KAKAO MOBILITY REPORT 2021

MOBILITY 2.0

Business | Regions using Premium Driver services: Near Seoul's Euljiro area

Taxi | Advantages of electric vehicles ● Owners ● Group considering purchase

1. Freedom from rotation scheme
2. Support measures
3. Fuel efficiency
4. Driving performance
5. Ride comfort
6. Design
7. Eco-friendliness

● 1st and ● 2nd years of COVID-19

Navi | Change patterns in mobility in the 1st and 2nd years of COVID-19: Retail

Business | Regions using Premium Driver services: Near Seoul's Yeouido area

Navi | Distribution of speeding by speed range : General road

Willingness to purchase an electric taxi
● Have willingness to purchase
● Have no willingness to purchase

Taxi | The number of trips Kakao T Taxi has logged
1.3 billion

● Weekdays ● Weekend

Bike | Riding pattern by time interval in leisure type cities : Busan

● Fewer than 5 years ● 5 to 10 years

Taxi | Number of monthly trips made by drivers according to their experience

100

50

0

Navi | Distribution of speed according to the average velocity calculation method (km/h)
● 10-minute arithmetic average speed
● Time-based weighted average speed
● User real-time average speed

● Restaurants
● Fashion
● Aquarium
● Cafes
● Movie theater
● Household goods stores
● Others

Parking | Status of COEX Mall web parking discount by business type

● First week of November 2020
● Fourth week of December 2020

Driver | Comparison of the distribution of social distancing calls in 2020

P. 216 BIKE

P. 74 TAXI

30 million
The taxi half of Korean people experienced

P. 39 TAXI
20.8
8.6
Trend of Kakao T Taxi dispatch time (seconds)

P. 177 DRIVER
−16%
● 2019 ● 2020
Shortening the driver matching time

P. 73 TAXI
1.3 billion
Total cumulative number of Kakao T Taxi trips completed

P. 195 PARKING
100
Liberation Day holiday
Everland parking lot availability prediction service page view

P. 85
1. Freedom from rotation scheme
2. Support measures
3. Fuel efficiency
4. Driving performance
5. Ride comfort
6. Design
7. Eco-friendliness
● Owners
● Group considering purchase
Advantages of electric vehicles

P. 215 BIKE
Riding pattern by time interval in leisure type cities : Daejeon
● Weekdays ● Weekend

P. 185 PARKING
10.52
−5.2%
9.97
● In normal time
● When alternative parking lot information is provided
Average speed at the entrance to COEX parking lot (km/h)

P. 75 TAXI
Kakao T Taxi driver classification status
● Regular mid-sized ● Brand

P. 75 TAXI
Age distribution of Kakao T Taxi drivers
● 56-60 ● 61-65

P. 133 NAVI
2018.07~2018.12
30
20
10
Usage rate by day of the week (based on starting Navi directions)
● Mobile Kakaonavi ● Android IVI ● iOS IVI

P. 246 BUSINESS
Regions using Premium Driver services : Near Seoul's Gangnam area

P. 171 DRIVER
● 10 PM ● 10:30 PM
−12%

P. 85 TAXI
● Charging
● Mileage
● Purchase prices
● Vehicle size
● Repair and maintenance
● Others
Considerations when purchasing an electric taxi

P. 183 PARKING
Changes in COEX entrance usage rate before and after information provision of other parking lot entrances on Kakao T Parking (2021)

P. 76 TAXI
36,000
Time length of 36,000 years Cumulative time on the move

P. 240 BIKE
0   10   20
Korea
World average
Per-capita carbon dioxide emissions

P. 246 BUSINESS
Regions using Premium Driver services : Near Seoul's Yeouido area

P. 226
● Less than 9 minutes
● 10-14 minutes
● 15-19 minutes
● 20-24 minutes
● 25-30 minutes
Changes in the share of usage time according to the rate plan change test

