x1, y0=y1)

- The ping-pong handover is a phenomenon in which a signal is transmitted to a BTS tower where the passenger is actually located, and a signal is transmitted to another BTS tower for a while due to a change in signal strength. Therefore, it shall be transmitted again to the original BTS tower.
- Accordingly, when data with the ping-pong phenomenon is listed in a chronological order, the same BTS tower coordinates appear repeatedly between different BTS tower coordinates.

▪ Condition 2

When stay time 1 (the time difference between Stay start time and Stay end time at the BTS tower recorded before) is longer than one minute, and the Stay time 2 at the currently recorded BTS tower is one minute*

* Because The ping-pong handover phenomenon occurs due to error data caused by changes in signal strength, and the Stay time does not appear for more than one minute.

- The BTS tower mobile phone signaling data can be used to identify the Stay time and the frequency of access to the BTS tower of each individual customer. So Stay Area and main Stay Area can be selected using log.
- In this project, characteristics of movement were identified as follows:

√ Moving logs shall be the Pass-by.

√ Logs a passenger has stayed for a certain period of time, repeatedly at a certain time, shall be the Stay Area.

√ Data for a certain period of time but has not been repeated in the log records shall be the Potential Stay Area

Table 4 I **Classification of Movement and Stay by Log**

Classification	Description	Criteria
Pass-by	When the terminal holder is passing the cell coverage of a BTS tower on his/her way to the destination and it is assumed that the signal of the terminal is recorded in the BTS tower	When stay time is less than 25 minutes
Stay Area	When it is assumed to be the departure or destination of the terminal holder	When stay time is more than 25 minutes, and more than 3 hours of stay is repeated three times a week or more
Potential Stay Area	When it is assumed to be the pass-by to the destination of the terminal holder	Log record which is not selected as Stay Area with stay time of more than 25 minutes

3rd Stage Personal trajectory movement formation

- In order to distinguish departure and destination, sort out individual data according to the log recording order based on the date, stay start time, and stay end time.
- Distinguish departure and destination by dividing into home-based trips and non-home-based trips.

Since the purpose of the project conducted in 2017 is to understand the traffic volume at the start and end points, the data classified into the Stay Area and the Potential Stay Area was classified into departure and destination except for the data classified as 'pass-by.'

- Home-based trip refers to a route where either the departure or the destination is

4) Point where the BTS tower with the record of log is located

included to the residence location data. So the area where the data classified as Stay Area (marked with 'N') at nighttime (from 0 to 6) should be the departure or destination location.

- 'Non-home-based trip' refers to a trip that does not include residence either for departure or the destination. So the area where the data classified as Potential Stay Area (marked with 'D') in daytime (from 6 a.m. to midday or from 1 p.m. to 6 p.m.) is recorded should be the departure or destination.

▪ **Reason for setting stay time "25 minutes" as the standard**

Based on the BTS tower log data generated for eight days in Mapo-gu (Mangwon 1-dong, Seogyo-dong) Seoul and Sejong City, the cumulative distribution function value for the Stay time of each BTS tower was analyzed. And according to the analysis result, the cumulative distribution function value of Stay time at all BTS towers is 95%, when the Stay time is more than 25 minutes.

▪ **Reasons for setting 'Stay time of more than three hours' and 'Record three times per week' as criteria for selection of Stay Areas**

- Repeated visiting spots of a passengers are considered to be the residence area, workplaces or school zones
- In the case of Stay areas, it is assumed that a passenger stays repeatedly mostly in nighttime (from midnight to 6 a.m.)
- In the case of workplace/school, it is assumed that a passenger stays repeatedly mostly in daytime (from 6 a.m. to midday or from 1 p.m. to 6 p.m.).
- Selection criteria were determined by way of satisfying the rate that is identified as Stay time for more than three hours is more than 90% at nighttime and more than 85% at daytime (Apply data-driven method)
- Among the identified data, data classified as a residence location is indicated as "nighttime" (hereinafter the 'N') and work places/ school zones are marked as "daytime" (hereinafter the 'D').

Classification	Final option 1		Final option 2	
	Condition	Identification rate	Condition	Identification rate
D	Visit more than three hours between 9 a.m. and noon/1 p.m. and 6 p.m. for four days	68.0%	Visit more than three hours between 9 a.m. and noon/1 p.m. and 6 p.m. for three days	88.5%
N	Visit more than four hours between 12 a.m. and 6 a.m./1 p.m. and 6 p.m. for four days	77.9%	Visit more than three hours between 12 a.m. and 6 a.m/1 p.m. and 6 p.m. for three days	91.2%

▪ **Process of Setting up Analysis Map (Traffic Polygon)**

1st Stage : Setting of the virtual cell radius of the main BTS tower, using the Voronoi diagram technique

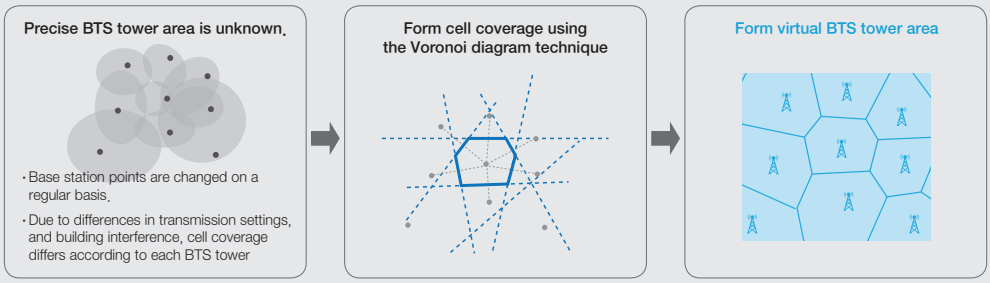


Figure 5 I **1st Stage of Establishing Traffic Polygon**

2st Stage : Cell radius of BTS tower and output area matching

- Base station cell radius and output area are overlapped so that BTS tower and output area make a ratio of at least one-to-one (or N: 1)

* Merge into one output area if the cell radius of one BTS tower covers multiple output areas

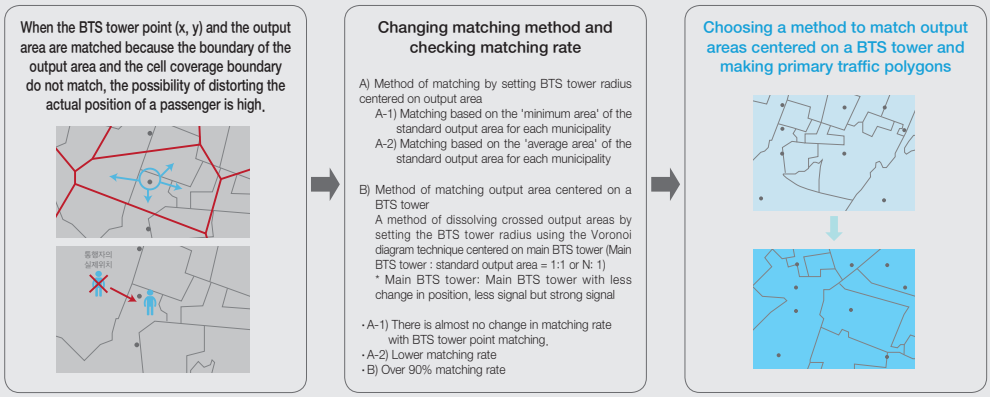


Figure 6 I **2nd Stage of Establishing Traffic Polygon**

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5) Draw a perpendicular line connecting arbitrary one point and another point, and then divide the space by connecting the intersections between the perpendicular lines

6) Main BTS tower with less change in position and strong signal

3st Stage : Correct inappropriate traffic polygon standards

- If the area is too small (with an area less than 5% of the cumulative distribution within the city), or even if it is linked to one polygon with same polygon ID, but is separated from each other, making it difficult to be viewed as a single polygon, merge traffic polygons into the near area from the center point.

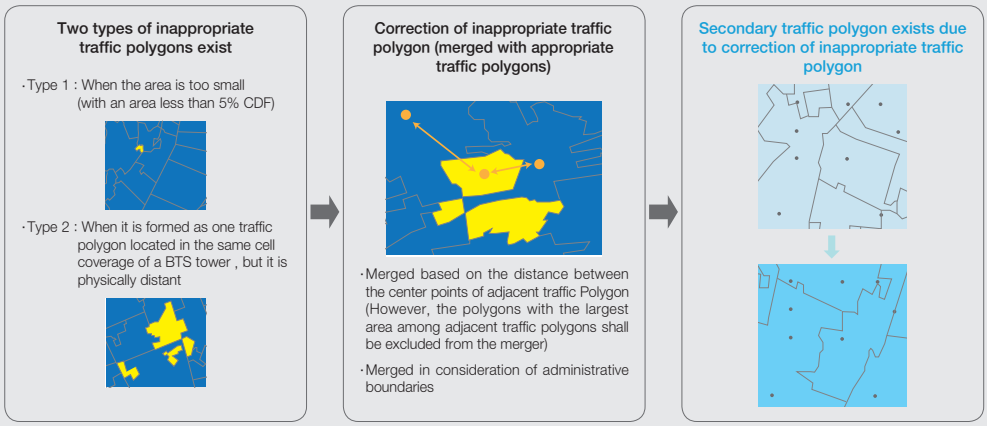


Figure 7 | 3rd Stage of Establishing Traffic Polygon

4th Stage : Achieving 100% of matching rate by correcting some traffic polygons

- If there is a traffic polygon on the river or the actual location of BTS tower is closer to the traffic polygon other than the matched traffic polygon, it shall be merged with the adjacent polygon belonging to the same administration.

Figure 8 | 4th Stage of Establishing Traffic Polygon

4th Stage Accumulation of analysis map - based on traffic volume

- Information on traffic volume at start and end points based on BTS tower needs to be collected in terms of consistency with other information and utilization.

  Calculation of information on traffic volume to the extent that it does not conflict with the "Personal Information Protection Act," and "Act on Promotion of Information and Communication Network Utilization and Information Protection."

  Aggregation in a form that can be matched with other data and statistics

  Since the cell coverage of the BTS tower changes continuously depending on differences in transmission setting, it is necessary to define the physical concept of the data by utilizing the fixed physical radius.

- Develop a fixed 'traffic polygon' in aggregation unit to group departure and destination

  The coordinates of BTS tower, which is the location information, are changed every day, and the cell coverage of the BTS tower also varies according to the difference in transmission settings. Therefore, a fixed aggregation unit (the "Traffic polygon") has been developed to group departure and destination.

  - Based on 'output area' where socioeconomically homogeneous populations are formed, a nationwide traffic polygon is formed through the following processing procedures.

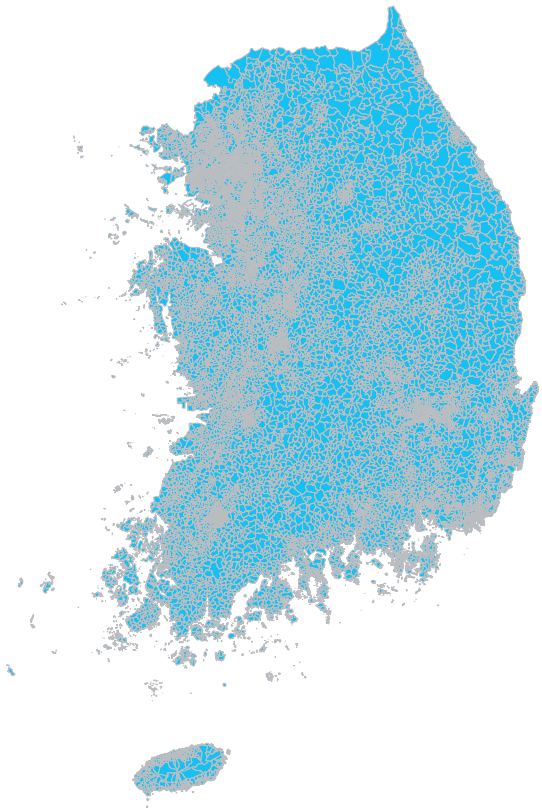


Figure 9 | **Nationwide Traffic Polygon**
(As of 2017, there are 15,937 polygons)

Results of Process

Table 10 | Example of Mobile data-based DB

Departure				Arrival				Age	Sex	Traffic volume	Record date
Polygon ID	Departure date	Time	Trip type	Polygon ID	Departure date	Time	Trip type				
110006	20160401	0	X	110006	20160401	0	N	20	M	3	20160401
110016	20160401	0	N	110016	20160401	1	X	20	F	3	20160401
110017	20160401	0	D	110716	20160401	12	X	20	F	3	20160401
110033	20160401	0	N	110386	20160401	0	X	60	F	3	20160401
110036	20160401	0	N	110036	20160401	0	D	70	M	3	20160401
110040	20160401	0	N	110628	20160401	0	X	30	F	3	20160401

Table 11 | Mobile DB Table Definition

Column ID	Name of column	Type	Remarks
o_polygon	Starting polygon ID	string	
o_base_ymd	Departure Date	string	yyyymmdd
o_timezn_cd	Departure Time	string	00~23
o_trip_type	Departure OD trip type	string	D (daytime Stay Area), N (nighttime Stay Area), X (Potential Stay Area)
d_polygon	Arrival Polygon ID	string	
d_base_ymd	Arrival Date	string	yyyymmdd
d_timezn_cd	Arrival Time	string	00~23
d_trip_type	Destination OD trip type	string	·D (daytime Stay Area): visit more than three hours from 9 a.m. to midday, and from 1 p.m. to 6 p.m. for more than three days ·N (nighttime Stay Area): Visit more than three hours from midnight to 6 a.m. for more than three days ·X (Potential Stay Area): Others (if not D or N)
age_itg_cd	Information on age	integer	0:0~9 10:10~19
sex_type_itg_cd	Information on gender	string	M,F
total	Population	integer	
base_ymd	Base date	string	yyyymmdd

Chapter 2

Analysis of Mobile DB-based Travel Characteristics

01 I Regional Analysis
02 I Time-based Analysis
03 I Seasonal analysis
04 I Daily Analysis
05 I Analysis by Age
06 I Analysis by Gender

· We have used the mobile data of KT Corporation ("KT") customers only, and all contents in this Chapter are merely preliminary values. Kindly, therefore, refer to the traffic distribution (ratio).

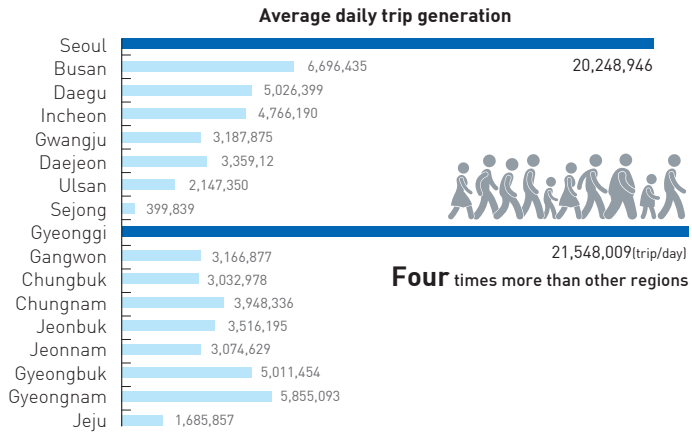
- KT's market share: Approximately 26% (As of March 2017 among "Statistics on Wireless Telecommunication Service Subscribers Declared in December 2017 by the Ministry of Science and ICT)

· This Chapter is composed of Q&A, and analysis method (analysis units, scope, etc.) as all analysis is presented at the end of the Chapter.

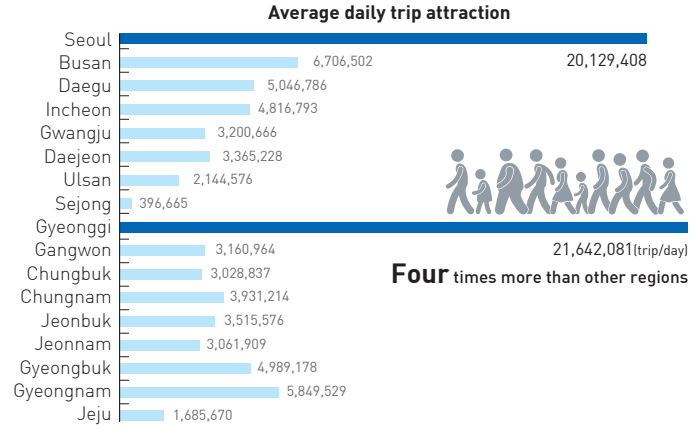
01_ Regional Analysis

• Which is the busiest traffic area in Korea?

Seoul (average daily traffic of about 20 million persons) and Gyeonggi (average daily traffic of about 21 million persons) show traffic volumes four times greater than other regions



City/ Province	Ranking	Trip generation (trip/day)
Seoul	2	20,248,946
Busan	3	6,696,435
Daegu	5	5,026,399
Incheon	7	4,766,190
Gwangju	11	3,187,875
Daejeon	10	3,359,121
Ulsan	15	2,147,350
Sejong	17	399,839
Gyeonggi	1	21,548,009
Gangwon	12	3,166,877
Chungbuk	14	3,032,978
Chungnam	8	3,948,336
Jeonbuk	9	3,516,195
Jeonnam	13	3,074,629
Gyeongbuk	6	5,011,454
Gyeongnam	4	5,855,093
Jeju	16	1,685,857



City/ Province	Ranking	Trip attraction (trip/day)
Seoul	2	20,129,408
Busan	3	6,706,502
Daegu	5	5,046,786
Incheon	7	4,816,793
Gwangju	11	3,200,666
Daejeon	10	3,365,228
Ulsan	15	2,144,576
Sejong	17	396,665
Gyeonggi	1	21,642,081
Gangwon	12	3,160,964
Chungbuk	14	3,028,837
Chungnam	8	3,931,214
Jeonbuk	9	3,515,576
Jeonnam	13	3,061,909
Gyeongbuk	6	4,989,178
Gyeongnam	4	5,849,529
Jeju	16	1,685,670

Analysis conditions

– Calculation of the daily average value for each region by dividing the traffic volume that is generated and arrived into 17 cities and provinces and then dividing by the total number of analyzed days (388 days).

- Gender: Male, Female
- Age: All ages recorded in the data
- Departing trip types: All Trip types
- Arrival trip types: All trip types
- Departure time: 24 hours
- Arrival time: 24 hours
- Temporal range: about 13 months (From March 7, 2016 to March 31, 2017)
- Spatial coverage: Nationwide (Analysis units: city and province)

• Which area has the greatest traffic volume?

All regions show high intra-travel rates, and except for Jeju, traffic to neighboring areas is also frequent.

Seoul

· Total travel volume
20,248,947(trip/day)
· Travel volume in the region
18,257,992(trip/day)

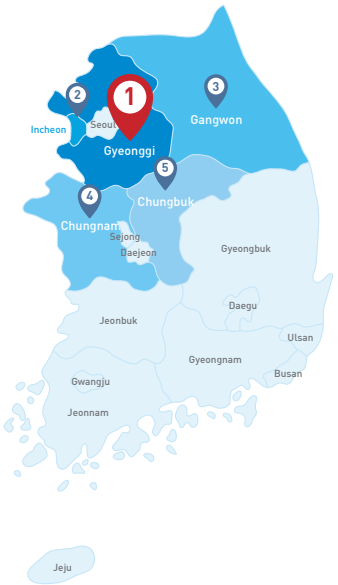
① Gyeonggi(1,615,384)

② Incheon(204,463)

③ Gangwon(34,924)

④ Chungnam(33,323)

⑤ Chungbuk(20,805)



City/Province	Ranking	Trip attraction (trip/day)
Seoul	-	18,257,992
Busan	10	8,283
Daegu	11	6,679
Incheon	**2**	**204,463**
Gwangju	14	4,852
Daejeon	6	13,606
Ulsan	16	2,359
Sejong	15	4,391
Gyeonggi	**1**	**1,615,384**
Gangwon	**3**	**34,924**
Chungbuk	**5**	**20,805**
Chungnam	**4**	**33,323**
Jeonbuk	8	10,535
Jeonnam	13	5,628
Gyeongbuk	7	10,536
Gyeongnam	12	6,513
Jeju	9	8,674

Busan

· Total travel volume
6,696,433(trip/day)
· Travel volume in the region
6,386,291(trip/day)

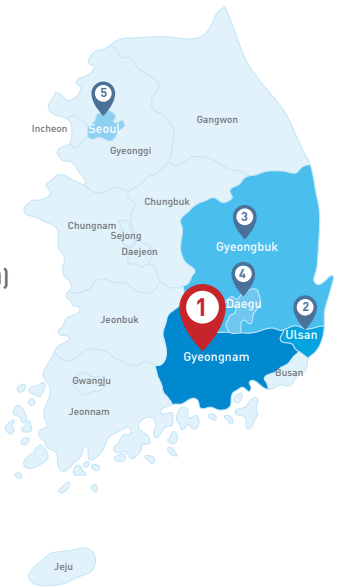
① Gyeongnam(211,870)

② Ulsan(38,840)

③ Gyeongbuk(20,530)

④ Daegu(8,916)

⑤ Seoul(8,308)



City/Province	Ranking	Trip attraction (trip/day)
Seoul	**5**	**8,308**
Busan	-	6,386,291
Daegu	**4**	**8,916**
Incheon	13	1,253
Gwangju	14	991
Daejeon	9	1,775
Ulsan	**2**	**38,840**
Sejong	16	258
Gyeonggi	6	5,375
Gangwon	15	984
Chungbuk	10	1,739
Chungnam	12	1,372
Jeonbuk	11	1,673
Jeonnam	7	3,418
Gyeongbuk	**3**	**20,530**
Gyeongnam	**1**	**211,870**
Jeju	8	2,840

Daegu

- Total travel volume
  5,026,400(trip/day)
- Travel volume in the region
  4,733,949(trip/day)

① Gyeongbuk(227,101)

② Gyeongnam(23,978)

③ Busan(9,020)

④ Seoul(6,551)

⑤ Gyeonggi(5,334)

City/Province	Ranking	Trip attraction (trip/day)
Seoul	4	6,551
Busan	3	9,020
Daegu	-	4,733,949
Incheon	14	1,076
Gwangju	15	707
Daejeon	8	2,346
Ulsan	6	4,604
Sejong	16	345
Gyeonggi	5	5,334
Gangwon	11	1,629
Chungbuk	7	3,288
Chungnam	9	1,801
Jeonbuk	10	1,764
Jeonnam	12	1,515
Gyeongbuk	1	227,101
Gyeongnam	2	23,978
Jeju	13	1,392

Incheon

- Total travel volume
  4,766,190(trip/day)
- Travel volume in the region
  4,231,325(trip/day)

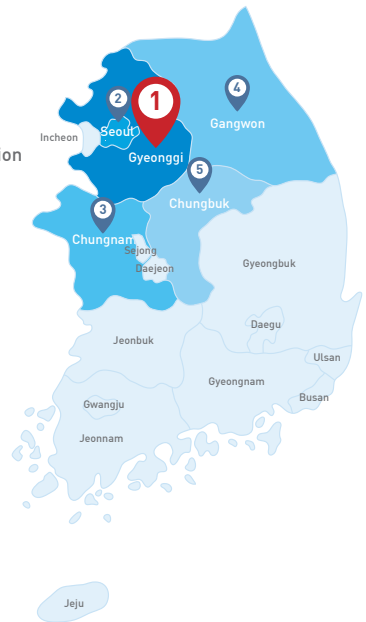
① Gyeonggi(321,936)

② Seoul(182,624)

③ Chungnam(9,982)

④ Gangwon(4,594)

⑤ Chungbuk(4,103)



City/Province	Ranking	Trip attraction (trip/day)
Seoul	2	182,624
Busan	10	901
Daegu	12	846
Incheon	-	4,231,325
Gwangju	13	783
Daejeon	7	1,979
Ulsan	16	263
Sejong	15	535
Gyeonggi	1	321,936
Gangwon	4	4,594
Chungbuk	5	4,103
Chungnam	3	9,982
Jeonbuk	6	2,123
Jeonnam	9	1,021
Gyeongbuk	8	1,729
Gyeongnam	11	876
Jeju	14	570

Gwangju

- Total travel volume
3,187,874(trip/day)
- Travel volume in the region
3,016,595(trip/day)

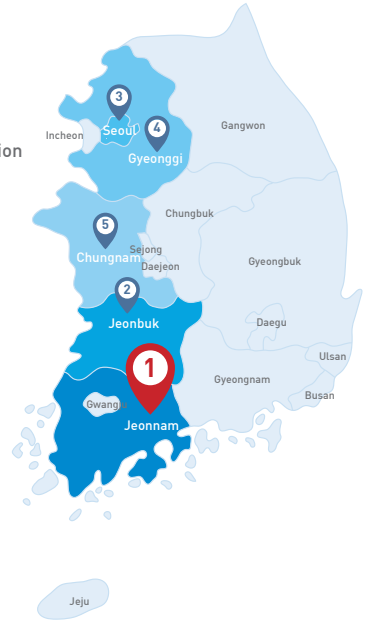
① Jeonnam(133,700)

② Jeonbuk(16,592)

③ Seoul(4,879)

④ Gyeongg(3,994)

⑤ Chungnam(2,622)



City/Province	Ranking	Trip attraction (trip/day)
Seoul	3	4,879
Busan	10	947
Daegu	13	682
Incheon	9	971
Gwangju	-	3,016,595
Daejeon	7	1,532
Ulsan	16	179
Sejong	15	302
Gyeonggi	4	3,994
Gangwon	14	314
Chungbuk	11	819
Chungnam	5	2,622
Jeonbuk	2	16,592
Jeonnam	1	133,700
Gyeongbuk	12	687
Gyeongnam	6	2,071
Jeju	8	988

Daejeon

- Total travel volume
3,359,122(trip/day)
- Travel volume in the region
3,156,924(trip/day)

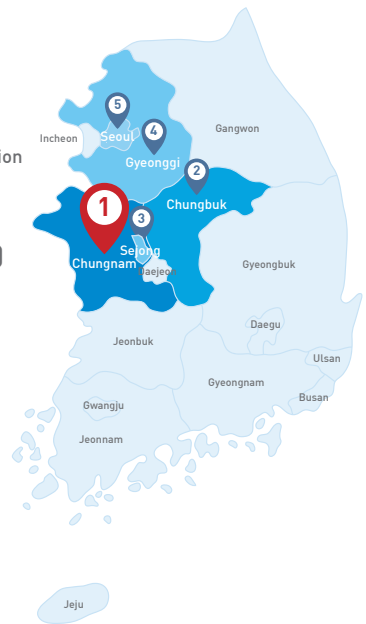
① Chungnam(69,411)

② Chungbuk(41,392)

③ Sejong(31,112)

④ Gyeonggi(14,777)

⑤ Seoul(13,827)



City/Province	Ranking	Trip attraction (trip/day)
Seoul	5	13,827
Busan	12	1,803
Daegu	9	2,440
Incheon	9	2,440
Gwangju	14	1,584
Daejeon	-	3,156,924
Ulsan	15	606
Sejong	3	31,112
Gyeonggi	4	14,777
Gangwon	13	1,726
Chungbuk	2	41,392
Chungnam	1	69,411
Jeonbuk	6	11,140
Jeonnam	11	1,925
Gyeongbuk	7	4,952
Gyeongnam	8	2,985
Jeju	16	78

Ulsan

- Total travel volume
  2,147,349(trip/day)
- Travel volume in the region
  2,027,184(trip/day)

① Busan(42,039)

② Gyeongbuk(35,668)

③ Gyeongnam(28,859)

④ Daegu(4,910)

⑤ Seoul(2,477)

City/Province	Ranking	Trip attraction (trip/day)
Seoul	5	2,477
Busan	1	42,039
Daegu	4	4,910
Incheon	13	385
Gwangju	14	184
Daejeon	9	657
Ulsan	-	2,027,184
Sejong	16	86
Gyeonggi	6	1,724
Gangwon	11	557
Chungbuk	7	791
Chungnam	10	626
Jeonbuk	12	413
Jeonnam	8	681
Gyeongbuk	2	35,668
Gyeongnam	3	28,859
Jeju	15	108

Sejong

- Total travel volume
  399,839(trip/day)
- Travel volume in the region
  311,777(trip/day)

① Daejeon(32,616)

② Chungbuk(21,694)

③ Chungnam(19,590)

④ Gyeonggi(4,880)

⑤ Seoul(4,557)

City/Province	Ranking	Trip attraction (trip/day)
Seoul	5	4,557
Busan	14	241
Daegu	10	355
Incheon	8	626
Gwangju	12	328
Daejeon	1	32,616
Ulsan	15	73
Sejong	-	311,777
Gyeonggi	4	4,880
Gangwon	13	327
Chungbuk	2	21,694
Chungnam	3	19,590
Jeonbuk	6	1,345
Jeonnam	11	352
Gyeongbuk	7	693
Gyeongnam	9	367
Jeju	16	18

Gyeonggi

- Total travel volume
  21,548,007(trip/day)
- Travel volume in the region
  19,413,137(trip/day)

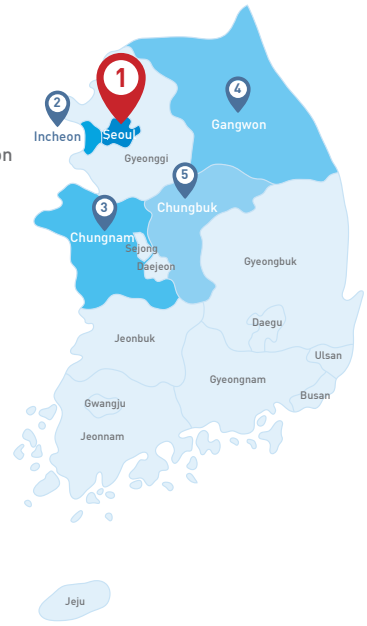
① Seoul(1,514,546)

② Incheon(345,060)

③ Chungnam(88,200)

④ Gangwon(63,535)

⑤ Chungbuk(48,407)



City/Province	Ranking	Trip attraction (trip/day)
Seoul	1	1,514,546
Busan	12	4,877
Daegu	10	5,548
Incheon	2	345,060
Gwangju	14	3,998
Daejeon	6	14,378
Ulsan	16	1,567
Sejong	13	4,521
Gyeonggi	-	19,413,137
Gangwon	4	63,535
Chungbuk	5	48,407
Chungnam	3	88,200
Jeonbuk	8	12,623
Jeonnam	11	5,518
Gyeongbuk	7	14,271
Gyeongnam	9	5,682
Jeju	15	2,139

Gangwon

- Total travel volume
  3,166,875(trip/day)
- Travel volume in the region
  3,023,047(trip/day)

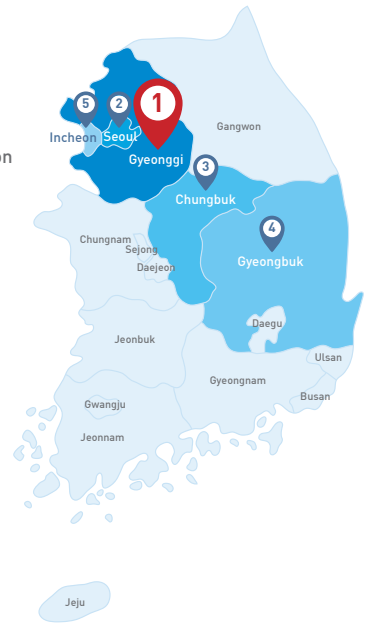
① Gyeonggi(66,367)

② Seoul(36,716)

③ Chungbuk(15,243)

④ Gyeongbuk(9,866)

⑤ Incheon(5,324)



City/Province	Ranking	Trip attraction (trip/day)
Seoul	2	36,716
Busan	9	1,053
Daegu	7	1,785
Incheon	5	5,324
Gwangju	13	325
Daejeon	8	1,754
Ulsan	12	564
Sejong	14	323
Gyeonggi	1	66,367
Gangwon	-	3,023,047
Chungbuk	3	15,243
Chungnam	6	2,325
Jeonbuk	11	763
Jeonnam	15	317
Gyeongbuk	4	9,866
Gyeongnam	10	929
Jeju	16	174

Chungbuk

- Total travel volume
  3,032,977(trip/day)
- Travel volume in the region
  2,822,851(trip/day)

① Gyeonggi(50,542)

② Daejeon(42,089)

③ Seoul(21,577)

④ Chungnam(21,147)

⑤ Sejong(20,913)

City/Province	Ranking	Trip attraction (trip/day)
Seoul	3	21,577
Busan	12	2,027
Daegu	10	3,661
Incheon	9	4,654
Gwangju	15	912
Daejeon	2	42,089
Ulsan	16	862
Sejong	5	20,913
Gyeonggi	1	50,542
Gangwon	7	15,159
Chungbuk	-	2,822,851
Chungnam	4	21,147
Jeonbuk	8	4,708
Jeonnam	14	1,296
Gyeongbuk	6	15,895
Gyeongnam	11	3,005
Jeju	13	1,679

Chungnam

- Total travel volume
  3,948,336(trip/day)
- Travel volume in the region
  3,638,253(trip/day)

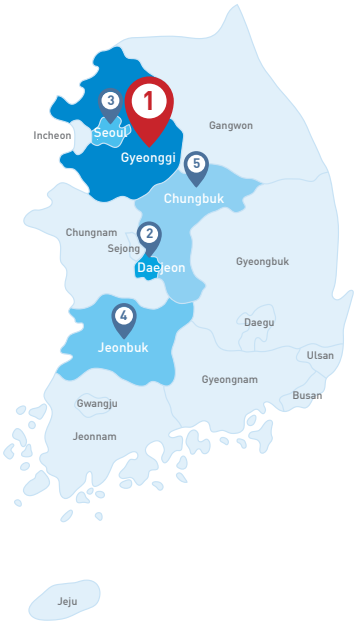
① Gyeonggi(94,722)

② Daejeon(73,216)

③ Seoul(34,801)

④ Jeonbuk(32,084)

⑤ Chungbuk(22,228)



City/Province	Ranking	Trip attraction (trip/day)
Seoul	3	34,801
Busan	14	1,491
Daegu	13	2,060
Incheon	7	11,378
Gwangju	11	3,103
Daejeon	2	73,216
Ulsan	15	627
Sejong	6	19,344
Gyeonggi	1	94,722
Gangwon	12	2,233
Chungbuk	5	22,228
Chungnam	-	3,638,253
Jeonbuk	4	32,084
Jeonnam	8	5,028
Gyeongbuk	9	4,367
Gyeongnam	10	3,274
Jeju	16	127

Jeonbuk

· Total travel volume
3,516,195(trip/day)
· Travel volume in the region
3,387,581(trip/day)

① Chungnam(30,688)

② Jeonnam(22,152)

③ Gwangju(17,337)

④ Gyeonggi(13,218)

⑤ Daejeon(11,384)

City/Province	Ranking	Trip attraction (trip/day)
Seoul	6	10,978
Busan	12	1,688
Daegu	11	2,007
Incheon	9	2,524
Gwangju	3	17,337
Daejeon	5	11,384
Ulsan	15	439
Sejong	13	1,276
Gyeonggi	4	13,218
Gangwon	14	750
Chungbuk	8	4,722
Chungnam	1	30,688
Jeonbuk	-	3,387,581
Jeonnam	2	22,152
Gyeongbuk	10	2,114
Gyeongnam	7	6,998
Jeju	16	339

Jeonnam

· Total travel volume
3,074,628(trip/day)
· Travel volume in the region
2,860,708(trip/day)

① Gwangju(144,997)

② Jeonbuk(22,647)

③ Gyeongnam(15,346)

④ Gyeonggi(5,931)

⑤ Seoul(5,812)

City/Province	Ranking	Trip attraction (trip/day)
Seoul	5	5,812
Busan	7	3,834
Daegu	10	1,673
Incheon	13	1,193
Gwangju	1	144,997
Daejeon	8	2,103
Ulsan	14	774
Sejong	15	351
Gyeonggi	4	5,931
Gangwon	16	334
Chungbuk	12	1,286
Chungnam	6	4,216
Jeonbuk	2	22,647
Jeonnam	-	2,860,708
Gyeongbuk	11	1,544
Gyeongnam	3	15,346
Jeju	9	1,879

Gyeongbuk

- Total travel volume
5,011,453(trip/day)
- Travel volume in the region
4,617,668(trip/day)

① Daegu(244,909)

② Ulsan(37,967)

③ Busan(21,592)

④ Gyeongnam(21,431)

⑤ Chungbuk(15,746)

City/Province	Ranking	Trip attraction (trip/day)
Seoul	7	10,959
Busan	3	21,592
Daegu	1	244,909
Incheon	11	2,058
Gwangju	14	753
Daejeon	9	5,277
Ulsan	2	37,967
Sejong	15	689
Gyeonggi	6	14,895
Gangwon	8	9,718
Chungbuk	5	15,746
Chungnam	10	4,225
Jeonbuk	12	2,001
Jeonnam	13	1,447
Gyeongbuk	-	4,617,668
Gyeongnam	4	21,431
Jeju	16	118

Gyeongnam

- Total travel volume
5,855,090(trip/day)
- Travel volume in the region
5,514,408(trip/day)

① Busan(218,493)

② Ulsan(27,324)

③ Daegu(25,269)

④ Gyeongbuk(21,040)

⑤ Jeonnam(15,370)

City/Province	Ranking	Trip attraction (trip/day)
Seoul	7	6,266
Busan	1	218,493
Daegu	3	25,269
Incheon	13	968
Gwangju	12	2,370
Daejeon	9	3,206
Ulsan	2	27,324
Sejong	15	365
Gyeonggi	8	5,901
Gangwon	14	870
Chungbuk	11	2,810
Chungnam	10	3,038
Jeonbuk	6	7,085
Jeonnam	5	15,370
Gyeongbuk	4	21,040
Gyeongnam	-	5,514,408
Jeju	16	307

Jeju

- Total travel volume
  1,685,859(trip/day)
- Travel volume in the region
  1,664,241(trip/day)

① Seoul(6,537)

② Gyeonggi(3,962)

③ Busan(1,920)

④ Jeonnam(1,833)

⑤ Daegu(1,097)

City/Province	Ranking	Trip attraction (trip/day)
Seoul	1	6,537
Busan	3	1,920
Daegu	5	1,097
Incheon	6	1,096
Gwangju	9	846
Daejeon	13	387
Ulsan	14	342
Sejong	16	76
Gyeonggi	2	3,962
Gangwon	15	263
Chungbuk	8	913
Chungnam	12	395
Jeonbuk	11	498
Jeonnam	4	1,833
Gyeongbuk	10	516
Gyeongnam	7	937
Jeju	-	1,664,241

Analysis conditions

– Calculation of the daily average arrival by dividing the total arrival traffic volume of each region by the total number of analyzed days (388 days) after collecting arrival traffic volume in 17 cities and provinces.

- Gender: Male, Female
- Age: All ages recorded in the data
- Departing trip types: All Trip types
- Arrival trip types: All trip types
- Departure time: 24 hours
- Arrival time: 2 4 hours
- Temporal range: about 13 months (From March 7, 2016 to March 31, 2017)
- Spatial coverage: Nationwide (Analysis units: city and province)

Regional traffic differences during the commute ?

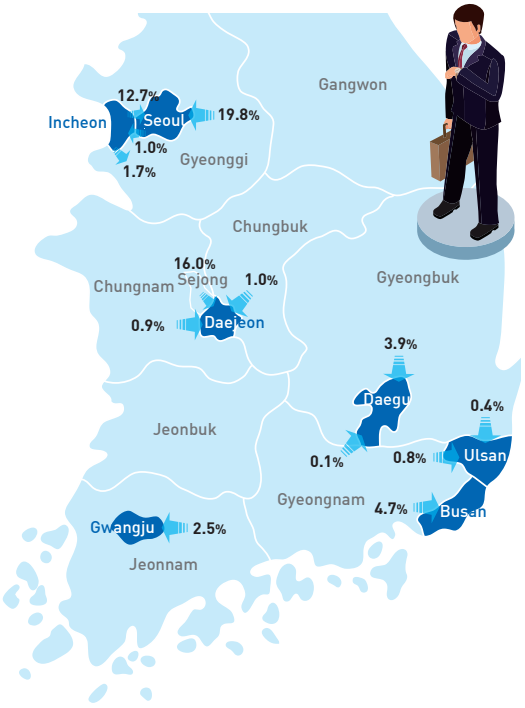
• Which is the (economically) most favored metropolitan city by the surrounding areas?

Seoul city shows the highest dependence on economic activity

Othercities and metropolitan cities are estimated to have less than 5% dependence on economic activity in the surrounding area, but Seoul metropolitan city shows more than 10%.

· Up to 19.8% of people living in Gyeonggi area, and 12.7% of people living in Incheon City travel to their workplaces in Seoul.

Dependence on economic activity in the surrounding areas of seven metropolitan cities (%)



Special/ Metropolitan cities (Destination)	Surrounding ares (Origin)	Total volumes of commuter traffic	Volume of commuter traffic in special/ metropolitan cities	Proportion
Seoul	Gyeonggi	273,539,405	54,165,961	19.8%
	Incheon	61,041,689	7,755,636	12.7%
Busan	Gyeongnam	65,357,249	3,052,527	4.7%
Daegu	Gyeongbuk	50,496,518	1,989,178	3.9%
	Gyeongnam	65,357,249	57,249	0.1%
Incheon	Gyeonggi	273,539,405	4,529,725	1.7%
	Seoul	246,870,471	2,386,223	1.0%
Gwangju	Jeonnam	28,801,351	728,318	2.5%
Daejeon	Sejong	5,239,343	839,763	16.0%
	Chungbuk	33,852,760	332,942	1.0%
	Chungnam	42,490,244	396,476	0.9%
Ulsan	Gyeongnam	65,357,249	510,287	0.8%
	Gyeongbuk	50,496,518	179,984	0.4%

Analysis conditions

– Calculation of the ratio of the number of departure from metropolitan cities to the number of arrivals in metropolitan cities
- Gyeonggi(N) → Seoul(D), Gyeongnam(N) → Busan(D), Gyeongbuk(N) → Daegu(D), Gyeonggi(N) → Incheon(D), Jeonnam(N) → Gwangju(D), Sejong(N) → Daejeon(D), Gyeongnam(N) → Ulsan(D)

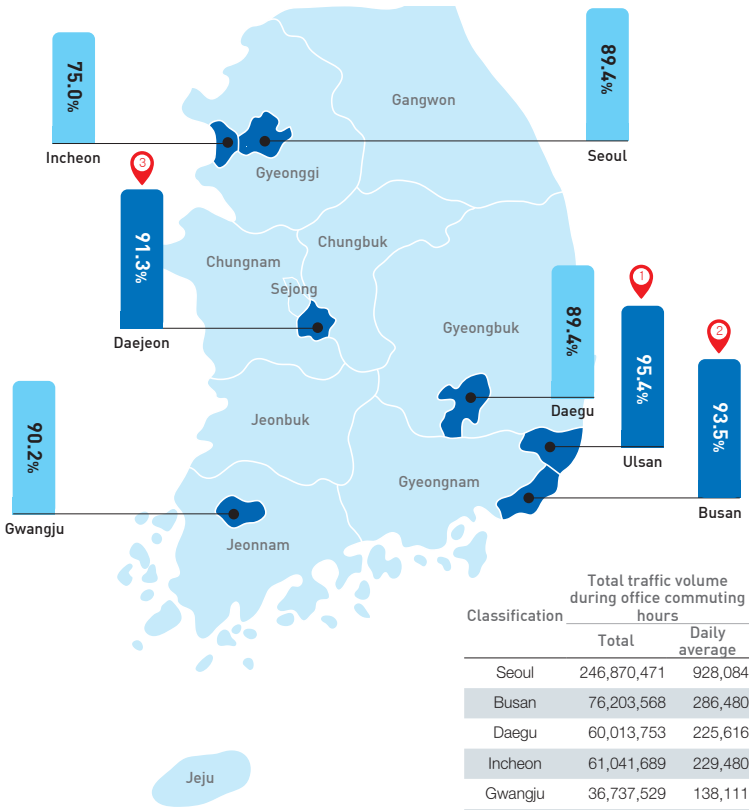
- Gender: Male, Female
- Age: All ages recorded in the data
- Departing trip types: Nighttime Stay Area (N)
- Arrival trip types: Daytime Stay Area (D)
- Departure time: 6 a.m.~9 a.m.
- Arrival time: 7 a.m.~10 a.m.
- Temporal range: About 13 months (From March 7, 2016 to March 31, 2017)
  -Excluding weekends and holidays (266 days in total)
- Spatial coverage: Nationwide (analysis units: city and province)
  -Origin: Cities and Provinces (17)
  -Destination: Metropolitan Cities (7)

• Which metropolitan cities have the highest self-coverage rate of economic activities?

Ulsan Metropolitan city (95.4%)

Ulsan, Busan, and Daejeon have the highest self-coverage rate in

Self-coverage rate of economic activities in seven metropolitan cities (%)



Classification	Total traffic volume during office commuting hours		Traffic volume during office commuting hours in the area		Percentage
	Total	Daily average	Total	Daily average	
Seoul	246,870,471	928,084	220,611,262	829,366	89.4%
Busan	76,203,568	286,480	71,274,917	267,951	93.5%
Daegu	60,013,753	225,616	53,630,765	201,619	89.4%
Incheon	61,041,689	229,480	45,810,062	172,218	75.0%
Gwangju	36,737,529	138,111	33,144,663	124,604	90.2%
Daejeon	38,953,038	146,440	35,582,707	133,770	91.3%
Ulsan	22,377,609	84,126	21,342,521	80,235	95.4%

Analysis conditions

– Calculation of the ratio of the traffic volume in the area regarding the volume of commuting traffic in metropolitan cities
- Seoul(N) → Seoul(D), Busan(N) → Busan(D), Daegu(N) → Daegu(D), Incheon(N) → Incheon(D), Gwangju(N) → Gwangju(D), Daejeon(N) → Daejeon(D), Ulsan(N) → Ulsan(D)

- Gender: Male, Female
- Age: All ages recorded in the data
- Departing trip types: Nighttime Stay Area (N)
- Arrival trip types: Daytime Stay Area (D)
- Departure time: 6 a.m.~9 a.m.
- Arrival time: 7 a.m.~10 a.m.
- Temporal range: About 13 months (From March 7, 2016 to March 31, 2017) -Excluding weekends and holidays (266 days in total)
- Spatial coverage: Nationwide (analysis unit: city)

• Which city has the largest number of people working in other areas?

Gyeonggi (77.8%) Incheon (75.0%) Sejong (65.7%)

In other areas, the percentage of people who work in the area is more than 80%.

Seoul

· Average daily traffic volume of Seoul
928,084(trip/day)
- Comprising 4.6% of Seoul total traffic volume

· Local traffic volume
829,366(trip/day)
- Comprising 89.4% of total commuting traffic volume

① Gyeonggi(88,098)

② Incheon(8,971)

③ Chungnam(493)

City/ Province	Ranking	Trip attraction (trip/day)
Seoul	-	829,366
Busan	11	4
Daegu	10	6
Incheon	**2**	**8,971**
Gwangju	13	3
Daejeon	7	81
Ulsan	14	2
Sejong	6	181
Gyeonggi	**1**	**88,098**
Gangwon	4	425
Chungbuk	5	419
Chungnam	**3**	**493**
Jeonbuk	9	13
Jeonnam	12	3
Gyeongbuk	8	14
Gyeongnam	15	2
Jeju	16	1

Busan

· Average daily traffic volume of Busan
286,480(trip/day)
- Comprising 4.3% of Busan total traffic volume

· Local traffic volume
267,951(trip/day)
- Comprising 93.5% of total commuting traffic volume

① Gyeongnam(14,997)

② Ulsan(3,347)

③ Gyeongbuk(136)

City/ Province	Ranking	Trip attraction (trip/day)
Seoul	5	3
Busan	-	267,951
Daegu	4	38
Incheon	13	0
Gwangju	14	0
Daejeon	6	2
Ulsan	**2**	**3,347**
Sejong	15	0
Gyeonggi	10	1
Gangwon	16	0
Chungbuk	9	1
Chungnam	8	1
Jeonbuk	12	0
Jeonnam	7	2
Gyeongbuk	**3**	**136**
Gyeongnam	**1**	**14,997**
Jeju	11	0

Daegu

- Average daily traffic volume of Daegu
  225,616(trip/day)
  - Comprising 4.5% of Daegu total traffic volume
- Local traffic volume
  201.619(trip/day)
  - Comprising 89.4% of total commuting traffic volume

① Gyeongbuk(22,761)

② Gyeongnam(1,041)

③ Busan(62)

City/ Province	Ranking	Trip attraction (trip/day)
Seoul	8	6
Busan	3	62
Daegu	-	201,619
Incheon	15	0
Gwangju	14	1
Daejeon	5	26
Ulsan	4	57
Sejong	11	2
Gyeonggi	9	4
Gangwon	12	2
Chungbuk	6	24
Chungnam	7	7
Jeonbuk	10	3
Jeonnam	13	1
Gyeongbuk	1	22,761
Gyeongnam	2	1,041
Jeju	16	0

Incheon

- Average daily traffic volume of Incheon
  229,480(trip/day)
  - Comprising 4.8% of Incheon total traffic volume
- Local traffic volume
  172.218(trip/day)
  - Comprising 75.0% of total commuting traffic volume

① Seoul(29,157)

② Gyeonggi(27,939)

③ Chungnam(114)

City/ Province	Ranking	Trip attraction (trip/day)
Seoul	1	29,157
Busan	11	0
Daegu	10	1
Incheon	-	172,218
Gwangju	12	0
Daejeon	5	8
Ulsan	14	0
Sejong	6	7
Gyeonggi	2	27,939
Gangwon	7	7
Chungbuk	4	26
Chungnam	3	114
Jeonbuk	9	1
Jeonnam	13	0
Gyeongbuk	8	1
Gyeongnam	16	0
Jeju	15	0

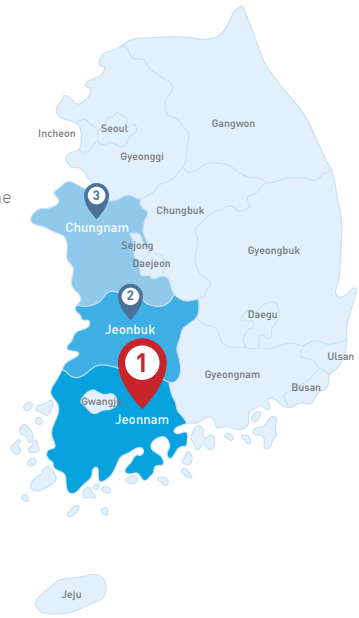
Gwangju

- Average daily traffic volume of Gwangju
  138,111(trip/day)
  - Comprising 4.3% of Gwangju total traffic volume
- Local traffic volume
  124.604(trip/day)
  - Comprising 90.2% of total commuting traffic volume

① Jeonnam(12,819)

② Jeonbuk(656)

③ Chungnam(9)



City/ Province	Ranking	Trip attraction (trip/day)
Seoul	6	3
Busan	13	0
Daegu	11	1
Incheon	12	0
Gwangju	-	124,604
Daejeon	4	6
Ulsan	14	0
Sejong	9	2
Gyeonggi	7	3
Gangwon	14	0
Chungbuk	8	2
Chungnam	3	9
Jeonbuk	2	656
Jeonnam	1	12,819
Gyeongbuk	10	1
Gyeongnam	5	5
Jeju	16	0

Daejeon

- Average daily traffic volume of Daejeon
  146,440(trip/day)
  - Comprising 4.4% of Daejeon total traffic volume
- Local traffic volume
  133.770(trip/day)
  - Comprising 91.3% of total commuting traffic volume

① Chungnam(5,901)

② Chungbuk(3,136)

③ Sejong(2,941)

City/ Province	Ranking	Trip attraction (trip/day)
Seoul	5	134
Busan	12	3
Daegu	8	15
Incheon	10	4
Gwangju	14	3
Daejeon	-	133,770
Ulsan	15	2
Sejong	3	2,941
Gyeonggi	7	114
Gangwon	13	3
Chungbuk	2	3,136
Chungnam	1	5,901
Jeonbuk	4	274
Jeonnam	11	3
Gyeongbuk	6	130
Gyeongnam	9	7
Jeju	16	0

Ulsan

- Average daily traffic volume of Ulsan
  84,126(trip/day)
  - Comprising 3.9% of Ulsan total traffic volume
- Local traffic volume
  80.235(trip/day)
  - Comprising 95.4% of total commuting traffic volume

① Gyeongbuk(2,509)

② Busan(723)

③ Gyeongnam(642)

City/ Province	Ranking	Trip attraction (trip/day)
Seoul	6	1
Busan	2	723
Daegu	4	13
Incheon	14	0
Gwangju	14	0
Daejeon	5	1
Ulsan	-	80,235
Sejong	13	0
Gyeonggi	8	0
Gangwon	11	0
Chungbuk	8	0
Chungnam	10	0
Jeonbuk	12	0
Jeonnam	7	1
Gyeongbuk	1	2,509
Gyeongnam	3	642
Jeju	16	0

Sejong

- Average daily traffic volume of Sejong
  19,697(trip/day)
  - Comprising 4.9% of Sejong total traffic volume
- Local traffic volume
  12.934(trip/day)
  - Comprising 65.7% of total commuting traffic volume

① Daejeon(3,157)

② Chungbuk(1,818)

③ Chungnam(1,572)

City/ Province	Ranking	Trip attraction (trip/day)
Seoul	4	85
Busan	15	0
Daegu	8	2
Incheon	9	2
Gwangju	10	1
Daejeon	1	3,157
Ulsan	14	0
Sejong	-	12,934
Gyeonggi	5	80
Gangwon	13	0
Chungbuk	2	1,818
Chungnam	3	1,572
Jeonbuk	6	25
Jeonnam	11	1
Gyeongbuk	7	17
Gyeongnam	12	1
Jeju	16	0

Gyeonggi

- Average daily traffic volume of Gyeonggi
  1,028,344(trip/day)
  - Comprising 4.8% of Gyeonggi total traffic volume
- Local traffic volume
  800.495(trip/day)
  - Comprising 77.8% of total commuting traffic volume

① Seoul(203,631)

② Incheon(17,029)

③ Chungnam(4,583)

City/ Province	Ranking	Trip attraction (trip/day)
Seoul	1	203,631
Busan	13	2
Daegu	10	4
Incheon	2	17,029
Gwangju	11	3
Daejeon	7	116
Ulsan	15	1
Sejong	6	215
Gyeonggi	-	800,495
Gangwon	5	864
Chungbuk	4	1,359
Chungnam	3	4,583
Jeonbuk	9	15
Jeonnam	12	3
Gyeongbuk	8	20
Gyeongnam	14	2
Jeju	16	1

Gangwon

- Average daily traffic volume of Gangwon
  114,311(trip/day)
  - Comprising 3.6% of Gangwon total traffic volume
- Local traffic volume
  112.599(trip/day)
  - Comprising 98.5% of total commuting traffic volume

① Gyeonggi(992)

② Chungbuk(313)

③ Seoul(237)

City/ Province	Ranking	Trip attraction (trip/day)
Seoul	3	237
Busan	12	0
Daegu	9	1
Incheon	6	3
Gwangju	15	0
Daejeon	7	1
Ulsan	14	0
Sejong	8	1
Gyeonggi	1	992
Gangwon	-	112599
Chungbuk	2	313
Chungnam	5	5
Jeonbuk	10	0
Jeonnam	11	0
Gyeongbuk	4	159
Gyeongnam	12	0
Jeju	15	0

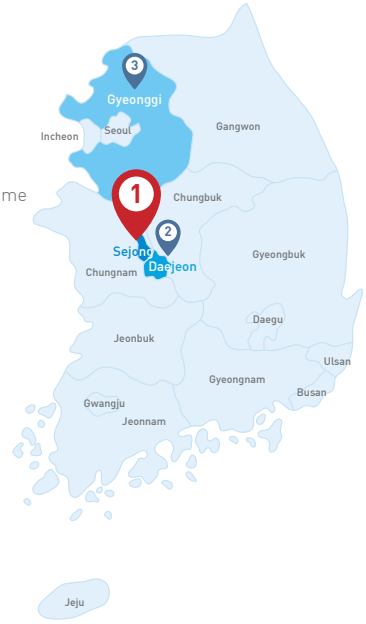
Chungbuk

- Average daily traffic volume of Chungbuk
  127,266(trip/day)
  - Comprising 4.2% of Chungbuk total traffic volume
- Local traffic volume
  121.921(trip/day)
  - Comprising 95.8% of total commuting traffic volume

① Sejong(1,671)

② Daejeon(1,252)

③ Gyeonggi(882)



City/ Province	Ranking	Trip attraction (trip/day)
Seoul	7	143
Busan	14	1
Daegu	9	9
Incheon	10	4
Gwangju	12	1
Daejeon	**2**	**1,252**
Ulsan	15	0
Sejong	**1**	**1,671**
Gyeonggi	**3**	**882**
Gangwon	5	372
Chungbuk	-	121,921
Chungnam	4	807
Jeonbuk	8	48
Jeonnam	13	1
Gyeongbuk	6	153
Gyeongnam	11	1
Jeju	16	0

Chungnam

- Average daily traffic volume of Chungnam
  159,738(trip/day)
  - Comprising 4.0% of Chungnam total traffic volume
- Local traffic volume
  152,978(trip/day)
  - Comprising 95.8% of total commuting traffic volume

① Gyeonggi(2,611)

② Daejeon(1,491)

③ Sejong(1,030)

City/ Province	Ranking	Trip attraction (trip/day)
Seoul	4	555
Busan	14	1
Daegu	9	2
Incheon	7	20
Gwangju	13	1
Daejeon	**2**	**1,491**
Ulsan	15	1
Sejong	**3**	**1,030**
Gyeonggi	**1**	**2,611**
Gangwon	10	2
Chungbuk	5	543
Chungnam	-	152,978
Jeonbuk	6	494
Jeonnam	11	1
Gyeongbuk	8	7
Gyeongnam	12	1
Jeju	16	0

Jeonbuk

- Average daily traffic volume of Jeonbuk
  132,477(trip/day)
  - Comprising 3.8% of Jeonbuk total traffic volume
- Local traffic volume
  130,779(trip/day)
  - Comprising 98.7% of total commuting traffic volume

① Chungnam(1,118)

② Jeonnam(279)

③ Gwangju(113)

City/ Province	Ranking	Trip attraction (trip/day)
Seoul	9	7
Busan	13	0
Daegu	12	1
Incheon	11	1
Gwangju	3	113
Daejeon	4	74
Ulsan	15	0
Sejong	7	18
Gyeonggi	8	11
Gangwon	14	0
Chungbuk	6	29
Chungnam	1	1,118
Jeonbuk	-	130,779
Jeonnam	2	279
Gyeongbuk	10	2
Gyeongnam	5	46
Jeju	16	0

Jeonnam

- Average daily traffic volume of Jeonnam
  108,276(trip/day)
  - Comprising 3.5% of Jeonnam total traffic volume
- Local traffic volume
  104,982(trip/day)
  - Comprising 97.0% of total commuting traffic volume

① Gwangju(2,738)

② Gyeongnam(341)

③ Jeonbuk(204)

City/ Province	Ranking	Trip attraction (trip/day)
Seoul	9	1
Busan	7	1
Daegu	13	0
Incheon	15	0
Gwangju	1	2,738
Daejeon	6	2
Ulsan	14	0
Sejong	12	0
Gyeonggi	8	1
Gangwon	16	0
Chungbuk	11	1
Chungnam	5	2
Jeonbuk	3	204
Jeonnam	-	104,982
Gyeongbuk	10	1
Gyeongnam	2	341
Jeju	4	3

Gyeongbuk

- Average daily traffic volume of Gyeongbuk
  189,837(trip/day)
  - Comprising 3.8% of Gyeongbuk total traffic volume
- Local traffic volume
  181,200(trip/day)
  - Comprising 95.5% of total commuting traffic volume

① Daegu(7,478)

② Ulsan(677)

③ Gyeongnam(173)

City/ Province	Ranking	Trip attraction (trip/day)
Seoul	10	5
Busan	6	42
Daegu	**1**	**7,478**
Incheon	14	0
Gwangju	15	0
Daejeon	7	13
Ulsan	**2**	**677**
Sejong	12	2
Gyeonggi	8	6
Gangwon	5	82
Chungbuk	4	150
Chungnam	9	5
Jeonbuk	11	3
Jeonnam	13	1
Gyeongbuk	-	181,200
Gyeongnam	**3**	**173**
Jeju	16	0

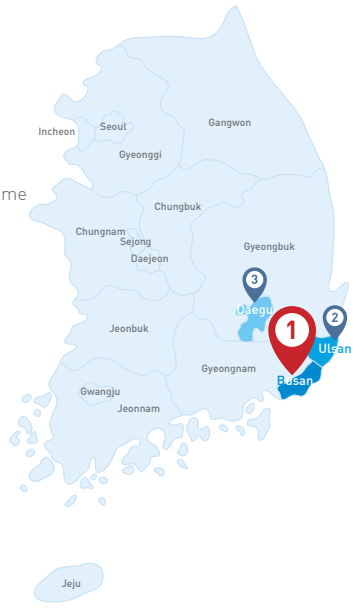
Gyeongnam

- Average daily traffic volume of Gyeongnam
  245,704(trip/day)
  - Comprising 4.2% of Gyeongnam total traffic volume
- Local traffic volume
  231,721(trip/day)
  - Comprising 94.3% of total commuting traffic volume

① Busan(11,476)

② Ulsan(1,918)

③ Daegu(215)



City/ Province	Ranking	Trip attraction (trip/day)
Seoul	12	1
Busan	**1**	**11,476**
Daegu	**3**	**215**
Incheon	16	0
Gwangju	10	1
Daejeon	8	2
Ulsan	**2**	**1,918**
Sejong	14	0
Gyeonggi	10	1
Gangwon	13	0
Chungbuk	9	2
Chungnam	7	3
Jeonbuk	6	38
Jeonnam	5	140
Gyeongbuk	4	184
Gyeongnam	-	231,721
Jeju	15	0

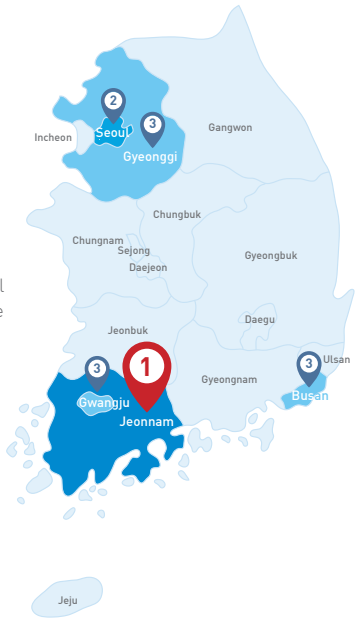
Jeju

- Average daily traffic volume of Jeju
  54,685(trip/day)
  - Comprising 3.2% of Jeju total traffic volume
- Local traffic volume
  54,676(trip/day)
  - Comprising 99.9% of total commuting traffic volume

① Jeonnam(3)

② Seoul(2)

③ Gyeonggi, Gwangju, Busan(1)



City/ Province	Ranking	Trip attraction (trip/day)
Seoul	2	2
Busan	5	1
Daegu	6	1
Incheon	8	0
Gwangju	4	1
Daejeon	10	0
Ulsan	15	0
Sejong	14	0
Gyeonggi	3	1
Gangwon	16	0
Chungbuk	7	0
Chungnam	8	0
Jeonbuk	13	0
Jeonnam	1	3
Gyeongbuk	11	0
Gyeongnam	11	0
Jeju	-	54,676

Analysis conditions

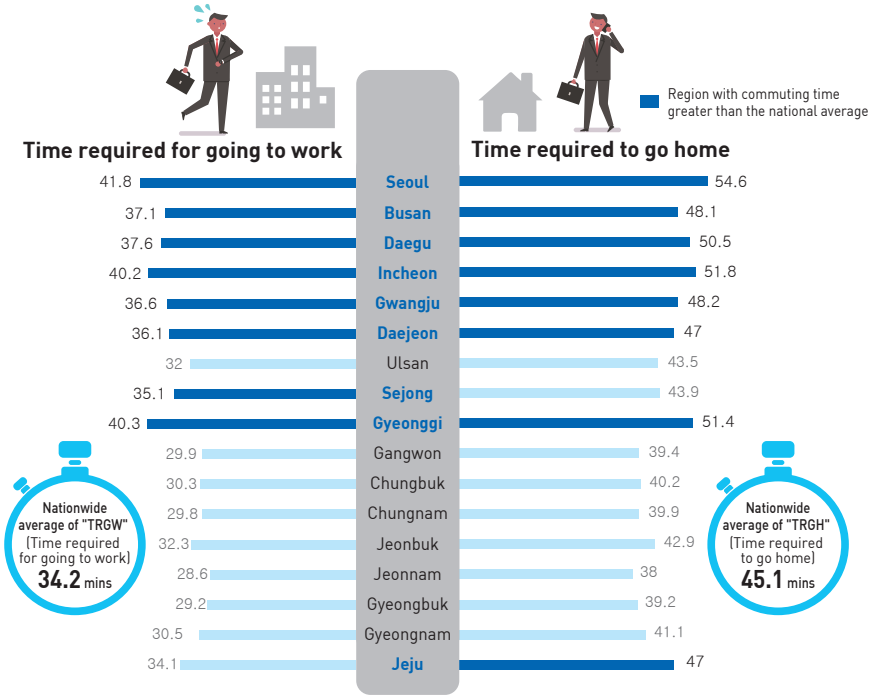
– Analysis of traffic distribution during workplace commuting hours between the cities and provinces
  - Rankings from 1st to 3rd in descending order of daily average arrival traffic volume

- Gender: Male, Female
- Age: All ages recorded in the data
- Departing trip types: Nighttime Stay Area (N)
- Arrival trip types: Daytime Stay Area (D)
- Departure time: 6 a.m.~9 a.m.
- Arrival time: 7 a.m.~10 a.m.
- Temporal range: About 13 months (from March 7, 2016 to March 31, 2017)
  - Excluding weekends and holidays (266 days in total)
- Spatial coverage: Nationwide (analysis units: city and province)

• What is the area with the longest commuting hours?

Based on the administrative district, metropolitan cities(Teuk-byeol, Gwang-yeok, Jachi cities) have longer commuting time than the provinces.

Seoul has the longest commuting time (41.8 minutes on average for work and 54.6 minutes on average from work to home), and travel time is 10 minutes longer than the area with the shortest commuting time.



Analysis conditions

– Extracted the history on commuting times, and calculated the time required for traveling to work and the time required to go home in each city and province
- The time required for commuting means the travel time, so the time was calculated by deducting the departure time from arrival time, plus one minute (for example, upon departing at 06:50 and arriving at 08:56, time required is 536 minutes. 410 minutes + 1 minute = later 'minutes'
- When calculating the average time for each city and province, the time for work was based on the departure (midnight time, Stay Area) and the time for home is based on the destination (midnight time, Stay Area).

Going to work (Gyeonggi area)	Getting off from work (Gyeonggi area)
(124 minutes + 150 minutes + 70 minutes)/ 3 persons = 114.6 minutes	(83 minutes +100 minutes +131 minutes) / 3 persons = 104.6 minutes
- A Customer: From Gyeonggi to Daejeon: 124 minutes - B Customer: From Gyeonggi to Gangwon: 150 minutes - C Customer: From Gyeonggi to Seoul: 70 minutes	- D Customer: From Seoul to Gyeonggi: 83 minutes - E Customer: From Incheon to Gyeonggi: 100 minutes - F Customer: From Gangwon to Gyeonggi: 131 minutes

- Gender: Male, Female
- Age: All ages recorded in the data
- Departing trip types:
  - (Going to work) Nighttime Stay Area (N)
  - (Getting off from work) Daytime Stay Area (D)
- Arrival trip types:
  - (Going to work) Daytime Stay Area (D)
  - (Getting off from work) Nighttime Stay Area (N)
- Departure time:
  - (Going to work) 6 a.m.~9 a.m.
  - (Getting off from work) 4 p.m.~9 p.m.
- Arrival time:
  - (Going to work) 7 a.m.~10 a.m.
  - (Getting off from work) 4 p.m.~11 p.m.
- Temporal range: About 13 months (From March 7, 2016 to March 31, 2017)
  -Excluding weekends and holidays (266 days in total)
- Spatial coverage: Nationwide (analysis units: city and province)

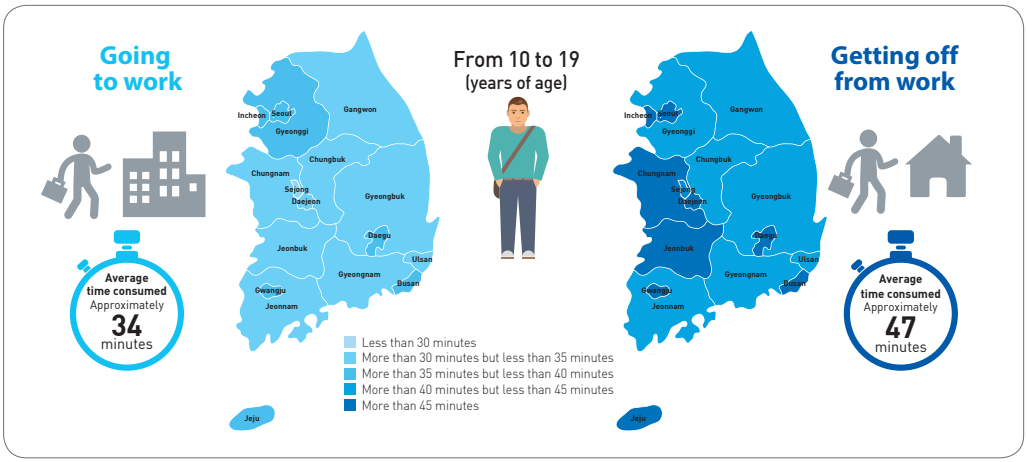
• The commuting time difference by age?

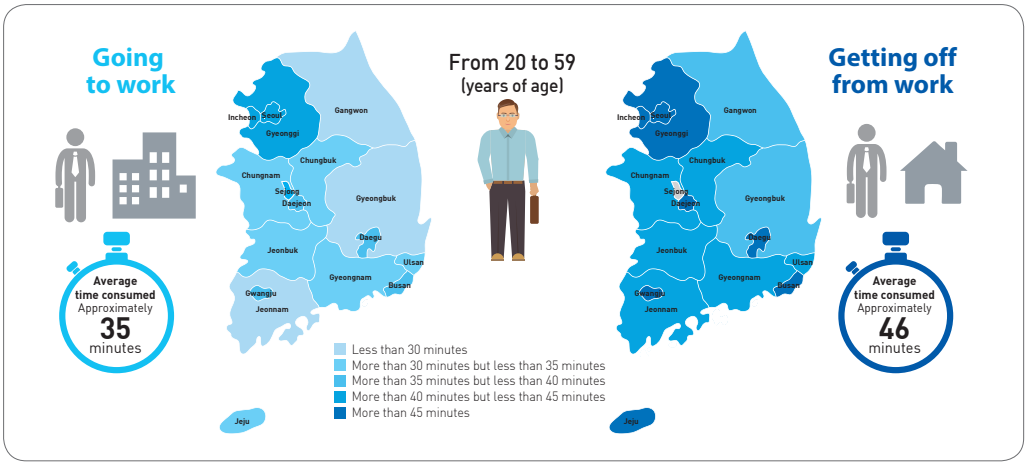
The time required for commuting of the people in their 60s to 70s is about 5 minutes shorter than other age groups.

- From 10 to 20 years of age: Approximately 34 minutes on average for work, approximately 47 minutes on average for home
- From 20 to 60 years of age: Approximately 35 minutes on average for work, approximately 46 minutes on average for home
- Over 60 years of age: Approximately 30 minutes on average for work, approximately 38 minutes on average for home

Unlike other age groups, the economically active population aged 20 to 60 years shows relatively large gaps in time required for commuting between cities and provinces.

- For all ages except those between 20 to 60 years of age, the time required for commuting is similar except for some metropolitan areas such as Seoul and Busan.





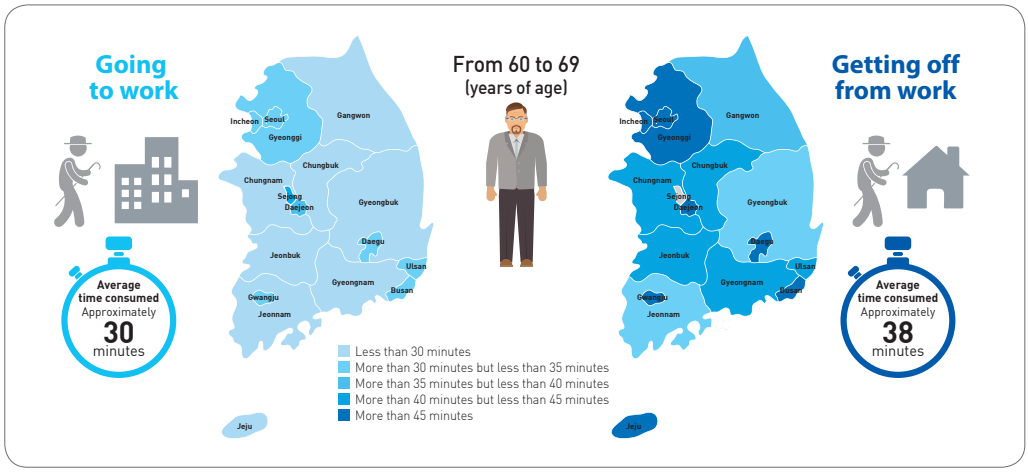


Table 2.1 I **Average Commuting Time by Age**

(Unit: Minute)

Commuting to work	From 10 to 19 years of age	From 20 to 59 years of age	From 60 to 69 years of age
Seoul	35.8	43.7	32.3
Busan	35.2	38.0	32.7
Daegu	37.1	38.1	34.0
Incheon	36.3	41.5	32.6
Gwangju	37.1	37.1	32.5
Daejeon	34.9	36.7	32.1
Ulsan	32.4	32.2	29.7
Sejong	33.6	35.8	28.2
Gyeonggi	36.6	41.5	33.4
Gangwon	33.2	29.9	27.2
Chungbuk	31.8	30.5	27.0
Chungnam	32.5	30.0	25.7
Jeonbuk	34.3	32.5	28.6
Jeonnam	30.5	28.7	26.2
Gyeongbuk	31.9	29.3	25.9
Gyeongnam	30.1	31.0	27.2
Jeju	39.3	34.1	29.5

Leaving office	From 10 to 19 years of age	From 20 to 59 years of age	From 60 to 69 years of age
Seoul	46.6	57.8	41.5
Busan	47.9	49.6	41.1
Daegu	53.1	51.2	44.0
Incheon	48.6	53.8	42.6
Gwangju	48.3	49.4	40.4
Daejeon	49.0	47.8	40.4
Ulsan	44.3	44.1	38.3
Sejong	45.5	44.7	34.3
Gyeonggi	47.5	53.1	43.0
Gangwon	46.2	39.4	34.1
Chungbuk	42.1	40.8	34.3
Chungnam	45.7	40.2	32.7
Jeonbuk	47.1	43.4	36.2
Jeonnam	42.7	38.2	32.4
Gyeongbuk	44.4	39.5	33.2
Gyeongnam	42.4	41.8	34.5
Jeju	59.2	46.8	38.0

Analysis conditions

– Calculated the time required for commuting of each city and province by classifying the traffic in the rush hour into three age groups (from 10 to 19 yrs., from 20 to 59 yrs., and from 60 to 69 yrs.)
- The calculation method of time required for commuting was the same as the above method.

- Gender: Male, Female
- Age: Divided into three age groups
  - 10 to 20 yrs.
  - 20 to 60 yrs.
  - 60 to 70 years
- Departing trip types:
  - (Going to work) Nighttime Stay Area (N)
  - (Getting off from work) Daytime Stay Area (D)
- Arrival trip types:
  - (Going to work) Daytime Stay Area (D)
  - (Getting off from work) Nighttime Stay Area (N)
- Departure time:
  - (Going to work) 6 a.m.~9 a.m.
  - (Getting off from work) 4 p.m.~9 p.m.
- Arrival time:
  - (Going to work) 7 a.m.~10 a.m.
  - (Getting off from work) 4 p.m.~11 p.m.
- Temporal range: About 13 months (From March 7, 2016 to March 31, 2017)
  -Excluding weekends and holidays (266 days in total)
- Spatial coverage: Nationwide (analysis units: city and province)

• Do men and women show differences in commuting time?

Men have a longer commuting time than women, and the gap between the regions is larger than that of women.

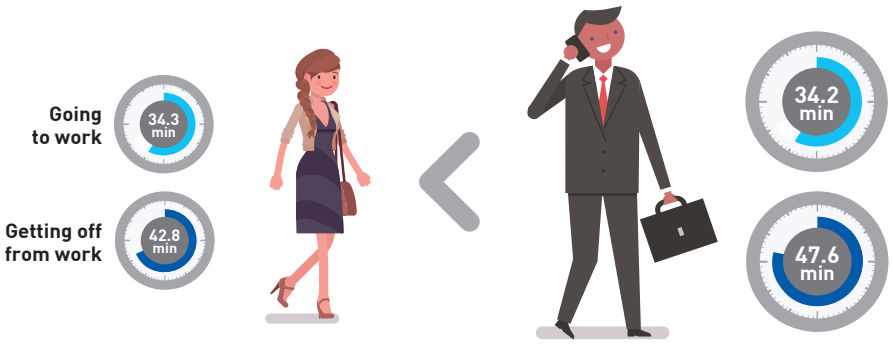


Table 2.2 I **Average Commuting Time by Gender** (Unit: Minute)

Commuting to work	Male	Female
Seoul	43.9	40.0
Busan	38.1	36.1
Daegu	38.2	37.0
Incheon	41.3	39.1
Gwangju	36.6	36.7
Daejeon	36.5	35.7
Ulsan	32.3	31.7
Sejong	35.5	34.6
Gyeonggi	41.3	39.2
Gangwon	28.7	31.4
Chungbuk	29.7	31.0
Chungnam	29.2	30.5
Jeonbuk	31.7	32.9
Jeonnam	28.0	29.3
Gyeongbuk	28.5	30.1
Gyeongnam	30.6	30.5
Jeju	33.5	34.8

Leaving office	Male	Female
Seoul	59.7	50.5
Busan	51.7	45.1
Daegu	54.2	47.2
Incheon	56.2	47.9
Gwangju	50.6	46.0
Daejeon	50.2	44.2
Ulsan	46.7	40.2
Sejong	47.3	40.4
Gyeonggi	55.2	47.9
Gangwon	39.4	39.3
Chungbuk	41.2	39.1
Chungnam	41.2	38.3
Jeonbuk	44.3	41.5
Jeonnam	38.6	37.3
Gyeongbuk	40.3	38.3
Gyeongnam	43.6	38.5
Jeju	48.2	45.9

Analysis conditions

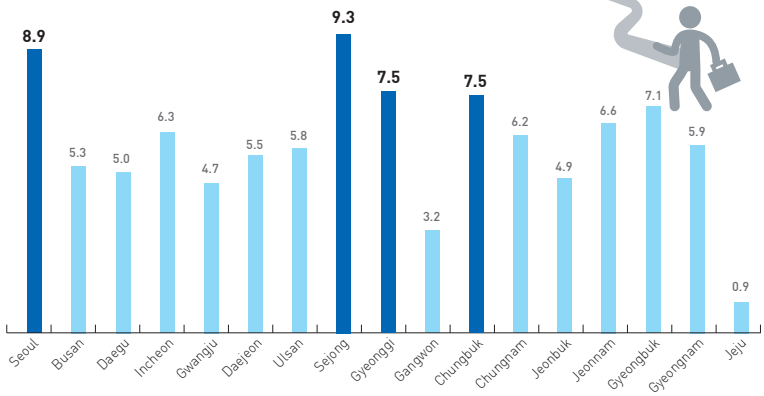
– Classify the traffic during commuting hours by gender and calculate the time required for commuting by city and province
  - The calculation method of time required for commuting was the same as the above method.

- Gender: Classified into male and female
- Age: All ages recorded in the data
- Departing trip types:
  - (Going to work) Nighttime Stay Area (N)
  - (Getting off from work) Daytime Stay Area (D)
- Arrival trip types:
  - (Going to work) Daytime Stay Area (D)
  - (Getting off from work) Nighttime Stay Area (N)
- Departure time:
  - (Going to work) 6 a.m.~9 a.m.
  - (Getting off from work) 4 p.m.~9 p.m.
- Arrival time:
  - (Going to work) 7 a.m.~10 a.m.
  - (Getting off from work) 4 p.m.~11 p.m.
- Temporal range: About 13 months (From March 7, 2016 to March 31, 2017)
  -Excluding weekends and holidays (266 days in total)
- Spatial coverage: Nationwide (analysis units: city and province)

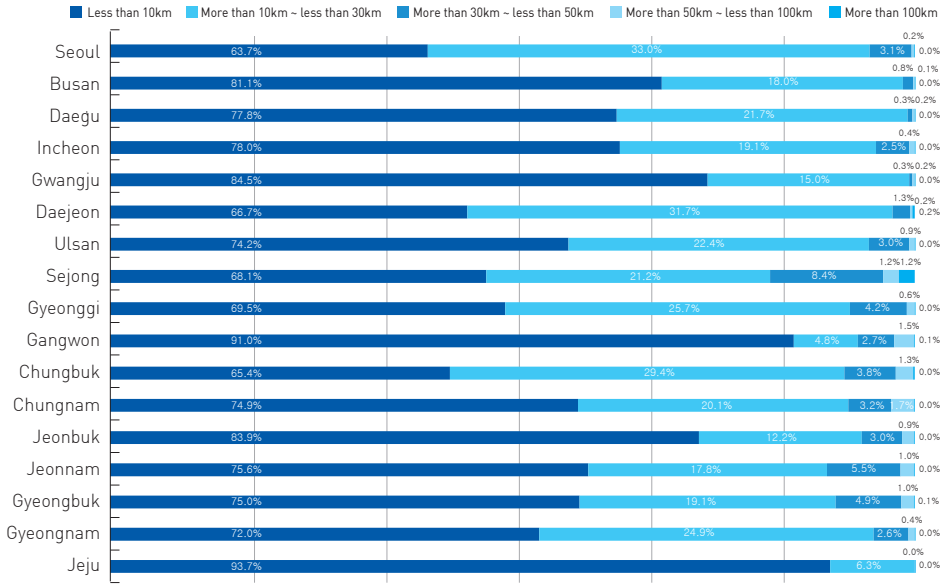
• What is the regional commuting distance?

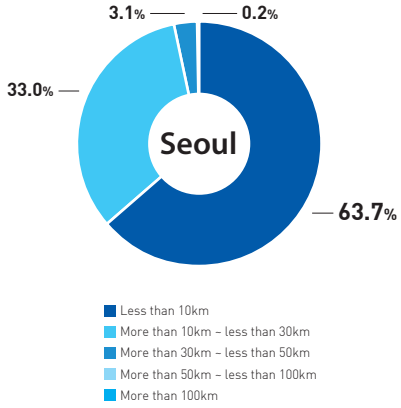
In Seoul, Sejong, Gyeonggi, and Chungbuk areas, where the travel distance to work is long compared to other regions, about 30% of the total passengers travel to areas more than 10 km in length. In Gangwon and Jeju areas, where the travel distance to work is relatively short, more than 90% of total passengers commute to work within 10km.

Average travel distance going for work by region (km)

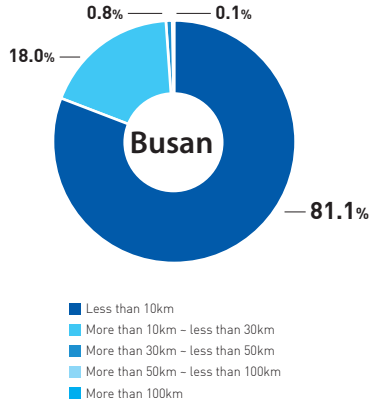


Proportion of travel distance by region

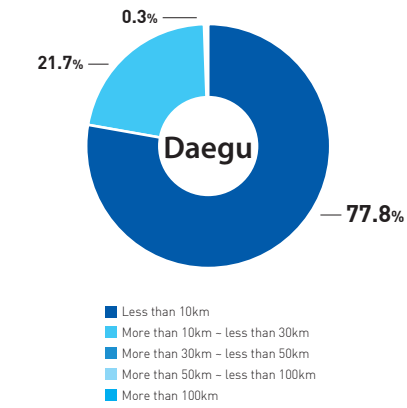




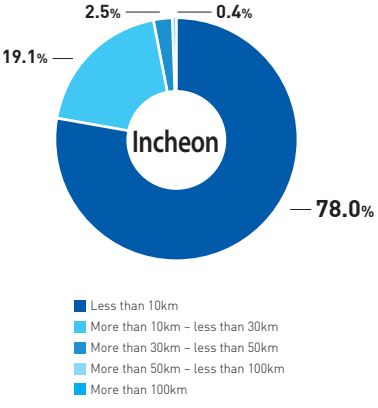
Classification	Total traffic volume	Ratio
Less than 10km	180,164,023	63.7%
More than 10km ~ less than 30km	93,226,275	33.0%
More than 30km ~ less than 50km	8,784,523	3.1%
More than 50km ~ less than 100km	575,184	0.2%
More than 100km	97,275	0.0%



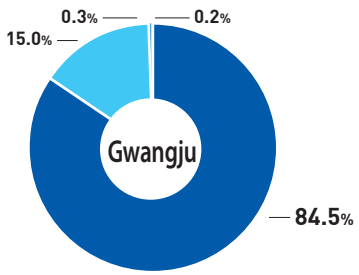
Classification	Total traffic volume	Ratio
Less than 10km	60,490,527	81.1%
More than 10km ~ less than 30km	13,398,973	18.0%
More than 30km ~ less than 50km	564,270	0.8%
More than 50km ~ less than 100km	90,900	0.1%
More than 100km	6,657	0.0%



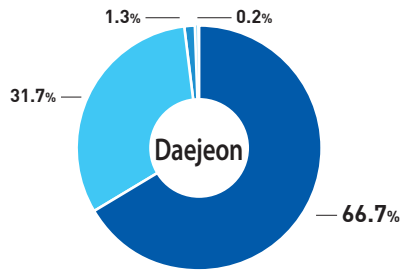
Classification	Total traffic volume	Ratio
Less than 10km	43,340,739	77.8%
More than 10km ~ less than 30km	12,062,376	21.7%
More than 30km ~ less than 50km	193,284	0.3%
More than 50km ~ less than 100km	93,321	0.2%
More than 100km	12,606	0.0%

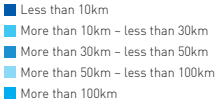


Classification	Total traffic volume	Ratio
Less than 10km	41,144,856	78.0%
More than 10km ~ less than 30km	10,073,994	19.1%
More than 30km ~ less than 50km	1,311,976	2.5%
More than 50km ~ less than 100km	197,093	0.4%
More than 100km	7,733	0.0%

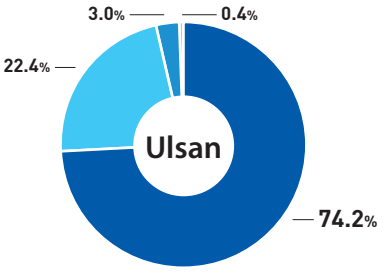


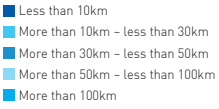
Classification	Total traffic volume	Ratio
Less than 10km	28,663,995	84.5%
More than 10km ~ less than 30km	5,097,917	15.0%
More than 30km ~ less than 50km	85,449	0.3%
More than 50km ~ less than 100km	55,284	0.2%
More than 100km	4,527	0.0%



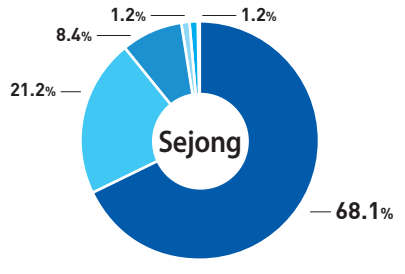


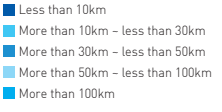
Classification	Total traffic volume	Ratio
Less than 10km	24,822,707	66.7%
More than 10km ~ less than 30km	11,801,464	31.7%
More than 30km ~ less than 50km	485,012	1.3%
More than 50km ~ less than 100km	74,010	0.2%
More than 100km	56,793	0.2%



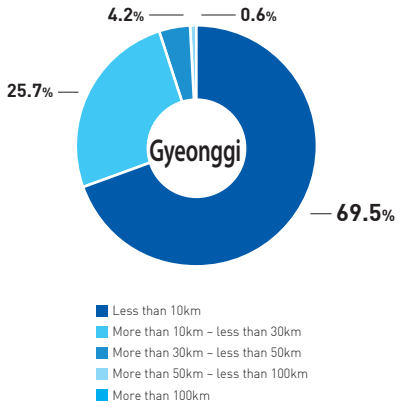


Classification	Total traffic volume	Ratio
Less than 10km	17,018,119	74.2%
More than 10km ~ less than 30km	5,138,264	22.4%
More than 30km ~ less than 50km	691,889	3.0%
More than 50km ~ less than 100km	89,115	0.4%
More than 100km	2,721	0.0%

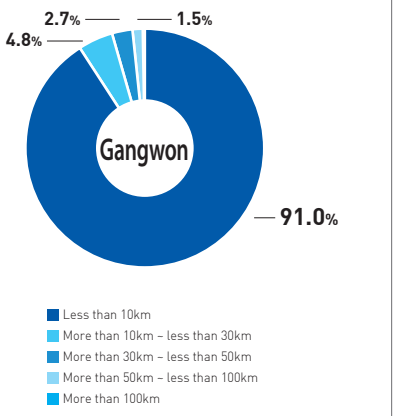




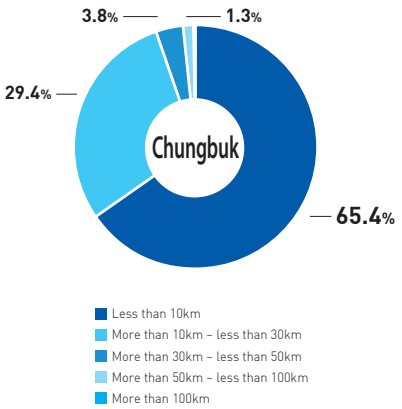
Classification	Total traffic volume	Ratio
Less than 10km	3,440,547	68.1%
More than 10km ~ less than 30km	1,069,450	21.2%
More than 30km ~ less than 50km	425,829	8.4%
More than 50km ~ less than 100km	59,874	1.2%
More than 100km	59,478	1.2%



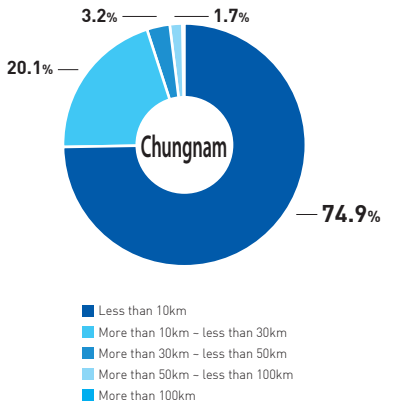
Classification	Total traffic volume	Ratio
Less than 10km	170,246,904	69.5%
More than 10km ~ less than 30km	63,025,133	25.7%
More than 30km ~ less than 50km	10,361,934	4.2%
More than 50km ~ less than 100km	1,382,206	0.6%
More than 100km	33,715	0.0%



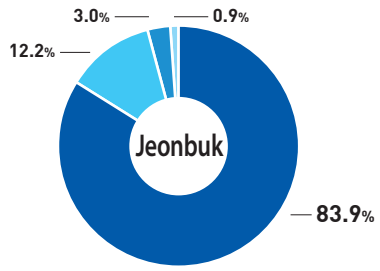
Classification	Total traffic volume	Ratio
Less than 10km	27,676,945	91.0%
More than 10km ~ less than 30km	1,451,200	4.8%
More than 30km ~ less than 50km	830,428	2.7%
More than 50km ~ less than 100km	442,184	1.5%
More than 100km	18,041	0.1%



Classification	Total traffic volume	Ratio
Less than 10km	22,555,345	65.4%
More than 10km ~ less than 30km	10,148,466	29.4%
More than 30km ~ less than 50km	1,310,008	3.8%
More than 50km ~ less than 100km	447,837	1.3%
More than 100km	49,944	0.1%

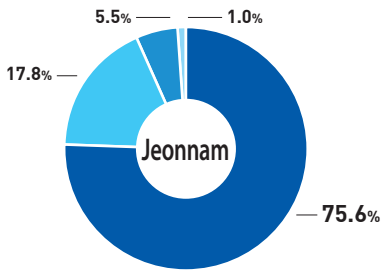


Classification	Total traffic volume	Ratio
Less than 10km	33,378,184	74.9%
More than 10km ~ less than 30km	8,982,378	20.1%
More than 30km ~ less than 50km	1,444,527	3.2%
More than 50km ~ less than 100km	749,702	1.7%
More than 100km	26,579	0.1%



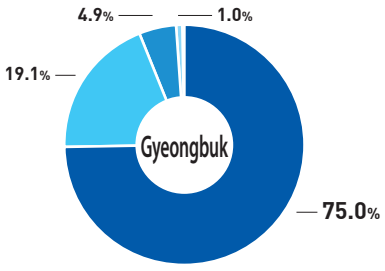
Less than 10km
More than 10km ~ less than 30km
More than 30km ~ less than 50km
More than 50km ~ less than 100km
More than 100km

Classification	Total traffic volume	Ratio
Less than 10km	29,581,991	83.9%
More than 10km ~ less than 30km	4,287,098	12.2%
More than 30km ~ less than 50km	1,053,217	3.0%
More than 50km ~ less than 100km	321,197	0.9%
More than 100km	15,780	0.0%



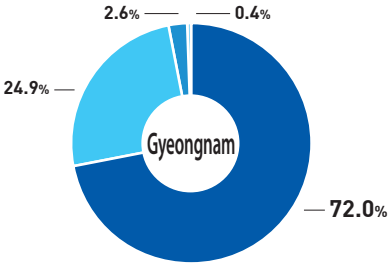
Less than 10km
More than 10km ~ less than 30km
More than 30km ~ less than 50km
More than 50km ~ less than 100km
More than 100km

Classification	Total traffic volume	Ratio
Less than 10km	23,789,942	75.6%
More than 10km ~ less than 30km	5,611,187	17.8%
More than 30km ~ less than 50km	1,719,858	5.5%
More than 50km ~ less than 100km	319,221	1.0%
More than 100km	11,740	0.0%



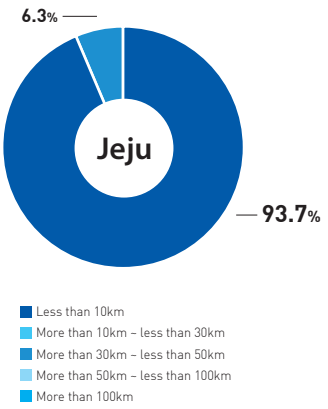
Less than 10km
More than 10km ~ less than 30km
More than 30km ~ less than 50km
More than 50km ~ less than 100km
More than 100km

Classification	Total traffic volume	Ratio
Less than 10km	41,370,437	75.0%
More than 10km ~ less than 30km	10,516,283	19.1%
More than 30km ~ less than 50km	2,684,867	4.9%
More than 50km ~ less than 100km	536,511	1.0%
More than 100km	32,237	0.1%



Less than 10km
More than 10km ~ less than 30km
More than 30km ~ less than 50km
More than 50km ~ less than 100km
More than 100km

Classification	Total traffic volume	Ratio
Less than 10km	47,705,729	72.0%
More than 10km ~ less than 30km	16,481,853	24.9%
More than 30km ~ less than 50km	1,733,070	2.6%
More than 50km ~ less than 100km	297,423	0.4%
More than 100km	10,557	0.0%



Classification	Total traffic volume	Ratio
Less than 10km	13,630,973	93.7%
More than 10km ~ less than 30km	912,963	6.3%
More than 30km ~ less than 50km	0	0.0%
More than 50km ~ less than 100km	494	0.0%
More than 100km	952	0.0%

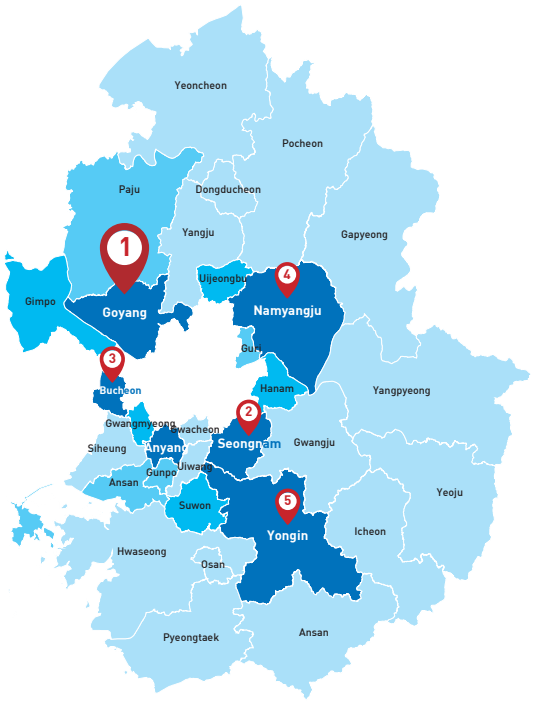
Analysis conditions

– Calculated the distance (the 'Travel distance') between the departure and the destination in the hours of traveling to work, and calculated the average hours by city and province.
  - The average travel distance by city and province was calculated by multiplying the travel distance by the traffic volume, adding together and dividing it by the total traffic volume of the area, and it shall be calculated based on the destination.
– Travel distance shall be divided into 'less than 10km, more than 10km but less than 30km, more than 30km but less than 50km, more than 50km, less than 100km, and more than 100km,' and total traffic volume of each city and province shall be calculated for percentage comparison.

- Gender: Classified into male and female
- Age: All ages recorded in the data
- Departing trip types: Nighttime Stay Area (N)
- Arrival trip types: Daytime Stay Area (D)
- Departure time: 6 a.m.~9 a.m.
- Arrival time: 7 a.m.~10 a.m.
- Temporal range: About 13 months (From March 7, 2016 to March 31, 2017) -Excluding weekends and holidays (266 days in total)
- Spatial coverage: Nationwide (analysis units: city and province)

• What are the top five areas in Gyeonggi-do that have a lot of people commuting to Seoul for work?