P. 240 BIKE
−7.3%
2019 2020S
Domestic greenhouse gas emissions trend

P. 171 DRIVER
Price change after 30 minutes of peak time Gangnam, Seoul → Songpa, Seoul

P. 214 BIKE
Riding pattern by time interval in daily life type cities : Hanam
● Weekdays ● Weekend

P. 35 TAXI
Big streets   Alleyways
Kakao T Taxi boarding location by type

P. 133 NAVI
2021.01~2021.07
20
10
Usage rate by day of the week (based on starting Navi directions)
● Mobile Kakaonavi ● Android IVI ● iOS IVI

P. 134 NAVI
Weekend
10
5
Usage rate by time of the day (%)
● Mobile Kakaonavi ● Android IVI ● iOS IVI

P. 30 TAXI
● Private hire vehicle ● Taxi
278
70318
1326
65038
Cumulative estimated fare (won)

12 trillion

P. 76 TAXI
Changes in mobility market in Seoul (2015, 2020)

P. 161 DRIVER
I am king of my neighborhood Goyang → Paju

P. 197 PARKING
Weekdays/Weekend
Comparison of vehicles entering Everland parking lot by time interval
● 2020 ● 2021

P. 138 NAVI
100
50
0
● 10-minute arithmetic average speed
● Time-based weighted average speed
● User real-time average speed
Distribution of speed according to the average velocity calculation method

P. 73 TAXI
1.3 billion
The number of trips Kakao T Taxi has logged

P. 234 BIKE
−15%
−37%
−34%
Change in accident loss ratio of Kakao T bike by year
● 2H 2019 ● 1H 2020 ● 2H 2020 ● 1H 2021

P. 134 NAVI
Weekday
10
5
Usage rate by time of the day (%)
● Mobile Kakaonavi ● Android IVI ● iOS IVI

P. 76 TAXI
26 thousand
260,000 rounds of the earth Cumulative trips made

P. 183 PARKING
Changes in COEX entrance usage rate before and after information provision of other parking lot entrances on Kakao T Parking (2020)

P. 130 NAVI
0.4
0
Distribution of speeding by speed range : General road

P. 155 DRIVER
100%
Insurance coverage rate of designated drivers

Distribution of speed according to the average velocity calculation method

P. 35 TAXI
2019   26
2021   65
Comparison of monthly app payment call user ratios (%)

P. 77 TAXI
40
30
The ratio of passengers who traveled less than 5 km

P. 154 DRIVER
4.5 hours
Working hours of designated drivers (Daily average)

P. 80 TAXI
38,732
A driver who fulfilled the highest number calls

P. 85 TAXI
Have no willingness   Have willingness
Willingness to purchase an electric taxi

P. 215 BIKE
Riding pattern by time interval in leisure type cities: Busan
● Weekdays ● Weekend

P. 185 PARKING
Alternative destination   Existing destination
Selection ratio when providing alternative parking lot guide

P. 130 NAVI
0.2
0
Distribution of speeding by speed range according to road grade : Highway

P. 167 DRIVER
● First week of November
● Fourth week of December
Comparison of the distribution of social distancing calls in 2020

P. 114 NAVI
100
50
0
−50
Change patterns in mobility in the 1st and 2nd years of COVID: Leisure
● 1st and ● 2nd years of COVID

P. 168 DRIVER
● First week of November 2020
● Fourth week of July 2021
Comparison of drivers' commute-to-work time distribution

P. 163 DRIVER

P. 189 PARKING
● Restaurants
● Fashion
● Aquarium
● Cafes
● Movie theater
● Household goods stores
● Others
Status of COEX Mall web parking discount by business type

P. 197 PARKING
Weekend
Comparison of vehicles entering Everland parking lot by time interval
● 2020 ● 2021

P. 161 DRIVER
I am king of my neighborhood Suwon → Yongin

P. 112 NAVI
150
100
50
0
−50
Change patterns in mobility in the 1st and 2nd years of COVID: Retail
● 1st and ● 2nd years of COVID

P. 218 BIKE
Major bike riding areas in Busan (Weekdays)

P. 81 TAXI
3,390
A driver who received 3,390 picks

P. 252 QUICK
61% No delivery progress notification
44% Delivery Delay
29%
25%
18%
1%
What was the most inconvenient experience while using the quick service?