Goyang, Seongnam, Bucheon, Namyangju, Yongin



Daily average traffic

- Less than half the average traffic volume (24-3,285)
- More than half the average traffic volume but less than the average traffic volume (3,266-6,569)
- More than average traffic volume but less than twice the average traffic volume (6,570-13,138)
- More than twice the average traffic volume (13,139-25,234)

Table 2.3 I **The Main Departures in Gyeonggi-do** (for the purpose of commuting to work)

Rank	Departure	Total traffic volume	Daily average traffic	Ratio
1	Goyang	6,712,369	25,234	12.39%
2	Seongnam	6,674,881	25,094	12.32%
3	Bucheon	5,438,642	20,446	10.04%
4	Namyangju	4,393,378	16,516	8.11%
5	Yongin	3,937,352	14,802	7.27%
6	Anyang	3,692,398	13,881	6.82%
7	Gwangmyeong	3,354,839	12,612	6.19%
8	Suwon	2,968,768	11,161	5.48%
9	Uijeongbu	2,725,249	10,245	5.03%
10	Hanam	1,935,205	7,275	3.57%
11	Gimpo	1,894,447	7,122	3.50%
12	Guri	1,680,581	6,318	3.10%
13	Gunpo	1,439,948	5,413	2.66%
14	Ansan	1,068,171	4,016	1.97%
15	Paju	932,570	3,506	1.72%
16	Uiwang	800,246	3,008	1.48%
17	Gwangju	799,210	3,005	1.48%
18	Hwaseong	798,111	3,000	1.47%
19	Gwacheon	792,751	2,980	1.46%
20	Siheung	664,783	2,499	1.23%
21	Yangju	603,690	2,270	1.11%
22	Osan	201,600	758	0.37%
23	Dongducheon	166,431	626	0.31%
24	Pyeongtaek	133,884	503	0.25%
25	Yangpyeong	126,852	477	0.23%
26	Pocheon	83,682	315	0.15%
27	Icheon	52,176	196	0.10%
28	Anseong	43,620	164	0.08%
29	Gapyeong	30,252	114	0.06%
30	Yeoju	13,563	51	0.03%
31	Yeoncheon	6,312	24	0.01%

Analysis conditions

– Extracted the history of traffic from the nighttime Stay Area (N) in Gyeonggi area to the daytime Stay Area (D) in Seoul during the morning rush hours (from 6:00 am to 10:00 am), and compiled the traffic volume by classifying the departure of each city

- Gender: Male and female
- Age: All ages recorded in the data
- Departing trip types: Nighttime Stay Area (N)
- Arrival trip types: Daytime Stay Area (D)
- Departure time: 6 a.m.~10 a.m.
- Arrival time: 6 a.m.~10 a.m.
- Temporal range: About 13 months (From March 7, 2016 to March 31, 2017)
  -Excluding weekends and holidays (266 days in total)
- Spatial coverage: (analysis units: city and province)
  - Seoul (Arrival)
  - Gyeonggi (Departure)

• Where is the hardest area to get Mapo-gu (in Seoul)?

Gwangmyeong-si in Gyeonggi-do

The average travel time per km from Gwangmyeong-si in Gyeonggi-do is 6.4 minutes, which is two minutes longer than that of other areas.

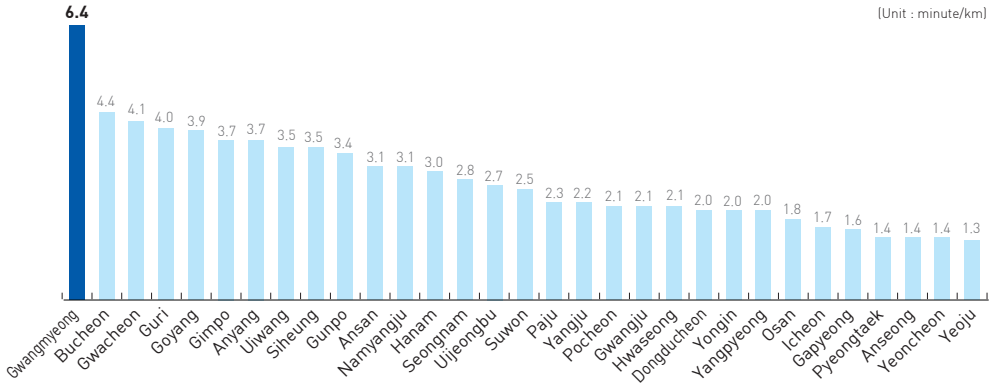


Table 2.4 I **Average Travel Time per km (Seoul 〉 Gyeonggi)**

Ranking	Destination	Average travel time (minute)	Average travel distance (km)	Travel time per km (min/km)
1	Gwangmyeong	79	12.41	6.4
2	Bucheon	82	18.65	4.4
3	Gwacheon	94	22.70	4.1
4	Guri	92	23.27	4.0
5	Goyang	76	19.41	3.9
6	Gimpo	85	22.94	3.7
7	Anyang	90	24.62	3.7
8	Uiwang	105	30.06	3.5
9	Siheung	103	29.38	3.5
10	Gunpo	98	28.59	3.4
11	Ansan	108	34.80	3.1
12	Namyangju	97	31.72	3.1
13	Hanam	103	34.21	3.0
14	Seongnam	99	34.92	2.8
15	Uijeongbu	98	36.67	2.7
16	Suwon	111	43.78	2.5

Ranking	Destination	Average travel time (minute)	Average travel distance (km)	Travel time per km (min/km)
17	Paju	87	38.45	2.3
18	Yangju	101	45.64	2.2
19	Pocheon	128	60.13	2.1
20	Gwangju	105	49.44	2.1
21	Hwaseong	107	50.95	2.1
22	Dongducheon	123	61.07	2.0
23	Yongin	112	55.76	2.0
24	Yangpyeong	125	62.49	2.0
25	Osan	116	63.71	1.8
26	Icheon	118	70.89	1.7
27	Gapyeong	120	75.61	1.6
28	Pyeongtaek	121	85.60	1.4
29	Anseong	131	94.75	1.4
30	Yeoncheon	126	91.01	1.4
31	Yeoju	119	89.02	1.3

Analysis conditions

– Extracted the travel history of the customers who live in Mapo-gu Seoul and travel to Gyeonggi areas from Seoul, and calculated the travel time per km of each city (Goyang, Uijeongbu, Guri, Hanam, Seongnam, Anyang, Gwangmyung, Bucheon, etc.) (Using mobile phone signaling data)
- Data with Stay time of 25 minutes or more were used, and only the data that moved from Seoul to Gyeonggi was extracted
- If the travel time is more than three hours, it is regarded as outliers and excluded.
- The travel time per km is calculated by dividing the average travel time by the average travel distance.

- Gender: Male and female
- Age: All ages recorded in the data
- Departing trip types: All trip types
- Arrival trip types: All trip types
- Departure time: 24 hours
- Arrival time: 2 4 hours
- Temporal range: 8days (From July 19, 2016 to July 26, 2016)
- Spatial coverage: (unit: cell coverage)
  - Seoul (Arrival)
  - Gyeonggi (Departure)

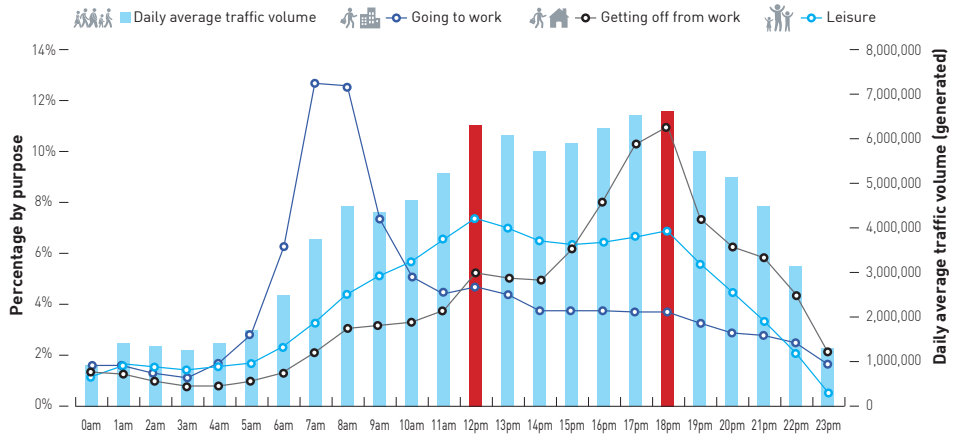
02_ Time-based Analysis

• When is the busiest traffic time?

Traffic is concentrated in the afternoon rather than in the morning, especially at mealtimes

The busiest traffic time is between 12 noon and 6 p.m., and the time with the highest arrivals is between 6 p.m. and 7 p.m.

Traffic volume (departure time)



Traffic volume (arrival time)

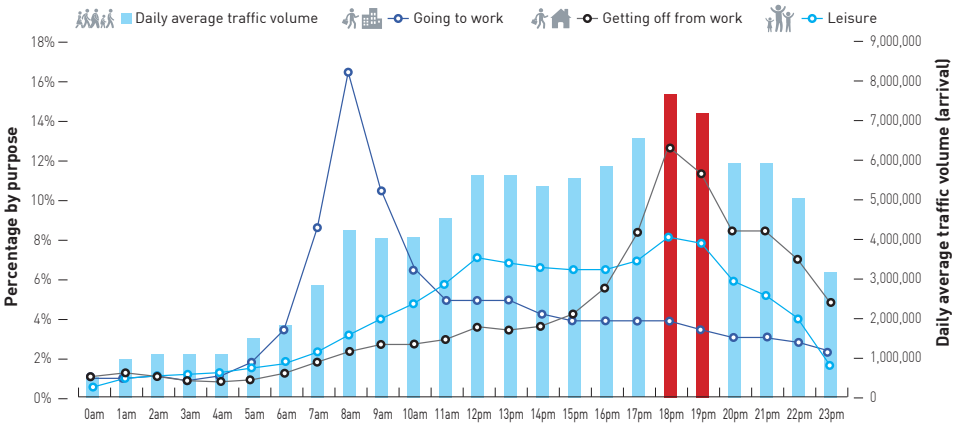


Table 2,5 I **Nationwide Traffic Volume by Time (Traffic volume generated /Traffic volume arrived)**

(Unit: pass-by/ day)

Classification	Traffic volume generated				Traffic volume arrived			
	Daily average traffic volume	Going to work	leaving office	Leisure	Daily average traffic volume	Going to work	leaving office	Leisure
0 am	939,945	1.6%	1.4%	1.1%	480,846	1.0%	1.0%	0.5%
1 am	1,411,631	1.6%	1.2%	1.6%	938,055	1.1%	1.2%	0.9%
2 am	1,377,211	1.3%	1.0%	1.5%	1,064,502	0.9%	1.0%	1.1%
3 am	1,280,663	1.2%	0.8%	1.4%	1,076,905	0.9%	0.8%	1.1%
4 am	1,449,784	1.7%	0.8%	1.6%	1,088,126	1.0%	0.7%	1.1%
5 am	1,722,364	2.8%	1.0%	1.7%	1,475,671	1.8%	0.9%	1.5%
6 am	2,518,033	6.4%	1.4%	2.3%	1,832,002	3.4%	1.2%	1.7%
7 am	3,797,281	12.7%	2.1%	3.2%	2,827,236	8.6%	1.7%	2.2%
8 am	4,482,500	12.6%	3.1%	4.4%	4,207,583	16.4%	2.3%	3.1%
9 am	4,405,047	7.4%	3.2%	5.1%	4,016,184	10.4%	2.6%	4.0%
10 am	4,650,234	5.2%	3.3%	5.7%	4,045,875	6.5%	2.7%	4.7%
11 am	5,259,766	4.5%	3.8%	6.5%	4,542,845	4.9%	2.9%	5.7%
12 pm	6,354,291	4.7%	5.3%	7.4%	5,625,089	4.8%	3.5%	7.0%
13 pm	6,107,076	4.4%	5.1%	7.1%	5,623,216	4.8%	3.4%	6.8%
14 pm	5,765,310	3.8%	5.0%	6.5%	5,360,725	4.1%	3.5%	6.5%
15 pm	5,944,086	3.7%	6.2%	6.4%	5,492,616	3.9%	4.1%	6.4%
16 pm	6,278,125	3.8%	8.1%	6.5%	5,825,385	3.8%	5.5%	6.4%
17 pm	6,573,370	3.7%	10.3%	6.7%	6,535,682	3.8%	8.5%	6.9%
18 pm	6,694,637	3.7%	11.1%	6.9%	7,657,124	3.8%	12.7%	8.1%
19 pm	5,746,001	3.3%	7.4%	5.6%	7,188,457	3.3%	11.2%	7.7%
20 pm	5,163,660	2.9%	6.3%	4.5%	5,907,076	3.0%	8.3%	5.8%
21 pm	4,507,358	2.8%	5.8%	3.4%	5,926,706	3.0%	8.4%	5.1%
22 pm	3,178,203	2.5%	4.4%	2.1%	5,029,430	2.7%	6.9%	4.0%
23 pm	1,312,480	1.6%	2.1%	0.5%	3,151,721	2.2%	4.7%	1.5%

Analysis conditions

– After calculating the traffic volume (generated volume, arrival volume) by time zone, and calculating the ratio of the total traffic volume
  - Compare major travel time by travel types such as going to work, getting off from work, and leisure

- Gender: Male and female
- Age: All ages recorded in the data
- Departing trip types:
  - (Total) : All Trip types
  - (Going to work) : Nighttime Stay Area (N)
  - (Getting off from work) : Daytime Stay Area (D)
  - (Leisure) : All Trip types
- Arrival trip types:
  - (Total) : All Trip types
  - (Going to work) : Nighttime Stay Area (N)
  - (Getting off from work) : Daytime Stay Area (D)
  - (Leisure) : Potential Stay Area (X)
- Departure time: 24 hours
- Arrival time: 24 hours
- Temporal range: About 13 months (from March 7, 2016 to March 31, 2017)
- Spatial coverage: Nationwide

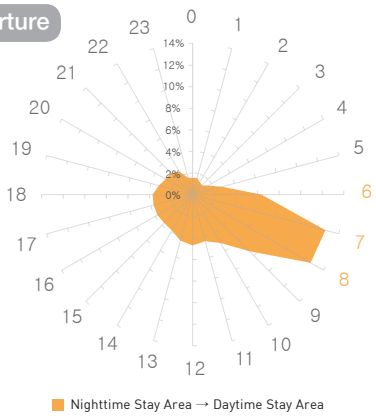
What is the average travel time by purpose?

• Going to work/school

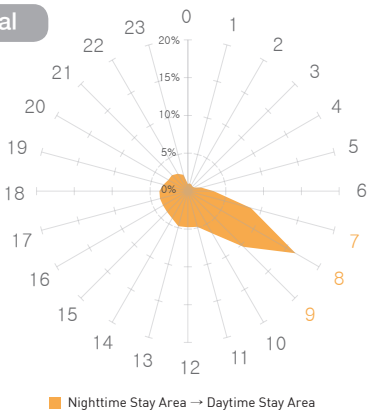
People usually depart between 6 a.m. and 8 a.m. and arrive at between 7 a.m. and 9 a.m. (8a.m. is the peak arrival time)

* It seems that moving from the 'nighttime Stay Area (e.g. Home)' to the 'daytime Stay Area (e.g. Company, school)' is considered as 'travel to go to work or school.'

Departure



Arrival

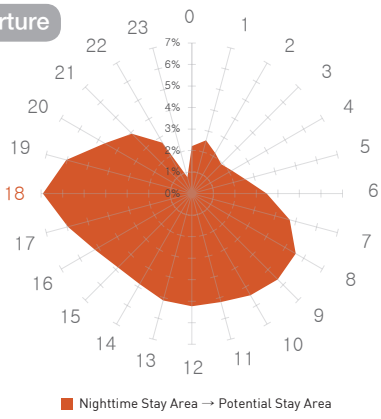


• Shopping, Leisure

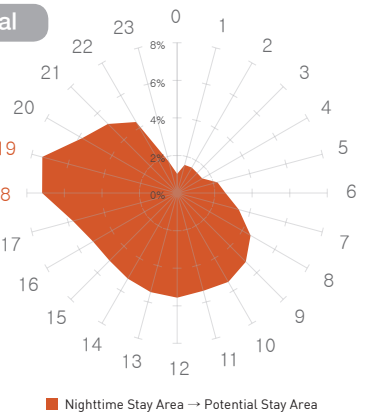
Since there is no big difference by time zone, it is not evident that there is a specific traffic hour. However, there is a tendency that the traffic rate is higher in the evening (after 5 p.m.) than in other time zones.

* It seems that moving from the 'nighttime Stay Area (eg: Home) to the Potential Stay Area (eg: Restaurant, department store, park, church, etc.) is considered as 'travel for shopping and leisure purposes.'

Departure



Arrival

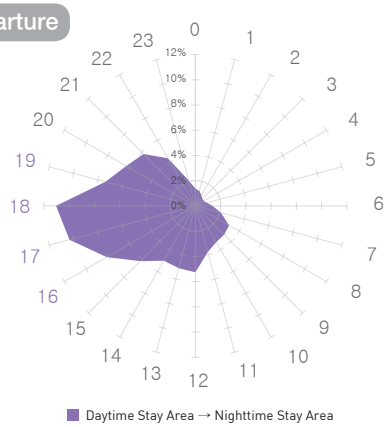


• Getting off from work/School

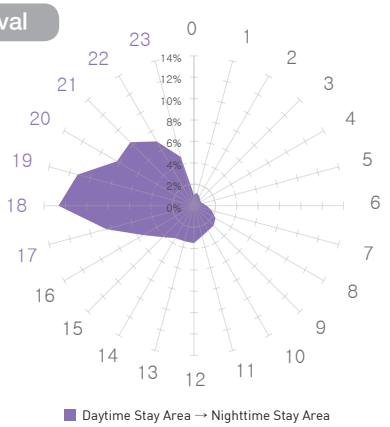
The time to move from the daytime Stay Area to the nighttime Stay Area is from 4:00 p.m. to 7:00 p.m., and the arrival time is from 5:00 p.m. to 11:00 p.m.

* It seems that moving from the 'daytime Stay Area (e.g. Company, School) to the nighttime Stay Area (e.g. Home) is considered as 'travel for leaving office/school.'

Departure



Arrival

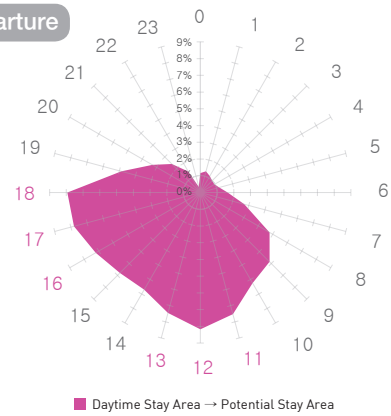


• Meals, Rest

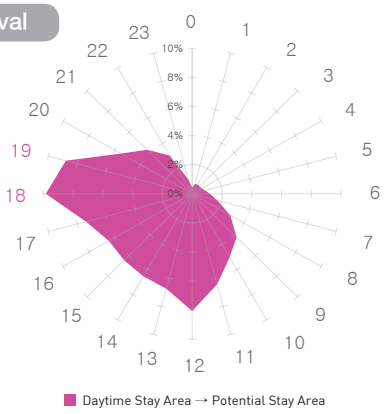
Traffic volume is relatively high between 11:00 a.m. and 1:00 p.m., and between 4:00 p.m. and 6:00 p.m.

* It seems that moving from the 'daytime Stay Area (eg: Company, School) to the Potential Stay Area (e.g. Restaurants, department stores, parks, churches, etc.) is considered as 'travel for meal and rest.'

Departure



Arrival



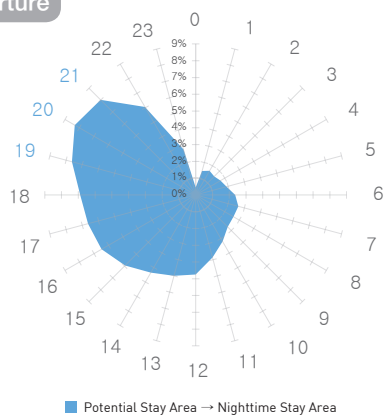
• Going Home

Traffic has increased since 4 p.m.

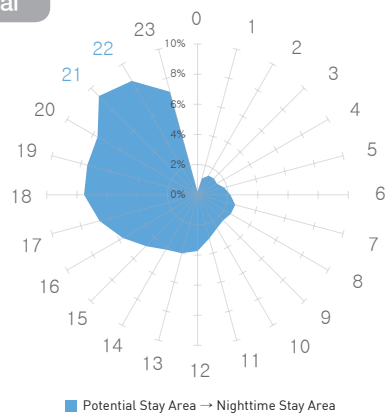
It usually leaves between 7 p.m. and 9 p.m. and arrives at between 9 p.m. and 10 p.m.

* It seems that moving from the 'Potential Stay Area (e.g. Restaurants, department stores, parks, churches, etc.)' to the 'Nighttime Stay Area' is considered as 'travel for coming home.'

Departure



Arrival

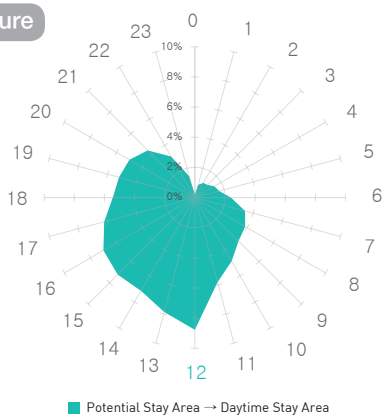


• Return after Personal Business

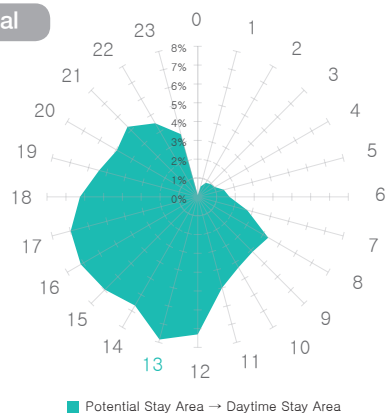
It usually leaves at 12 noon and arrives at 1 p.m.

* It seems that moving from the 'Potential Stay Area (e.g. restaurants, department stores, parks, church, etc.)' to the 'daytime Stay Area' is considered as 'travel for returning after personal business.'

Departure



Arrival

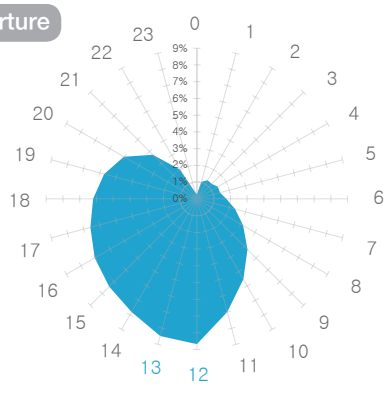


• Shopping, Leisure, Others

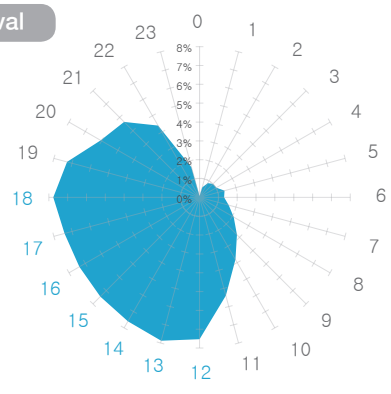
These travelers usually travel in the afternoon rather than in the morning, and the traffic distribution by time of day is even, so traffic is not concentrated at a certain time.

* It seems that moving from the "Potential Stay Area (e.g. restaurants, department stores, parks, church, etc.)" to the 'daytime Stay Area' is considered as 'travel for returning after personal business.'

Departure



Arrival



Analysis conditions

- Checked the main travel time (departure time, arrival time) of seven travel types
  - After classifying the travel types into seven types according to the combination of departure trip type and arrival trip type, checked traffic distribution by time zone.
    - Going to work/school (N → D) / Shopping, Leisure (N → X) / Getting off from work/School (D → N) / Meals, Rest (D → X) / Going Home (X → N) / Return after personal business (X → D) / Others (X → X)

- Gender: Male and female
- Age: All ages recorded in the data
- Departing trip types:
  - Nighttime Stay Area (N)
  - Daytime Stay Area (D)
  - Potential Stay Area (X)
- Arrival trip types:
  - Nighttime Stay Area (N)
  - Daytime Stay Area (D)
  - Potential Stay Area (X)
- Departure time: 24 hours
- Arrival time: 24 hours
- Temporal range: About 13 months (from March 7, 2016 to March 31, 2017)
- Spatial coverage: Nationwide

Lifestyle of Seoul citizens

• The busiest area at night

Seogyo-dong, Mapo-gu / Yeoksam 1-dong, Gangnam-gu / Jongno 1-ga · 2-ga · 3-ga · 4-ga, Jongno-gu / Sinchon-dong, Seodaemun-gu / Hwayang-dong, Gwangjin-gu

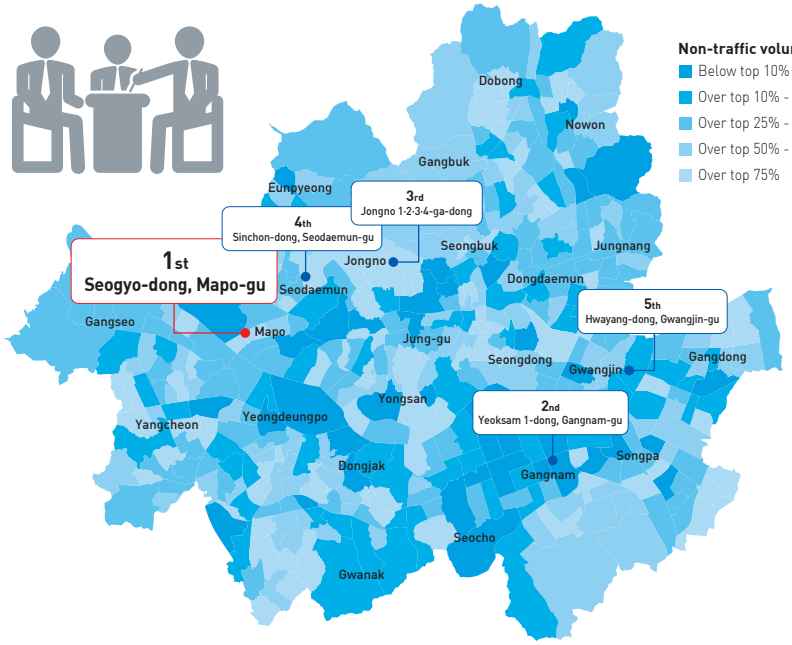


Table 2.6 I The busiest area at night

Ranking	Area	Non-traffic volume
1	Seogyo-dong, Mapo-gu	330,360
2	Yeoksam 1-dong, Gangnam-gu	272,945
3	Jongno 1 · 2 · 3 · 4-ga-dong	196,562
4	Sinchon-dong, Seodaemun-gu	190,109
5	Hwayang-dong, Gwangjin-gu	155,780
6	Yeoui-dong, Yeongdeungpo-gu	154,830
7	Seocho 3-dong, Seocho-gu	121,805
8	Yeongdeungpo-dong, Yeongdeungpo-gu	111,858
9	Seocho 4-dong, Seocho-gu	103,778
10	Nonhyeon 1-dong, Gangnam-gu	101,554
11	Apgujeong-dong, Gangnam-gu	98,790
12	Jamsilbon-dong, Songpa-gu	97,384
13	Gil-dong, Gangdong-gu	96,335
14	Nonhyeon 2-dong, Gangnam-gu	92,138
15	Sinsa-dong, Gangnam-gu	91,638
16	Cheongdam-dong, Gangnam-gu	90,900
17	Bangi 2-dong, Songpa-gu	90,625
18	Noryangjin 1-dong, Dongjak-gu	87,474
19	Sanggye 2-dong, Nowon-gu	87,267
20	Myeong-dong, Jung-gu	83,807

Ranking	Area	Non-traffic volume
21	Sillim-dong, Gwanak-gu	83,179
22	Hyehwa-dong, Jongno-gu	82,153
23	Mok 1-dong, Yangcheon-gu	79,507
24	Anam-dong, Seongbuk-gu	78,591
25	Sangam-dong, Mapo-gu	77,632
26	Daechi 4-dong, Gangnam-gu	75,724
27	Galhyeon 1-dong, Eunpyeong-gu	75,484
28	Garakbon-dong, Songpa-gu	75,127
29	Sageun-dong, Seongdong-gu	74,515
30	Sangdo 1-dong, Dongjak-gu	74,142
31	Gongneung 1-dong, Nowon-gu	73,026
32	Ihwa-dong, Jongno-gu	72,973
33	Itaewon 1-dong, Yongsan-gu	72,047
34	Samseong 1-dong, Gangnam-gu	71,885
35	Chunghyeon, Seodaemun-gu	71,768
36	Yangjae 1-dong, Seocho-gu	71,247
37	Daechi 2-dong, Gangnam-gu	70,318
38	Gasan-dong, Geumcheon-gu	70,121
39	Gongneung 2-dong, Nowon-gu	69,718
40	Jamsil 3-dong, Songpa-gu	69,447

• Areas of people staying at home all day

Yeoksam 1-dong, Gangnam-gu / Nonhyeon 1-dong, Gangnam-gu / Noryangjin 1-dong, Dongjak-gu / Hwagok 1-dong, Gangseo-gu / Daehak-dong, Gwanak-gu / Nonhyeon 2-dong, Gangnam-gu

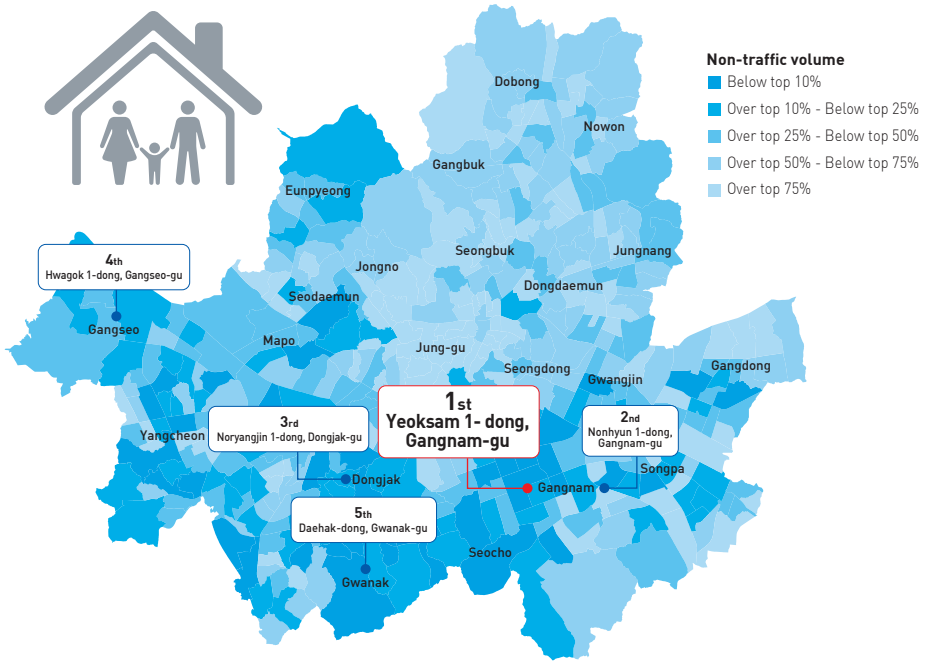


Table 2.7 I **Areas with the highest 'Staying Home' rate**

Ranking	Area	Non-traffic volume
1	Yeoksam 1-dong, Gangnam-gu	4,738
2	Nonhyeon 1-dong, Gangnam-gu	4,147
3	Noryangjin 1-dong, Dongjak-gu	3,993
4	Hwagok 1-dong, Gangseo-gu	3,584
5	Daehak-dong, Gwanak-gu	3,476
6	Nonhyeon 2-dong, Gangnam-gu	3,107
7	Seocho 3-dong, Seocho-gu	2,745
8	Sillim-dong, Gwanak-gu	2,739
9	Seorim-dong, Gwanak-gu	2,489
10	Sangdo 1-dong, Dongjak-gu	2,488
11	Doksan 1-dong, Geumcheon-gu	2,364
12	Nangok-dong, Gwanak-gu	2,306
13	Hwagokbon-dong, Gangseo-gu	2,301
14	Banpo 1-dong, Seocho-gu	2,249
15	Daebang-dong, Dongjak-gu	2,235
16	Gil-dong, Gangdong-gu	2,210
17	Yangjae 1-dong, Seocho-gu	2,209
18	Seogyo-dong, Mapo-gu	2,196
19	Jamsilbon-dong, Songpa-gu	2,191
20	Gaepo 4-dong, Gangnam-gu	2,102

Ranking	Area	Non-traffic volume
21	Gaebong 1-dong, Guro-gu	2,095
22	Samseong 2-dong, Gangnam-gu	2,070
23	Sinjeong 3-dong, Yangcheon-gu	2,023
24	Inhun-dong, Gwanak-gu	1,992
25	Euncheon-dong, Gwanak-gu	1,992
26	Mok 2-dong, Yangcheon-gu	1,988
27	Cheonho 2-dong, Gangdong-gu	1,976
28	Sadang 1-dong, Dongjak-gu	1,962
29	Daechi 4-dong, Gangnam-gu	1,954
30	Cheongnyong-dong, Gwanak-gu	1,954
31	Cheongdam-dong, Gangnam-gu	1,944
32	Seokchon-dong, Songpa-gu	1,935
33	Dangsan-dong, Yeongdeungpo-gu	1,926
34	Sinjeong 4-dong, Yangcheon-gu	1,903
35	Haengun-dong, Gwanak-gu	1,860
36	Hwayang-dong, Gwangjin-gu	1,845
37	Bangbae 2-dong, Seocho-gu	1,827
38	Yeonhui-dong, Seodaemun-gu	1,802
39	Yeongdeungpo-dong, Yeongdeungpo-gu	1,792
40	Gocheok 1-dong, Guro-gu	1,781

• Areas of people working overtime, at night

Sinjeong 3·4-dong, Yangcheon-gu / Gongneung 1-dong, Nowon-gu / Ogeum-dong, Songpa-gu / Pungnap 2-dong, Songpa-gu

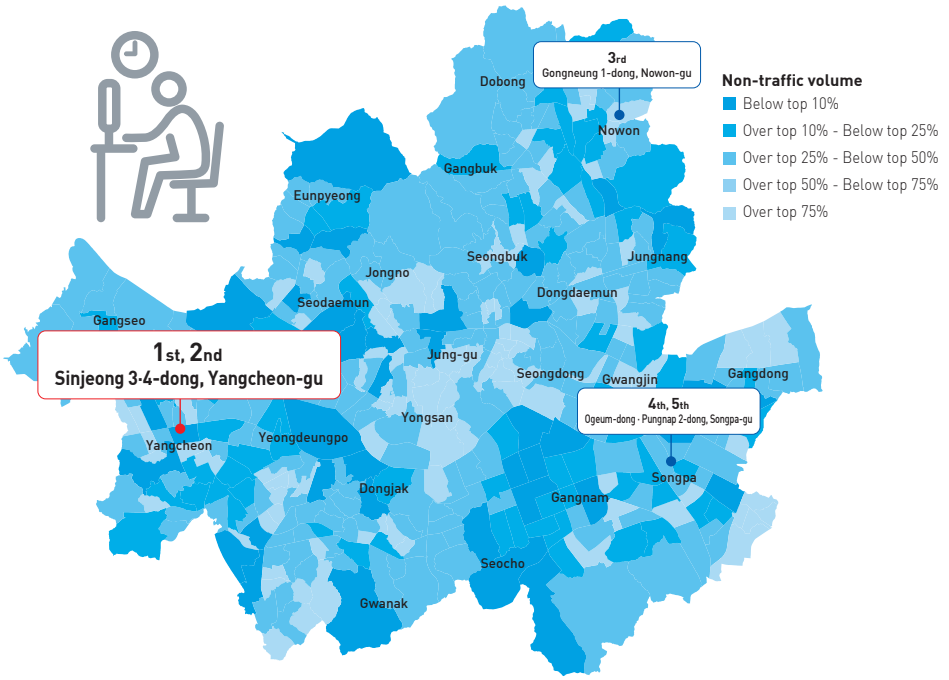


Table 2.8 I **Area Rates with People Working Overtime, at Night**

Ranking	Area	Non-traffic volume
1	Sinjeong 3-dong, Yangcheon-gu	3,125
2	Sinjeong 4-dong, Yangcheon-gu	2,743
3	Gongneung 1-dong, Nowon-gu	2,637
4	Ogeum-dong, Songpa-gu	2,672
5	Pungnap 2-dong, Songpa-gu	2,611
6	Jongam-dong, Seongbuk-gu	2,641
7	Hwagok 1-dong, Gangseo-gu	3,484
8	Yangjae 2-dong, Seocho-gu	2,708
9	Yangjae 1-dong, Seocho-gu	3,914
10	Seocho 3-dong, Seocho-gu	4,862
11	Sinchon-dong, Seodaemun-gu	3,437
12	Yeonhui-dong, Seodaemun-gu	3,410
13	Bukgajwa 2-dong, Seodaemun-gu	2,592
14	Chunghyeon-dong, Seodaemun-gu	3,176
15	Sangdo 1-dong, Dongjak-gu	3,537
16	Daebang-dong, Dongjak-gu	2,997
17	Noryangjin 1-dong, Dongjak-gu	4,189
18	Daechi 2-dong, Gangnam-gu	3,106
19	Nonhyeon 1-dong, Gangnam-gu	3,650
20	Nonhyeon 2-dong, Gangnam-gu	3,413

Ranking	Area	Non-traffic volume
21	Cheongdam-dong, Gangnam-gu	2,997
22	Apgujeong-dong, Gangnam-gu	3,022
23	Yeoksam 1-dong, Gangnam-gu	7,665
24	Seogyo-dong, Mapo-gu	4,554
25	Sangam-dong, Mapo-gu	3,222
26	Gongdeok-dong, Mapo-gu	2,637
27	Nokbeon-dong, Eunpyeong-gu	2,726
28	Yeokchon-dong, Eunpyeong-gu	2,940
29	Jingwan-dong, Eunpyeong-gu	3,102
30	Sinnae 1-dong, Jungnang-gu	2,701
31	Yongsin-dong, Dongdaemun-gu	3,731
32	Myeong-dong, Jung-gu	2,934
33	Gil-dong, Gangdong-gu	3,400
34	Cheonho 2-dong, Gangdong-gu	2,672
35	Daehak-dong, Gwanak-gu	3,292
36	Yeoui-dong, Yeongdeungpo-gu	4,397
37	Guro 3-dong, Guro-gu	3,077
38	Jongno 1 · 2 · 3 · 4-ga-dong	4,877
39	Gasan-dong, Geumcheon-gu	4,198
40	Doksan 1-dong, Geumcheon-gu	2,962

Analysis conditions

- Analyzed using non-traffic data
  - Non-traffic data means the data of a person who has not moved, and there is no destination information unlike general traffic data
- Areas preferred for evening appointments: data was generated between 19:00 and 24:00, so there is no destination information until 23:59.
- Staying home area: As the area where the data was generated between 0:00 and 6:00 as nighttime Stay Area, there is no destination information until 23:59.
- Area with the most people working at night: data was generated between midday and 2:00 p.m. as daytime Stay Area, so there is no destination information until 23:59.

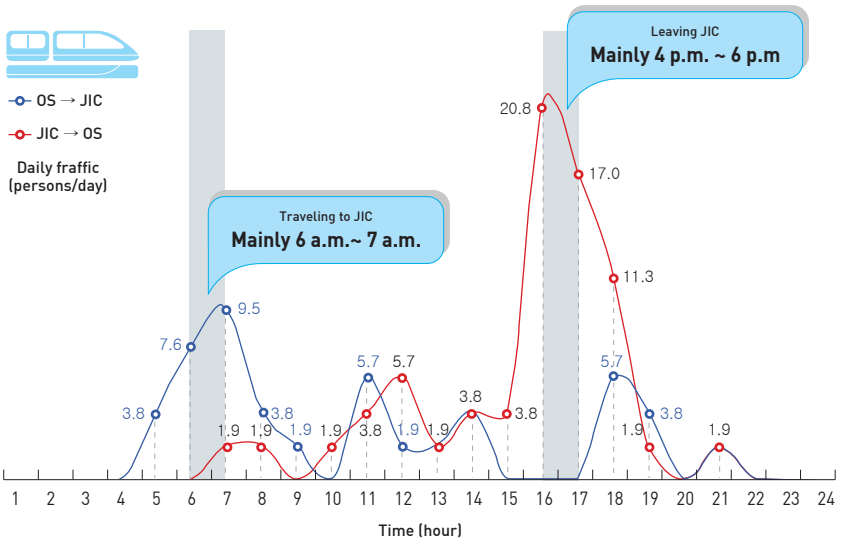
- Gender: Male and female
- Age: All ages recorded in the data
- Departing trip types:
  - (The busiest area at night) Potential Stay Area
  - (Areas of people staying at home all day) Nighttime Stay Area
  - (Areas of people working overtime, at night) Daytime Stay Area
- Arrival trip types: no data is available
- Departure time
  - (The busiest area at night) 19:00 - 24:00
  - (Areas of people staying at home all day) 0:00 - 6:00
  - (Areas of people working overtime, at night) 12:00 - 14:00
- Arrival time: no information is available
- Temporal range: one month (May 1, 2016 - May 31, 2016)
- Spatial coverage: Seoul (Analysis units: town, township and neighborhood)

The traffic timeline of Jincheon Innovation City (JIC)

(Osong Station (OS) - JIC, Cheongju International Airport (CJJ) - OS)

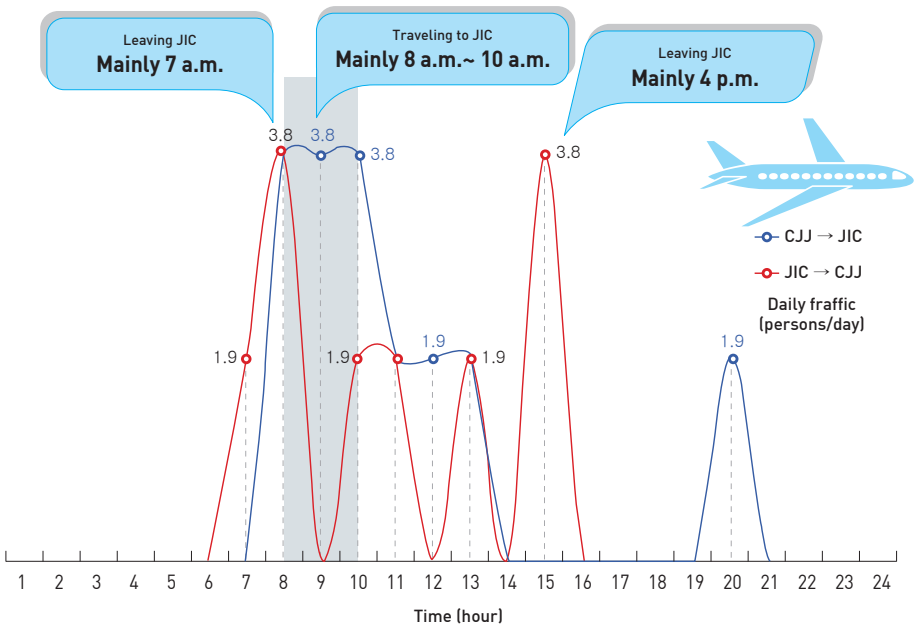
- **Transfer at OS?**

  Those who visited JIC via OS depart from OS at around 6 a.m.to 7 a.m. and leave JIC at around 4 p.m. to 6 p.m.



• Transfer at CJJ

Those who visited JIC via CJJ mainly depart from Cheongju International Airport at around 8a.m. and 10 a.m. and leave JIC at around 7 a.m. and 3 p.m.



Analysis conditions

– Analysis of travel characteristics in new town in Jincheon Innovation City, which was established in Duksan-myeon, Jincheon-gun and Maeng-dong-myeon, Emseong-gun Chungcheongbuk-do
  - After setting Osong Station and Cheongju Airports near Jincheon Innovation City as departure and destination, analyze the data with history of visiting Jincheon Innovation City.

- Gender: Male and female
- Age: All ages recorded in the data
- Departing trip types: All Trip types
- Arrival trip types: All trip types
- Departure time: 24 hours
- Arrival time: 2 4 hours
- Temporal range: 5 days (October 16-20, 2017)
- Spatial coverage
  - JIC ~ OS
  - JIC ~ CJJ

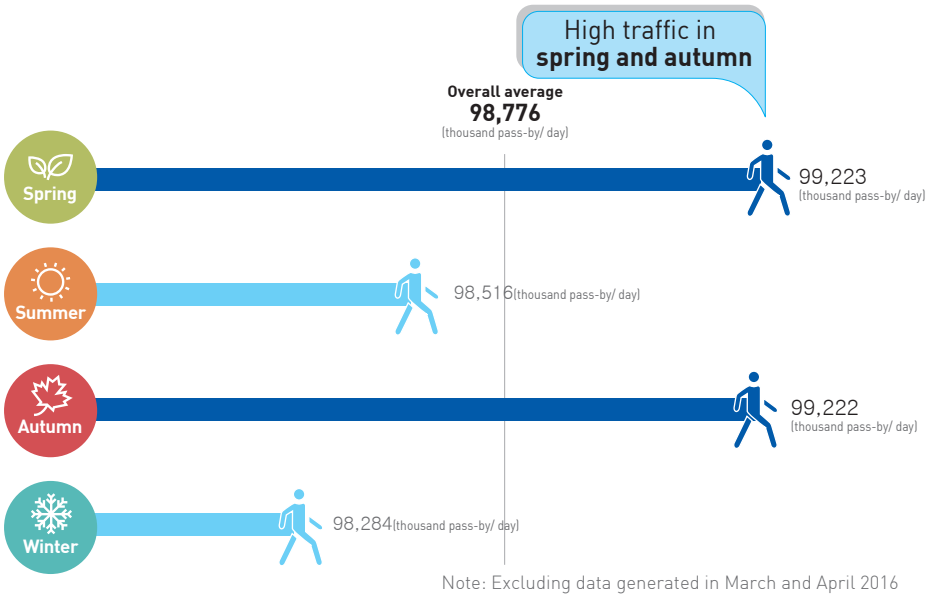
03_ Seasonal Analysis

• Which season has the highest traffic volume?

Compared with summer and winter, traffic volume is high in spring and autumn, and the season with the most traffic volume is spring.

The average traffic volume per day in spring and autumn is one million more than in summer and winter.

Daily average traffic volume by season



Note: Excluding data generated in March and April 2016

Analysis conditions

– Collected the data of traffic volume by dividing into spring, summer, autumn and winter seasons, and then divided it by the number of days to calculate the daily average traffic volume

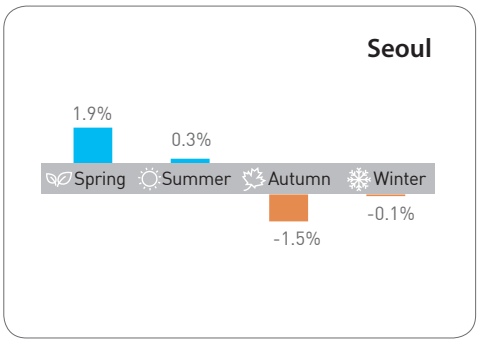
- Gender: Male and female
- Age: All ages recorded in the data
- Departing trip types: All Trip types
- Arrival trip types: All trip types
- Departure time: 24 hours
- Arrival time: 2 4 hours
- Temporal range: 11 months (May 1, 2016 - March 31, 2017)
  - (Spring) May 2016, March 2017 (61 days, excluding one day error data)
  - (Summer) June - August 2016 (92 days)
  - (Fall) September - November 2016 (91 days)
  - (Winter) December 2016, January and February of 2017 (89 days, excluding one day error data)
- Spatial coverage: Nationwide

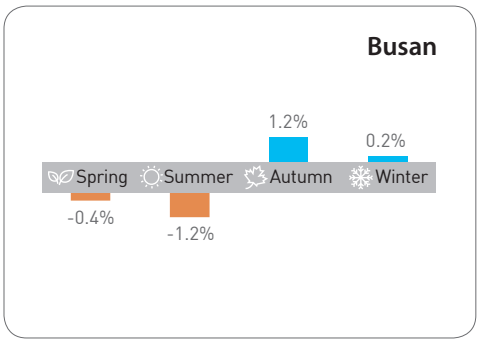
• Which area is the most sensitive to seasonal traffic changes?

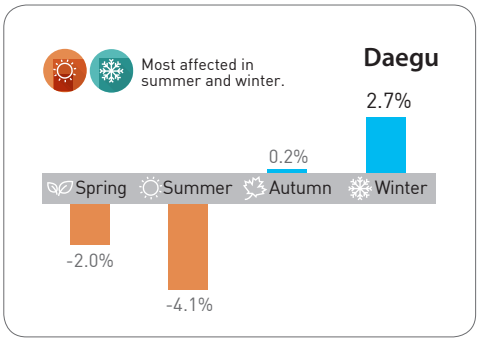
Areas with large traffic changes by season are Daegu, Incheon, Gwangju, Daejeon, Sejong, Gangwon, Choogbuk, Choognam, and Gyeongbuk

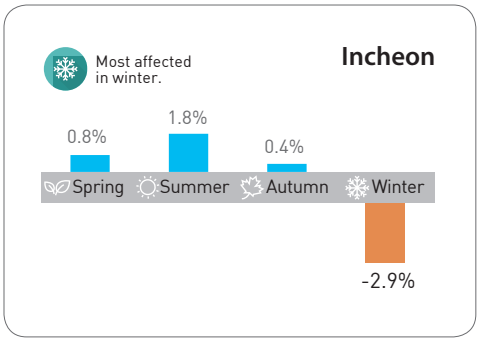
- Areas affected in spring : Gyeongbuk(▲), Daejeon(▼), Sejong(▼), Chungbuk(▼), Chungnam(▼)
- Areas affected in summer : Sejong(▼), Daegu(▼), Kangwon(▲), Gyeongbuk(▼)
- Areas affected in autumn : Sejong(▲), Chungbuk(▲), Chungnam(▲)
- Areas affected in winter : Daegu(▲), Incheon(▼), Gwangju(▲), Sejong(▲)

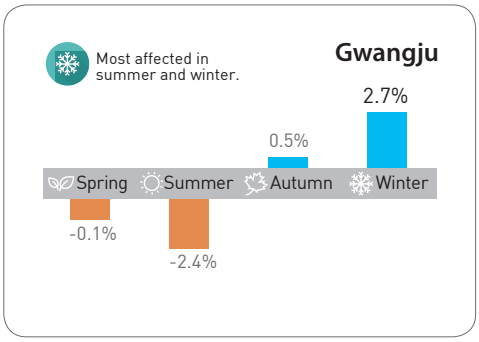
※ Excluding data generated in March and April 2016
※ '▲', '▼' in parentheses means change of inflow

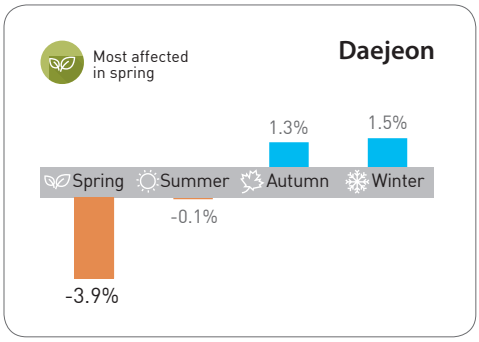


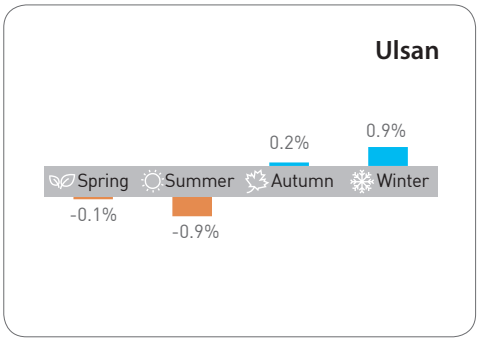


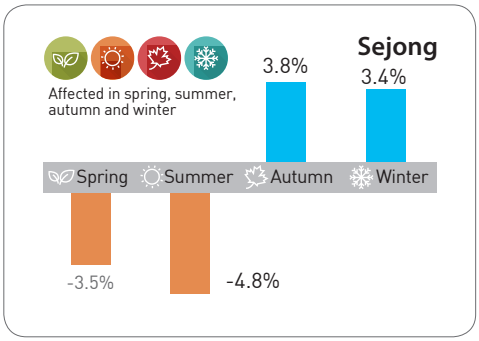


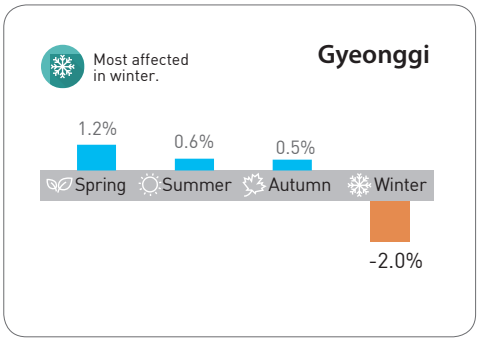


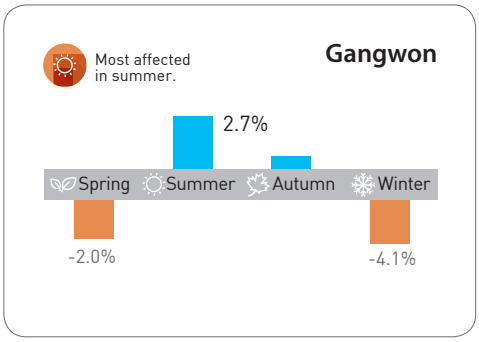


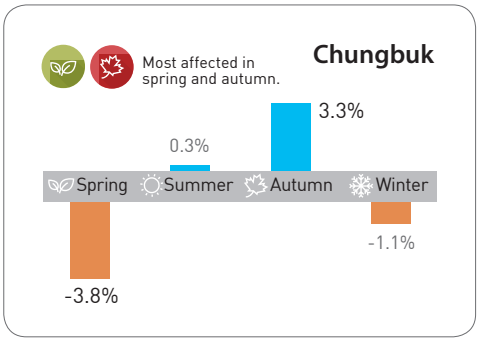


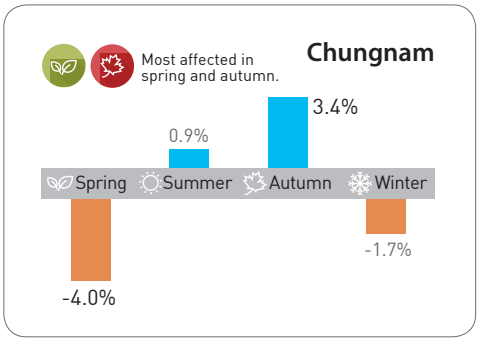

Ulsan
Spring
Summer
Autumn
Winter
-0.1%
-0.9%
0.2%
0.9%

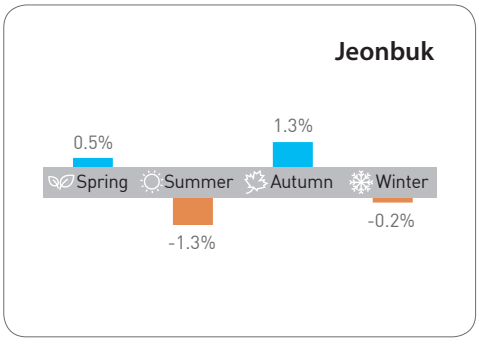

Sejong
Affected in spring, summer, autumn and winter
Spring
Summer
Autumn
Winter
-3.5%
-4.8%
3.8%
3.4%

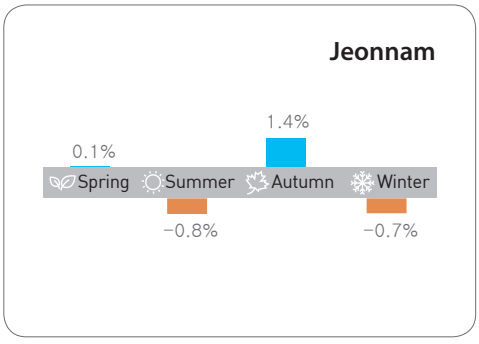

Gyeonggi
Most affected in winter.
Spring
Summer
Autumn
Winter
1.2%
0.6%
0.5%
-2.0%

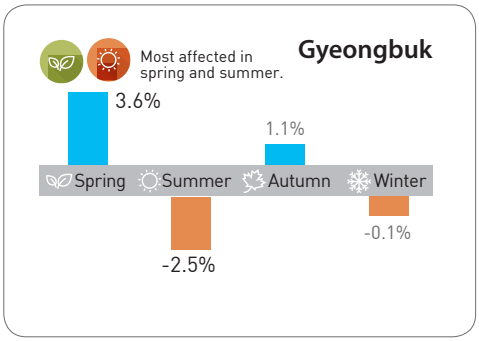

Gangwon
Most affected in summer.
Spring
Summer
Autumn
Winter
-2.0%
2.7%
-4.1%

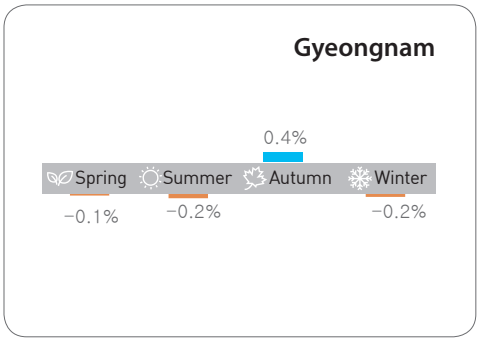

Chungbuk
Most affected in spring and autumn.
Spring
Summer
Autumn
Winter
-3.8%
0.3%
3.3%
-1.1%

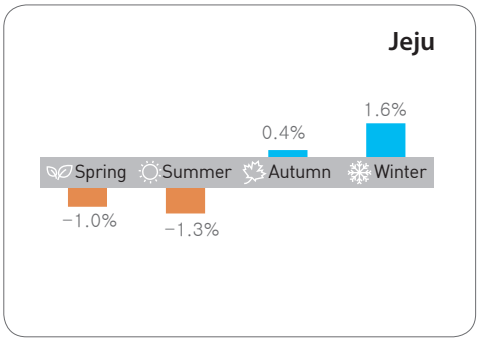

Chungnam
Most affected in spring and autumn.
Spring
Summer
Autumn
Winter
-4.0%
0.9%
3.4%
-1.7%


Jeonbuk
Spring
Summer
Autumn
Winter
0.5%
-1.3%
1.3%
-0.2%


Jeonnam
Spring
Summer
Autumn
Winter
0.1%
−0.8%
1.4%
−0.7%







Analysis conditions

- Checked the traffic distribution by season (spring, summer, autumn, winter) by city and province
  - Calculated the daily average traffic volume for each region and compared it with the daily average arrival traffic volume of the region

- Gender: Male and female
- Age: All ages recorded in the data
- Departing trip types: All Trip types
- Arrival trip types: All trip types
- Departure time: 24 hours
- Arrival time: 2 4 hours
- Temporal range: 11 months (May 1, 2016 - March 31, 2017)
  - (Spring) May 2016, March 2017 (61 days, excluding one day error data)
  - (Summer) June - August 2016 (92 days)
  - (Fall) September - November 2016 (91 days)
  - (Winter) December 2016, January amd February of 2017 (89 days, excluding one day error data)
- Spatial coverage: Nationwide (Analysis units: city and province)

- **Where is "the hottest spot"* in the east?**

  1st Gyeongpo-dong, Gangneung; 2nd Ganghyeon-myeon, Yangyang-gun, 3rd Cheongho-dong, Sokcho-si; 4th Jugwang-myeon, Goseong-gun; 5th Toseong-myeon, Goseong-gun

  * The busiest traffic area for Seoul residents, usually during the summer vacation months

Table 2.9 I **Traffic Volume in the Gangwon province area near the East Sea that Seoul residents visit for summer vacation**

Ranking	Administrative district	Resort	Traffic volume	Rate
1	Gyeongpo, Gangneung-si	Sungeut beach, Sageunjin Beach, Gyeongpo Beach (Located with Gyeongpo Lake, Ojukheon House and Gangneung-Wonju National University Gangneung Campus)	2,811	7.5%
2	Ganghyeon-myeon, Yangyang-gun	Seorak Beach, Jeongam Beach, Naksan Beach (Located with Naksan Central Bus Terminal and Dunjeon Valley)	2,442	6.5%
3	Cheongho-dong, Sokcho-si	Cheonghodong seawall, Gani Beach, Sokcho Port International Cruise Terminal	2,247	6.0%
4	Jugwang-myeon, Goseong-gun	Gajin Port, Gajin Beach, Songjiho Beach, Bongsudae Beach, Sampo Beach, Baekdo Beach, Munam Beach	2,034	5.4%
5	Toseong-myeon, Goseong-gu	Gyoamri Beach, Ayajin Beach, Ayajin Port, Cheonggan Beach, Cheonjin Beach, Bongpo Beach, Bongpo Port (Located with report, training center and etc.)	1,971	5.3%
6	Hyeonnam-myeon, Yangyang-gun	Donsan Beach, Namae Beach, Namae Port	1,821	4.9%
7	Jumunjin-eup, Gangneung-si	Jumunjin Port, Jumunjin Beach	1,764	4.7%
8	Geundeok-myeon, Samcheok-si	Hanjaemit Beach, Maengbang Beach, Deoksan Beach, Deoksan Harbor (Chodang Reservoir), Bunam Beach, Daejin Port, Gungchon Beach, Wonpyeong Beach, Chogok Port, Yonghwa Beach, Jangho Beach, Jangho Port	1,722	4.6%
9	Daepo-dong, Sokcho-si	Daepohang Port, Seolak Port, Oeongchi Beach	1,695	4.5%
10	Songjeong-dong, Gangneung-si	Songjeong Beach	1,414	3.8%
11	Geumho-dong, Sokcho-si	Vicinity of Yeongnangho Lake (YoungRangHo Resort), Vicinity of Cheongcho Lake (nearby Sokcho Port)	1,362	3.6%
12	Yeongnang-dong, Sokcho-si	Deungdae Beach (Location of Sokcho Lighthouse Observatory)	1,320	3.5%
13	Dongmyeong-dong, Sokcho-si	Dongmyeong Port (Location of Sokcho Intercity Bus Terminal and Sokcho Port International Passenger Terminal)	1,158	3.1%
14	Gangdong-myeon, Gangneung-si	Anin Beach, Deungmyeong Beach, Jeongdongjin Beach, Simgok Harbor (Location of Anin Station and Dankyunggol Valley)	1,089	2.9%
15	Hyeonnae-myeon, Goseong-gun	Daejin Port, Myeongpa Beach, Machajin Beach, Chodo Beach, Hwajinpo Beach	1,077	2.9%
16	Sonyang-myeon, Yangyang-gun	Osan Beach, Susan Port, Dongho Beach (Location of Yangyang International Airport)	1,068	2.8%
17	Hyeonbuk-myeon, Yangyang-gun	Hajodae Beach, Gisamun Port, Gisamun Beach	1,038	2.8%
18	Sacheon-myeon, Gangneung-si	Sacheonjin Port, Sacheonjin Beach, Hapyeong Beach, Sunpo Beach (Location of Yongyeon Valley Camping Site)	978	2.6%
19	Gyo-dong, Samcheok-si	Jageunhujin Beach (Location of Samcheok Stadium, Gangwon University Samcheok Campus and Sculpture Garden)	885	2.4%
20	Mukho-dong, Donghae-si	Daejin Port, Oedal Port, Oedal Beach	867	2.3%
21	Geojin-eup, Goseong-gun	Geojin port, Banam Beach	861	2.3%
22	Cheongok-dong, Donghae-si	Gobulgae Beach, Cheongok Pork, Hanseom Beach	840	2.2%
23	Mangsang-dong, Donghae-si	Gagok Beach, Mangsang Beach, Nobong Beach	804	2.1%
24	Chodang-dong, Gangneung-si	Gyeongpo Port, Vicinity of Gangmun Beach	762	2.0%
25	Yangyang-eup, Yangyang-gun	Yangyang Intercity Bus Terminal, Naksan Provincial Park (vicinity of Naksan Beach)	654	1.7%
26	Balhan-dong, Donghae-si	Mukho Port	504	1.3%
27	Yeongok-myeon, Gangneung-si	Yeongjin Port, Yeongok Beach (Location of Sogeumgan Valley and Guryong Fall)	462	1.2%
28	Jeongna-dong, Samcheok-si	Samcheok Port (Locaton of Samcheok Hot Spring)	372	1.0%
29	Wondeok-eup, Samcheok-si	Sinnam Beach, Imwon Beach, Nogok Beach, Hosan Port, Gopo Port	339	0.9%
30	Bugok-dong, Donghae-si	Donghae Express Bus Terminal, Mukho Port (vicinity of Hapyeong Beach)	288	0.8%
31	Seongdeok-dong, Gangneung-si	Namhangjin Beach (vicinity of Ganeung Port)	231	0.6%
32	Okgye-myeon, Gangneung-si	Okgye Port, Geunjin Port, Geumjin Beach	222	0.6%
33	Ganseong-eup, Goseong-gun	(Locaiton of Ganseong Hyanggyo, Alps Sky Resort, and Jangsin Amusement Park)	210	0.6%
34	Bukpyeong-dong, Donghae-si	Vicinity of Donghae Port	108	0.3%
35	Songjeong-dong, Donghae-si	Donghae Port	99	0.3%
36	Namyang-dong, Samcheok-si	Samcheok Bus Terminal, Vicinity of Samcheok Port	12	0.0%

- **"The hottest spot" during the summer - by age**

  For people in their 20s - beaches (Gyeongpo beach, Seongjin Beach) in Gyeongpo-dong; in their 30s- beaches (Namhae beach etc.) in Hyeongnam-myeon; in their 40s - beaches (Gajin beach) in Jookwang-myeon; and in their 50s- beaches (Jumunjin beach) in Jumunjin-eup.

Figure 6 | Destination for Summer Vacation by Age

Table 2.10 | **Traffic by Areas in Gangwon by Age**

Administrative District	1 - 9	10 - 19	20 - 29	30 - 39	40 - 49	50 - 59	60 - 69	70 - 79	80 - 89	Over 90	Grand total
Jumunjin-eup, Gangneung-si	18	123	336	306	348	390	198	30	15		1,764
Gangdong-myeon, Gangneung-si	3	87	357	231	180	147	60	24			1,089
Okgye-myeon, Gangneung-si	3	27	66	36	42	18	24	6			222
Sacheon-myeon, Gangneung-si	3	99	219	213	204	165	69	6			978
Yeongok-myeon, Gangneung-si		42	141	108	81	57	21	12			462
Chodang-dong, Gangneung-si		75	348	117	90	75	54	3			762
Songjeong-dong, Gangneung-si		87	477	204	217	276	123	30			1,414
Seongdeok-dong, Gangneung-si		15	81	39	30	48	15	3			231
Gyeongpo-dong, Gangneung-si	9	327	1,434	402	318	228	54	30	9		2,811
Cheongok-dong, Donghae-si	3	54	237	165	135	162	54	24	6		840
Songjeong-dong, Donghae-si		9	27	21	15	21	6				99
Bugok-dong, Donghae-si		30	102	57	57	39			3		288
Balhan-dong, Donghae-si	6	33	93	81	90	129	63	9			504
Mukho-dong, Donghae-si	3	69	135	153	147	246	90	21	3		867
Bukpyeong-dong, Donghae-si	3	18	12	30	18	21		3	3		108
Mangsang-dong, Donghae-si	9	90	186	207	174	93	30	12	3		804
Yeongnang-dong, Sokcho-si	3	126	348	321	234	177	84	24	3		1,320
Dongmyeong-dong, Sokcho-si		81	258	219	240	234	105	21			1,158
Geumho-dong, Sokcho-si	3	93	402	294	264	186	102	15	3		1,362
Cheongho-dong, Sokcho-si	18	327	756	396	378	291	63	15	3		2,247
Daepo-dong, Sokcho-si	9	120	453	273	339	360	114	27			1,695
Wondeok-eup, Samcheok-si	3	18	66	72	60	99	15	6			339
Geundeok-myeon, Samcheok-si	9	183	516	375	348	162	105	18	6		1,722
Namyang-dong, Samcheok-si		0	3	0	3	6					12
Gyo-dong, Samcheok-si	3	138	159	195	252	63	51	24			885
Jeongna-dong, Samcheok-si		39	72	51	69	99	30	12			372
Ganseong-eup, Goseong-gun	3	9	114	15	24	30	9	6			210
Geojin-eup, Goseong-gun	3	72	114	141	228	189	102	9		3	861
Hyeonnae-myeon, Goseong-gun	6	117	123	231	306	180	93	18	3		1,077
Jugwang-myeon, Goseong-gun	21	228	300	468	567	279	138	30	3		2,034
Toseong-myeon, Goseong-gun	18	156	429	447	441	288	156	33	3		1,971
Yangyang-eup, Yangyang-gun		60	156	108	180	108	27	12	3		654
Sonyang-myeon, Yangyang-gun	18	132	192	273	243	126	66	12	6		1,068
Hyeonbuk-myeon, Yangyang-gun	6	93	258	294	207	102	60	18			1,038
Hyeonnam-myeon, Yangyang-gun	9	117	513	516	342	204	105	9	6		1,821
Ganghyeon-myeon, Yangyang-gun	15	282	645	492	501	333	141	30		3	2,442
Total	207	3,576	10,128	7,551	7,372	5,631	2,427	552	81	6	37,531

Analysis conditions

– Analyzing the history of visits to the East Sea by residents of Seoul
- Analyzed the history of moving from Seoul to the areas (traffic polygon) facing the East Sea of Gangwon Province
- In order to analyze only the characteristics of visiting traffic except the travel characteristics of residential population in Gangwon-do, the arrival trip type was limited to 'Potential Stay Area (X)'.
- Analysis period was limited to period for special traffic measures (summer season).

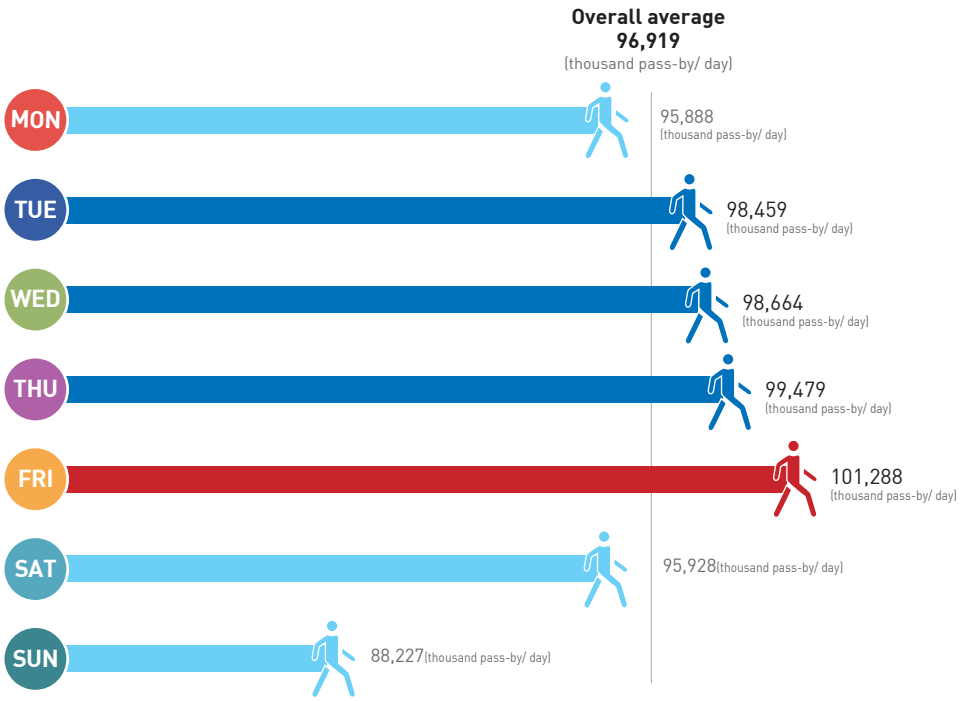
- Gender: Male and female
- Age: All ages recorded in the data
- Departing trip types: All Trip types
- Arrival trip types: All trip types
- Departure time: 24 hours
- Arrival time: 2 4 hours
- Time range: 7 days (July 30, 2016-August 5, 2016)
- Spatial coverage: Seoul, Gangwondo (Analysis units: town, township and neighborhood)

04_ Daily Analysis

• How did the traffic change by day?

Traffic gradually increased from Monday and then decreased on Friday.

On Fridays with the highest traffic volume, about four million passengers increased from the average traffic volume (96.9 million passengers/ day), and on Sunday with the lowest traffic volume, passengers numbered about 8.7 million lower than average.



Analysis conditions

– The daily average traffic volume was calculated by dividing the traffic volume generated by day (Monday through Sunday).

- Gender: Male and female
- Age: All ages recorded in the data
- Departing trip types: All Trip types
- Arrival trip types: All trip types
- Departure time: 24 hours
- Arrival time: 2 4 hours
- Temporal range: about 13 months (From March 7, 2016 to March 31, 2017)
  - Monday (56 days), Tuesday (56 days), Wednesday (56 days), Thursday (56 days), Friday (55 days), Saturday (55 days), Sunday (54 days)
- Spatial coverage: Nationwide

• The region with the biggest traffic difference, between days

Saturday

- Both generation and arrivals are reduced from daily average traffic on Mondays and Sundays, while they are increasing from Tuesday to Friday.
- It has decreased in Seoul, Daejeon, Ulsan, Sejong, Gyeonggi, Chungbuk and Chungnam than daily traffic, while it has increased in Busan, Daegu, Incheon, Gwangju, Gangwon, Jeonnam, Gyeongbuk, Gyeongnam and Jeju.

Increase : Decrease :

Generation	MON	TUE	WED	THU	FRI	SAT	SUN
Seoul	-0.1%	3.2%	3.4%	4.3%	5.6%	-4.1%	-12.7%
Busan	-1.2%	1.3%	1.1%	2.6%	4.0%	0.1%	-8.2%
Daegu	-1.2%	0.6%	1.1%	1.6%	4.5%	2.4%	-9.2%
Incheon	-1.5%	0.3%	1.1%	2.0%	3.8%	0.6%	-6.5%
Gwangju	-0.8%	1.1%	1.5%	2.2%	3.7%	0.1%	-8.1%
Daejeon	-0.1%	2.8%	2.0%	2.5%	5.1%	-2.7%	-9.9%
Ulsan	-1.2%	3.0%	2.3%	3.6%	5.0%	-1.8%	-11.1%
Sejong	0.5%	5.1%	4.7%	5.7%	5.8%	-7.2%	-15.2%
Gyeonggi	-1.4%	1.1%	1.7%	2.6%	4.4%	-0.7%	-8.1%
Gangwon	-2.7%	-0.7%	0.0%	1.8%	3.2%	2.5%	-4.2%
Chungbuk	-0.7%	2.3%	1.9%	3.0%	5.2%	-2.5%	-9.5%
Chungnam	-0.6%	2.6%	1.9%	3.1%	4.5%	-2.4%	-9.3%
Jeonbuk	-1.3%	0.8%	1.0%	2.2%	3.7%	0.0%	-6.5%
Jeonnam	-1.8%	0.4%	0.7%	2.7%	3.4%	0.2%	-5.7%
Gyeongbuk	-1.7%	0.9%	0.7%	2.6%	4.4%	0.7%	-7.8%
Gyeongnam	-1.8%	1.3%	1.5%	2.8%	4.1%	0.3%	-8.4%
Jeju	-1.8%	-0.4%	0.1%	2.0%	3.2%	1.2%	-4.4%

Table 2.11 I **Traffic Production by Day of Each City and Province**

Generation	MON	TUE	WED	THU	FRI	SAT	SUN	Daily average
Seoul	20,290,700	20,957,368	21,000,280	21,180,180	21,440,127	19,478,649	17,724,585	20,308,397
Busan	6,630,811	6,798,084	6,788,918	6,888,914	6,981,075	6,718,273	6,164,010	6,712,107
Daegu	4,975,650	5,066,294	5,092,845	5,120,042	5,262,997	5,156,567	4,574,275	5,037,004
Incheon	4,704,099	4,790,043	4,824,893	4,867,731	4,957,045	4,803,133	4,464,992	4,774,171
Gwangju	3,168,084	3,230,973	3,241,446	3,265,779	3,312,959	3,199,163	2,936,726	3,194,592
Daejeon	3,362,328	3,462,011	3,433,600	3,451,344	3,537,075	3,275,754	3,034,875	3,366,775
Ulsan	2,127,100	2,216,728	2,202,174	2,230,378	2,260,930	2,113,795	1,913,155	2,153,086
Sejong	403,448	421,762	420,199	423,977	424,573	372,373	340,094	401,244
Gyeonggi	21,303,598	21,834,004	21,966,408	22,167,192	22,548,215	21,449,682	19,856,705	21,596,221
Gangwon	3,089,720	3,154,822	3,176,484	3,234,220	3,278,049	3,255,009	3,041,004	3,175,840
Chungbuk	3,019,028	3,112,142	3,099,296	3,131,217	3,198,156	2,966,361	2,753,121	3,041,163
Chungnam	3,934,875	4,060,946	4,037,000	4,082,749	4,136,789	3,863,393	3,592,074	3,959,933
Jeonbuk	3,480,573	3,552,503	3,561,314	3,603,069	3,654,721	3,525,672	3,295,546	3,525,616
Jeonnam	3,030,033	3,095,468	3,106,447	3,167,350	3,189,529	3,089,782	2,907,209	3,084,310
Gyeongbuk	4,943,461	5,071,170	5,063,425	5,158,073	5,249,674	5,061,470	4,636,017	5,027,528
Gyeongnam	5,765,272	5,950,069	5,956,215	6,034,304	6,110,974	5,888,631	5,377,210	5,870,814
Jeju	1,659,264	1,684,259	1,692,653	1,723,895	1,744,827	1,709,997	1,615,552	1,690,256

Increase : Decrease :

Arrival	MON	TUE	WED	THU	FRI	SAT	SUN
Seoul	-0.3%	3.0%	3.2%	4.2%	5.6%	-4.0%	-12.1%
Busan	-1.3%	1.3%	1.2%	2.7%	4.1%	0.1%	-8.3%
Daegu	-1.3%	0.7%	1.1%	1.7%	4.7%	1.9%	-9.0%
Incheon	-1.4%	0.5%	1.2%	2.1%	3.9%	0.4%	-6.9%
Gwangju	-0.9%	1.2%	1.4%	2.2%	3.8%	-0.3%	-7.7%
Daejeon	-0.1%	2.9%	1.9%	2.5%	5.0%	-3.1%	-9.3%
Ulsan	-1.1%	2.9%	2.2%	3.5%	4.6%	-2.2%	-10.1%
Sejong	1.1%	5.1%	4.5%	5.2%	4.3%	-7.8%	-12.8%
Gyeonggi	-1.1%	1.3%	1.8%	2.7%	4.3%	-1.1%	-8.0%
Gangwon	-2.8%	-0.7%	0.2%	2.0%	3.8%	3.6%	-6.3%
Chungbuk	-0.6%	2.3%	1.9%	2.9%	5.1%	-2.3%	-9.7%
Chungnam	-0.4%	2.5%	1.9%	3.1%	4.3%	-1.9%	-9.9%
Jeonbuk	-1.3%	0.8%	1.1%	2.3%	3.9%	0.4%	-7.3%
Jeonnam	-1.8%	0.3%	0.8%	2.8%	3.4%	1.0%	-6.8%
Gyeongbuk	-1.7%	0.8%	0.8%	2.6%	4.4%	1.3%	-8.4%
Gyeongnam	-1.8%	1.4%	1.5%	2.8%	4.0%	0.4%	-8.5%
Jeju	-1.9%	-0.4%	0.2%	2.1%	3.3%	1.2%	-4.6%

Table 2.12 | Trip Attraction by Day of Each City and Province

(Unit: trip/day)

Arrival	MON	TUE	WED	THU	FRI	SAT	SUN	Daily average
Seoul	20,096,966	20,771,975	20,822,075	21,006,871	21,297,706	19,362,855	17,733,118	20,167,528
Busan	6,638,134	6,812,781	6,804,519	6,904,964	7,003,207	6,730,373	6,165,851	6,724,962
Daegu	4,997,338	5,096,425	5,120,076	5,148,729	5,298,920	5,158,690	4,608,607	5,062,725
Incheon	4,766,869	4,856,855	4,892,557	4,936,199	5,022,346	4,854,897	4,499,900	4,833,974
Gwangju	3,181,945	3,248,652	3,256,947	3,282,320	3,334,130	3,199,923	2,963,129	3,210,552
Daejeon	3,371,202	3,471,768	3,440,256	3,460,083	3,542,346	3,268,807	3,060,613	3,375,030
Ulsan	2,125,769	2,211,550	2,196,450	2,224,785	2,249,055	2,101,846	1,933,586	2,149,980
Sejong	401,567	417,487	415,066	417,822	414,393	366,251	346,360	397,288
Gyeonggi	21,458,343	21,977,417	22,093,121	22,288,893	22,633,520	21,466,317	19,970,092	21,705,339
Gangwon	3,080,797	3,146,806	3,173,531	3,233,186	3,290,158	3,284,027	2,969,370	3,168,681
Chungbuk	3,018,748	3,107,424	3,094,137	3,125,503	3,190,528	2,967,970	2,741,238	3,036,365
Chungnam	3,923,015	4,039,755	4,016,455	4,061,509	4,111,097	3,863,508	3,551,537	3,939,864
Jeonbuk	3,477,493	3,552,178	3,563,112	3,604,560	3,660,621	3,539,112	3,267,490	3,524,435
Jeonnam	3,014,038	3,078,994	3,094,379	3,153,384	3,174,014	3,098,280	2,860,742	3,068,404
Gyeongbuk	4,916,697	5,040,944	5,037,550	5,128,855	5,219,204	5,066,769	4,578,312	4,999,753
Gyeongnam	5,761,322	5,943,575	5,950,425	6,027,645	6,101,041	5,887,256	5,364,026	5,864,072
Jeju	1,657,800	1,684,057	1,692,941	1,725,106	1,745,428	1,710,823	1,613,178	1,690,103

Analysis conditions

– Indicating changes in traffic (degree of increase / decrease) by day and by region in rate and drawing comparisons.
- The changes in traffic volume indicate the differences between daily average traffic volume were calculated by dividing total traffic volume by the total analysis period (388 days) and daily average traffic volume was calculated by dividing total traffic volume by the analysis period by the day (Monday ~ Thursday: 56 days, Friday ~ Saturday: 55 days, Sunday: 54 days).

- Gender: Male and female
- Age: All ages recorded in the data
- Departing trip types: All Trip types
- Arrival trip types: All trip types
- Departure time: 24 hours
- Arrival time: 2 4 hours
- Temporal range: about 13 months (From March 7, 2016 to March 31, 2017)
  - Monday (56 days), Tuesday (56 days), Wednesday (56 days), Thursday (56 days), Friday (55 days), Saturday (55 days), Sunday (54 days)
- Spatial coverage: Nationwide (Analysis units: city and province)

• Weekdays · How is the weekend traffic different?

On weekdays, traffic is concentrated between 8:00 a.m., 12:00 p.m., and 6:00 p.m., but on weekends, traffic is not concentrated at certain times.

On weekdays, traffic is high between 7 a.m. and 8 p.m., and on weekends, traffic is high between 12 p.m. and 6 p.m.

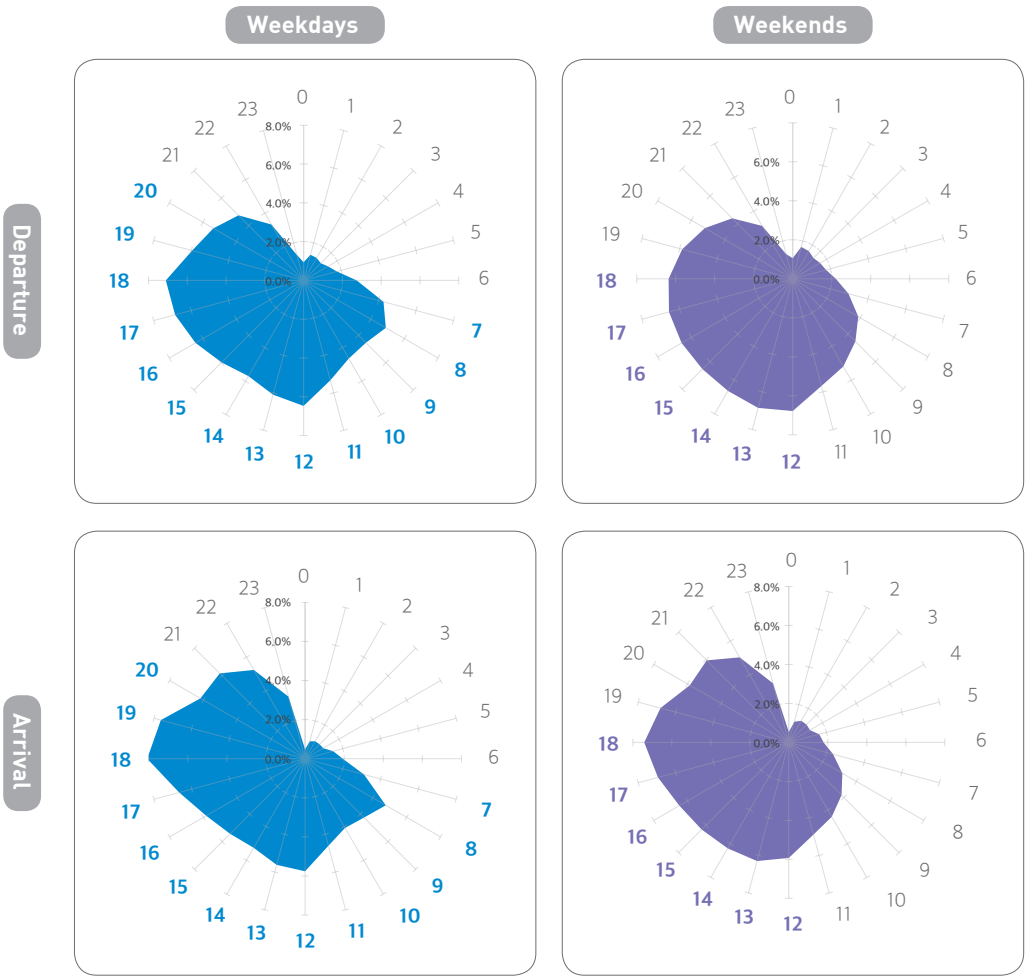


Table 2.13 | Traffic Volume by Time of Day

(Unit: trip/day)

Classification	Generation				Arrival			
	Weekdays		Weekends		Weekdays		Weekends	
	Daily average traffic volume	Ratio	Daily average traffic volume	Ratio	Daily average traffic volume	Ratio	Daily average traffic volume	Ratio
0 am	926,347	0.9%	974,749	1.1%	476,553	0.5%	491,834	0.5%
1 am	1,354,378	1.4%	1,558,177	1.7%	908,863	0.9%	1,012,775	1.1%
2 am	1,323,277	1.3%	1,515,261	1.6%	1,020,217	1.0%	1,177,856	1.3%
3 am	1,238,374	1.3%	1,388,905	1.5%	1,033,778	1.0%	1,187,295	1.3%
4 am	1,432,905	1.5%	1,492,990	1.6%	1,061,031	1.1%	1,157,477	1.3%
5 am	1,758,623	1.8%	1,629,556	1.8%	1,470,912	1.5%	1,487,852	1.6%
6 am	2,705,849	2.7%	2,037,294	2.2%	1,905,583	1.9%	1,643,659	1.8%
7 am	4,214,725	4.3%	2,728,776	3.0%	3,084,504	3.1%	2,168,725	2.4%
8 am	4,836,442	4.9%	3,576,538	3.9%	4,709,745	4.8%	2,922,232	3.2%
9 am	4,490,966	4.5%	4,185,127	4.5%	4,208,575	4.3%	3,523,733	3.8%
10 am	4,598,984	4.7%	4,781,414	5.2%	4,040,201	4.1%	4,060,400	4.4%
11 am	5,266,910	5.3%	5,241,478	5.7%	4,556,228	4.6%	4,508,588	4.9%
12 pm	6,396,858	6.5%	6,245,336	6.8%	5,689,692	5.8%	5,459,729	5.9%
13 pm	6,026,714	6.1%	6,312,773	6.9%	5,552,469	5.6%	5,804,301	6.3%
14 pm	5,628,846	5.7%	6,114,606	6.6%	5,197,035	5.3%	5,779,709	6.3%
15 pm	5,909,845	6.0%	6,031,731	6.5%	5,363,335	5.4%	5,823,527	6.3%
16 pm	6,363,416	6.4%	6,059,812	6.6%	5,767,547	5.8%	5,973,430	6.5%
17 pm	6,778,075	6.9%	6,049,399	6.6%	6,587,800	6.7%	6,402,278	7.0%
18 pm	7,020,202	7.1%	5,861,311	6.4%	7,979,516	8.1%	6,831,920	7.4%
19 pm	5,880,439	6.0%	5,401,889	5.9%	7,544,646	7.6%	6,276,743	6.8%
20 pm	5,309,405	5.4%	4,790,606	5.2%	6,104,701	6.2%	5,401,231	5.9%
21 pm	4,690,008	4.7%	4,039,842	4.4%	6,099,660	6.2%	5,484,007	6.0%
22 pm	3,292,365	3.3%	2,885,992	3.1%	5,181,285	5.2%	4,640,737	5.0%
23 pm	1,352,835	1.4%	1,209,188	1.3%	3,252,910	3.3%	2,892,711	3.1%

Analysis conditions

– The traffic generation volume and the arrival traffic volume by time zone were classified into weekdays and weekends, and then they are divided by the number of analysis days (279 days on weekdays and 109 days on weekdays) to calculate daily average traffic volume (generation and arrivals).

- Gender: Male and female
- Age: All ages recorded in the data
- Departing trip types: All Trip types
- Arrival trip types: All trip types
- Departure time: 24 hours
- Arrival time: 2 4 hours
- Temporal range: about 13 months (From March 7, 2016 to March 31, 2017)
  - Weekdays(279 days), Weekends(109 days)
- Spatial coverage: Nationwide

05_ Analysis by Age

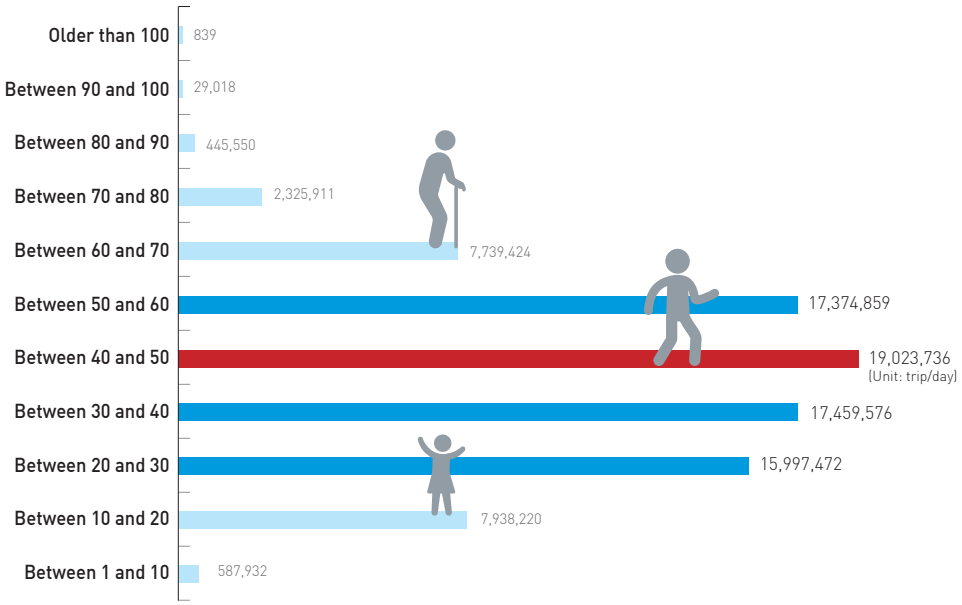
• Which age generates the most traffic volume?

Those in their 40s (over 40 and under 50) are the most frequent passengers in Korea, and similar age groups are in their 20s, 30s, and 50s.

The next most frequent passengers are teens (over 10 and under 20); and those in their 60s (over 60 and under 70)

- When grouping age groups with similar daily average traffic, age groups can be divided into three types:

·The daily average traffic volume was analyzed by dividing the age by decade. As a result, it was divided into the group whose daily average traffic volume is more than 15 million (between 20 and 60), group with more than 7 million (between 10 and 20) and group with less than 7 million (between 1 and 10, and between 70 and 110 years old).



Analysis conditions

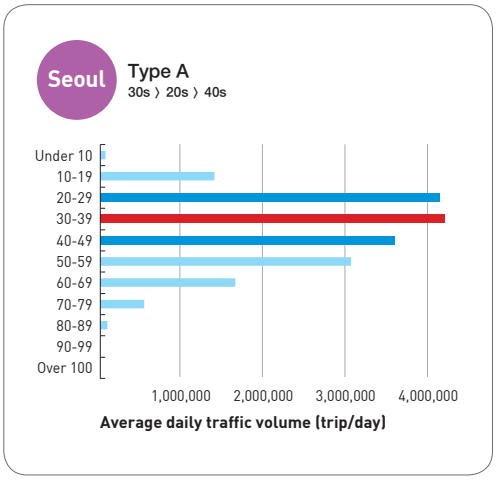
– Calculated daily average traffic volume for each age group by dividing the age by decade, and then dividing the traffic volume by the number of analyzed days (total 388 days)

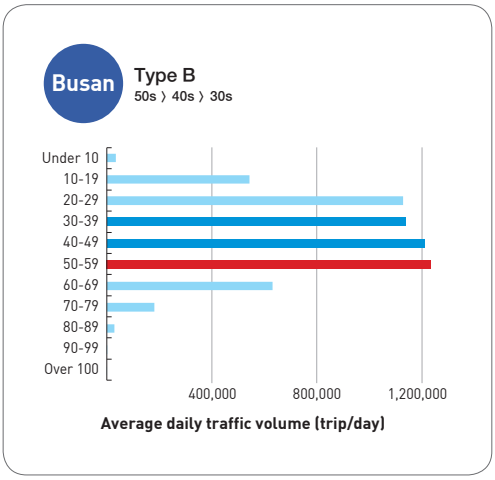
- Gender: Male and female
- Age: All ages recorded in the data
- Departing trip types: All trip types
- Arrival trip types: All trip types
- Departure time: 24 hours
- Arrival time: 24 hours
- Temporal range: about 13 months (From March 7, 2016 to March 31, 2017)
- Spatial coverage: Nationwide

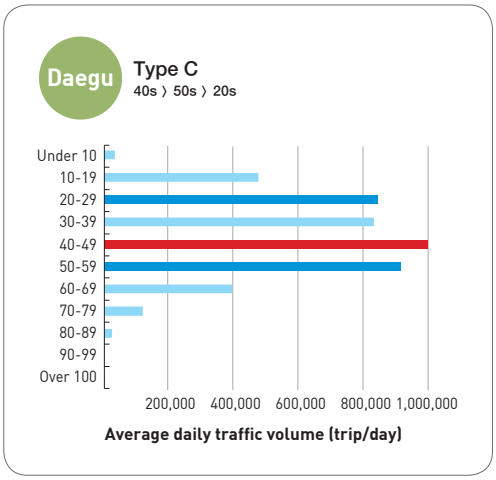
• Which age group generates the highest traffic volume (by region)?

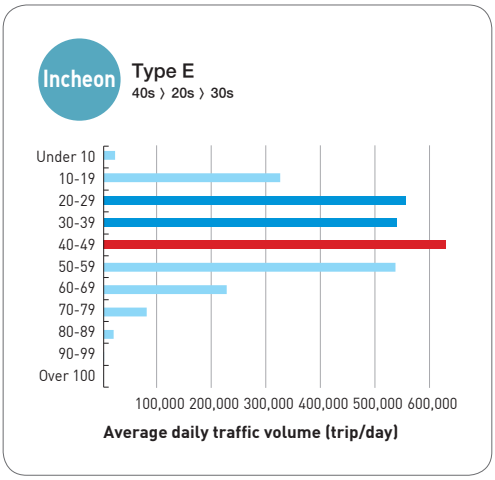
The age group generating the highest average daily traffic is people between 20 and 60 years of age in all regions. However, when classified by age group, the order from 1st to 3rd in traffic generation is different according to region.