P. 225 BIKE
● 0-9 minutes
● 10-14 minutes
● 15-29 minutes
● More than 30 minutes
Share of Kakao T Bike users by time interval

P. 169 DRIVER
● First week of November 2020
● Fourth week of July 2021
Comparison of drivers' commute-to-home time distribution

P. 153 DRIVER
17 thousand
The number of Kakao T Driver drivers

P. 123 NAVI
Top-five differences in the number of Navi directions before and after TV airing : The Sinchons (Baek's Alley Restaurant)

P. 175 DRIVER
Acceptance rate 99%
● Acceptance within 5 minutes
● Acceptance after 5 minutes
● Call failure
Booking call acceptance rate for designated drivers

P. 167 DRIVER
● First week of June
● Fourth week of July
Comparison of the distribution of social distancing calls in 2021

P. 246 BUSINESS
Regions using Premium Driver services : Near Seoul's Euljiro area

P. 246 BUSINESS
Regions using Premium Driver services : Near Gyeonggi's Pangyo area

P. 123 NAVI
Top-five differences in the number of Navi directions before and after TV airing : Munjeong Sikdang (Master of Living)

P. 116 NAVI
100
50
0
−50
Change patterns in mobility in the 1st and 2nd years of COVID: Travel
● 1st and ● 2nd years of COVID

Double jobbers who come to work in their own car : Bundang-gu ↔ Giheung-gu

P. 187 PARKING
100
0
● Kakao T app payment
● Advance payment machine
● Exit payment
Changes in the share of parking fee payment methods at COEX

P. 59 TAXI
● Fewer than 5 years
● 5 to 10 years

P. 171 DRIVER
● 10 PM ● 10:30 PM
−9%
Price change after 30 minutes of peak time Bundang, Seongnam → Suji, Yongin

P. 124 NAVI
Top-five differences in the number of Navi directions before and after TV airing : Noodle Story (Baek's Alley Restaurant)

P. 214 BIKE
Riding pattern by time interval in daily life type cities : Ansan
● Weekdays ● Weekend

P. 81 TAXI
358
358 drivers who have been with us from the start of Kakao T Taxi

P. 189 PARKING
40
0
Movie theater, Aquarium 1 hour 2 hours 3 hours
Status of web discount offers by hour at COEX Mall parking lot

P. 227 BIKE
User benefit interval for short distances of less than 9 minutes
● Short distance-centered rate plan
● Existing rate plan
Comparison of charges for each hour of use under the existing rate plan and the short distance-centered rate plan

Number of monthly trips made by drivers according to their experience

CEO's Message

Kakao Mobility has worked hard for the past six years to innovate mobility. We have kept pace with the global mobility industry trend by introducing various technological innovations such as mobile, artificial intelligence, platform, and data to the domestic taxi market, which was once a digital wasteland. With the regulatory framework for app-based taxi hailing businesses introduced as a result of the Great Social Compromise in 2019, we have made efforts in various ways to promote coexistence with the existing taxi industry while at the same time providing services that meet the needs of users. Kakao T integrates not only taxis but also various mobility services, and has established itself as an indispensable service for all users. Kakaonavi, a navigator program, has been reborn as a platform for drivers beyond telling simple directions.

2021 was characterized by the year when the COVID-19 pandemic reached its peak, and society's interest in platform business was higher than ever before. With this as the background, the 2021 Kakaomobility report took Mobility 2.0 as the main theme. It contains Kakao Mobility's concerns about the direction to which mobility should move forward, such as future mobility, movement of objects and services, and issues about ESG .

During the 2010s, the world's mobility market experienced abrupt changes. The market has been reorganized rapidly in the United States, Europe, China, and Southeast Asia, with major mobility platforms such as Uber, DiDi, and Grab at its center.

The domestic market was no exception in this wave of change. The institutional framework that incorporates new mobility services and concerns about coexistence with existing taxi operators is becoming more important than ever. Kakao Mobility will continue to move forward with sincerity, harmonizing innovation with coexistence for better mobility services in the future.