- Type A (Seoul): 30s 〉 20s 〉 40s
- Type B (Busan, Gangwon): 50s 〉 40s 〉 30s
- Type C (Daegu): 40s 〉 50s 〉 20s
- Type D (Sejong, Gyeonggi): 40s 〉 30s 〉 50s
- Type E (Incheon, Gwangju, Daejeon): 40s 〉 20s 〉 30s
- Type F (Ulsan, Chungbuk, Chungnam, Jeonbuk, Jeonnam, Gyeongbuk, Gyeongnam, Jeju): 40s 〉 50s 〉 30s





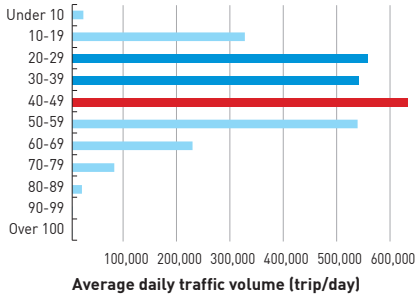




Gwangju

Type E

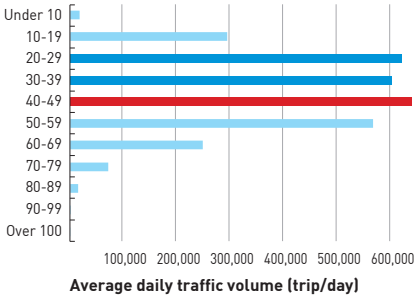
40s 〉 20s 〉 30s



Daejeon

Type E

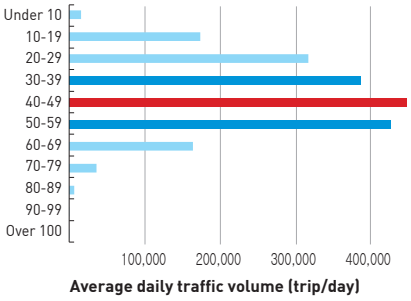
40s 〉 20s 〉 30s



Ulsan

Type F

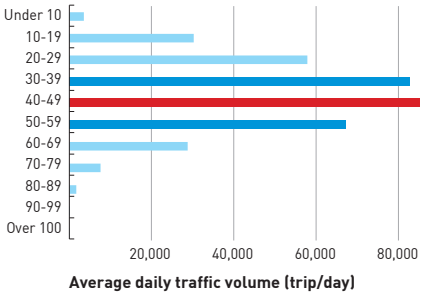
40s 〉 50s 〉 30s



Sejong

Type D

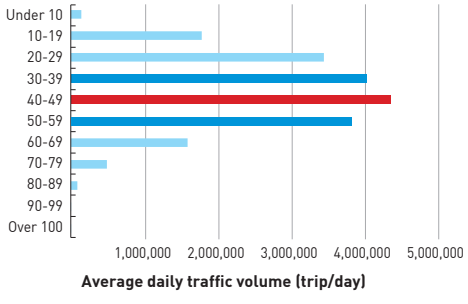
40s 〉 30s 〉 50s



Gyeonggi

Type D

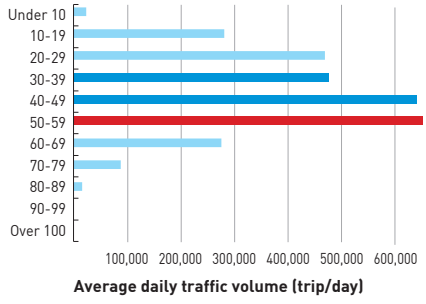
40s 〉 30s 〉 50s



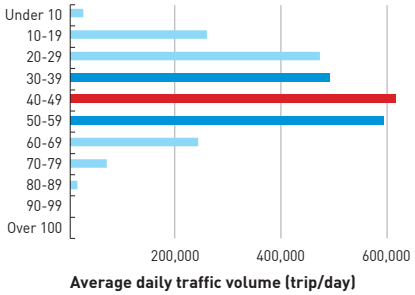
Gangwon

Type B

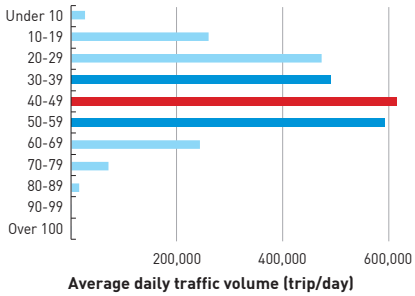
50s 〉 40s 〉 30s



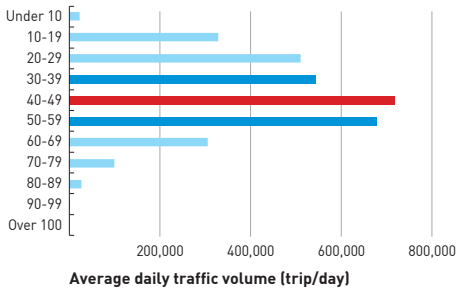
Chungbuk Type F
40s 〉 50s 〉 30s



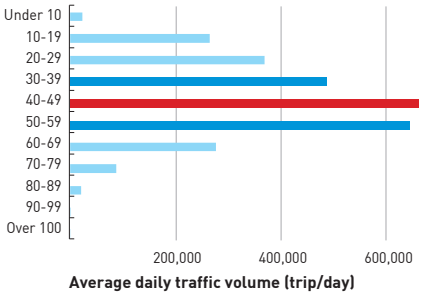
Chungnam Type F
40s 〉 50s 〉 30s



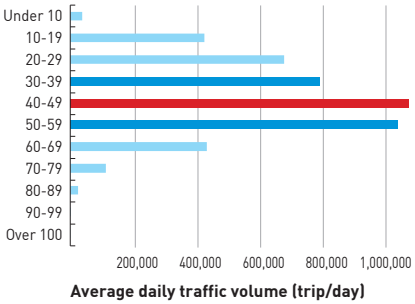
Jeonbuk Type F
40s 〉 50s 〉 30s



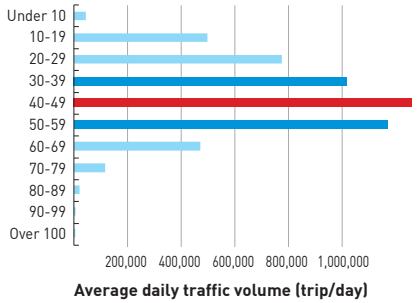
Jeonnam Type A
40s 〉 50s 〉 30s

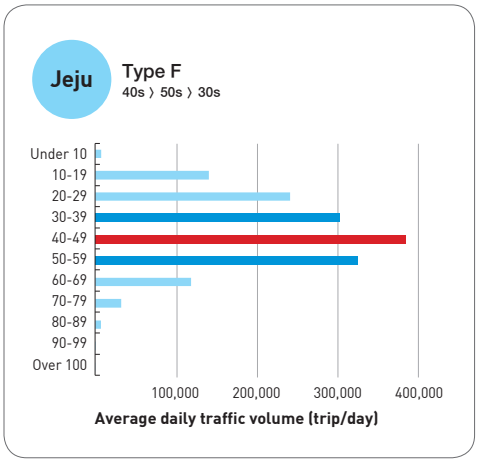


Gyeongbuk Type F
40s 〉 50s 〉 30s



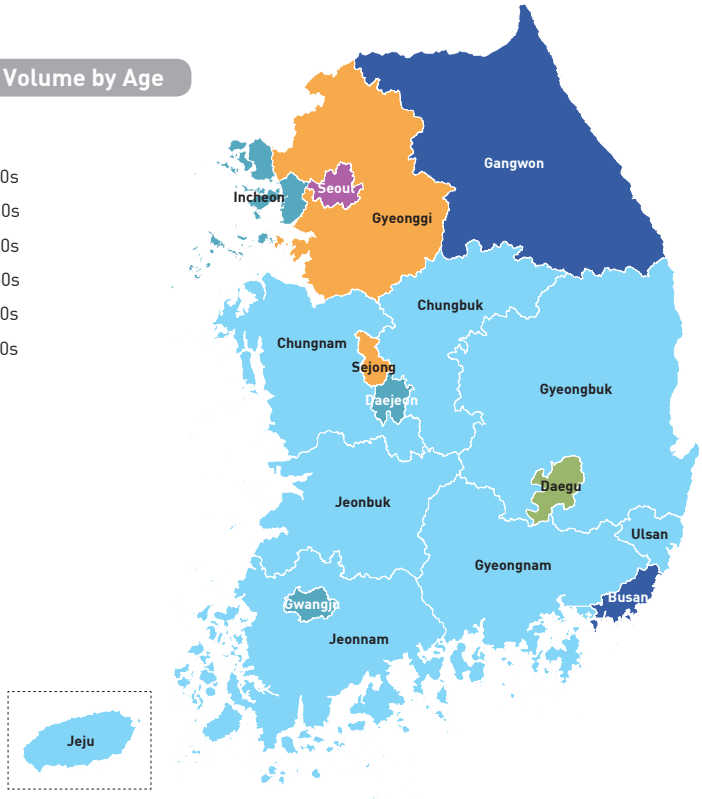
Gyeongnam Type F
40s 〉 50s 〉 30s





Type of Average Daily Traffic Volume by Age

- Type A: 30s > 20s > 40s
- Type B: 50s > 40s > 30s
- Type C: 40s > 50s > 20s
- Type D: 40s > 30s > 50s
- Type E: 40s > 20s > 30s
- Type F: 40s > 50s > 30s



Analysis conditions

– Calculated daily average traffic volume by city and province in accordance with classification criteria by age group, then listed the order by age and grouped the areas in the same order

- Gender: Male and female
- Age: All ages recorded in the data
- Departing trip types: All trip types
- Arrival trip types: All trip types
- Departure time: 24 hours
- Arrival time: 24 hours
- Temporal range: about 13 months (From March 7, 2016 to March 31, 2017)
- Spatial coverage: Nationwide (Analysis units: city and province)

Which age group has the highest traffic by type of activity?

• Going to Work/School

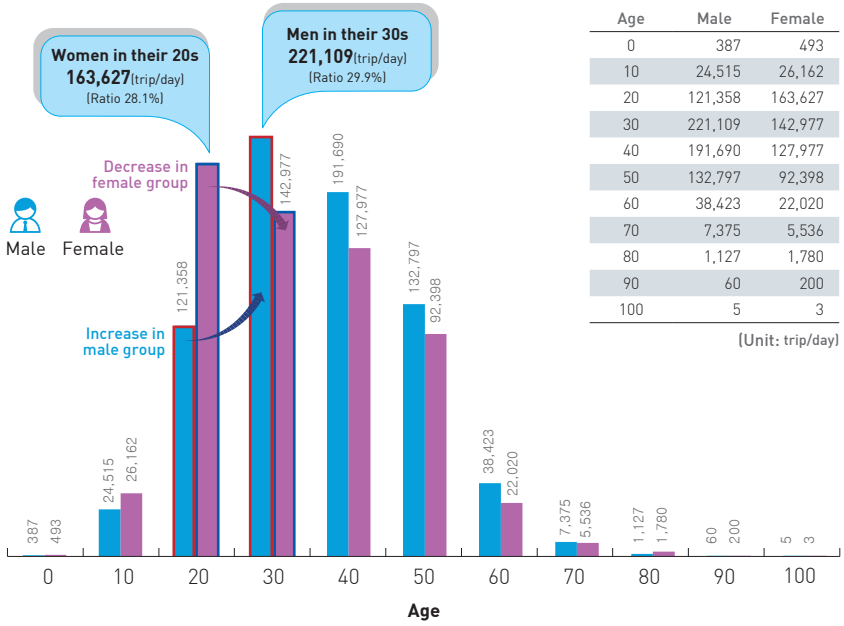
Men in their 30s and women in their 20s created the highest traffic volume.

Under their 20s, women are more likely to travel than men, but from their 30s, women's traffic volume is lower than men.

·If women are considered to be on their way to work, they are more likely to participate in economic activities earlier than men, but from their 30s, participation in economic activities may be lower than men.

※ It seems that moving from the 'nighttime Stay Area (e.g., home) to the 'daytime Stay Area (e.g., company, school, etc.) is considered as 'travel to go to work or school.'

Going to work



Age	Male	Female
0	387	493
10	24,515	26,162
20	121,358	163,627
30	221,109	142,977
40	191,690	127,977
50	132,797	92,398
60	38,423	22,020
70	7,375	5,536
80	1,127	1,780
90	60	200
100	5	3

(Unit: trip/day)

• Leisure

Travel between cities and counties: Men in their 40s and women in their 20s create the highest traffic volume.

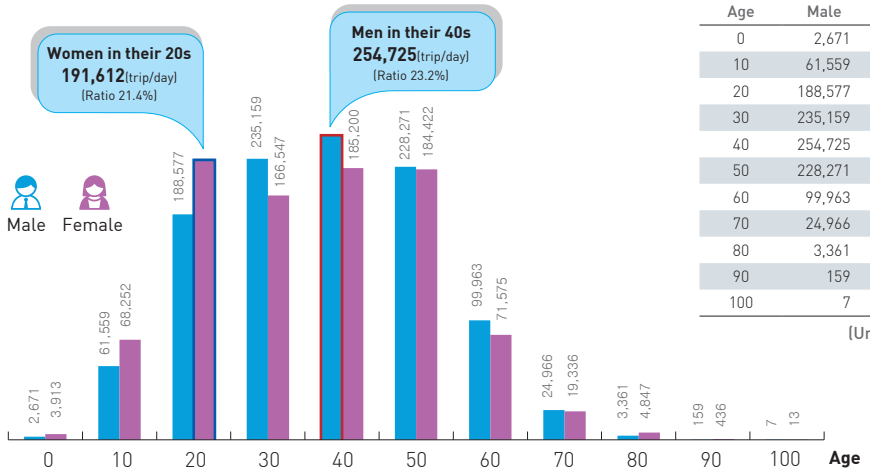
Female traffic is higher than men in their 20s, while male traffic is higher than women in their 30s.

Travel in city and county: Both men and women in their 40s have the highest traffic volume.

Unlike the travel between the cities and counties, women in their 40s and 50s show higher traffic volume than men.

※ Regardless of the trip type at the departure, traveling to the 'Potential Stay Area (e.g., restaurants, department stores, parks, churches, etc.)' is considered as travel for leisure.

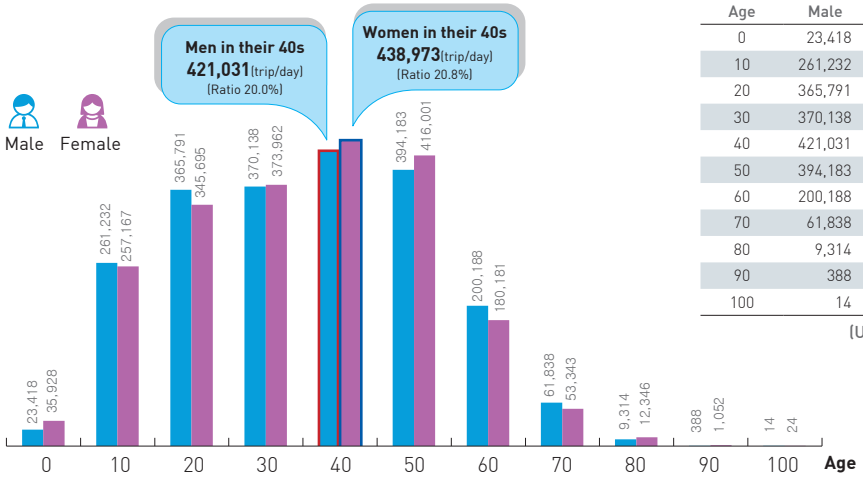
Travels between cities and counties



Age	Male	Female
0	2,671	3,913
10	61,559	68,252
20	188,577	191,612
30	235,159	166,547
40	254,725	185,200
50	228,271	184,422
60	99,963	71,575
70	24,966	19,336
80	3,361	4,847
90	159	436
100	7	13

(Unit: trip/day)

Travels within cities and counties



Age	Male	Female
0	23,418	35,928
10	261,232	257,167
20	365,791	345,695
30	370,138	373,962
40	421,031	438,973
50	394,183	416,001
60	200,188	180,181
70	61,838	53,343
80	9,314	12,346
90	388	1,052
100	14	24

(Unit: trip/day)

Analysis conditions

- Calculated daily average traffic volume for each age group of men and women by extracting traffic histories that are estimated to be for work, school, and leisure activities
  - Extracted history of traveling between cities and counties for activities of going to work and school.
  - Leisure activities are classified into travel history between cities and counties and travel history within cities and counties.

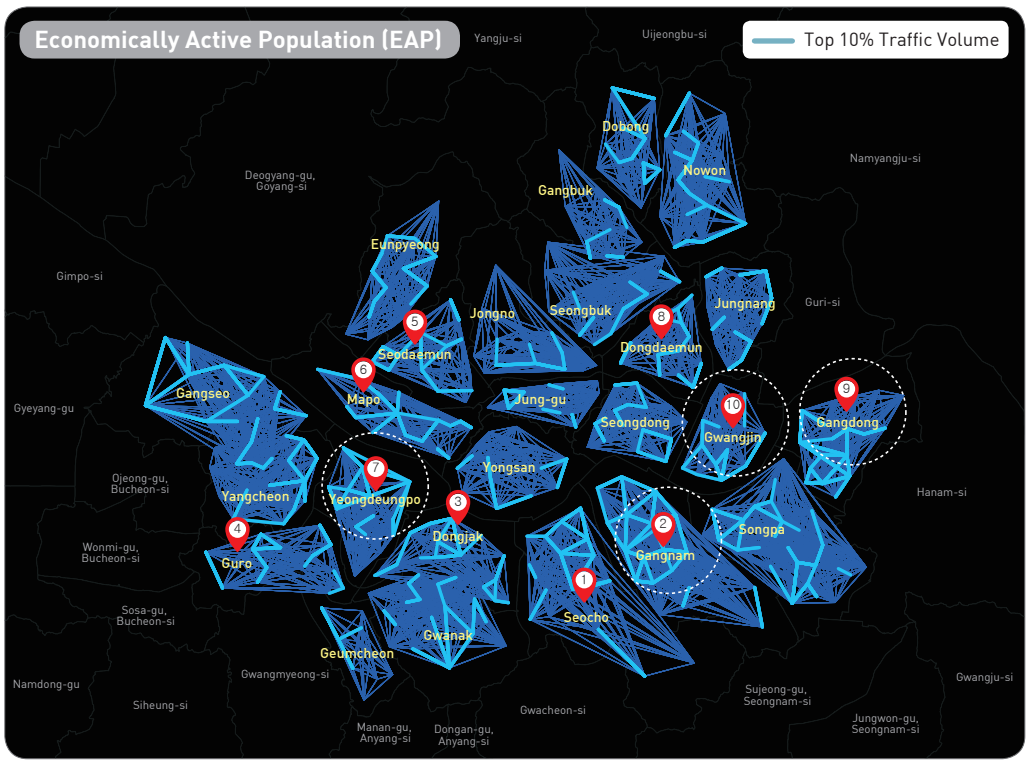
- Gender: Classified into male and female
- Age: All ages recorded in the data
- Departing trip types:
  - (Commuting to work · Going to school) Nighttime Stay Area (N)
  - (Leisure) : All Trip types
- Arrival trip types:
  - (Commuting to work · Going to school) Daytime Stay Area (D)
  - (Leisure) : Potential Stay Area (X)
- Departure time:
  - (Commuting to work · Going to school) : 6 a.m.~9 a.m.
  - (Leisure) : 24 hours
- Arrival time:
  - (Commuting to work · Going to school) : 7 a.m.~10 a.m.
  - (Leisure) : 24 hours
- Temporal range: about 13 months (From March 7, 2016 to March 31, 2017)
- Spatial coverage: Nationwide (analysis units: city and province)

• What is the difference in traffic between the economically active population (EAP) and seniors?

The EAP and seniors show differences in travel area even in the same city and country.

The bold line represents the top 10% in traffic volume, indicating that the economically active population differs from the elderly in terms of travel type.

Unlike the elderly, the economically active population has a high internal traffic volume in the eastern regions of Seoul (Gangnam-gu, Gwangjin-gu, and Gangdong-gu), while the elderly have a large internal traffic volume in northern areas of Seoul (Seodaemun-gu, Eunpyeong-gu, Gangbuk-gu and Dobong-gu).



Analysis conditions

– Analyzing the differences in traffic volume and traffic patterns between economically active population and the elderly
- Those aged between 20 to 60 yrs. who show a large traffic volume compared to other ages are regarded as economically active population, and the population aged 70 or older is regarded as the elderly.
- Since the economically active population is concentrated on commuting time, the time going to work (from 6:00 a.m. to 10:00 a.m.) which is expected to show big difference in traffic patterns between the economically active population and the elderly is set as the analysis time zone.
- Collected data of top 10% in traffic volume and calculated the percentage of total traffic.

- Gender: Male and female
- Age: - Economically active population: over 20 years old and under 60 years old
  - Elderly population: over 70 years old
- Departing trip types: All Trip types
- Arrival trip types: All trip types
- Departure time: 6 a.m.~10 a.m.
- Arrival time: 6 a.m.~10 a.m.
- Temporal range: about 13 months (From March 7, 2016 to March 31, 2017)
- Spatial coverage: Seoul (Analysis units: town, township and neighborhood)

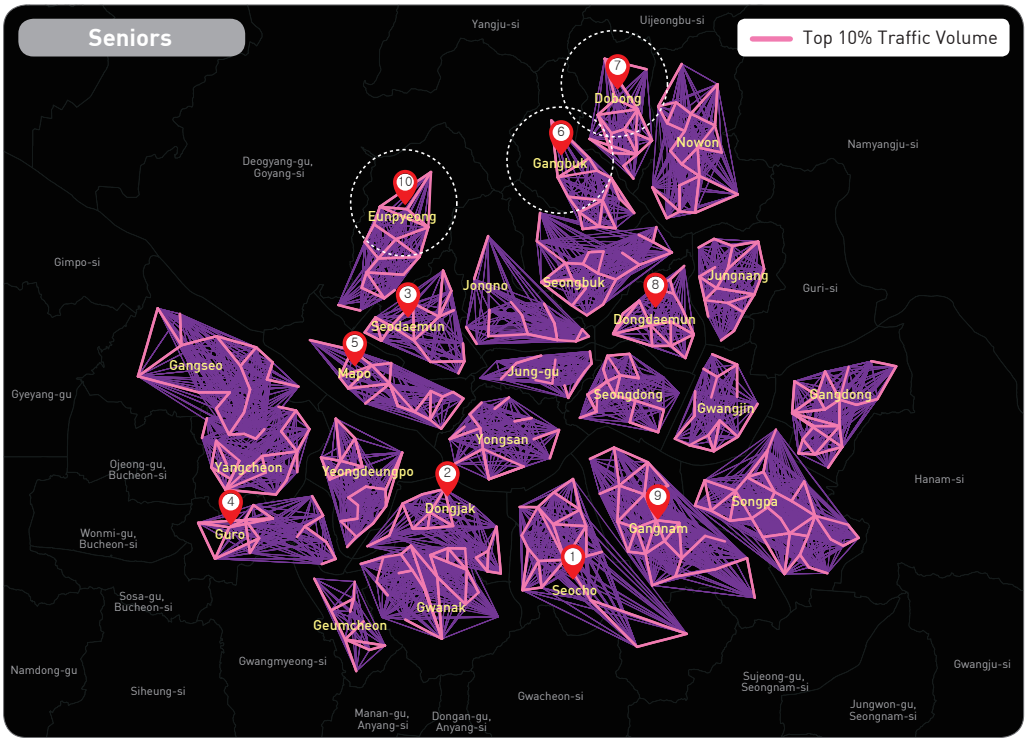


Table 2.14 | **Comparison of Regional Traffic Volumes of EAP and the Seniors**

Economically Active Population (20s~50s)

Ranking	District	Top 10% Traffic Volume	Total trips	Rate
1	Seocho	19,497,286	35,884,741	77.9%
2	Gangnam	38,499,385	50,124,046	76.8%
3	Dongjak	16,589,635	21,791,626	76.1%
4	Guro	15,643,474	20,748,178	75.4%
5	Seodaemun	14,059,923	18,651,882	75.4%
6	Mapo	19,594,825	26,259,301	74.6%
7	Yeongdeungpo	19,867,669	27,779,900	71.5%
8	Dongdaemun	14,359,771	20,181,663	71.2%
9	Gangdong	20,726,386	29,330,169	70.7%
10	Gwangjin	13,841,411	19,975,981	69.3%
11	Songpa	28,673,256	42,788,651	67.0%
12	Eunpyeong	13,544,469	20,417,594	66.3%
13	Jungnang	12,519,162	18,957,377	66.0%
14	Nowon	18,239,087	27,666,940	65.9%
15	Gwanak	16,446,770	25,039,354	65.7%
16	Seongdong	12,264,051	18,707,367	65.6%
17	Gangseo	19,497,286	29,915,050	65.2%
18	Jongno	8,603,531	13,343,424	64.5%
19	Geumcheon	6,959,681	10,941,478	63.6%
20	Seongbuk	14,982,551	23,745,672	63.1%
21	Yangcheon	13,119,439	20,883,548	62.8%
22	Yongsan	9,733,930	15,605,894	62.4%
23	Dobong	9,627,276	15,481,312	62.2%
24	Jung-gu	8,002,371	13,213,758	60.6%
25	Gangbuk	8,481,634	14,443,987	58.7%

The Elderly (70s~110s)

Ranking	District	Top 10% Traffic Volume	Total trips	Rate
1	Seocho	1,940,257	2,246,467	86.4%
2	Dongjak	1,168,445	1,355,560	86.2%
3	Seodaemun	1,032,896	1,201,219	86.0%
4	Guro	946,239	1,113,399	85.0%
5	Mapo	1,126,438	1,329,041	84.8%
6	Gangbuk	950,224	1,122,707	84.6%
7	Dobong	906,929	1,071,762	84.6%
8	Dongdaemun	1,021,398	1,220,925	83.7%
9	Gangnam	2,038,872	2,440,071	83.6%
10	Eunpyeong	1,215,835	1,455,676	83.5%
11	Yeongdeungpo	1,280,631	1,549,842	82.6%
12	Songpa	1,965,573	2,390,139	82.2%
13	Seongdong	834,342	1,030,103	81.0%
14	Gangdong	1,282,141	1,594,414	80.4%
15	Nowon	1,193,735	1,487,625	80.2%
16	Geumcheon	420,449	526,010	79.9%
17	Seongbuk	1,181,336	1,490,217	79.3%
18	Jungnang	845,764	1,079,574	78.3%
19	Gwanak	1,116,660	1,433,060	77.9%
20	Gwangjin	794,197	1,023,232	77.6%
21	Yongsan	761,649	985,005	77.3%
22	Gangseo	1,203,949	1,566,154	76.9%
23	Yangcheon	768,256	1,015,982	75.6%
24	Jongno	536,070	720,049	74.4%
25	Jung-gu	389,154	590,778	65.9%

06_ Analysis by Gender

- **What is the average daily traffic (ADT) for men and women?**

  The daily average traffic for men is about 50 million, and the daily average traffic for women is about 46 million.

  Men account for 52% in total traffic volume while women account for 48%.

Type	Total	ADT
Men	19,460,819,729	50,156,752
Women	18,143,773,624	46,762,303

Analysis conditions

– Classified total traffic volume into those of male and female, and divided them by the number of analyzed days (total 388 days) to calculate the daily average traffic volume

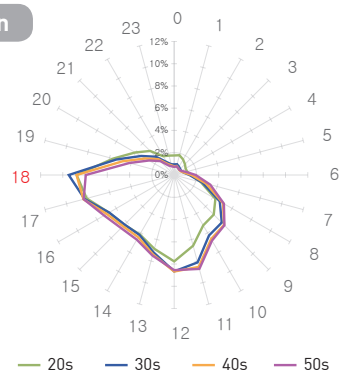
- Gender: Classified into male and female
- Age: All ages
- Departing trip types: All Trip types
- Arrival trip types: All trip types
- Departure time: 24 hours
- Arrival time: 24 hours
- Temporal range: About 13 months (from March 7, 2016 to March 31, 2017)
- Spatial coverage: Nationwide

• What is the moving difference by gender?

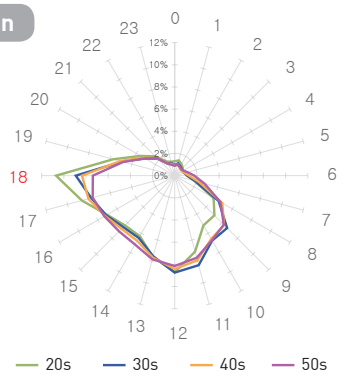
Both males and females have the highest traffic volume at 6 p.m., but the percentage of males and females differ by age.

Men show similar traffic percentage in all age groups while women show big differences in percentage by age.

Men



Women



Analysis conditions

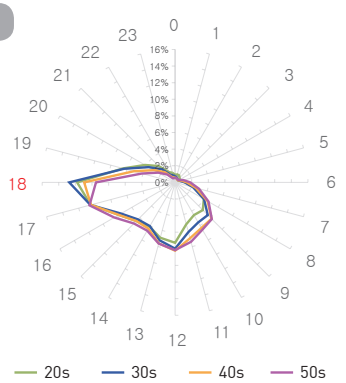
Classified the traffic history for men and women, and classified the traffic distribution by time and by age (20s, 30s, 40s, and 50s)

- Gender: Classified into male and female
- Age: Divided into four age groups
  - (20s) 20-29
  - (30s) 30-39
  - (40s) 40-49
  - (50s) 50-59
- Departing trip types: All trip types
- Arrival trip types: All trip types
- Departure time: 24 hours
- Arrival time: 24 hours
- Temporal range: About 13 months (from March 7, 2016 to March 31, 2017)
- Spatial coverage: Nationwide

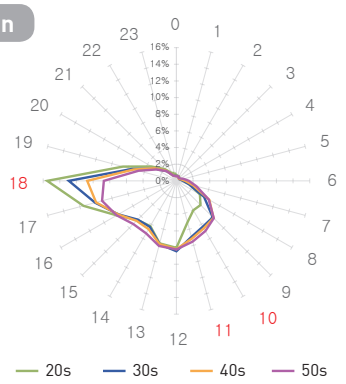
• What is the difference between women and men in leisure travel?

At 6:00 p.m., the difference in the percentage of female passengers by age groups is greater than that of male passengers. Unlike male passengers, the percentage of female passengers in their 20s decreases significantly between 10:00 a.m. and 11:00 a.m.

Men



Women



Analysis conditions

– Extracted the passage history of moving from the daytime Stay Area (D) to the Potential Stay Area (X) during the daytime and classify it into history for males and females. Then, showed the traffic distribution by time and by age (20s, 30s, 40s, and 50s).

- Gender: Classified into male and female
- Age: Divided into four age groups
  - (20s) 20-29
  - (30s) 30-39
  - (40s) 40-49
  - (50s) 50-59
- Departing trip types: Daytime Stay Area (D)
- Arrival trip types: Potential Stay Area (X)
- Departure time: 24 hours
- Arrival time: 24 hours
- Temporal range: About 13 months (from March 7, 2016 to March 31, 2017)
- Spatial coverage: Nationwide

• Which area has the best number of female commuters at midnight?

Areas departing from Gangnam-gu, Mapo-gu and Seocho-gu to Namyangju-si, Deokyang-gu Goyang-si, and Gwangmyeong-si, Gyeonggi-do

The areas with the largest traffic volume are Gangnam-gu, Mapo-gu and Seocho-gu, and the areas with the highest arrival traffic volume are Gwangmyeong-si, Namyangju-si, Deokyang-gu Goyang-si, and Hanam-si, Gyeonggi-do.

Among them, the areas with the highest demand for moving are the areas moving from Gumcheon-gu, Seoul to Gwangmyeong-si, Gyeonggi-do, and from Guro-gu, Seoul to Gwangmyeong-si, Gyeonggi-do. Unlike other areas, annual traffic volume of those areas is over 150,000.

Table 2.15 | **Top 3 destinations of Female commuters at midnight**

Origin (Seoul)	Destination					
	Top 1	Traffic volume	Top 2	Traffic volume	Top3	Traffic volume
Jongno	Deogyang-gu, Goyang-si, Gyeonggi-do	7,404	Uijeongbu-si, Gyeonggi-do	5,985	Bundang-gu, Seongnam-si, Gyeonggi-do	5,769
Jung-gu	Namyangju-si, Gyeonggi-do	9,027	Bundang-gu, Seongnam-si, Gyeonggi-do	7,839	Deogyang-gu, Goyang-si, Gyeonggi-do	7,218
Yongsan	Bundang-gu, Seongnam-si, Gyeonggi-do	11,391	Deogyang-gu, Goyang-si, Gyeonggi-do	5,133	Namyangju-si, Gyeonggi-do*	4,782
Gwangjin	Namyangju-si, Gyeonggi-do	12,855	Guri-si, Gyeonggi-do	8,541	Hanam-si, Gyeonggi-do*	4,647
Dongdaemun	Namyangju-si, Gyeonggi-do	7,854	Uijeongbu-si	5,460	Guri-si, Gyeonggi-do*	4,383
Jungnang	Namyangju-si, Gyeonggi-do	17,313	Guri-si, Gyeonggi-do	12,141	Uijeongbu-si, Gyeonggi-do*	4,182
Gangbuk	Uijeongbu-si, Gyeonggi-do	11,769	Deogyang-gu, Goyang-si, Gyeonggi-do*	2,933	Namyangju-si, Gyeonggi-do*	2,913
Dobong	Uijeongbu-si, Gyeonggi-do	23,164	Deogyang-gu, Goyang-si, Gyeonggi-do	7,287	Namyangju-si, Gyeonggi-do*	2,211
Nowon	Uijeongbu-si, Gyeonggi-do	30,416	Namyangju-si, Gyeonggi-do	26,587	Guri-si, Gyeonggi-do	5,548
Eunpyeong	Deogyang-gu, Goyang-si, Gyeonggi-do	32,836	Ilsandong-gu, Goyang-si, Gyeonggi-do*	3,420	Paju-si, Gyeonggi-do*	1,938
Seodaemun	Deogyang-gu, Goyang-si, Gyeonggi-do	9,075	Ilsandong-gu, Goyang-si, Gyeonggi-do	5,202	Wonmi-gu, Bucheon-si, Gyeonggi-do*	2,859
Mapo	Deogyang-gu, Goyang-si, Gyeonggi-do	35,972	Ilsandong-gu, Goyang-si, Gyeonggi-do	17,781	Wonmi-gu, Bucheon-si, Gyeonggi-do	14,733
Yangcheon	Ojeong-gu, Bucheon-si, Gyeonggi-do	19,709	Wonmi-gu, Bucheon-si, Gyeonggi-do	5,411	Kwangmyong-si, Kyonggi-do*	4,236
Gangseo	Ojeong-gu, Bucheon-si, Gyeonggi-do	19,647	Gimpo-si, Gyeonggi-do	11,864	Deogyang-gu, Goyang-si, Gyeonggi-do	10,594
Guro	Kwangmyong-si, Kyonggi-do	159,414	Sosa-gu, Bucheon-si, Gyeonggi-do	25,978	Wonmi-gu, Bucheon-si, Gyeonggi-do	13,967
Geumcheon	Kwangmyong-si, Kyonggi-do	168,640	Manan-gu, Anyang-si, Gyeonggi-do	18,482	Wonmi-gu, Bucheon-si, Gyeonggi-do*	2,733
Yeongdeungpo	Kwangmyong-si, Kyonggi-do	11,655	Wonmi-gu, Bucheon-si, Gyeonggi-do	10,272	Bupyeong-gu, Incheon	6,876
Gwanak	Kwangmyong-si, Kyonggi-do	8,856	Wonmi-gu, Bucheon-si, Gyeonggi-do*	3,798	Manan-gu, Anyang-si, Gyeonggi-do*	3,495
Seocho	Gwacheon-si, Gyeonggi-do	61,992	Bundang-gu, Seongnam-si, Gyeonggi-do	23,295	Sujeong-gu, Seongnam-si, Gyeonggi-do	10,480
Gangnam	Bundang-gu, Seongnam-si, Gyeonggi-do	39,423	Sujeong-gu, Seongnam-si, Gyeonggi-do	22,772	Namyangju-si, Gyeonggi-do	19,914
Songpa	Hanam-si, Gyeonggi-do	83,535	Sujeong-gu, Seongnam-si, Gyeonggi-do	50,427	Namyangju-si, Gyeonggi-do	15,234
Gangdong	Hanam-si, Gyeonggi-do	99,525	Namyangju-si, Gyeonggi-do	9,561	Guri-si, Gyeonggi-do	8,335

* : Region not in the top 10%

Analysis conditions

– In order to analyze the areas requiring security for safe return of women, we analyzed the areas with the highest demand for moving from midnight to 5:00 a.m.
  - In the case of moving from Seoul to another area during nighttime, only the history of moving from the daytime Stay Area or the Potential Stay Area to the Stay Area in the evening was extracted to calculate the traffic volume in cities and counties.

- Gender: Female
- Age: All ages (0~110s)
- Departing trip types: Daytime Stay Area (D), Potential Stay Area (X)
- Arrival trip types: Nighttime Stay Area (N)
- Departure time: 0 a.m.~5 a.m.
- Arrival time: 0 a.m.~5 a.m.
- Temporal range: About 13 months (from March 7, 2016 to March 31, 2017)
- Spatial coverage: departure from Seoul, arrival at anywhere of the country (exclude trips arrived at Seoul, analysis units: city, county and district)

Vehicle Mobility Report

Understanding the Nation's Transport in the Perspective of Vehicle Mobility

Chapter 1

Overview of Vehicle Mobility Report

01 I What is Mobility of Vehicle?

02 I Introduction of the Data Used in the Report

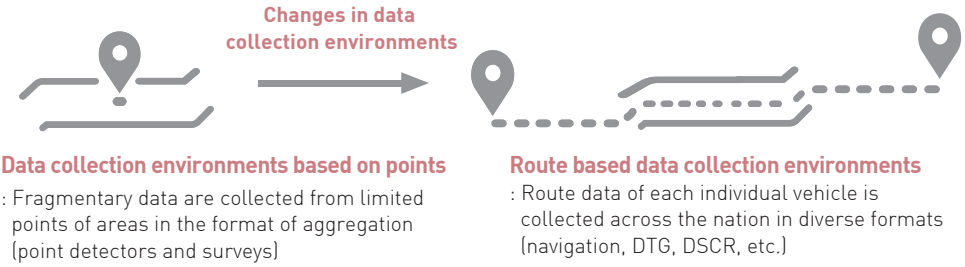
03 I How the Mobility Indexes in the Report Was Produced

04 I Notes for the Result Values of This Study

01_What is 'Mobility of Vehicles'?

- In the past point-based data collection environment, there was no data for identifying 'Movements of Vehicles'. However, as the environment of data acquisition techniques is getting evolved in various ways, the emergence of many new types of methodology has resulted to help knowing the 'Movement of Vehicles' more effectively.

- Using the method of data collection based on the points has had several limitations:
  - It has provided fragmentary information which leads to capture only part of the occurring events and the scope of data collected was also very limited (the coverage of the national traffic volume and a velocity were only reached by 3 percent and 16 percent of the total, respectively).
  - Data gathered by the point-based methods made traffic mangers unable to capture the overall traffic conditions and had them to prescribe temporary measures, thus, preventing them from solving the fundamental problem.
  - Furthermore, it made hard to grasp the attributes of vehicles with a question of 'why do cars travel from where to where with what purposes with whom and how?'.



[Figure 1] Changes in data collection environments

- Data achieved from 'Mobility of Vehicles' has many distinguished features which could overcome lots of difficulties that traffic specialists have encountered in the past. First, the aggregated data is able to monitor the current traffic condition which is usually unknown before. This could be realized as it collects the data across the country due to the data's spatiotemporal connectivity attribute. Hence, it helps to identifying the practical pattern of trip of vehicles in real time.

- Therefore, this report will discuss and analyze the following four areas; traffic condition, traffic congestion, traffic environment, and traffic safety in Korea with a new perspective by utilizing 'Navigation Data'. The 'Navigation Data' refers to the data gathered while each vehicles travel their trips using their own personal electric devices of cellphone, navigator, and similar tools.

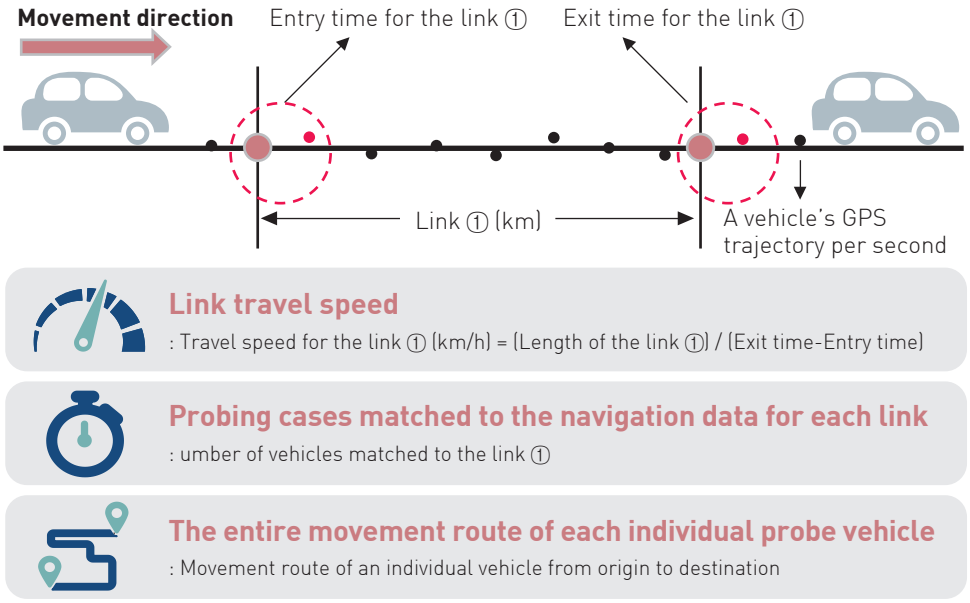
- By utilizing the route–based data, we expect that this report will provide leaders with a starting point to chart their own journey toward the establishment of the transport monitoring system

which covers the nationwide, build the idea to contribute the diagnosis the fundamental causes of problems, and aim to suggest ultimately the customized solutions for them.

02_Introduction of the Data Used in the Report (Navigation Data)

- Navigation data is a dimensional type of data which collects mobility of vehicle in each individual trip's (trajectory) time continuity and spatial connectivity simultaneously. It has a feature of gathering data regardless of temporal and spatial constraints as it uses personal devices such as cellphones and navigator devices.

- Navigation data, also, is able to collect travel the speed of the section and each individual vehicle's travel path.
  - Traffic volume of navigation data accumulated for each link can be additionally generated.



[Figure 2] Information gathered from the navigation data

[Table 1] Table of specifications for the navigation data

Column	Explanation	Data Type	Notes
auth_key	Navigator ID	Datetime	-
link_time	Collected time (year/month/day/time/ minute/second)	Integer	-
from_link	Entry link ID	Integer	-
to_link	Exit link ID	Integer	-
speed	Link travel speed (km/h)	Integer	-

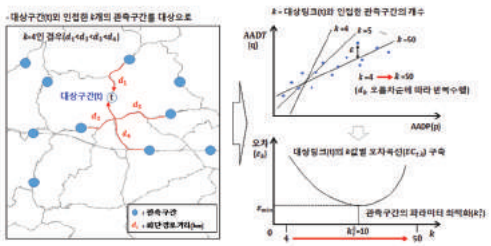
03_How the Index in This Report Was Produced

◎ Traffic volume

■ Traffic volume is forecasted in four steps as below:

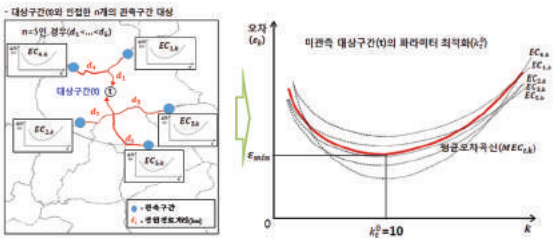
Step 1

Drawing error curves between an unobserved point and K nearest neighbors



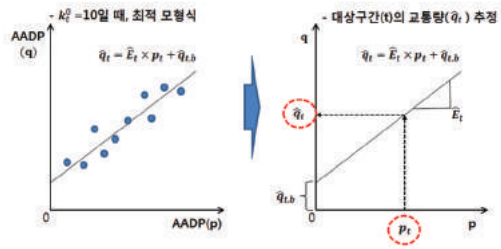
Step 2

Optimizing K parameters for N error curves neighboring to the unobserved point



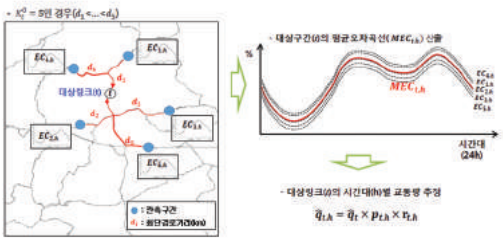
Step 3

Estimating average yearly traffic volume for the unobserved points



Step 4

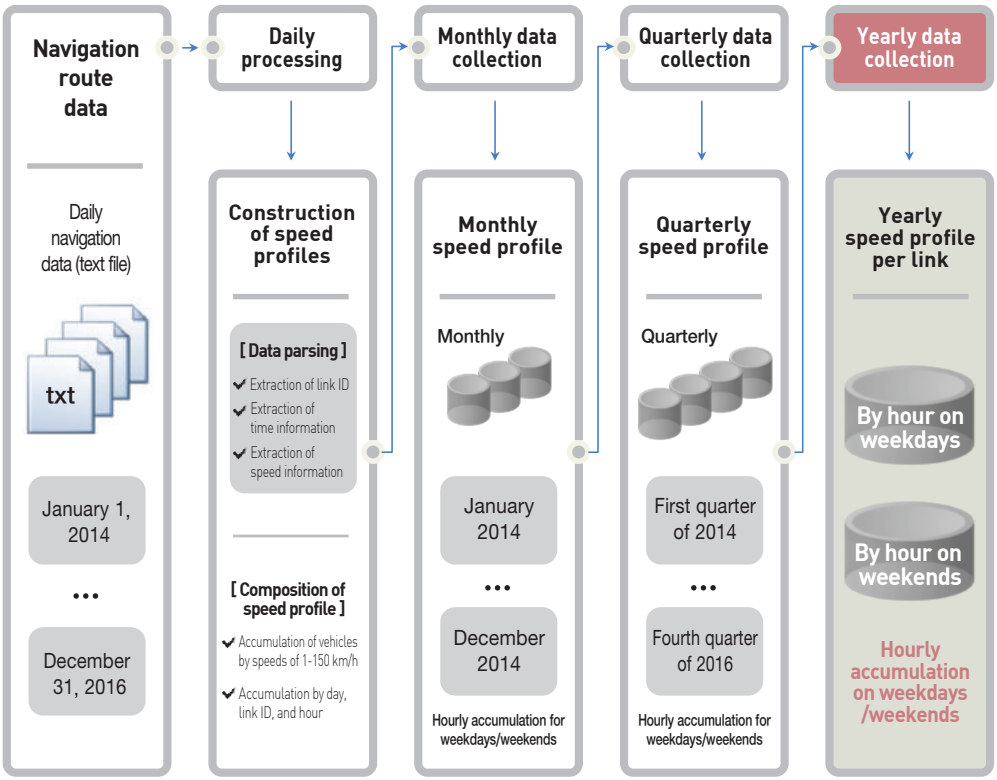
Estimating hourly traffic volume of the unobserved points on the basis of the yearly average traffic volume estimated for the points



[Figure 3] Methods for Estimating Traffic Volumes

◎ Speed

- Constructing speed profile database for individual link and hour using the raw data acquired from the navigators
- Producing diverse speed indexes including overall average speed, average speed during peak period, average speed during off-peak period and so forth by using speed profile DB



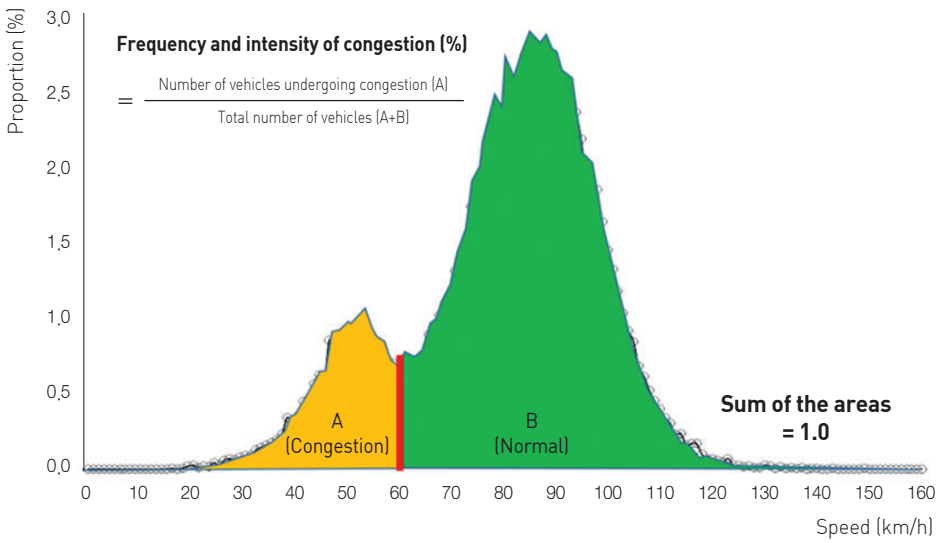
[Figure 4] How to construct speed profiles for each individual link

[Table 2] Formats of speed profile DB (example)

Link ID (Lv6 criteria)	Year	Weekdays/ Weekends	Time of day	Speed profile (cases/hour)					
				Total	1km/h	2km/h	...	149km/h	150km/h
41230004401	2015	Weekdays	0am-1am	12	0	0	...	1	0
41230004401	2015	Weekdays	1am-2am	15	0	0	...	2	0
41230004401	2015	Weekdays	2am-3am	17	0	0	...	3	0
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮

◎ Frequency and intensity of congestion

- The frequency and intensity of congestion refer to the proportion of vehicles undergoing congestion among the total number of vehicles



[Figure 5] Method for calculating frequency and intensity of congestion

◎ CO_2 emissions

- "Establishment of a Climate Change Responding System for Transportation Sector (II) - Development of Bottom-up Type GHGs Emission Factors for Vehicles" suggests CO_2 emission factors for all vehicles.
- The emission factors suggested are comprised of speed functions, and applied differently in accordance with the vehicle types and fuel types.
- In order to enhance accuracy of CO_2 emission calculation, the basic units of CO_2 emission are decided based on emission efficient equations considering road occupancy rates by vehicle type and fuel type.
- The CO_2 emission volume is calculated based on CO_2 emission basic unit, expanded traffic volume for a link, vehicle composition ratio and length of a link.
- CO_2 emission volume (g) = CO_2 emission factors by vehicle type (g/km) X vehicle kilometers traveled (vehicle*km)

◎ Volume of particulate matter emissions

- A Guidebook on How to Calculate National Air Pollutants Emission (III), (National Institute of Environmental Research, 2013) suggests emission factors of air pollutants (CO, VOC, NOx, PM) for all types of vehicle.
- Just as in the case of CO_2 emission factors, particulate matter emission factors are also comprised of speed functions, and applied differently according to vehicle types and fuel types.
- Volume of particulate matter (g) = emission factors by vehicle type (g/km) X vehicle kilometers traveled (vehicle*km)

04_Notes for the Result Values of This Study

- Indexes presented in this study are not official statistics. indexes from other institutions may differ from those in this study as they may be produced based on different calculation methods and data.
  - Indexes in the study are produced by using independently developed index calculation method and based on navigation data obtained from K-BiewT (www.viewt.ktdb.go.kr).
- Different criteria and scopes are applied to indexes in this study for year 2014, 2015 and 2016, as the indexes have different criteria and scopes due to yearly changing road networks situations (such as changes in road type and change/establishment/expansion of administrative division, etc.).
- Different data aggregation and production methodologies could bring about different index results.

Chapter 2

National Transport in the Perspective of Vehicle Mobility

01 | Transport Status by Road in the Perspective of Vehicle Mobility

02 | Transport Status by Region in the Perspective of Vehicle Mobility

03 | Traffic Congestion in the Perspective of Vehicle Mobility

04 | Transport Environments in the Perspective of Vehicle Mobility

05 | Transport Safety in the Perspective of Vehicle Mobility

06 | Movements of the Nation in the Perspective of Vehicle Mobility

01_Transport Status by Road in the Perspective of Vehicle Mobility

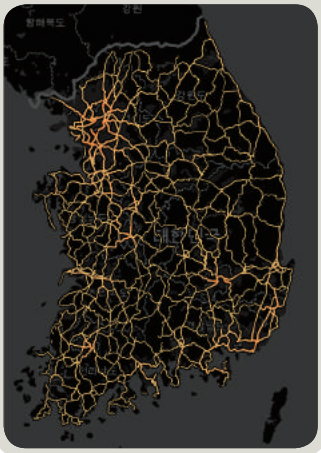
1) Traffic Volumes by Road

Expressways

Average daily traffic
25,574vehicles/day

National highways

Average daily traffic
7,023vehicles/day



Special/Metropolitan city roads

Average daily traffic
14,026vehicles/day

Urban expressways

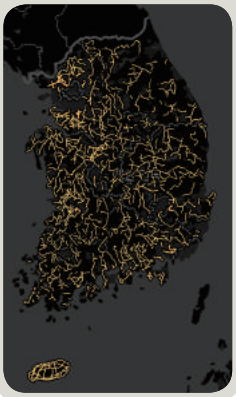
Average daily traffic
47,695vehicles/day

Government-aided provincial roads

Average daily traffic
3,401 vehicles/day

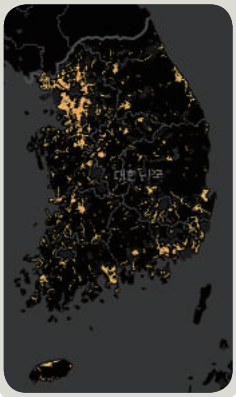
Local highways

Average daily traffic
1,463vehicles/day



City/County roads

Average daily traffic
5,166vehicles/day

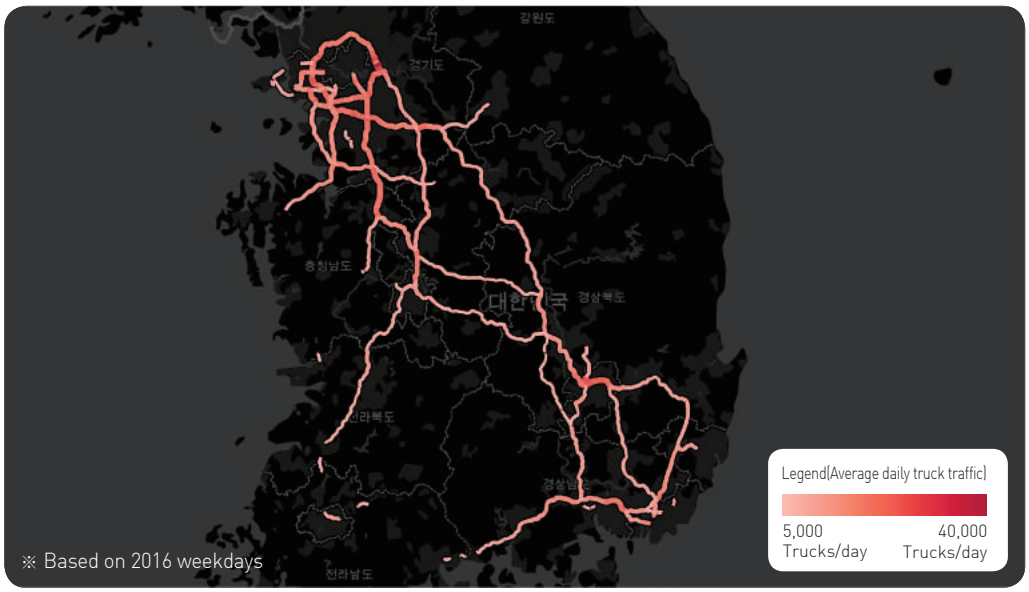


※ Based on 2016 weekdays

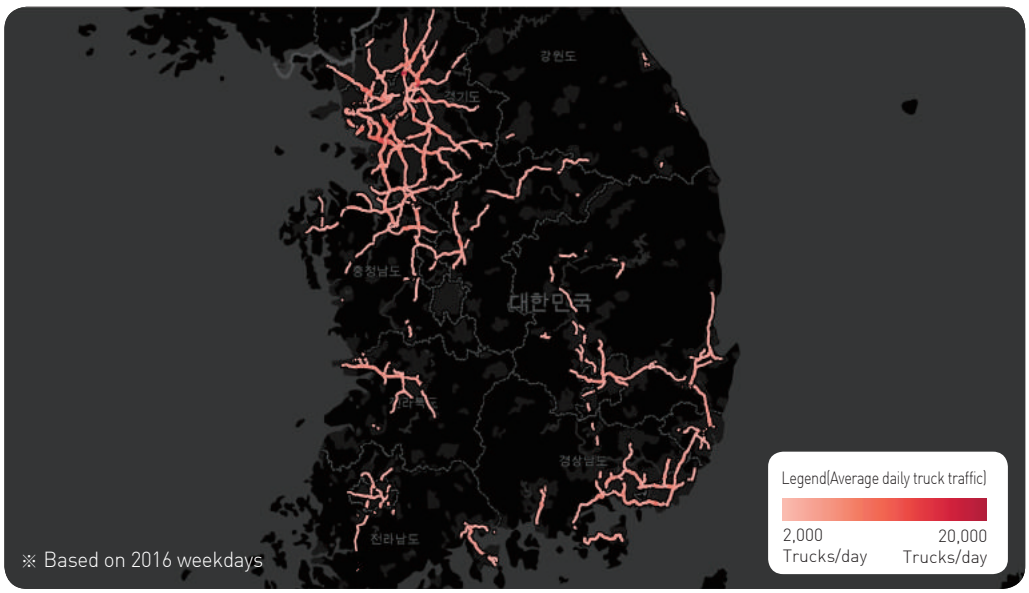
Legend (Average daily traffic)

0 — 150,000 vehicle/day

◎ **Which expressways are traveled by freight vehicles the most?**
(Expressways used by more than 5,000 freight vehicles per day)



◎ **Which national highways are traveled by freight vehicles the most?**
(National highways used by more than 2,000 freight vehicles per day)



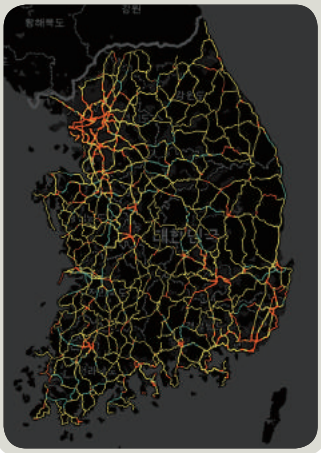
2) Travel Speed by Road

Expressways

Average daily travel speed
94.8km/h

National highways

Average daily travel speed
62.8km/h

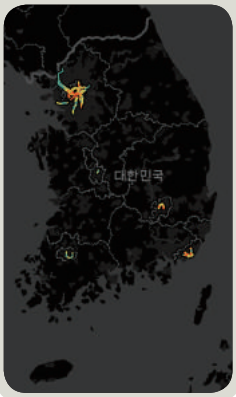


Special/Metropolitan city roads

Average daily travel speed
35.2km/h

Urban expressways

Average daily travel speed
70.3km/h

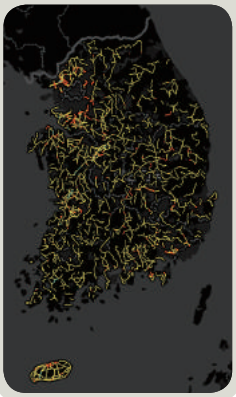


Government-aided provincial roads

Average daily travel speed
52.6km/h

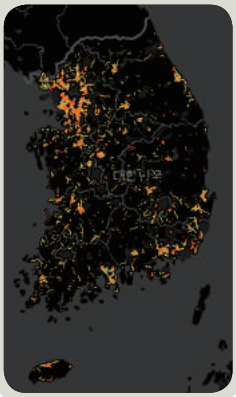
Local highways

Average daily travel speed
50.8km/h



City/County roads

Average daily travel speed
41.4km/h

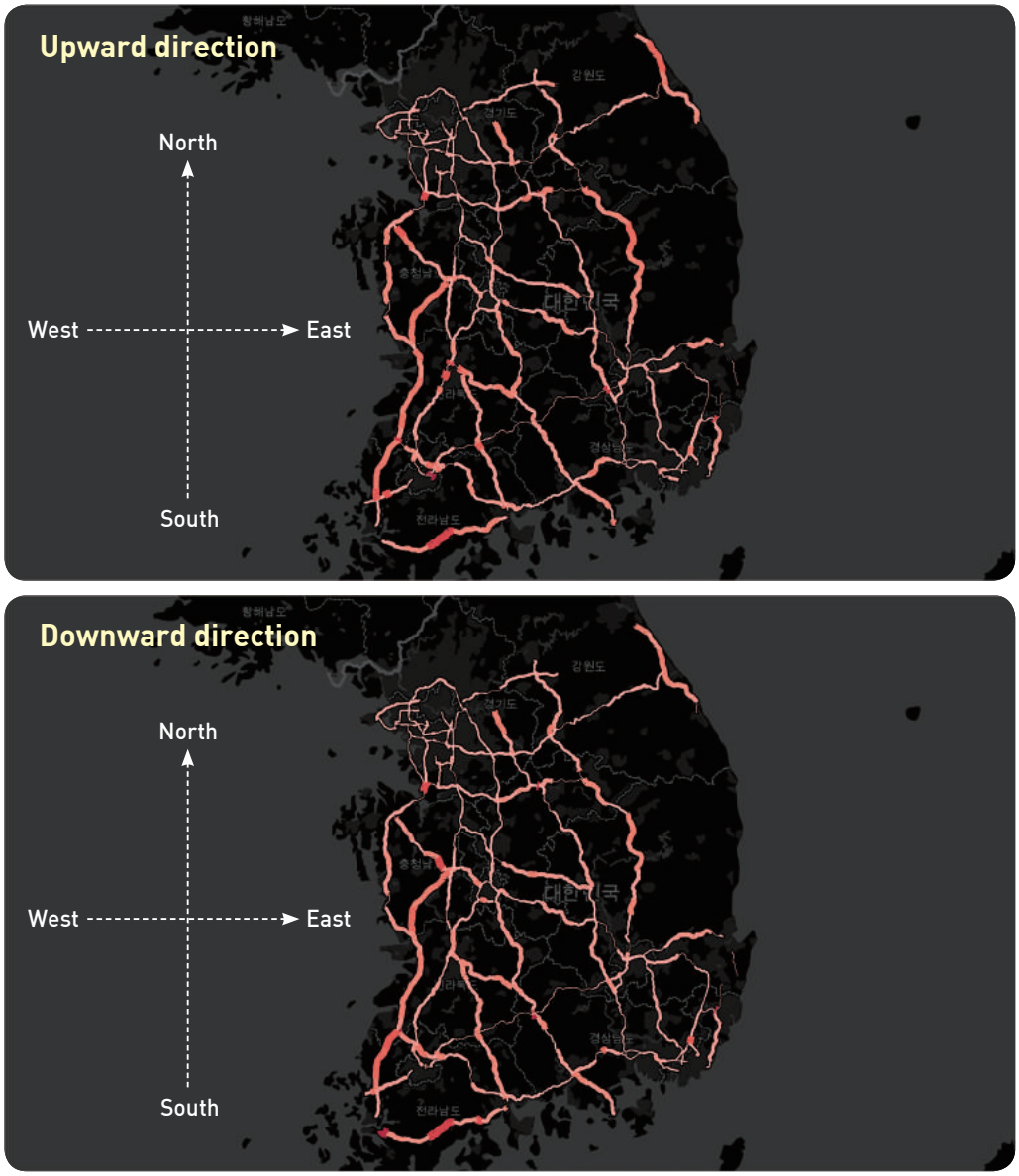


※ Based on 2016 weekdays, The figure illustrates average speed during afternoon peak hours (18:00-19:00)
※ The presented daily average speed refers to the day before

Legend (Average travel speed)

0 — 130 km/h

◎ **Which sections of the expressways face speeding the most?**



※ Speeding is defined as vehicles traveling at over 130 km/h.
※ The figure illustrates the proportion of the number of vehicles speeding over 130km/h out of the total number of vehicles.
※ Based on 2015 weekdays
※ The thicker the line and the darker the red color, the higher the speeding rate

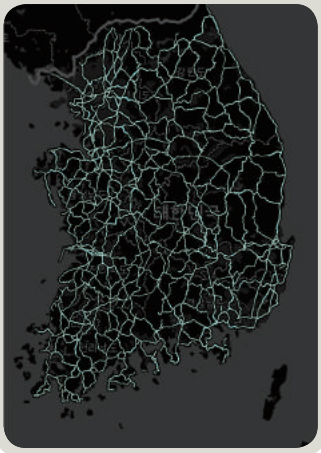
3) Vehicle Kilometers Traveled (VKT) by Road

Expressways

Daily vehicle kilometers traveled
150,319 million vehicles-km

National highways

Daily vehicle kilometers traveled
117,427 million vehicles-km



Special/Metropolitan city roads

Daily vehicle kilometers traveled
84,958 million vehicles-km

Urban expressways

Daily vehicle kilometers traveled
30,552 million vehicles-km

Government-aided provincial roads

Daily vehicle kilometers traveled
13,687 million vehicles-km

Local highways

Daily vehicle kilometers traveled
20,898 million vehicles-km

City/County roads

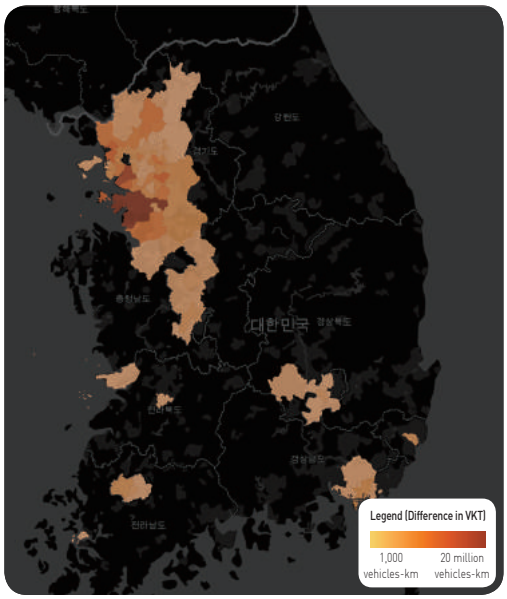
Daily vehicle kilometers traveled
69,312 million vehicles-km

※ Based on 2016 weekdays

Legend (Vehicle kilometers travelled (VKT))

0 — 150,000 vehicles-km

◎ **Which towns, townships or districts have higher traffic volume during weekdays compared to weekends?**



During weekdays, traffic volume is usually concentrated in urban areas.

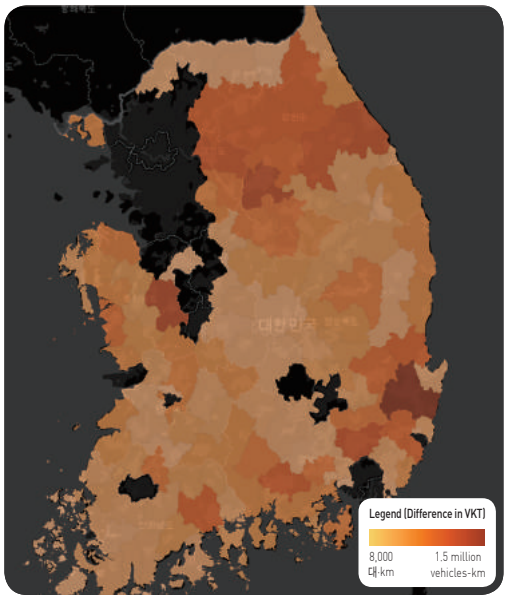
(Total of 101 towns, townships and districts)

Top 10 towns, townships and districts whose VKT is longer during weekends compared to weekdays

Ranking	Name of city/ province	Name of city/ county/district	Difference in VKT (10,000 vehicles-km)
1	Gyeonggi	Bundang-gu, Seongnam	13.0
2	Gyeonggi	Pyeongtaek	11.3
3	Gyeonggi	Uiwang	10.6
4	Gyeonggi	Danwon, Ansan	8.6
5	Gyeonggi	Gunpo	8.0
6	Seoul	Seodaemun	6.3
7	Gyeonggi	Sangnok, Ansan	6.0
8	Seoul	Dongjak	6.0
9	Gyeonggi	Sujeong, Seongnam	5.8
10	Incheon	Seo-gu	5.5

※ Weekdays VKT - Weekends VKT ※ In 2015

◎ **Which towns, townships or districts have higher traffic volume during weekends compared to weekdays?**



During weekends, traffic volume is usually concentrated in rural areas.

(Total of 145 towns, townships and districts)

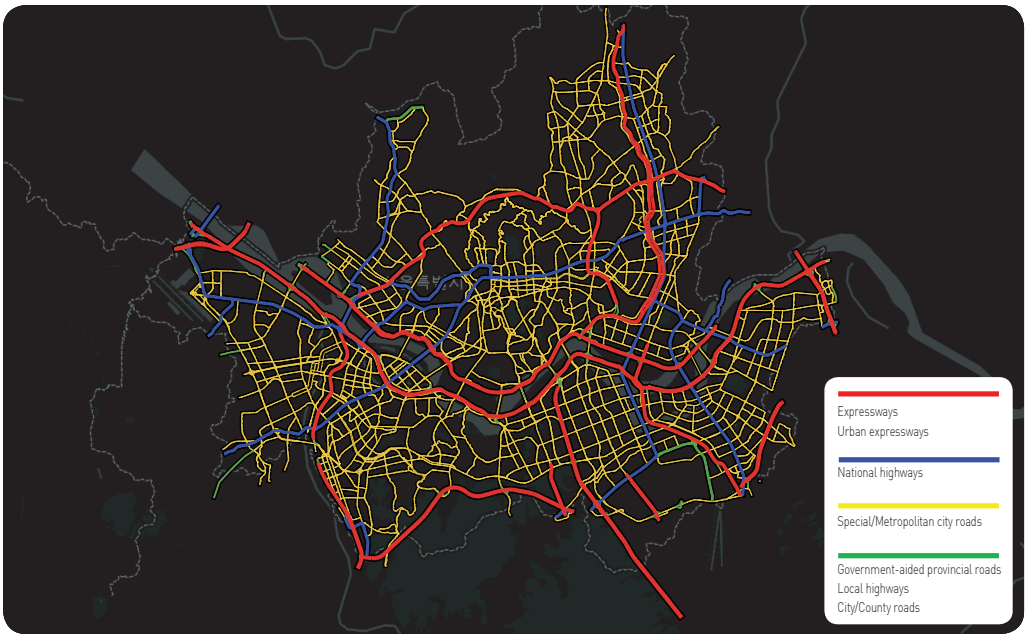
Top 10 towns, townships and districts whose VKT is longer during weekends compared to weekdays

Ranking	Name of city/ province	Name of city/ county/district	Difference in VKT (10,000 vehicles-km)
1	Gyeonggi	Icheon	26.3
2	Gangwon	Wonju	24.5
3	Gyeongbuk	Yeongcheon	22.3
4	Gyeongbuk	Gyeongju	22.1
5	Gyeongbuk	Buk-gu, Pohang	21.0
6	Gangwon	Gangneung	18.6
7	Gyeonggi	Yeoju	18.2
8	Ulsan	Ulju	18.1
9	Gangwon	Hoengseong	16.5
10	Gyeongbuk	Cheongdo	15.9

※ Weekdays VKT - Weekends VKT ※ In 2015

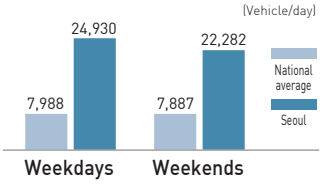
02_Transport Status by Region in the Perspective of Vehicle Mobility

1) Transport Status of Seoul Metropolitan City (in 2016)



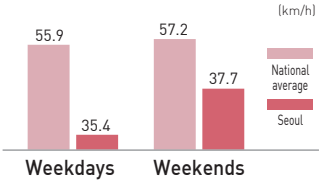
Average traffic volume

(Vehicle/day)



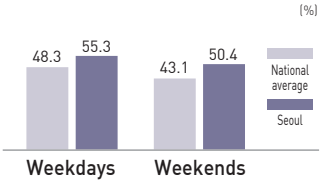
Average speed

(km/h)



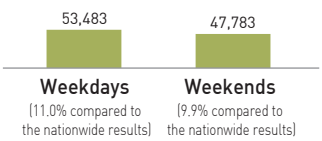
Frequency and intensity of traffic congestion

(%)



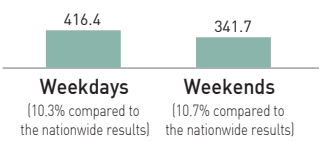
Vehicle kilometers travelled

(1,000 vehicles-km)



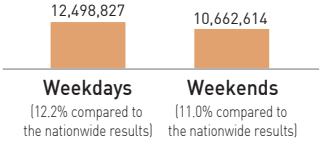
PM-10

(kg/day)

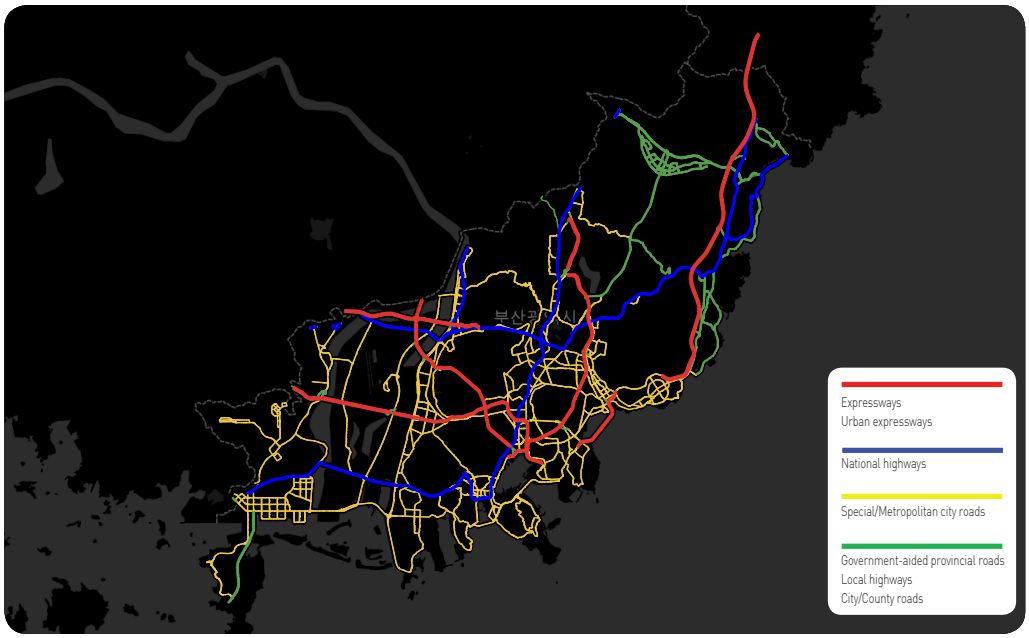


CO_2

(kg/day)

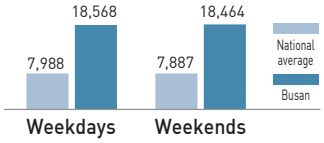


2) Transport Status of Busan Metropolitan City (in 2016)



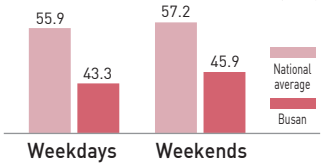
Average traffic volume

(Vehicle/day)



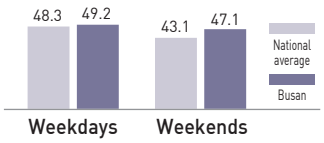
Average speed

(km/h)



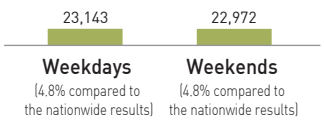
Frequency and intensity of traffic congestion

(%)



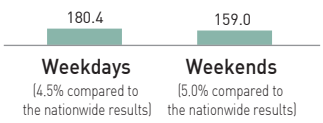
Vehicle kilometers travelled

(1,000 vehicles-km)



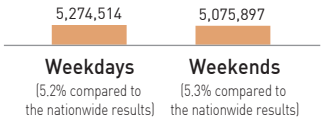
PM-10

(kg/day)

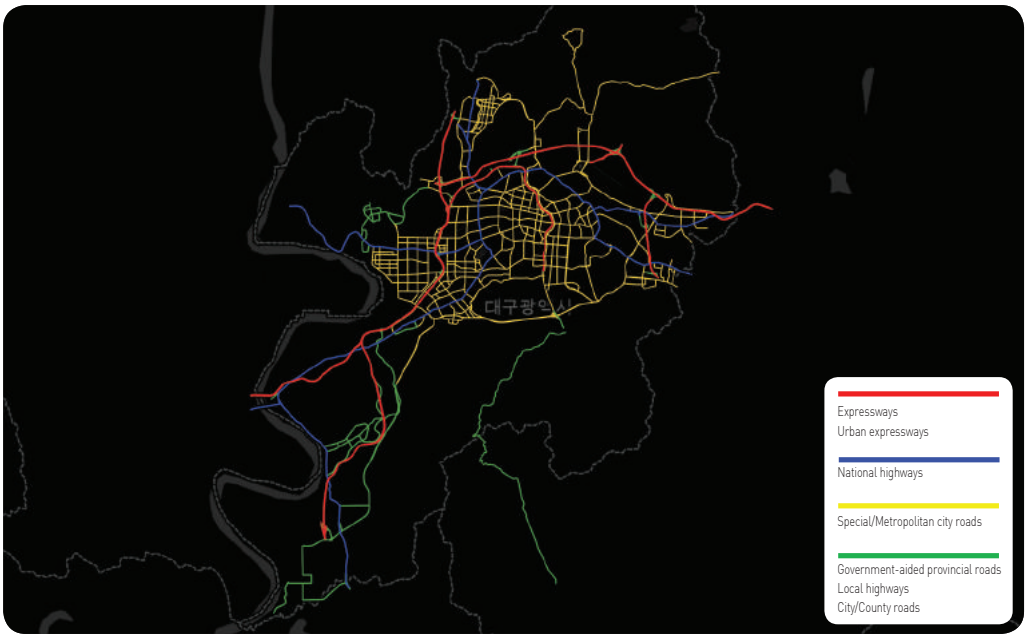


CO_2

(kg/day)

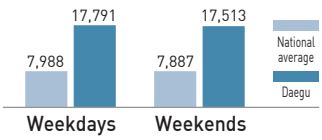


3) Transport Status of Daegu Metropolitan City (in 2016)



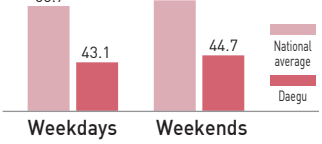
Average traffic volume

(Vehicle/day)



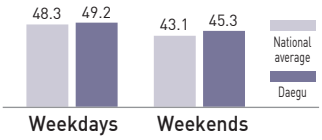
Average speed

(km/h)



Frequency and intensity of traffic congestion

(%)



Vehicle kilometers travelled

(1,000 vehicles-km)

Weekdays	Weekends
20,883	20,543
(4.3% compared to the nationwide results)	(4.3% compared to the nationwide results)

PM-10

(kg/day)

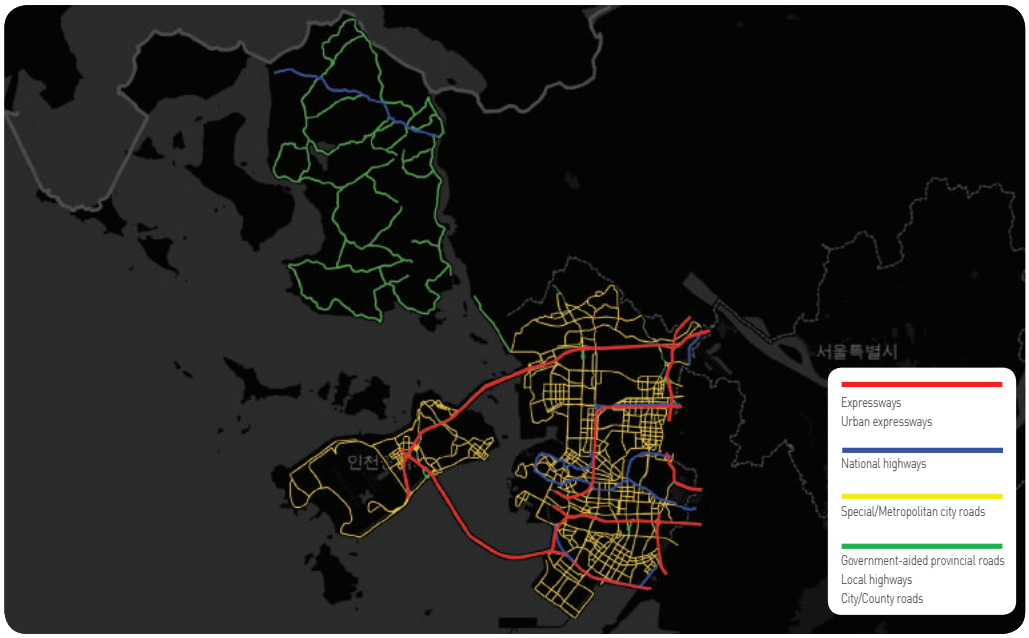
Weekdays	Weekends
162.4	145.1
(4.0% compared to the nationwide results)	(4.5% compared to the nationwide results)

CO_2

(kg/day)

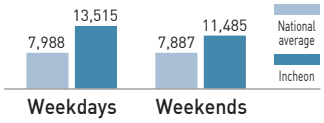
Weekdays	Weekends
4,739,721	4,531,396
(4.6% compared to the nationwide results)	(4.7% compared to the nationwide results)

4) Transport Status of Incheon Metropolitan City (in 2016)



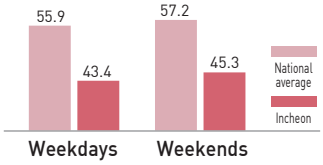
Average traffic volume

(Vehicle/day)



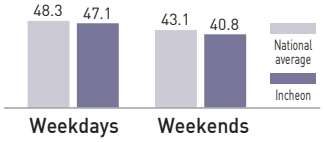
Average speed

(km/h)



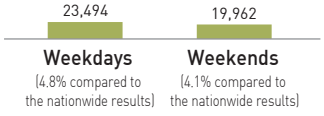
Frequency and intensity of traffic congestion

(%)



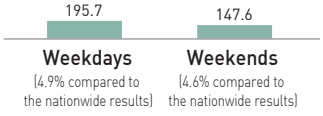
Vehicle kilometers travelled

(1,000 vehicles-km)



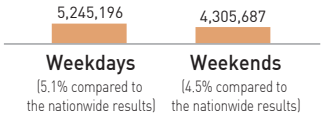
PM-10

(kg/day)

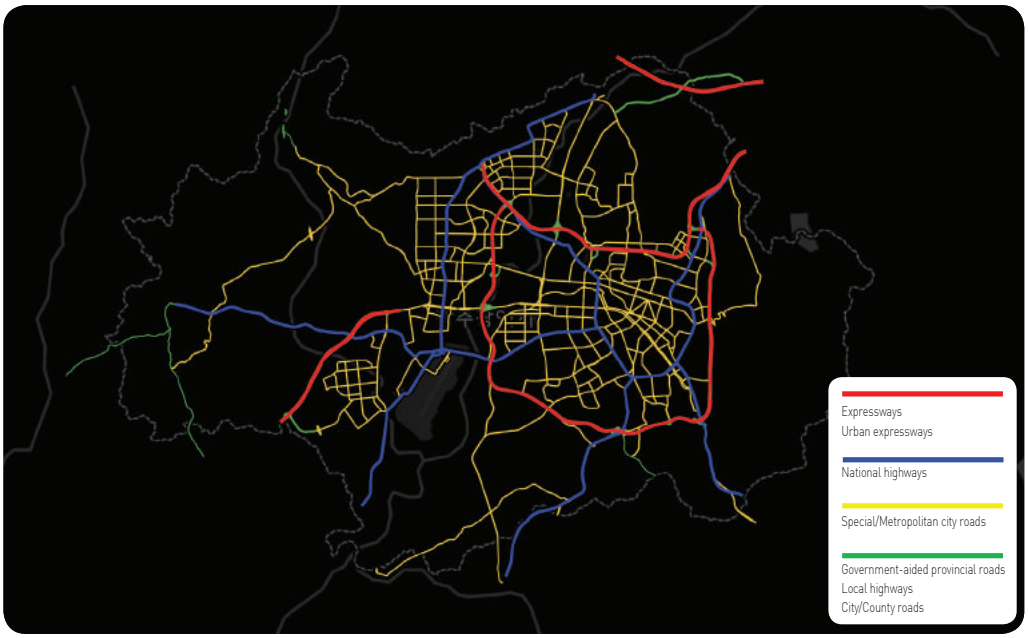


CO_2

(kg/day)

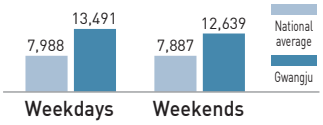


5) Transport Status of Gwangju Metropolitan City (in 2016)



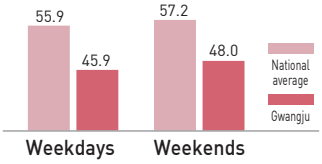
Average traffic volume

(Vehicle/day)



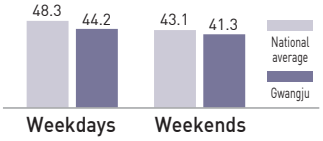
Average speed

(km/h)



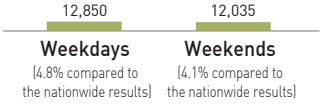
Frequency and intensity of traffic congestion

(%)



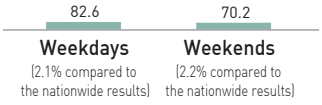
Vehicle kilometers travelled

(1,000 vehicles-km)



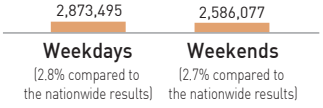
PM-10

(kg/day)

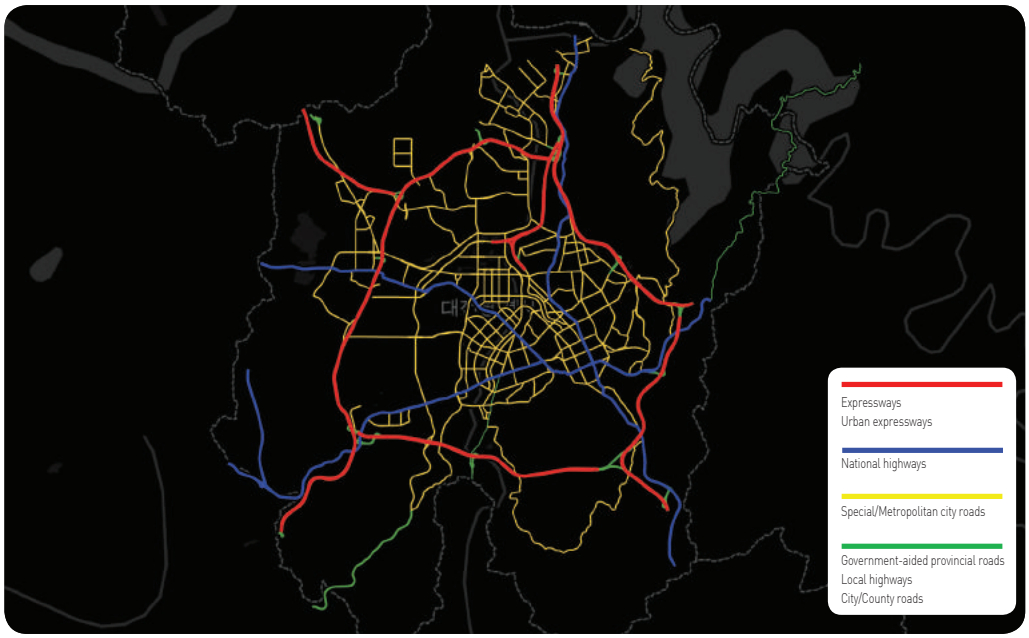


CO_2

(kg/day)

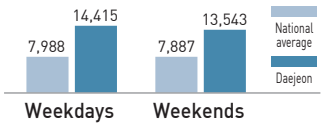


6) Transport Status of Daejeon Metropolitan City (in 2016)



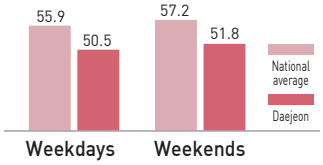
Average traffic volume

(Vehicle/day)



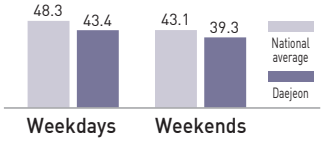
Average speed

(km/h)



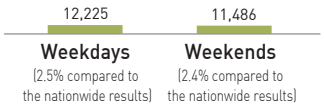
Frequency and intensity of traffic congestion

(%)



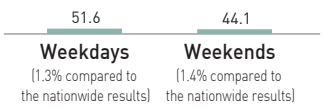
Vehicle kilometers travelled

(1,000 vehicles-km)



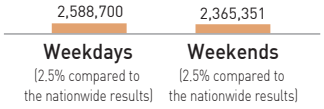
PM-10

(kg/day)

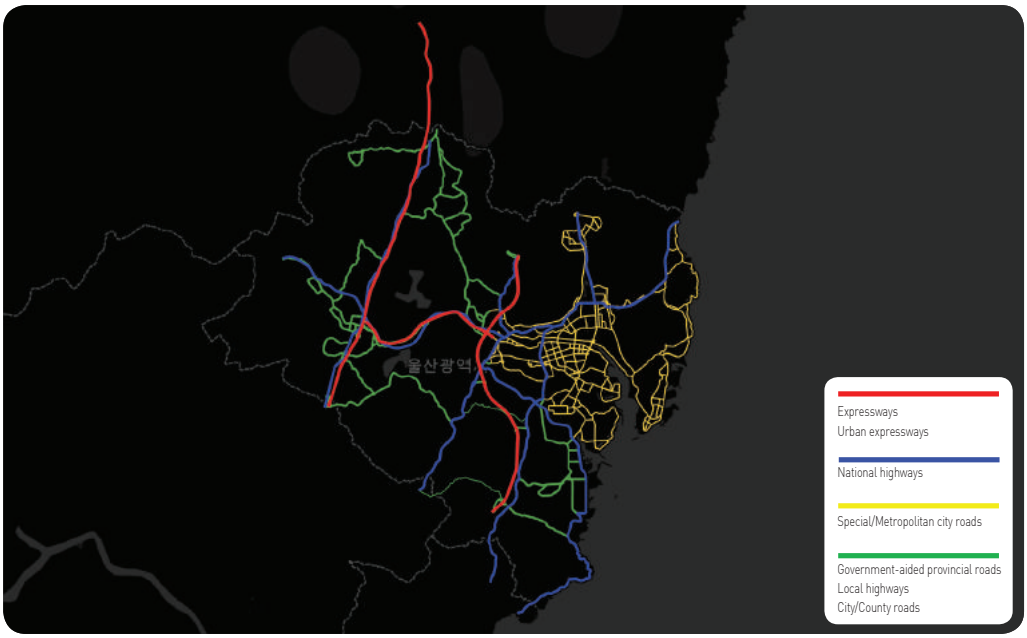


CO_2

(kg/day)

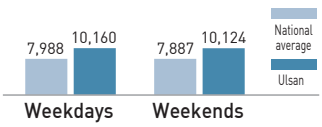


7) Transport Status of Ulsan Metropolitan City (in 2016)



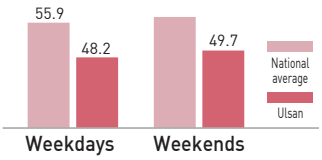
Average traffic volume

(Vehicle/day)



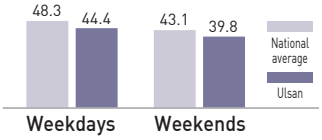
Average speed

(km/h)



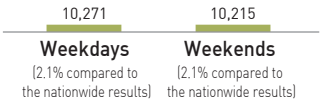
Frequency and intensity of traffic congestion

(%)



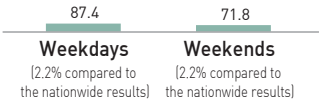
Vehicle kilometers travelled

(1,000 vehicles-km)



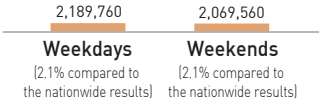
PM-10

(kg/day)



CO_2

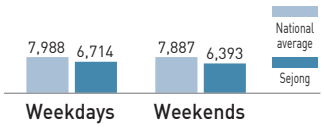
(kg/day)



8) Transport Status of Sejong Special Self-governing City (in 2016)

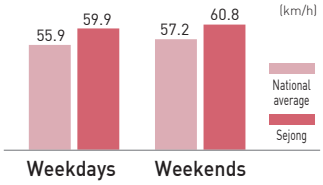
Average traffic volume

(Vehicle/day)



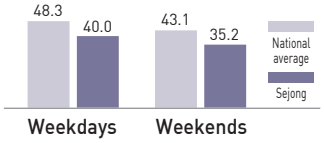
Average speed

(km/h)



Frequency and intensity of traffic congestion

(%)



Vehicle kilometers travelled

(1,000 vehicles-km)

Weekdays	Weekends
2,943	2,803
(0.6% compared to the nationwide results)	(0.6% compared to the nationwide results)

PM-10

(kg/day)

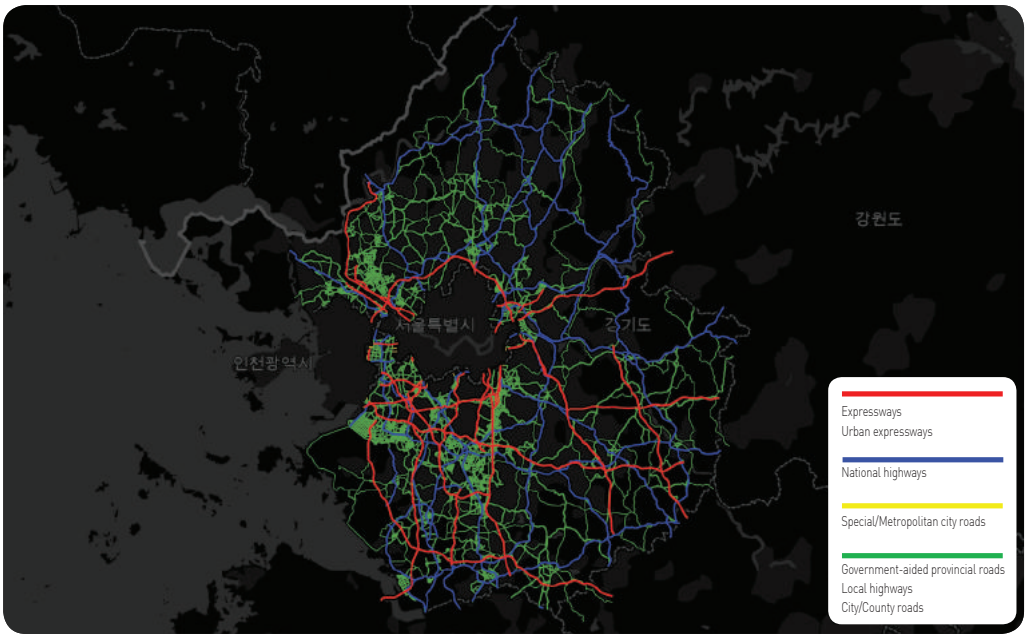
Weekdays	Weekends
19.7	13.3
(0.5% compared to the nationwide results)	(0.4% compared to the nationwide results)

CO_2

(kg/day)

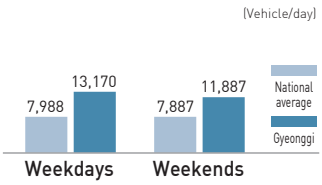
Weekdays	Weekends
530,132	484,913
(0.5% compared to the nationwide results)	(0.5% compared to the nationwide results)

9) Transport Status of Gyeonggi Province (in 2016)



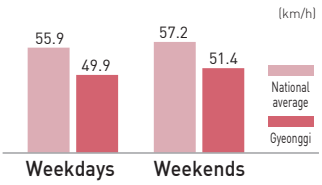
Average traffic volume

(Vehicle/day)



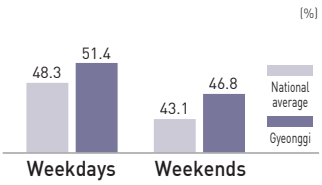
Average speed

(km/h)



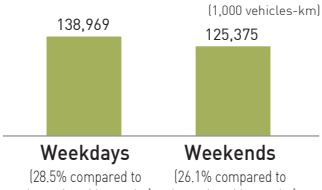
Frequency and intensity of traffic congestion

(%)



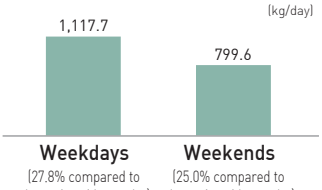
Vehicle kilometers travelled

(1,000 vehicles-km)



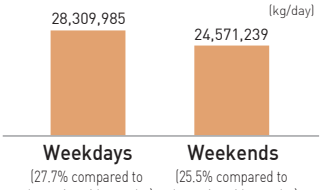
PM-10

(kg/day)

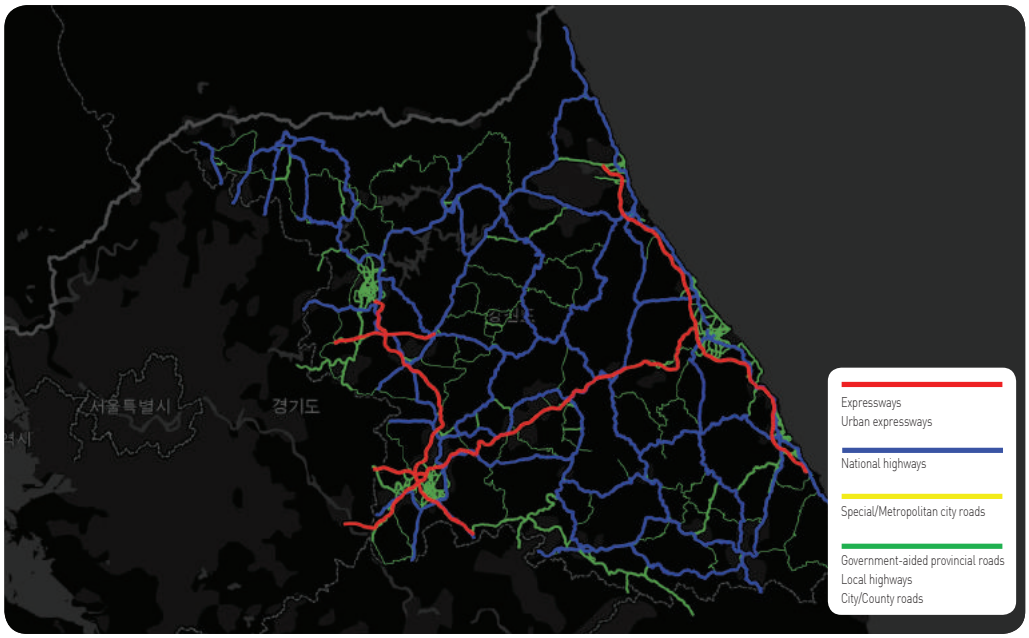


CO_2

(kg/day)

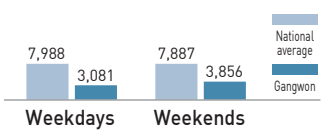


10) Transport Status of Gangwon Province (in 2016)



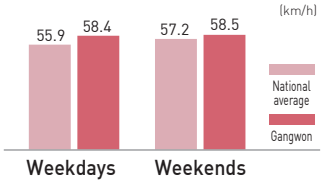
Average traffic volume

(Vehicle/day)



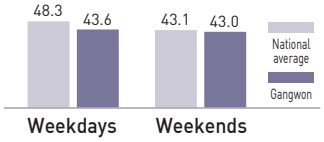
Average speed

(km/h)



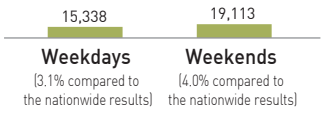
Frequency and intensity of traffic congestion