We hope that this report that we have prepared with sincerity will serve as a good reference not only for workers in the industry, such as taxi drivers and designated drivers, who work hard every day and night, but also for the lawmakers, policymakers, and researchers who want to make better policies. Above all, we hope that it will help 30 million Kakao T users and 22 million Kakaonavi users to imagine better mobility services beyond the one available now.

Gungseon Ryu
CEO of Kakao Mobility Corp.

About kakaomobility report 2021

This year's kakaomobility report consists of three chapters with the theme of Mobility 2.0. First, we look at Kakao T Taxi from the beginning to the present, which made Kakao Mobility possible today, and discuss the future mobility that will emerge in the future. In addition, this report contains concerns about mobility services for drivers , which have become more important due to COVID-19, and mobility services for better mobility.

Part 1 consists of a special feature on Kakao T Taxi. It has been six years since Kakao T Taxi first debuted in 2015. Kakao Mobility has worked relentlessly to create a ride-hailing service that is faster, more convenient, and safer based on the data it has accumulated. As a result, there have been many changes in the taxi service environment. In this report, we look at how taxi services have changed for the past six years, and also deal with the prospects for the future mobility market that will be opened up by eco-friendly electric vehicles and self-driving cars.

Part 2 contains efforts to improve services for drivers such as Kakaonavi, Kakao T Driver, and Kakao T Parking. Accurate maps and positioning technology are the core competencies of location-based mobility services. Kakaonavi is thus a technology that not only serves as a "guide to unfamiliar places" and serves as a basis for all services installed in Kakao T, such as Taxi, Driver, and Bike. We now introduce the performance of Kakaonavi, which is getting more advanced with deep learning technology. In addition, we also look at lifestyle changes after COVID-19 based on data gathered from Navi, Driver, and Parking.

Part 3 searches for a new paradigm shift in the field of mobility. A 100 years ago, when cars replaced horse-drawn wagons, the aspects of human life changed dramatically. Today, we live in the era of climate change, and another change is coming in mobility. With experts in the field of humanities, we have considered the issue of mobility from the perspective of humanities and re-imagined it from the ground up. In addition, it includes an analysis of new experiences in the mobility field, such as examining the process of Kakao T Bike adapting to each city's environment based on data. The vision for Kakao Mobility's new service initiatives such as Kakao T Business and Kakao T Quick is also put forward.

With this latest report, we want to reflect on the change process of mobility service and include efforts and tasks in response to changes in the future mobility environment. It also contains the ideas and practices of Kakao Mobility from an ESG point of view.

Data and experience are more valuable as they accumulate. It has been six years since Kakao Mobility set sail for the first time. We hope that the value of the data and experience will be doubled by sharing it with our readers.

kakaomobility report 2021
writers

Kakao T Taxi

For the past six years, Kakao T Taxi has consistently worked to create and expand services to provide a variety of transportation options that consumers want beyond simply connecting taxi drivers with users.

Looking back, many things that we take for granted now were not available before Kakao T Taxi. There were times when we went out on the street for a long time on a cold day to catch a cab, or struggled to explain to the taxi driver my destination.

But now it is not difficult for us to call a taxi exactly to where we are, and we don't have to explain our desired destination. In addition, the safe and convenient automatic payment system without face-to-face contact, introduced for the first time in 2018 by Kakao T Taxi, has become the norm for taxi platforms.

According to the situation and occasion, various taxi services are now household names, such as Kakao T Blue, which pays close attention to service quality, Kakao T Venti for a spacious and comfortable ride, and Kakao T Black, a premium mobility service.

Diverse cutting-edge technologies such as artificial intelligence are incorporated in the dispatch process to improve the driving efficiency of taxi drivers. Anyone can earn more than a certain level of income through Kakao T Taxi without special skills, so a wider variety of people can now drive taxis.

Kakao T Taxi wants to go one step further. As we are able to provide more diverse services in accordance with the Passenger Transport Service Act amended in April 2021, we want to satisfy the diverse needs of users in their daily life by offering services that were not available previously, such as advance booking, app meters, and taxis with a fixed-rate plan.