(%)



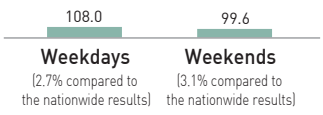
Vehicle kilometers travelled

(1,000 vehicles-km)



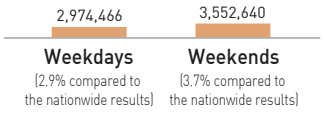
PM-10

(kg/day)

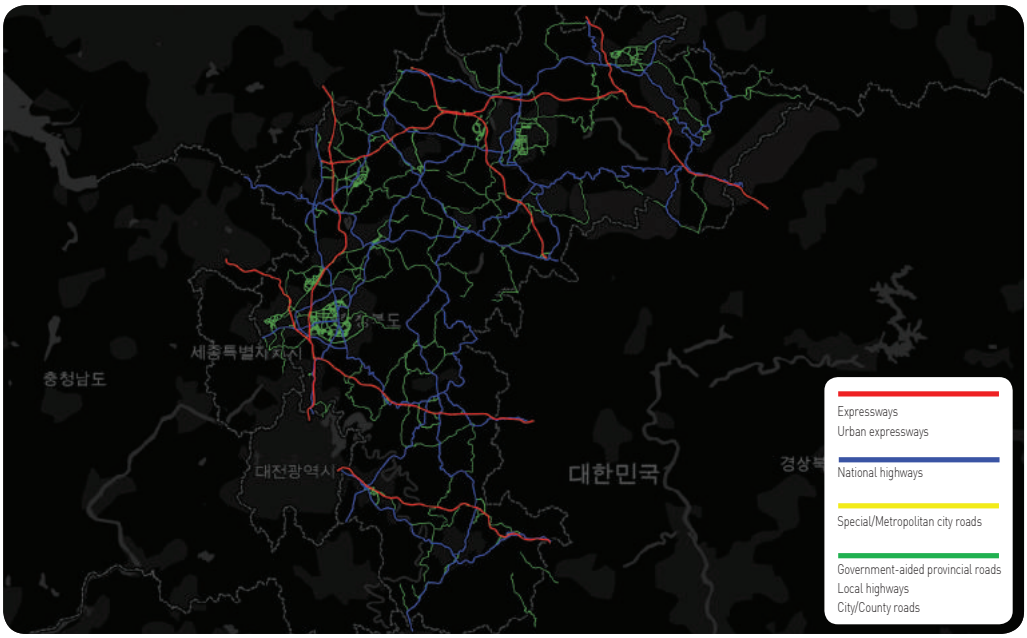


CO_2

(kg/day)

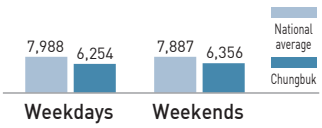


11) Transport Status of Chungbuk Province (in 2016)



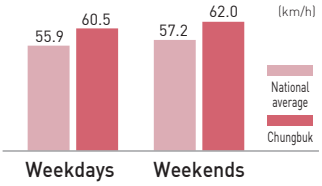
Average traffic volume

(Vehicle/day)



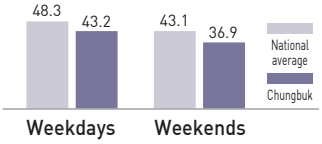
Average speed

(km/h)



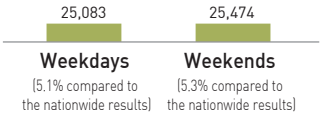
Frequency and intensity of traffic congestion

(%)



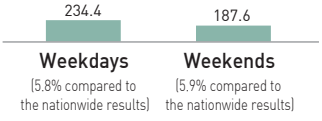
Vehicle kilometers travelled

(1,000 vehicles-km)



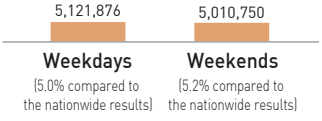
PM-10

(kg/day)



CO_2

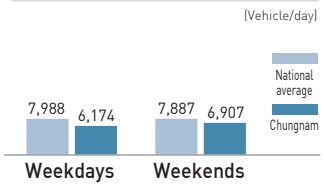
(kg/day)



12) Transport Status of Chungnam Province (in 2016)

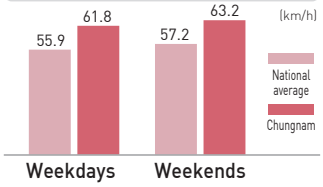
Average traffic volume

(Vehicle/day)



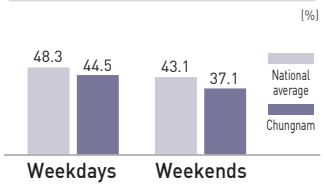
Average speed

(km/h)



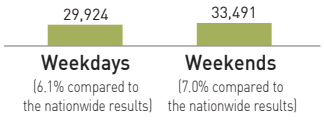
Frequency and intensity of traffic congestion

(%)



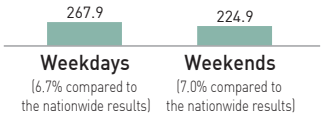
Vehicle kilometers travelled

(1,000 vehicles-km)



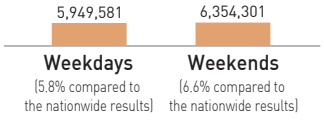
PM-10

(kg/day)

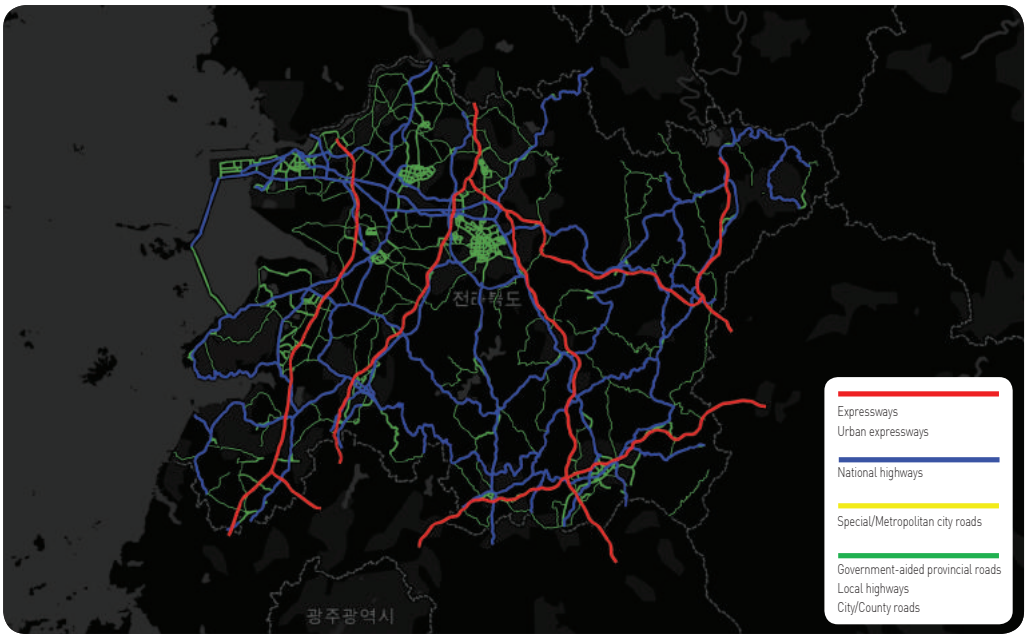


CO_2

(kg/day)

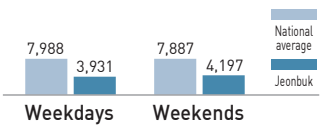


13) Transport Status of Jeonbuk Province (in 2016)



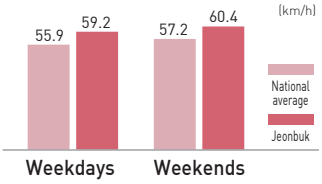
Average traffic volume

(Vehicle/day)



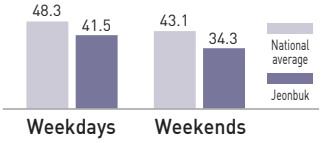
Average speed

(km/h)



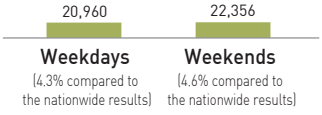
Frequency and intensity of traffic congestion

(%)



Vehicle kilometers travelled

(1,000 vehicles-km)

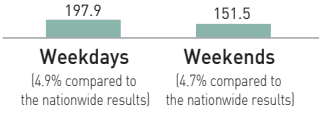


(4.3% compared to the nationwide results)

(4.6% compared to the nationwide results)

PM-10

(kg/day)

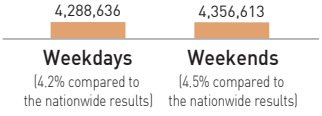


(4.9% compared to the nationwide results)

(4.7% compared to the nationwide results)

CO_2

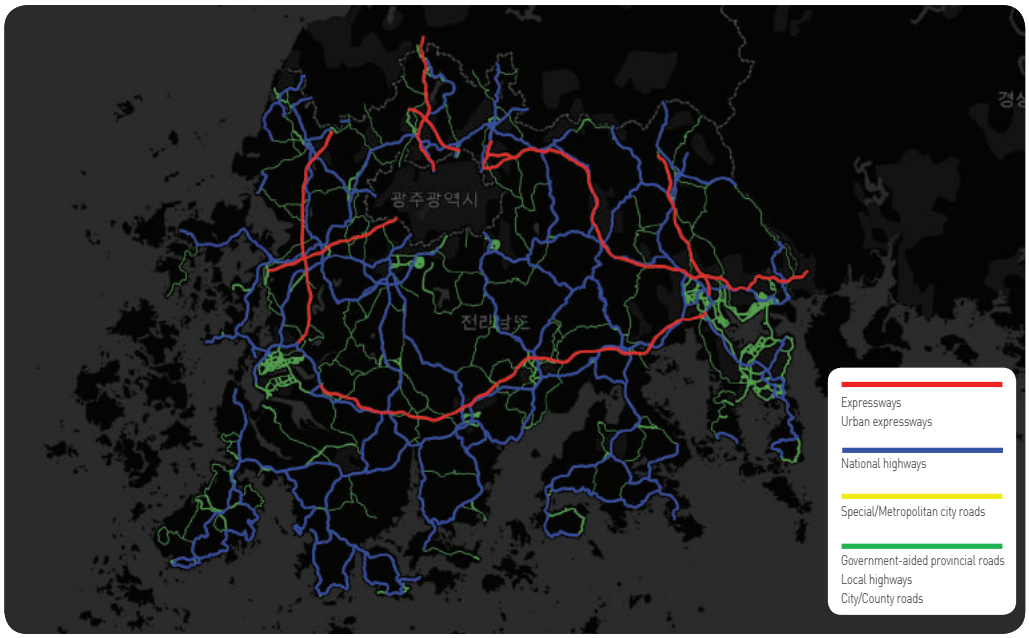
(kg/day)



(4.2% compared to the nationwide results)

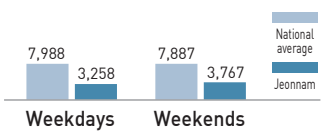
(4.5% compared to the nationwide results)

14) Transport Status of Jeonnam Province (in 2016)



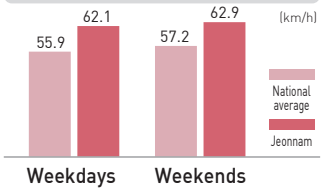
Average traffic volume

(Vehicle/day)



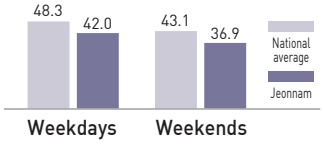
Average speed

(km/h)



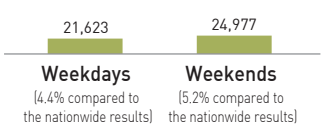
Frequency and intensity of traffic congestion

(%)



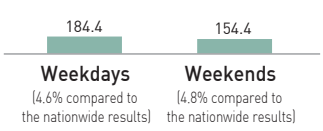
Vehicle kilometers travelled

(1,000 vehicles-km)



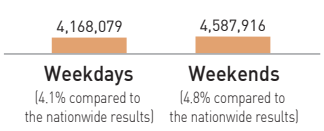
PM-10

(kg/day)



CO_2

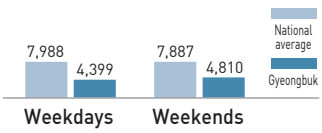
(kg/day)



15) Transport Status of Gyeongbuk Province (in 2016)

Average traffic volume

(Vehicle/day)

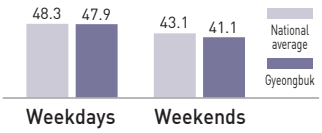


Average speed

(km/h)

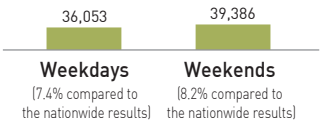
Frequency and intensity of traffic congestion

(%)



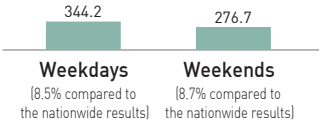
Vehicle kilometers travelled

(1,000 vehicles-km)



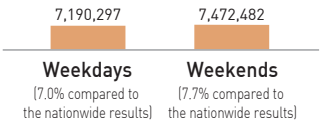
PM-10

(kg/day)

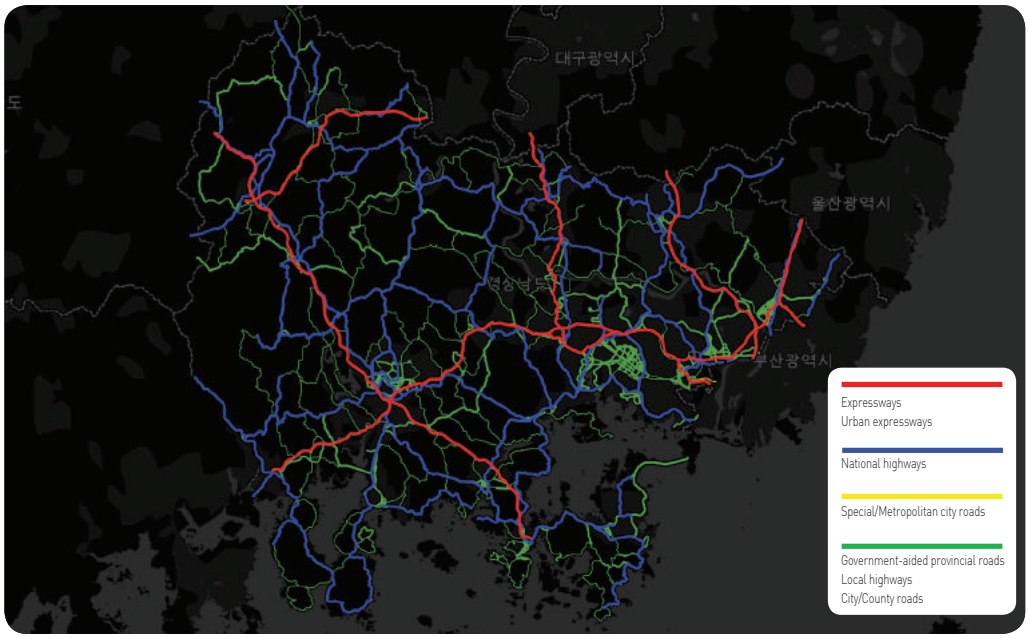


CO_2

(kg/day)

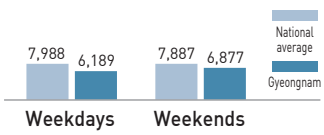


16) Transport Status of Gyeongnam Province (in 2016)



Average traffic volume

(Vehicle/day)

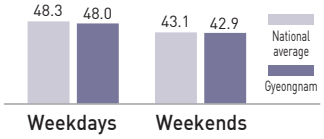


Average speed

(km/h)

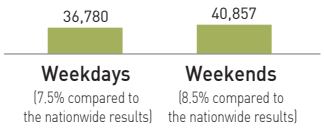
Frequency and intensity of traffic congestion

(%)



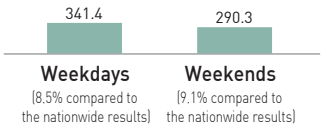
Vehicle kilometers travelled

(1,000 vehicles-km)



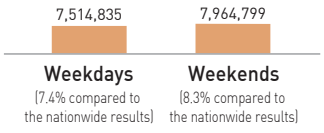
PM-10

(kg/day)



CO_2

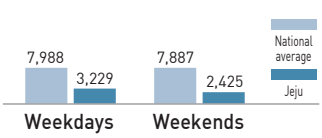
(kg/day)



17) Transport Status of Jeju Special Self-Governing Province (in 2016)

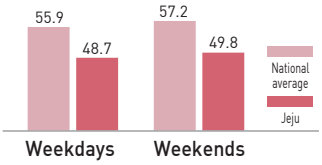
Average traffic volume

(Vehicle/day)



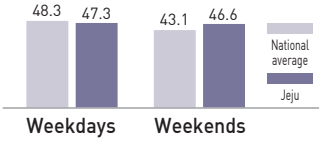
Average speed

(km/h)



Frequency and intensity of traffic congestion

(%)



Vehicle kilometers travelled

(1,000 vehicles-km)

Weekdays	Weekends
3,132	2,350
(0.6% compared to the nationwide results)	(0.5% compared to the nationwide results)

PM-10

(kg/day)

Weekdays	Weekends
34.2	20.0
(0.8% compared to the nationwide results)	(0.6% compared to the nationwide results)

CO_2

(kg/day)

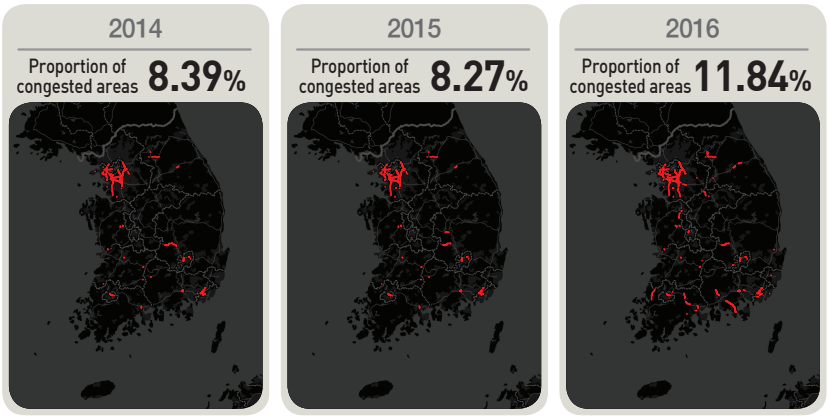
Weekdays	Weekends
775,980	566,278
(0.8% compared to the nationwide results)	(0.6% compared to the nationwide results)

03_Traffic Congestion in the Perspective of Vehicle Mobility

1) Changes in Congested Area by Road Class

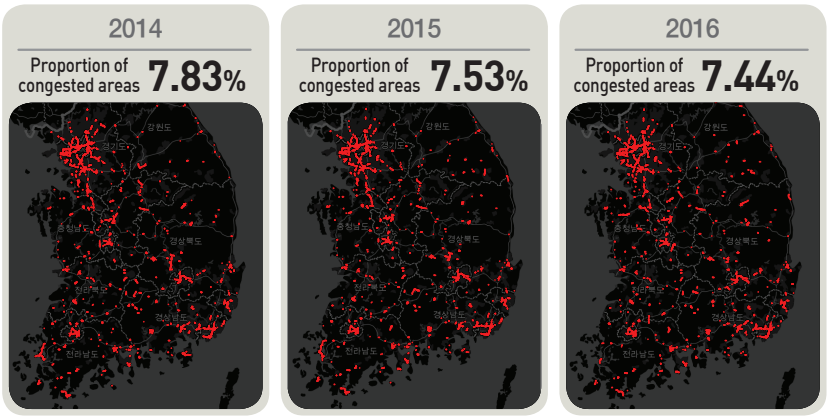
Expressways

The areas where average speed is lower than 70 km/h at least for an hour throughout a day were selected as congested areas



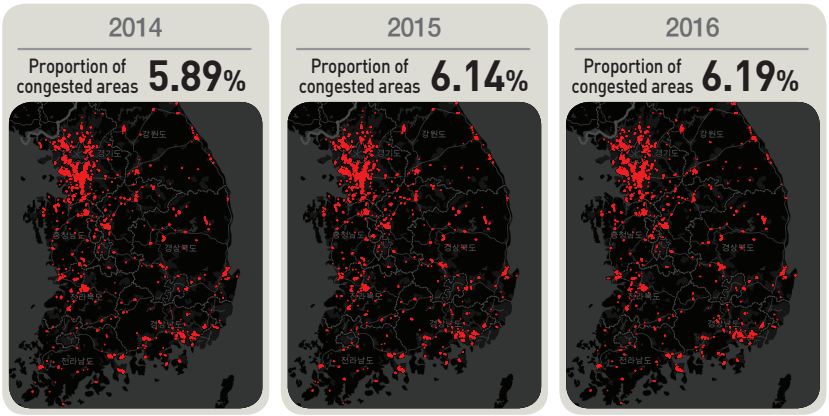
National highways

The areas whose average speed is lower than 30 km/h at least for an hour throughout a day were selected as congested areas.



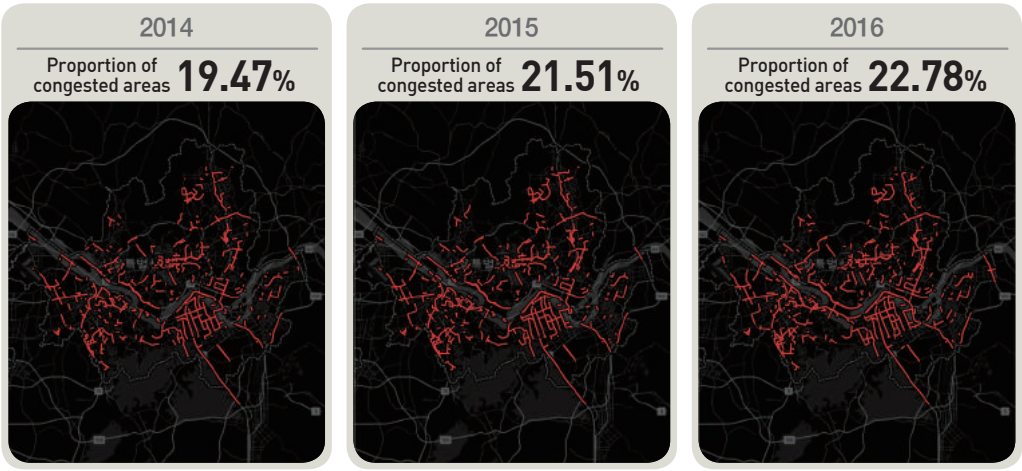
Provincial roads
City/County roads

The areas where average speed is lower than 20 km/h at least for an hour throughout the day were selected as congested areas



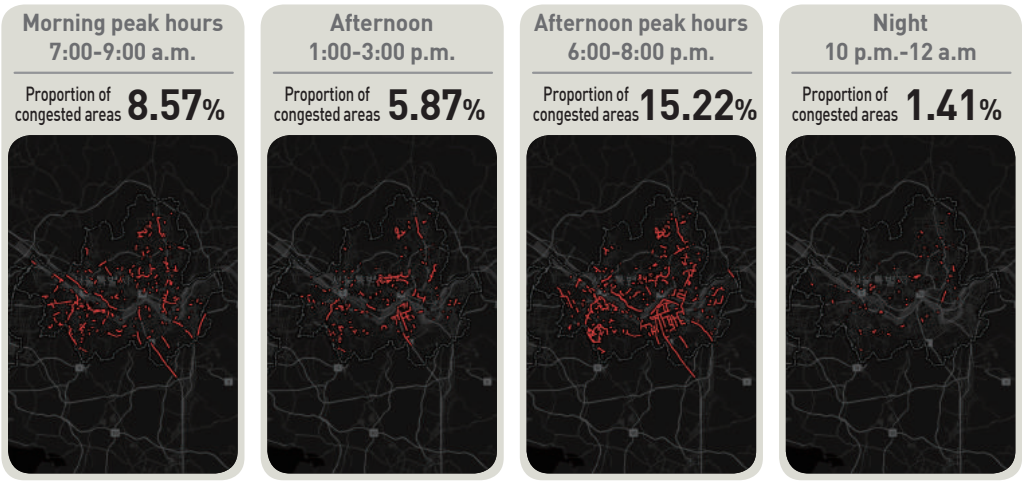
2) Status of Traffic Congestion in Seoul Metropolitan City

◎ How have congested areas of Seoul changed by year?



※ Targets were expressways, urban expressways, and special/metropolitan city roads.
※ Congestion reference speed: Less than 40 km/h for expressways; less than 30 km/h for urban expressways; and less than 15 km/h for special metropolitan city roads and metropolitan city roads
※ Congested areas are selected as road sections that are lower than the congestion reference speed even in one hour of 24 hours.
※ Proportion of congested areas = Sum of congested kilometers / Total length of roads in the city

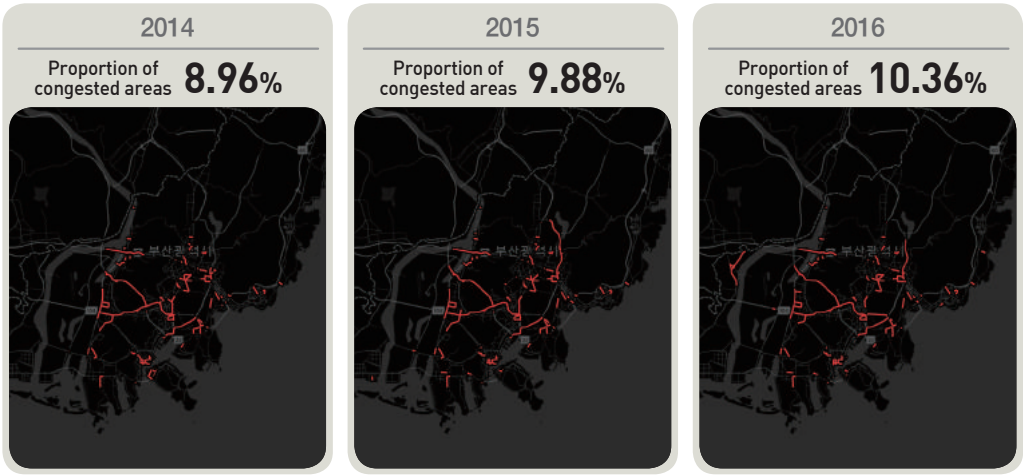
◎ How have congested areas of Seoul change throughout a day? (one weekday in 2015)



※ Targets were expressways, urban expressways, and special/metropolitan city roads.
※ Congestion reference speed: less than 40 km/h for expressways, less than 30 km/h for urban expressways, and less than 15 km/h for special metropolitan city roads and metropolitan city roads
※ Proportion of congested areas = Sum of congested kilometers / Total length of roads in the city

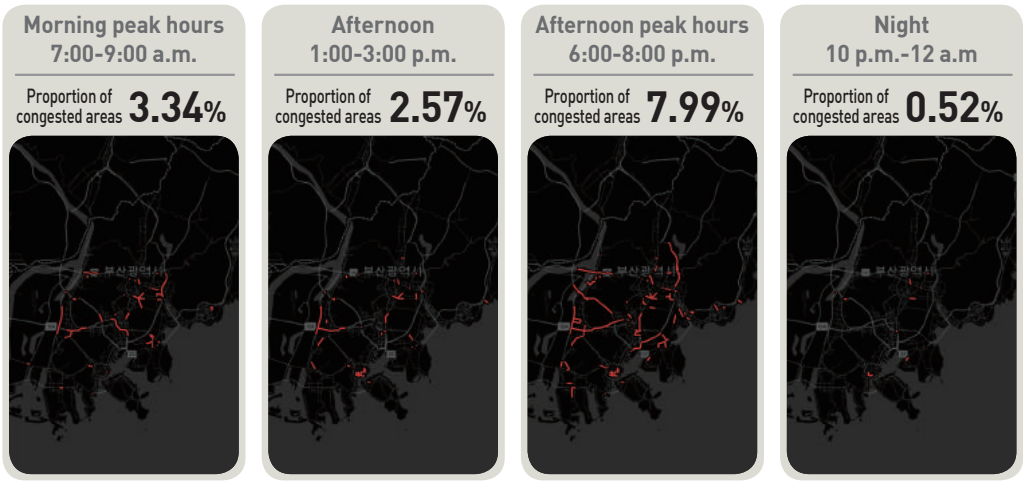
3) Status of Traffic Congestion in Busan Metropolitan City

◎ How have congested areas of Busan changed by year?



※ Targets were expressways, urban expressways, and special/metropolitan city roads.
※ Congestion reference speed: less than 40 km/h for expressways, less than 30 km/h for urban expressways, and less than 15 km/h for special metropolitan city roads and metropolitan city roads
※ Congested areas are selected as road sections that are lower than the congestion reference speed even in one hour of 24 hours
※ Proportion of congested areas = Sum of congested kilometers / Total length of roads in the city

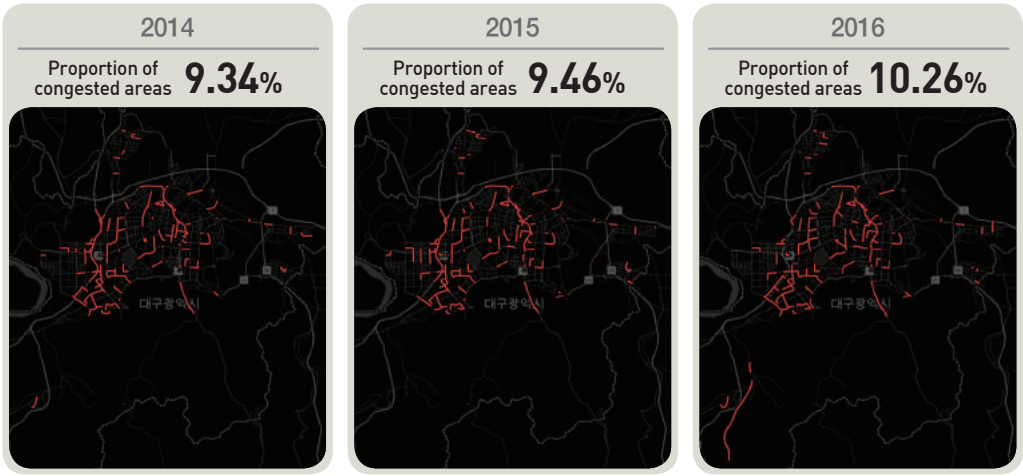
◎ How have congested areas of Busan changed throughout the day? (one weekday in 2015)



※ Targets are expressways, urban expressways, and special metropolitan city roads and metropolitan city roads.
※ Congestion reference speed: less than 40 km/h for expressways, less than 30 km/h for urban expressways, and less than 15 km/h for special metropolitan city roads and metropolitan city roads
※ Proportion of congested areas = Sum of congested kilometers / Total length of roads in the city

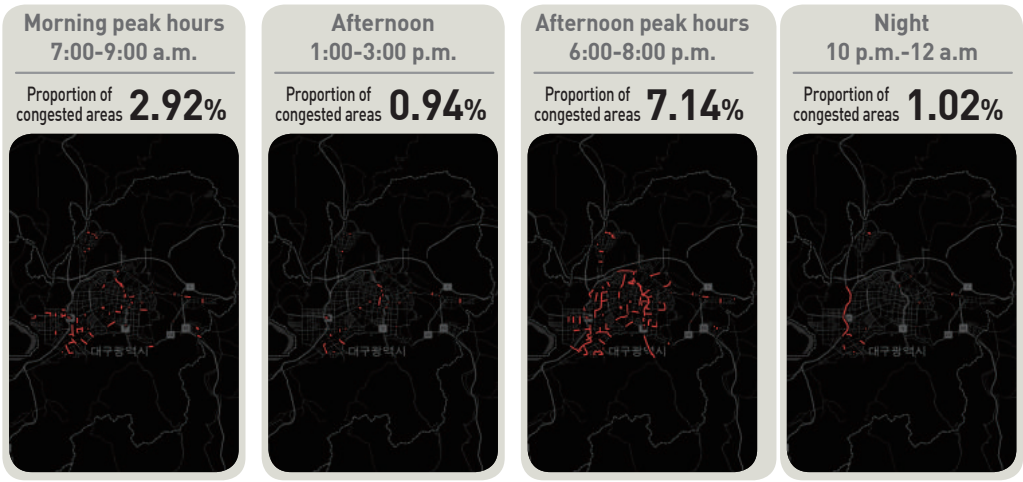
4) Status of traffic congestion in Daegu Metropolitan City

◎ How have congested areas of Daegu changed by year?



※ Expressways, urban expressways, and special/metropolitan city roads were reviewed.
※ Congestion reference speed: Less than 40 km/h for expressways, less than 30 km/h for urban expressways, and less than 15 km/h for special metropolitan city roads and metropolitan city roads
※ Congested areas indicates road sections that have lower vehicle travel speed than the congestion reference speed even in one hour of 24 hours.
※ Proportion of congested areas = Sum of congested kilometers / Total length of roads in the city

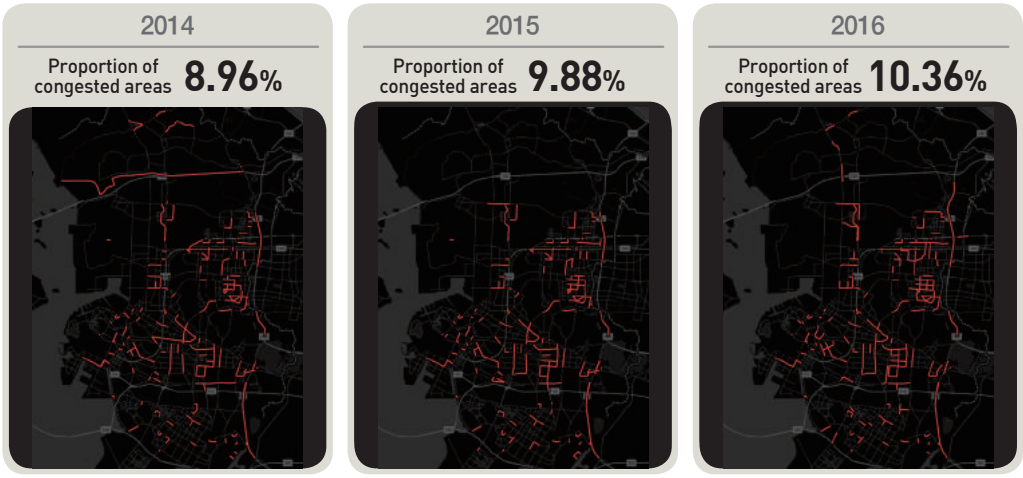
◎ How have congested areas of Daegu changed throughout a day? (one weekday in 2015)



※ Expressways, urban expressways, and special/metropolitan city roads were reviewed.
※ Congestion reference speed: Less than 40 km/h for expressway, less than 30 km/h for urban expressway, and less than 15 km/h for special metropolitan city roads and metropolitan city roads
※ Proportion of congested areas = Sum of congested kilometers / Total length of roads in the city

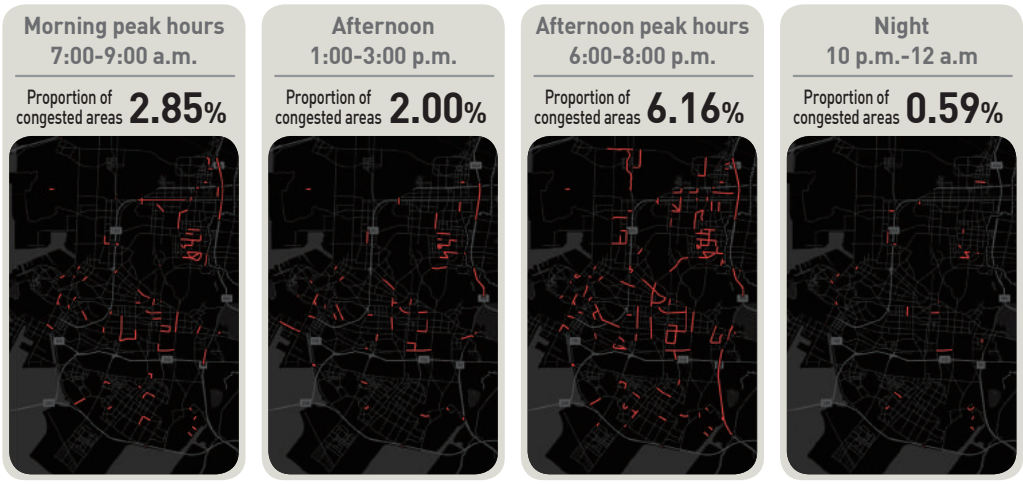
5) Status of traffic congestion in Incheon Metropolitan City

◎ How have congested areas of Incheon changed by year?



※ Expressways, urban expressways, and special/metropolitan city roads were reviewed.
※ Congestion reference speed: Less than 40 km/h for expressways, less than 30 km/h for urban expressways, and less than 15 km/h for special metropolitan city roads and metropolitan city roads
※ Congested areas indicates road sections that have lower vehicle travel speed than the congestion reference speed even in one hour of 24 hours.
※ Proportion of congested areas = Sum of congested kilometers / Total length of roads in the city

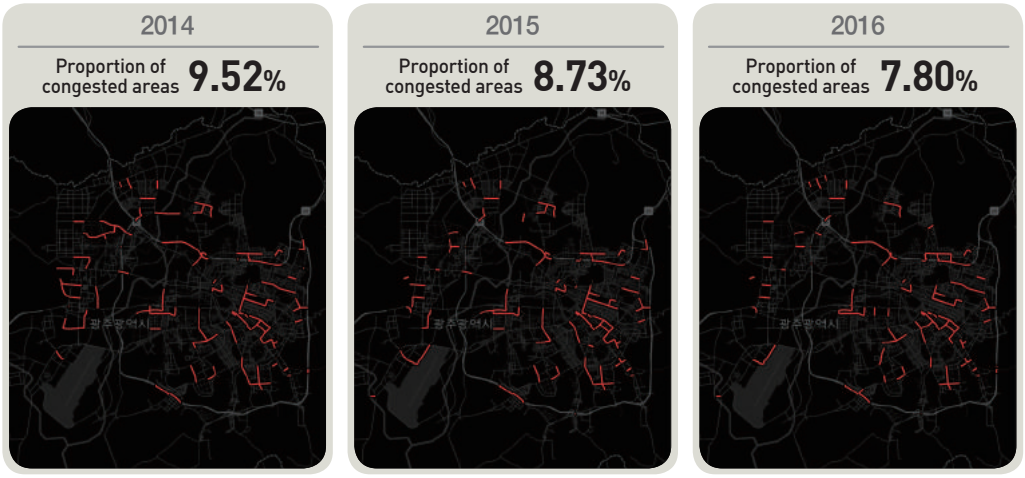
◎ How have congested areas of Incheon changed throughout a day? (one weekday in 2015)



※ Expressways, urban expressways, and special/metropolitan city roads were reviewed.
※ Congestion reference speed: Less than 40 km/h for expressway, less than 30 km/h for urban expressway, and less than 15 km/h for special metropolitan city roads and metropolitan city roads
※ Proportion of congested areas = Sum of congested kilometers / Total length of roads in the city

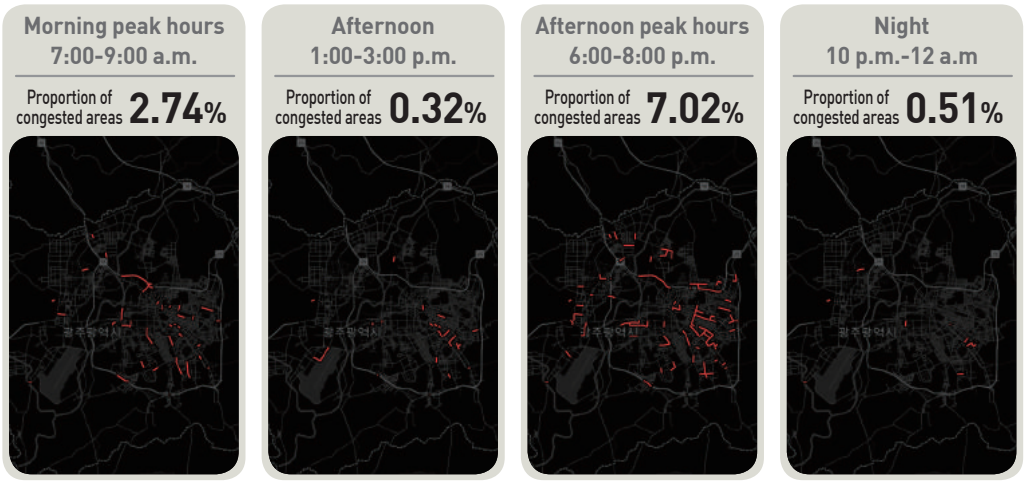
6) Status of Traffic Congestion in Gwangju Metropolitan City

◎ How have congested areas of Gwangju changed by year?



※ Expressways, urban expressways, and special/metropolitan city roads were reviewed.
※ Congestion reference speed: Less than 40 km/h for expressways, less than 30 km/h for urban expressways, and less than 15 km/h for special metropolitan city roads and metropolitan city roads
※ Congested areas indicates road sections that have lower vehicle travel speed than the congestion reference speed even in one hour of 24 hours.
※ Proportion of congested areas = Sum of congested kilometers / Total length of roads in the city

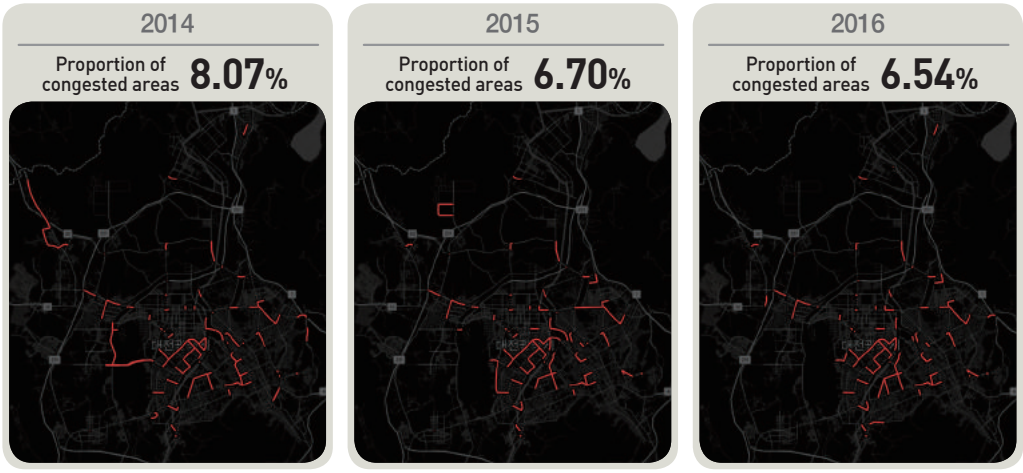
◎ How have congested areas of Gwangju changed throughout a day? (one weekday in 2015)



※ Expressways, urban expressways, and special/metropolitan city roads were reviewed.
※ Congestion reference speed: Less than 40 km/h for expressway, less than 30 km/h for urban expressway, and less than 15 km/h for special metropolitan city roads and metropolitan city roads
※ Proportion of congested areas = Sum of congested kilometers / Total length of roads in the city

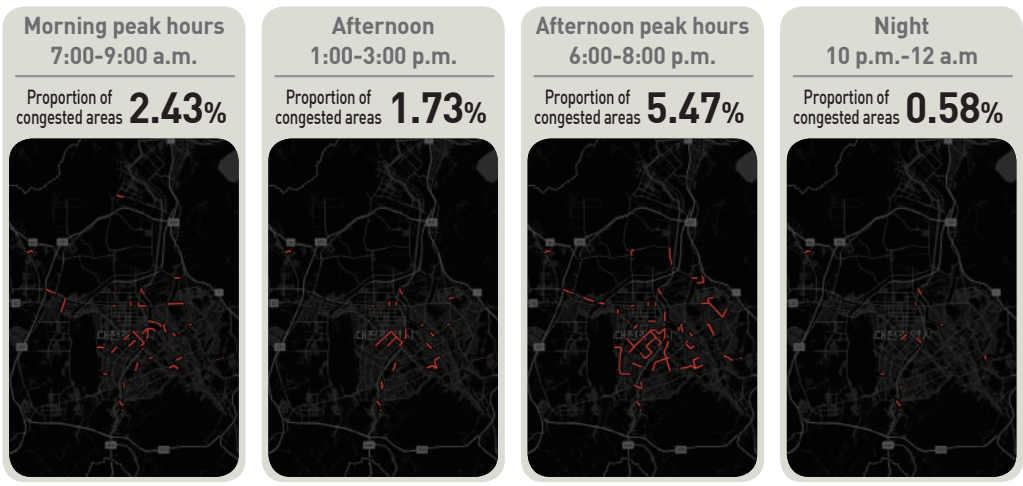
7) Status of Traffic Congestion in Daejeon Metropolitan City

◎ How have congested areas of Daejeon changed by year?



※ Expressways, urban expressways, and special/metropolitan city roads were reviewed.
※ Congestion reference speed: Less than 40 km/h for expressways, less than 30 km/h for urban expressways, and less than 15 km/h for special metropolitan city roads and metropolitan city roads
※ Congested areas indicates road sections that have lower vehicle travel speed than the congestion reference speed even in one hour of 24 hours.
※ Proportion of congested areas = Sum of congested kilometers / Total length of roads in the city

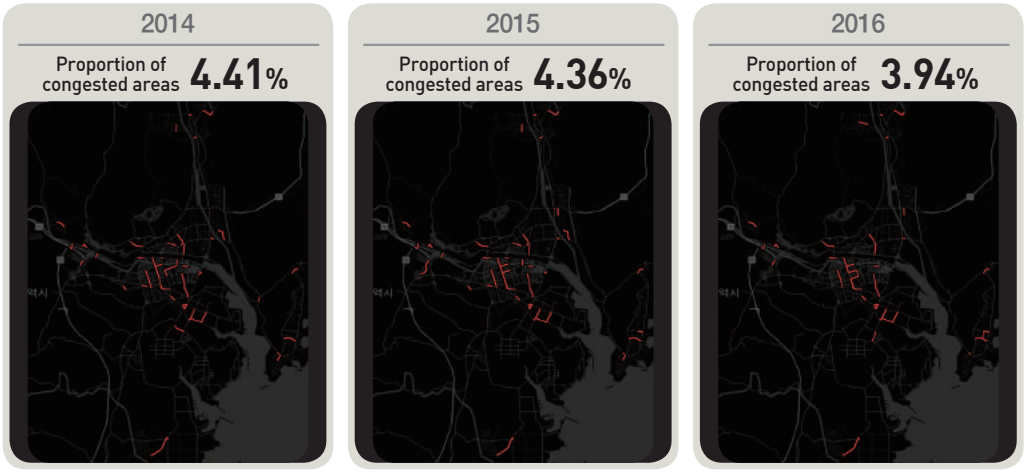
◎ How have congested areas of Daejeon changed throughout a day? (one weekday in 2015)



※ Expressways, urban expressways, and special/metropolitan city roads were reviewed.
※ Congestion reference speed: Less than 40 km/h for expressway, less than 30 km/h for urban expressway, and less than 15 km/h for special metropolitan city roads and metropolitan city roads
※ Proportion of congested areas = Sum of congested kilometers / Total length of roads in the city

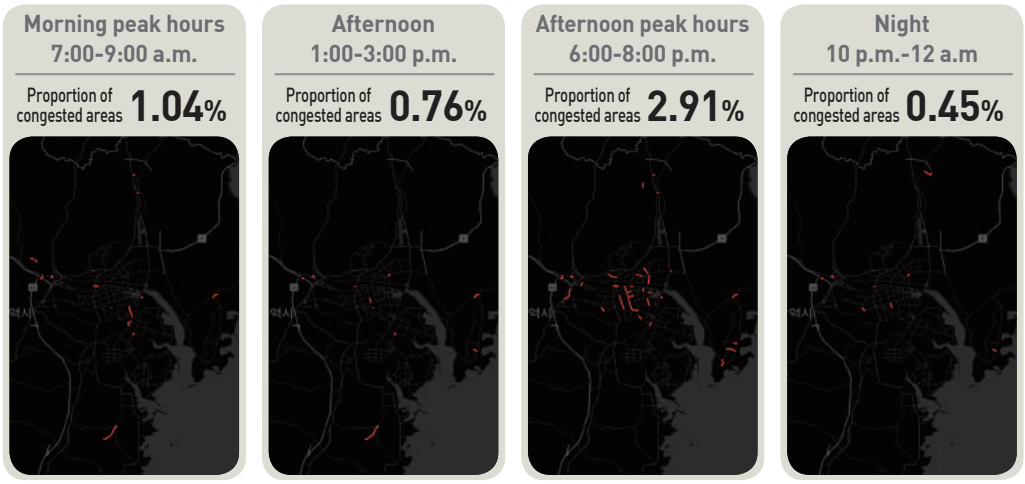
8) Status of Traffic Congestion in Ulsan Metropolitan City

◎ How have congested areas of Ulsan changed by year?



※ Expressways, urban expressways, and special/metropolitan city roads were reviewed.
※ Congestion reference speed: Less than 40 km/h for expressways, less than 30 km/h for urban expressways, and less than 15 km/h for special metropolitan city roads and metropolitan city roads
※ Congested areas indicates road sections that have lower vehicle travel speed than the congestion reference speed even in one hour of 24 hours.
※ Proportion of congested areas = Sum of congested kilometers / Total length of roads in the city

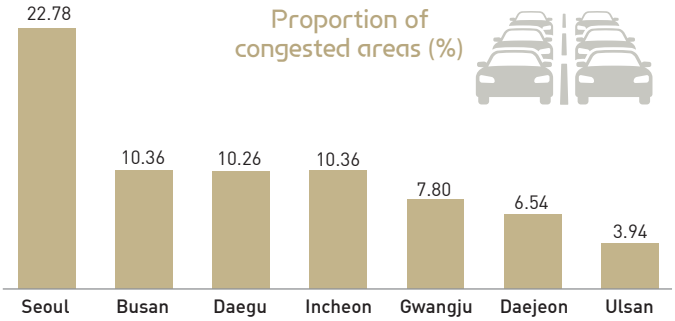
◎ How have congested areas of Ulsan changed throughout a day? (one weekday in 2015)

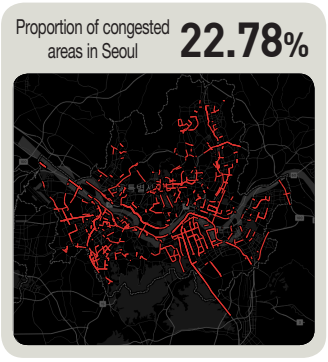


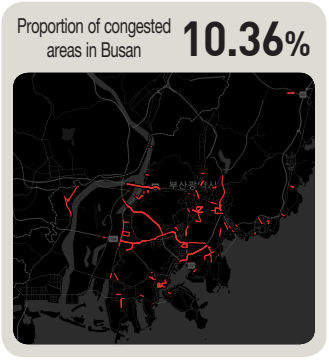
※ Expressways, urban expressways, and special/metropolitan city roads were reviewed.
※ Congestion reference speed: Less than 40 km/h for expressway, less than 30 km/h for urban expressway, and less than 15 km/h for special metropolitan city roads and metropolitan city roads
※ Proportion of congested areas = Sum of congested kilometers / Total length of roads in the city

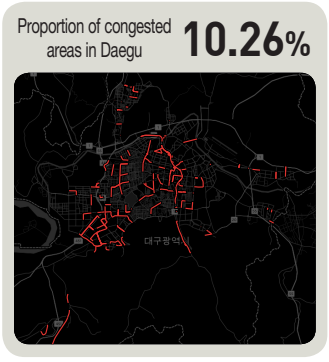
9) Characteristics of Traffic Congestion of Seven Special and Metropolitan Cities

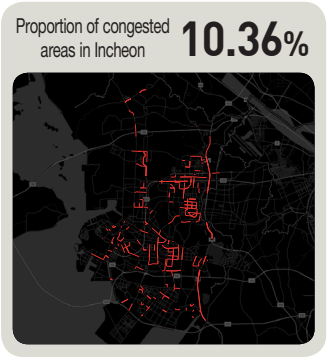
◎ **Which city has the highest proportion of congested areas among metropolitan cities? (in 2016)**

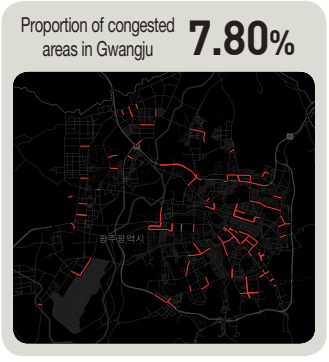


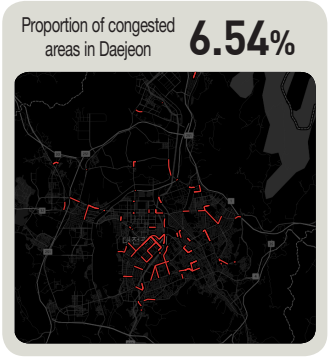


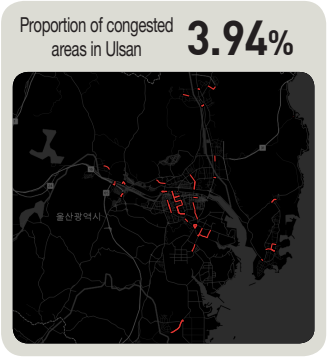












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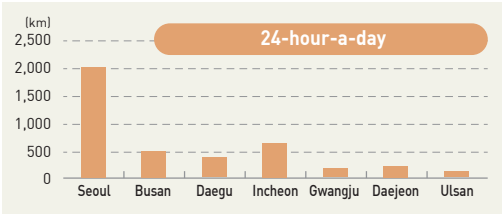
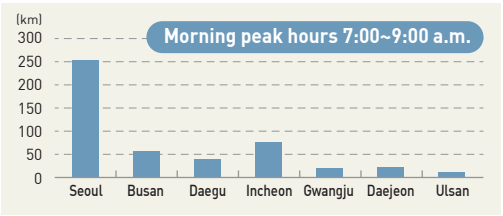
※ Congested areas indicates road sections that have lower vehicle travel speed than the congestion reference speed even in one hour of 24 hours.
※ Proportion of congested areas = Sum of congested kilometers / Total length of roads in the city

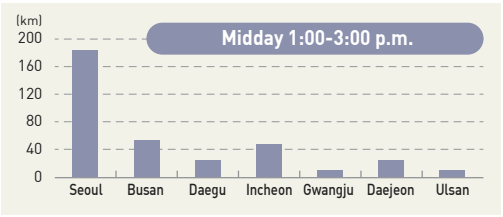
◎ **How long would they be if congested areas are aggregated?** (in 2016)

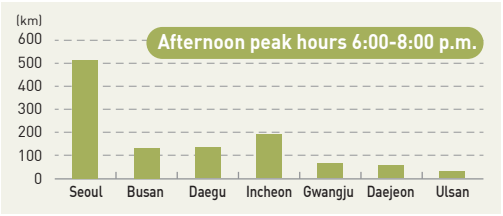
Region	Time	Length of congested areas(km)
Seoul	24-hour-a-day	2,040
	Morning peak hours 7:00~9:00 a.m.	254
	Midday 1:00-3:00 p.m.	188
	Afternoon peak hours 6:00-8:00 p.m.	508
	Night 10:00 p.m.~12 a.m.	31
Busan	24-hour-a-day	492
	Morning peak hours 7:00~9:00 a.m.	57
	Midday 1:00-3:00 p.m.	54
	Afternoon peak hours 6:00-8:00 p.m.	129
	Night 10:00 p.m.~12 a.m.	7
Daegu	24-hour-a-day	363
	Morning peak hours 7:00~9:00 a.m.	40
	Midday 1:00-3:00 p.m.	25
	Afternoon peak hours 6:00-8:00 p.m.	131
	Night 10:00 p.m.~12 a.m.	6
Incheon	24-hour-a-day	635
	Morning peak hours 7:00~9:00 a.m.	76
	Midday 1:00-3:00 p.m.	48
	Afternoon peak hours 6:00-8:00 p.m.	187
	Night 10:00 p.m.~12 a.m.	16
Gwangju	24-hour-a-day	164
	Morning peak hours 7:00~9:00 a.m.	21
	Midday 1:00-3:00 p.m.	10
	Afternoon peak hours 6:00-8:00 p.m.	64
	Night 10:00 p.m.~12 a.m.	3
Daejeon	24-hour-a-day	214
	Morning peak hours 7:00~9:00 a.m.	23
	Midday 1:00-3:00 p.m.	25
	Afternoon peak hours 6:00-8:00 p.m.	55
	Night 10:00 p.m.~12 a.m.	4
Ulsan	24-hour-a-day	110
	Morning peak hours 7:00~9:00 a.m.	11
	Midday 1:00-3:00 p.m.	10
	Afternoon peak hours 6:00-8:00 p.m.	28
	Night 10:00 p.m.~12 a.m.	2

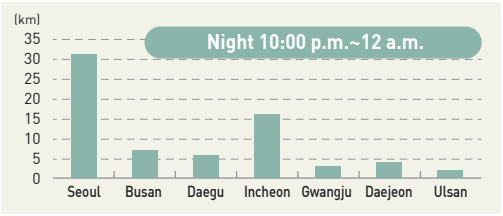
Hourly length of congested areas





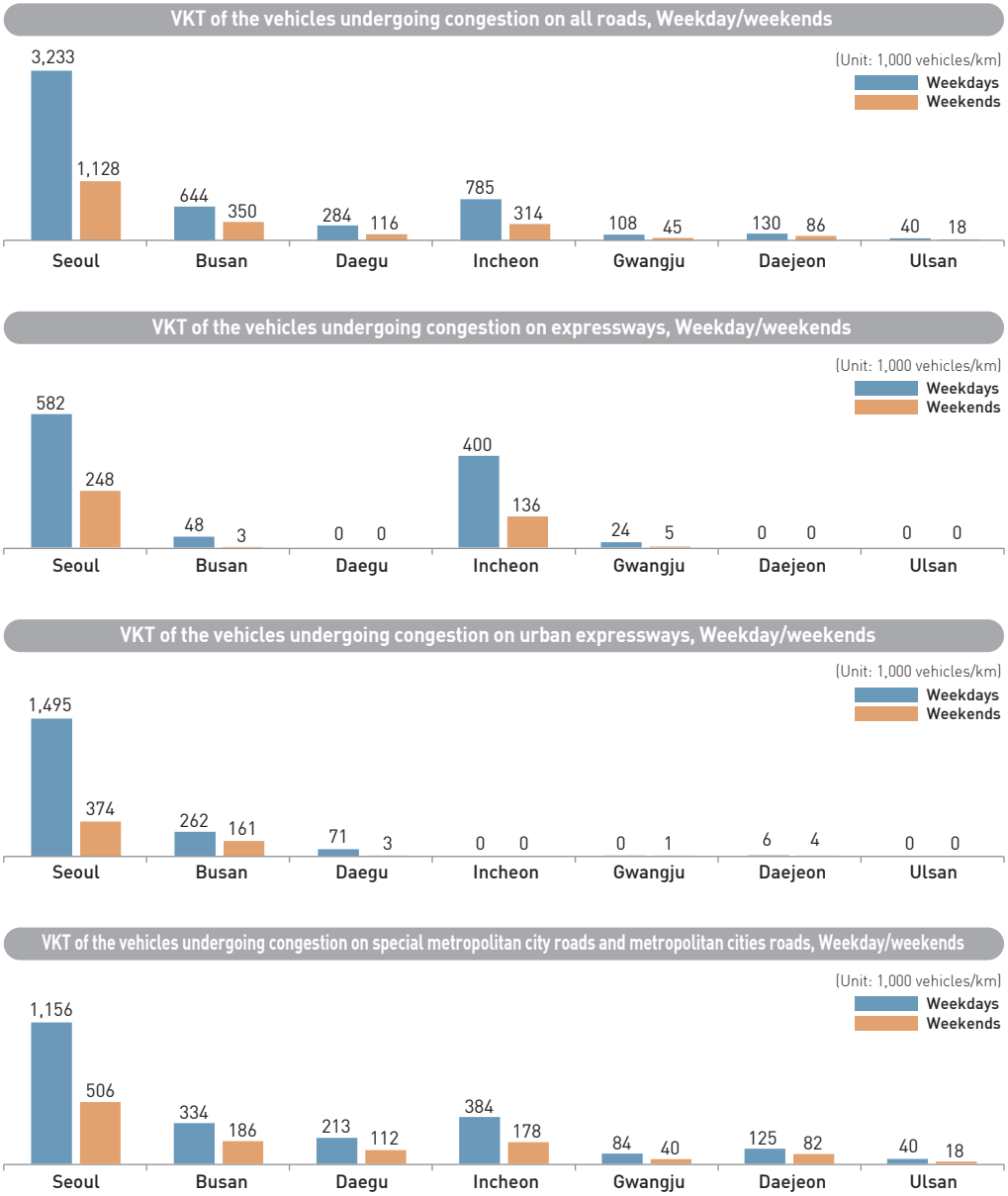






※ Expressways, urban expressways, and special/metropolitan city roads were reviewed.
※ Congestion reference speed: Less than 40 km/h for expressways, less than 30 km/h for urban expressways, and less than 15 km/h for special metropolitan city roads and metropolitan city roads
※ Congested areas indicates road sections that have lower vehicle travel speed than the congestion reference speed even in one hour of 24 hours.
※ Proportion of congested areas = Sum of congested kilometers / Total length of roads in the city

◎ **How long would be the total VKT (vehicle kilometers traveled) of vehicles undergoing congestion?** (in 2016)



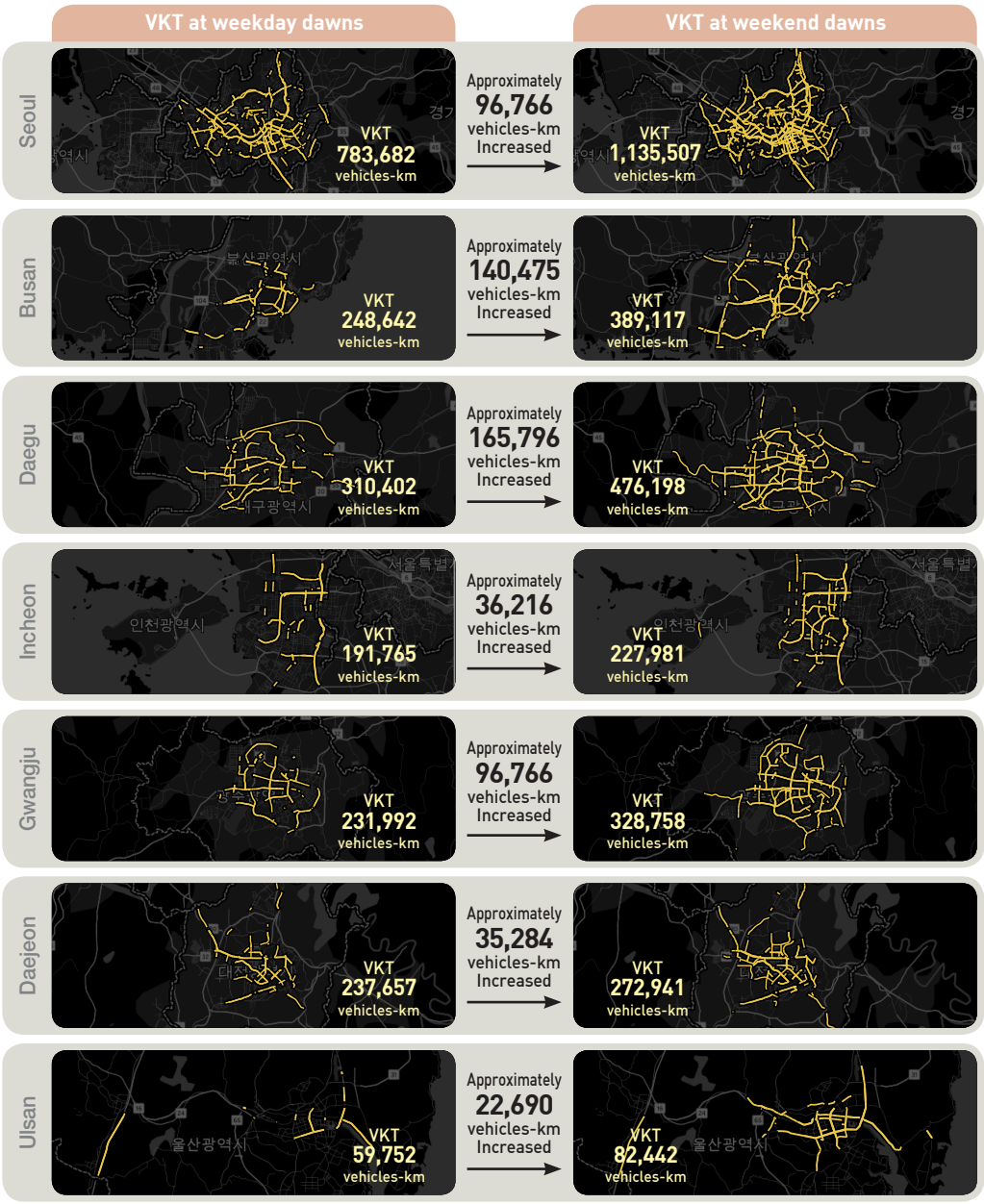
※ Expressways, urban expressways, and special/metropolitan city roads were reviewed.
※ Congestion reference speed: Less than 40 km/h for expressways, less than 30 km/h for urban expressways, and less than 15 km/h for special metropolitan city roads and metropolitan city roads
※ Road sections where vehicles move slower than the congestion reference speed were selected as congested areas.
※ Length of each congested area and its traffic volume are multiplied to produce total vehicle kilometers traveled

◎ **How large would the difference be between the average speed on weekday mornings and weekend mornings?** (in 2016, 8:00 a.m.-9:00 a.m.)

※ The figure illustrates the congested areas of expressways, urban expressways and special metropolitan roads and metropolitan cities roads between 8:00 a.m. and 9:00 a.m. on weekdays and weekends.

※ Congestion reference speed: Less than 40 km/h for expressways, Less than 30 km/h for urban expressways, Less than 15 km/h for Special/Metropolitan city roads

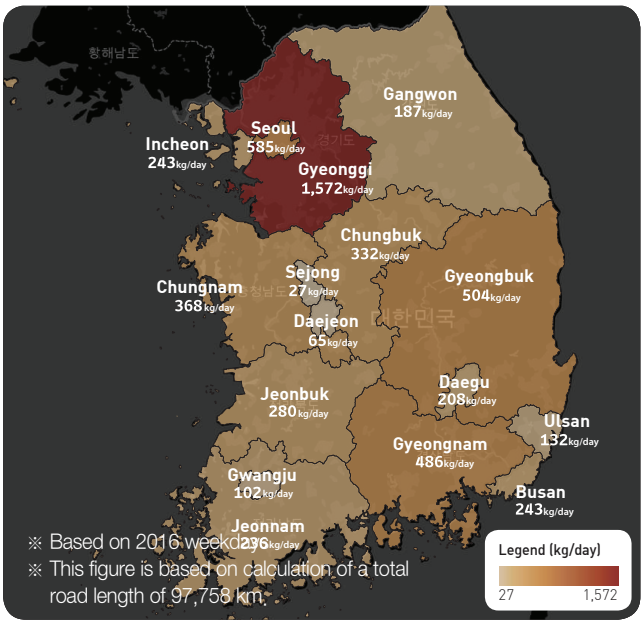
◎ **Night fever on weekends** (in 2016, 3:00 a.m.-4:00 a.m.)



※ The figure above presents road with more than 500 vehicles/hour during 3-4 am in the morning.

04_Transport Environments in the Perspective of Vehicle Mobility

1) How Much PM (Particulate Matter) is Produced by Vehicle Traffic?



◎ Daily total PM emissions volume by city/province

Ranking	City/Province	Emissions of PM (kg/day)
1	Gyeonggi	1,572
2	Seoul	585
3	Gyeongbuk	504
4	Gyeongnam	486
5	Chungnam	368
6	Chungbuk	332
7	Jeonbuk	280
8	Busan	243
9	Incheon	243
10	Jeonnam	236
11	Daegu	208
12	Gangwon	187
13	Ulsan	132
14	Gwangju	102
15	Daejeon	65
16	Jeju	62
17	Sejong	27
	Total	5,632

◎ PM emissions volume per 1 km by city/province

Ranking	City/Province	Length (km)	Emissions of PM per 1kg (kg/day)
1	Seoul	3,241	0.18
2	Busan	1,914	0.13
3	Daegu	1,680	0.12
4	Daejeon	1,178	0.1
5	Gwangju	1,254	0.1
6	Incheon	2,483	0.08
7	Gyeonggi	16,083	0.08
8	Ulsan	1,574	0.06
9	Gyeongnam	9,708	0.05
10	Sejong	637	0.05
11	Chungbuk	6,630	0.04
12	Chungnam	8,276	0.04
13	Jeju	1,753	0.04
14	Gyeongbuk	13,598	0.04
15	Jeonbuk	8,567	0.03
16	Gangwon	9,303	0.02
17	Jeonnam	9,879	0.02
	Total	97,758	0.05

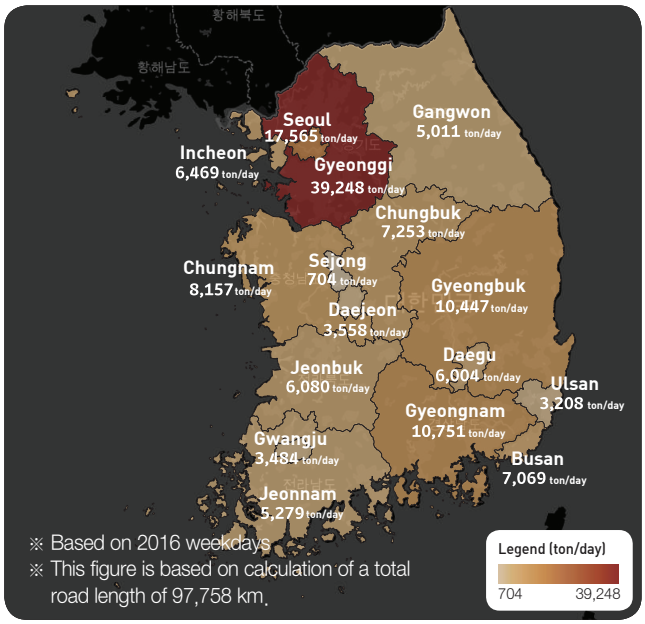
◎ Daily total PM emissions volume by road class

Ranking	Road class	Emissions of PM (kg/day)	Emissions of PM per 1km (km/day)
1	Expressways	1,669	0.18
2	National highways	1,439	0.13
3	Roads in cities/counties	889	0.12
4	Special/Metropolitan city roads	852	0.1
5	Local highways	324	0.1
6	Urban expressways	278	0.08
7	Government-aided provincial roads	182	0.08
	Total	5,632	0.06

◎ PM emissions volume per 1km by road class

Ranking	Road class	Length (km)	Emissions of PM per 1kg (kg/day)
1	Urban expressways	906	0.31
2	Expressways	8,894	0.19
3	Special/Metropolitan city roads	8,242	0.1
4	National highways	27,035	0.05
5	Roads in cities/counties	19,768	0.04
6	Government-aided provincial roads	6,831	0.03
7	Local highways	23,717	0.01

2) How Much CO_2 (Greenhouse Gases) is Produced by Vehicle Traffic?



◎ Daily CO_2 emissions volume by city/province

Ranking	City/Province	Emissions of CO_2 (ton/day)
1	Gyeonggi	39,248
2	Seoul	17,565
3	Gyeongbuk	10,751
4	Gyeongnam	10,447
5	Chungnam	8,157
6	Chungbuk	7,253
7	Jeonbuk	7,069
8	Busan	6,469
9	Incheon	6,080
10	Jeonnam	6,004
11	Daegu	5,279
12	Gangwon	5,011
13	Ulsan	3,558
14	Gwangju	3,484
15	Daejeon	3,208
16	Jeju	1,385
17	Sejong	704
	Total	141,672

◎ CO_2 emissions volume per km by city/province

Ranking	City/Province	Length (km)	Emissions of CO_2 per 1km (ton/day)
1	Seoul	3,241	5.42
2	Busan	1,914	3.69
3	Daegu	1,680	3.57
4	Daejeon	1,178	3.02
5	Gwangju	1,254	2.78
6	Incheon	2,483	2.61
7	Gyeonggi	16,083	2.44
8	Ulsan	1,574	2.04
9	Gyeongnam	9,708	1.11
10	Sejong	637	1.11
11	Chungbuk	6,630	1.09
12	Chungnam	8,276	0.99
13	Jeju	1,753	0.79
14	Gyeongbuk	13,598	0.77
15	Jeonbuk	8,567	0.71
16	Gangwon	9,303	0.54
17	Jeonnam	9,879	0.53
	Total	97,758	0.69

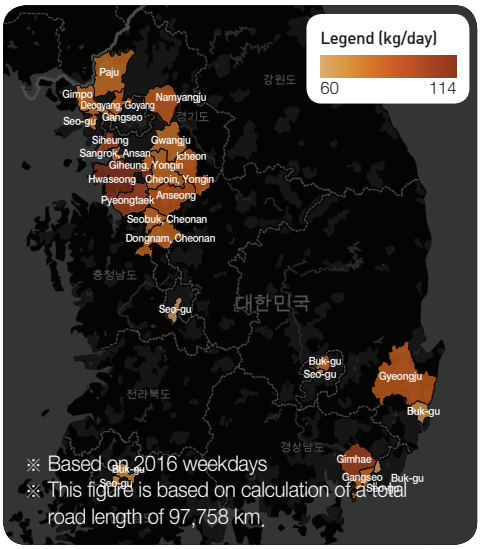
◎ Daily total CO_2 emissions volume by road class

Ranking	Road class	Emissions of CO_2 (ton/day)
1	Expressways	39,585
2	National highways	34,245
3	Roads in cities/counties	27,351
4	Special/Metropolitan city roads	21,267
5	Local Highways	7,808
6	Urban expressways	7,033
7	Government-aided provincial roads	4,382
	Total	141,672

◎ CO_2 emissions volume per km by road class

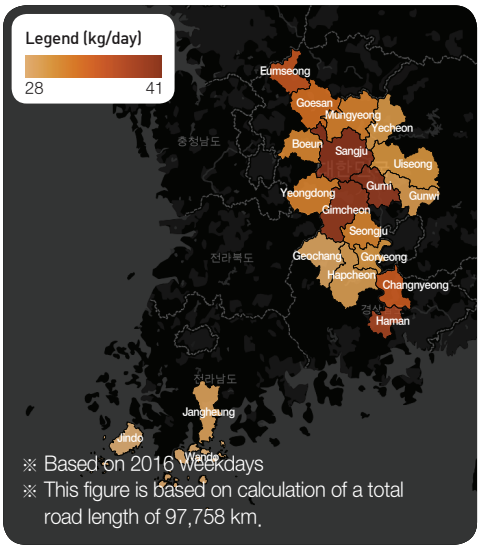
Ranking	Road class	Length (km)	Emissions of CO_2 per 1km (ton/day)
1	Urban expressways	906	8.62
2	Expressways	8,894	4.45
3	Special/Metropolitan city roads	8,242	3.32
4	National highways	27,035	1.27
5	Roads in cities/counties	19,768	1.08
6	Government-aided provincial roads	6,831	0.64
7	Local highways	23,717	0.30

3) Which Region Produces the Most PM Emissions from Freight Vehicles?



Ranking	Metropolitan city/Province	City/County /District	Emissions of PM-10(kg/day)
			Truck
1	Gyeonggi	Hwaseong	94.5
2	Gyeongnam	Gimhae	79.4
3	Gyeonggi	Pyeongtaek	76.2
4	Gyeonggi	Siheung	75.1
5	Gyeonggi	Anseong	56.0
6	Gyeongbuk	Gyeongju	51.4
7	Gyeonggi	Namyangju	51.4
8	Gyeonggi	Icheon	49.6
9	Gyeonggi	Deogyang, Goyang	47.9
10	Daegu	Buk-gu	44.0
11	Chungnam	Dongnam, Cheonan	44.0
12	Busan	Gangseo	43.2
13	Gyeonggi	Cheoin, Yongin	42.5
14	Chungnam	Seobuk, Cheonan	42.3
15	Incheon	Seo-gu	41.9
16	Gyeonggi	Gimpo	41.5
17	Gyeonggi	Sangrok, Ansan	40.7
18	Gyeonggi	Paju	39.7
19	Gyeonggi	Gwangju	39.0
20	Gyeonggi	Giheung, Yongin	38.0

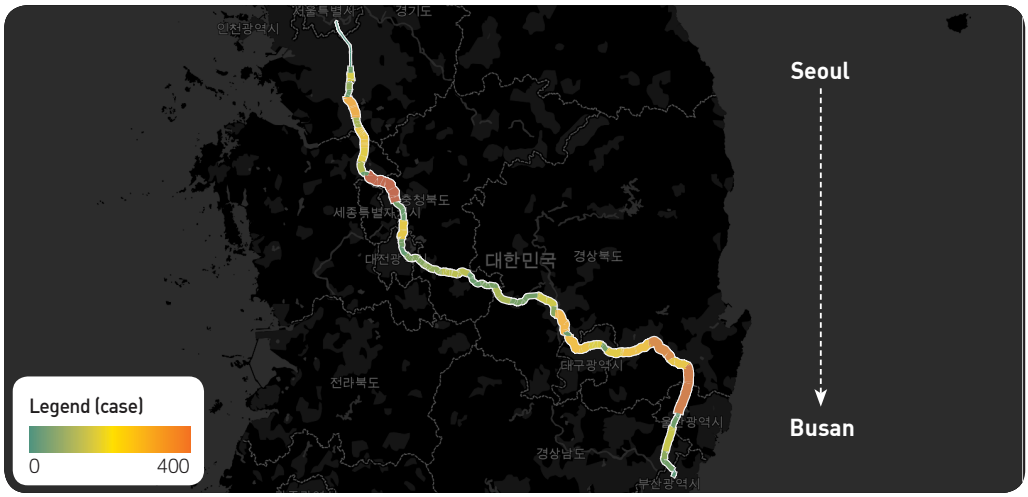
4) Which Region Accounts for the Highest Proportion of PM Emissions from Freight Vehicles?



Ranking	Metropolitan city/Province	City/County /District	Emissions of PM-10(kg/day)		Proportion of PM-10 emissions from trucks
			Total	Truck	
1	Jeonnam	Wando	3.9	3.5	91%
2	Chungbuk	Boeun	13.9	12.5	90%
3	Gyeongbuk	Sangju	41.9	37.4	89%
4	Gyeongbuk	Seongju	14.5	12.9	89%
5	Gyeongnam	Hapcheon	7.5	6.7	89%
6	Gyeongnam	Geochang	5.6	5.0	89%
7	Gyeongbuk	Gimcheon	39.3	35.0	89%
8	Gyeongbuk	Goryeong	10.1	8.9	89%
9	Jeonnam	Jangheung	6.3	5.6	89%
10	Jeonnam	Jindo	2.8	2.5	89%
11	Gyeongbuk	Gunwi	8.1	7.2	89%
12	Gyeongbuk	Uiseong	10.3	9.1	88%
13	Chungbuk	Yeongdong	14.8	13.0	88%
14	Gyeongnam	Changnyeong	25.2	22.3	88%
15	Gyeongbuk	Gumi	40.8	36.0	88%
16	Chungbuk	Eumseong	27.4	24.2	88%
17	Gyeongnam	Haman	35.4	31.2	88%
18	Gyeongbuk	Yecheon	9.1	8.0	88%
19	Gyeongbuk	Mungyeong	14.8	13.0	88%
20	Gyeongbuk	Goesan	19.5	17.1	88%

05_Transport Safety in the Perspective of Vehicle Mobility

◎ **At which sections of the Gyeongbu Expressway (southbound lane) do the most vehicle accidents occur?**



※ The accident data represent the aggregation of accident records from 2008 to 2014.

◎ **Which sections of the Gyeongbu Expressway (southbound lane) have the highest accident rate?**

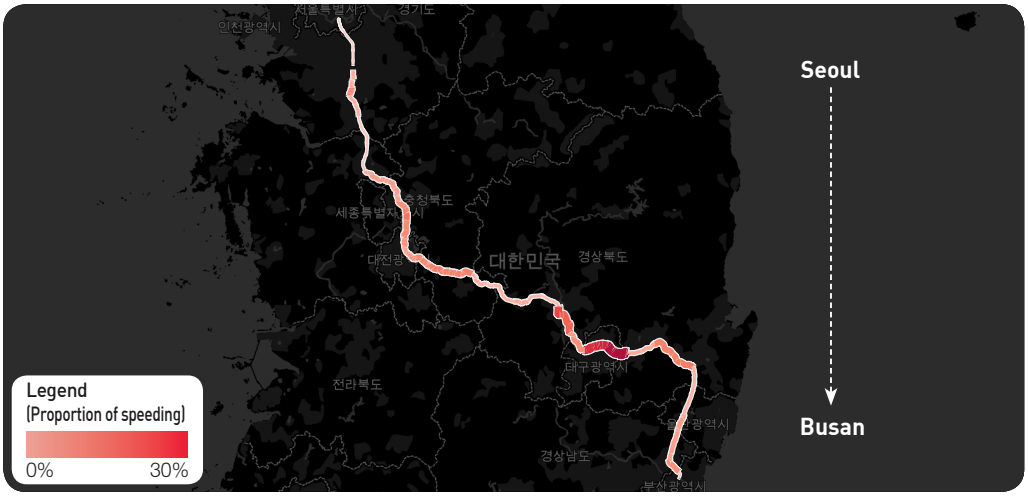
※ Accident rate is an index to compare the relative risk of traffic accidents (With simple counting of the number of accidents, it is difficult to make a comparison among road sections as they have different traffic volume, length, distance traveled, etc.)

※ Accident rate is the annual number of accidents occurring per million vehicles-1 km

※ Based on the average daily traffic volume of 2014

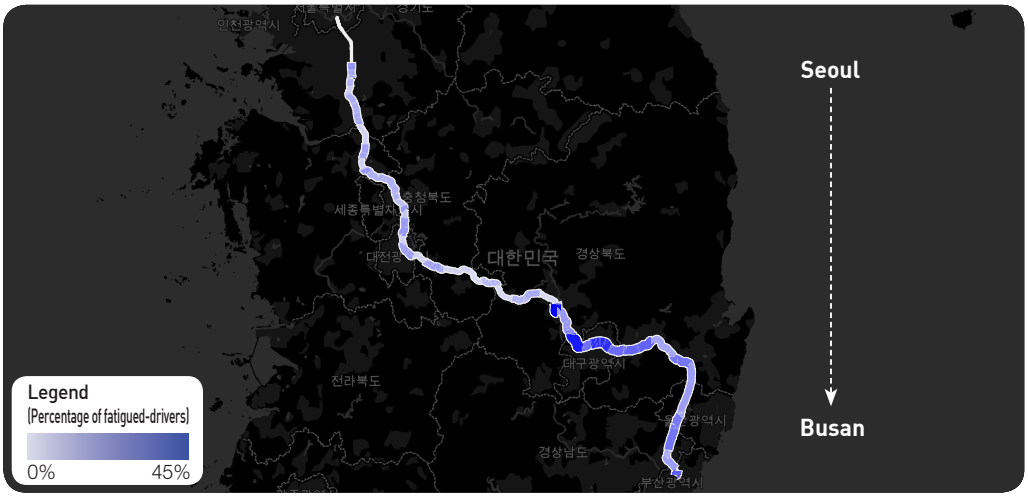
※ Accident rate (AR) = $\frac{\text{The number of accidents that occurred in the road section (numbers/year)}}{\text{Annual average daily traffic of the road section (AADT)} \times \text{Lengths (km)} \times 365 \text{ days}} \times 10^6$

◎ **At which sections of the Gyeongbu Expressway (southbound lane) does speeding occur the most?**



※ Speeding is defined as vehicles driving over 130 km/h.
※ The figure illustrates the proportion of the number of vehicles speeding over 130 km/h out of the total number of vehicles.
※ The thicker the lines and the darker the red lines, the higher the proportion of speeding vehicles.
※ Analysis was conducted based on navigation data collected during weekdays in 2014.

◎ **At which sections of the Gyeongbu Expressway (southbound lane) do drivers feel the highest degree of fatigue?**

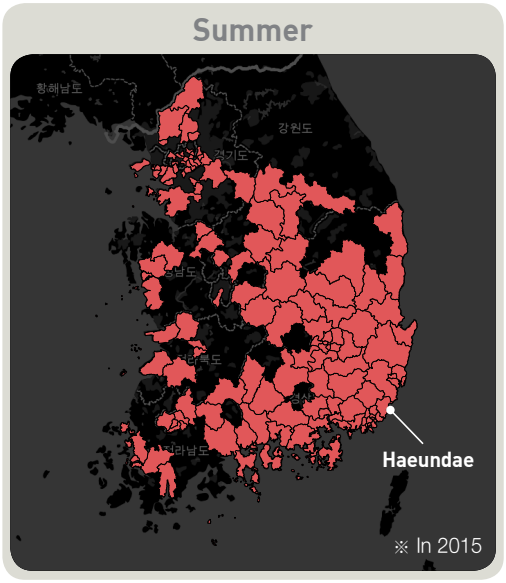


※ It is defined that drivers feel fatigue in cases where they drive vehicles for more than two hours.
※ The figure illustrates the proportion of drivers driving more than two hours out of the entire drivers.
※ The thicker the lines and the darker the blue lines, the higher the proportion of long duration drivers.
※ Analysis is conducted using navigation route data collected during weekdays in 2014.

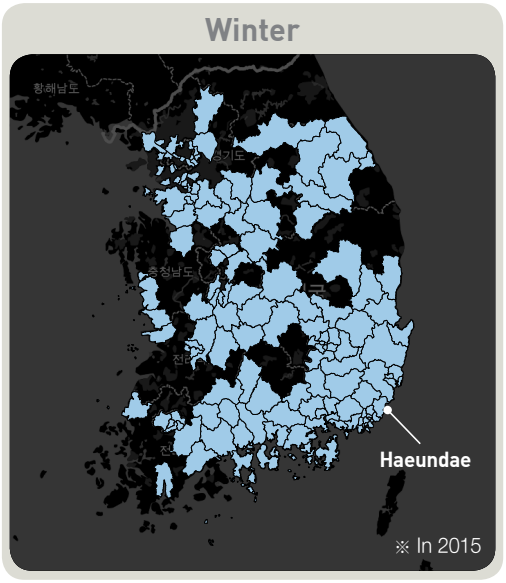
06_Movements of the Nation in the Perspective of Vehicle Mobility

1) Is Haeundae More Popular for Tourists in Winter than Summer?

- The total number of tourists in summer outweighs that in winter; but the number of regions they come from in winter outweighs that in summer.

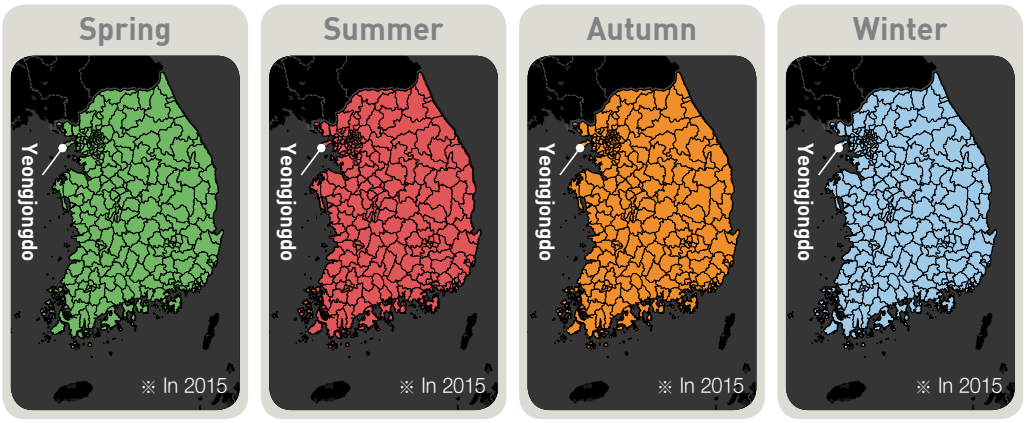


▶ Summer : tourists coming from **137** towns, townships and districts



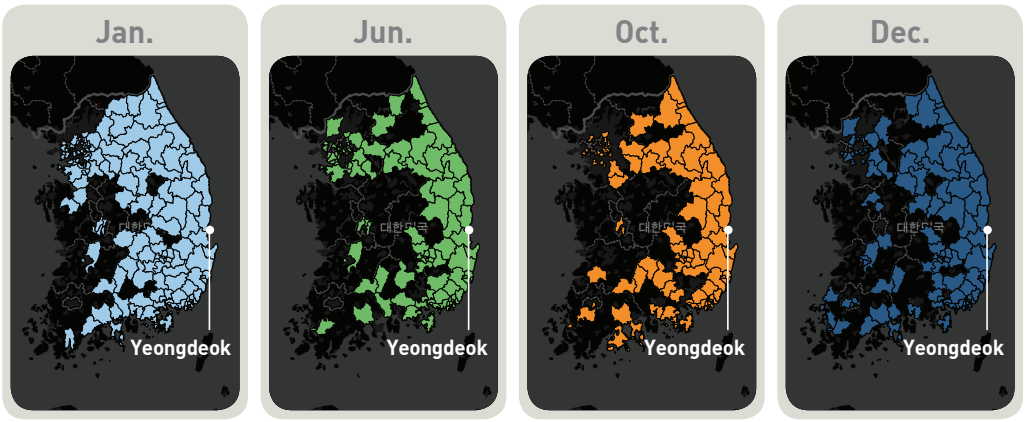
▶ Winter: tourists coming from **142** towns, townships and districts

2) Yeongjongdo Island is Visited by Tourists from all over the Nation throughout the Year



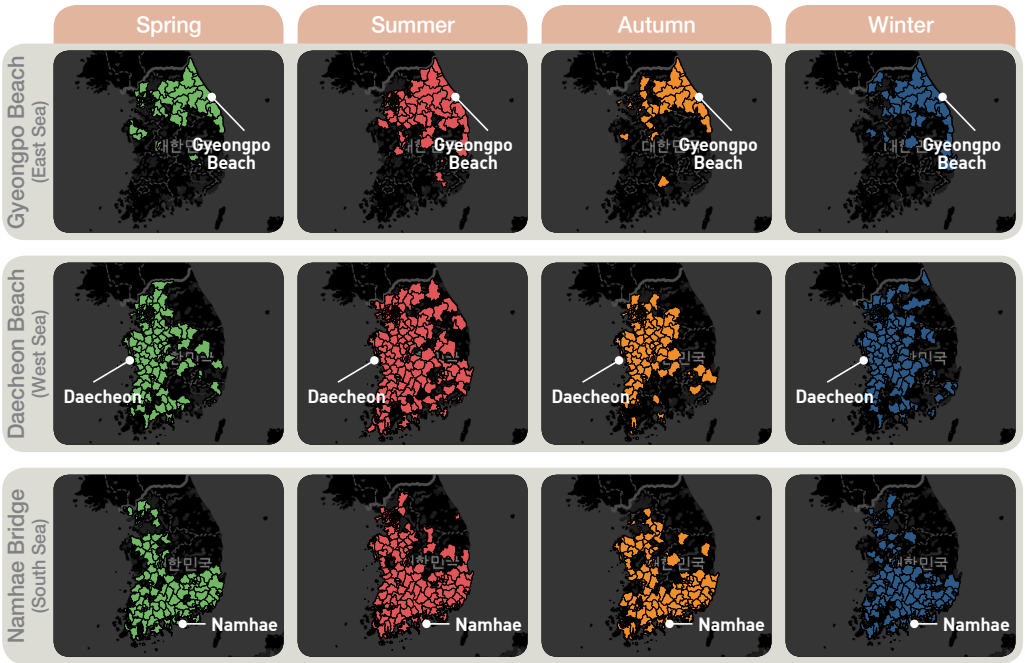
▶ Tourists come throughout the year from all **248** towns, townships and districts across the nation

3) Guess When is the Season of the Yeongdeok Snow Crabs Referred to in the Figure below?



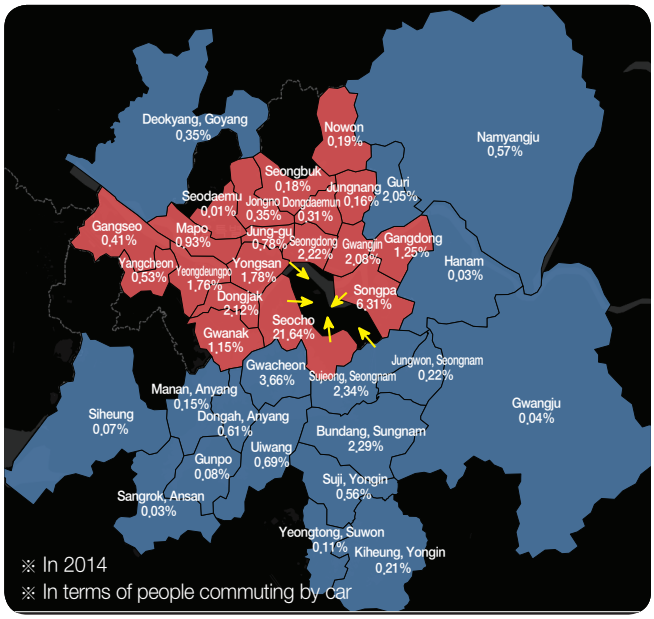
※ In 2015

4) How has the Distribution of Tourists on the East Coast, the West Coast, and the South Coast of Korea Been Changing by Season?



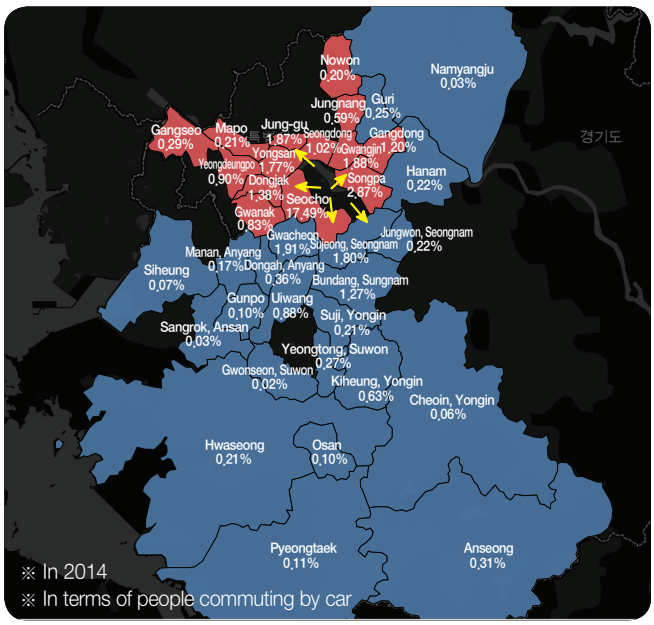
※ In 2015

5) Busy As a Beaver! Where Do People Working in Gangnam District Usually Commute from? (8:00 a.m.-9:00 a.m.)



Ranking	Metropolitan city/Province	City/County /District	Entry rates
1	Seoul	Seocho	21,6%
2	Seoul	Songpa	6,3%
3	Gyeonggi	Gwacheon	3,7%
4	Gyeonggi	Sujeong, Seongnam	2,3%
5	Gyeonggi	Bundang, Sungnam	2,3%
6	Seoul	Seongdong	2,2%
7	Seoul	Dongjak	2,1%
8	Seoul	Gwangjin	2,1%
9	Gyeonggi	Guri	2,0%
10	Seoul	Yongsan	1,8%
11	Seoul	Yeongdeungpo	1,8%
12	Seoul	Gangdong	1,2%
13	Seoul	Gwanak	1,2%
14	Seoul	Mapo	0,9%
15	Seoul	Jung-gu	0,8%
16	Gyeonggi	Uiwang	0,7%
17	Gyeonggi	Dongah, Anyang	0,6%
18	Gyeonggi	Namyangju	0,6%
19	Gyeonggi	Suji, Yongin	0,6%
20	Seoul	Yangcheon	0,5%
21	Seoul	Gangseo	0,4%
22	Seoul	Jongno	0,3%
23	Gyeonggi	Deokyang, Goyang	0,3%
24	Seoul	Dongdaemun	0,3%
25	Gyeonggi	Jungwon, Seongnam	0,2%
26	Gyeonggi	Giheung, Yongin	0,2%
27	Seoul	Nowon	0,2%
28	Seoul	Seongbuk	0,2%
29	Seoul	Jungnang	0,2%
30	Gyeonggi	Manan, Anyang	0,1%

6) Where Do Citizens of Gangnam District Commute to? (8:00 a.m.-9:00 a.m.)



Ranking	Metropolitan city/Province	City/County /District	Exit rates
1	Seoul	Seocho	17,5%
2	Seoul	Songpa	2,9%
3	Gyeonggi	Gwacheon	1,9%
4	Seoul	Gwangjin	1,9%
5	Seoul	Jung-gu	1,9%
6	Gyeonggi	Sujeong, Seongnam	1,8%
7	Seoul	Yongsan	1,8%
8	Seoul	Dongjak	1,4%
9	Gyeonggi	Bundang, Sungnam	1,3%
10	Seoul	Gangdong	1,2%
11	Seoul	Seongdong	1,0%
12	Seoul	Yeongdeungpo	0,9%
13	Gyeonggi	Uiwang	0,9%
14	Seoul	Gwanak	0,8%
15	Gyeonggi	Kiheung, Yongin	0,6%
16	Seoul	Jungnang	0,6%
17	Gyeonggi	Dongah, Anyang	0,4%
18	Gyeonggi	Anseong	0,3%
19	Seoul	Gangseo	0,3%
20	Gyeonggi	Suwon, Suwon	0,3%
21	Gyeonggi	Guri	0,3%
22	Gyeonggi	Jungwon, Seongnam	0,2%
23	Gyeonggi	Hanam	0,2%
24	Gyeonggi	Hwaseong	0,2%
25	Seoul	Mapo	0,2%
26	Gyeonggi	Suji, Yongin	0,2%
27	Seoul	Nowon	0,2%
28	Gyeonggi	Manan, Anyang	0,2%
29	Gyeonggi	Pyeongtaek	0,1%
30	Gyeonggi	Osan	0,1%