Many studies are underway to bring the future of mobility into our reality as soon as possible, such as electric taxis, self-driving taxis, and urban air mobility. Going forward, Kakao T Taxi will keep taking the lead in providing more innovative and enjoyable travel experiences.

Kakaonavi

Kakaonavi is a smartphone-based navigation service launched in February 2016. Since its launch, it has continued to grow and has established itself as the nation's leading navigation service with 190 million monthly wayfinding cases.

Based on the vast amount of data collected from Kakaonavi users and users of Kakao T services, such as Taxi and Driver, we analyze the flow of vehicles 24/7 and provide quick and accurate directions in 1-minute intervals. To support various platforms, we provide navigation services to "Android Auto" and "Apple CarPlay," improving user convenience through continuous improvement.

Kakaonavi is constantly striving to help users drive more conveniently and smartly by incorporating various needs, such as the application of 3D maps and the addition of an electric vehicle charging station search functionality. We succeeded in commercializing FIN (Fused Indoor Localization), an LTE-based indoor positioning technology, for the first time in the world, thereby allowing drivers to get accurate driving instructions in tunnels where GPS signals do not reach.

Kakaonavi is also innovating in technology for road driving directions. By introducing machine learning algorithms to the real-time traffic information and speed prediction provided by Navi, it measures the estimated arrival time more accurately to users and guides more advanced and realistic routes.

Kakao T Driver

Kakao T Driver has been serviced over five years since its first launch in May 2016. Over the past five years, Kakao T Driver, which has helped 64 million users go home safely, has now established itself as the leading service that comes to mind when users need designated drivers in Korea.

Kakao T Driver has innovated itself every year to relieve the inconvenience of the existing designated driving services. Many users who had to wait for a designated driver while exchanging information on the street are now getting the driver assigned in a short time (1) at a reasonable rate (2) through AI-recommended fare. In addition, Kakao T Driver provides the driver's facial photo, name, and insurance information and supports sending a reassuring message to the user's family or friends. In the first half of 2020, the screen user experience was completely renovated to make calling drivers easier and more convenient.

Kakao T Driver launched "Kakao T Driver Premium" in the second half of 2020 in response to the diversified demands of users, providing advanced designated services to corporate and individual users. In the first half of 2021, by adding the Kakao T Driver reservation feature, we are responding quickly to the mobility needs of users that were

previously not available, such as daytime hours or calls to outlying areas. These segmented services create new demand in the designated driving market and contribute to overall market growth.

Kakao T Driver is creating "the perfect experience in entrusting my car." Even in the difficult situation due to COVID-19, with Kakao T Driver, users and drivers can make payments and communicate with a minimum of contact. Kakao T Driver will continue to come up with new services with a sense of mission so that all users in Korea can go home safely and more conveniently.

Kakao T Parking

Kakao T Parking, which started its service in October 2017, provides "Smart Parking", allowing drivers to proceed from parking lot search through parking lot partnership to reservation and payment all at once. Through "T-connected Parking," a parking control solution introduced by combining cloud and big data analysis technology in addition to mobile experience and capability for parking service, it is reborn as a "parking lot total solution" service that performs direct management and consignment operation of the parking lot. The Kakao T Parking service, which digitizes and makes the parking lot smarter, provides services such as parking lot availability prediction and alternative parking space information when full, in addition to the previously provided services such as parking reservation and automatic parking fee payment, so that parking lot users can find it more convenient. We are also taking the lead in providing contactless services by supporting self-discount of parking fees (QR code) and online (mobile) purchases of parking tickets/discount tickets.

Kakao T Parking platform operation know-how is applied to various types of parking lots, from general-purpose buildings to multi-purpose facilities and cultural gathering places, to enable efficient and smart parking lot operation. With this, each parking lot operator can establish reasonable rate plans and set operating hours according to different circumstances based on big data analysis, enabling efficient parking lot operation.

Now, the parking lot is not just a space to park vehicles, but an important "base service" where mobility services are connected with each other. Actually, the parking lot is connected with various services such as car washing, light maintenance, and electric vehicle charging. It is also being used as a hub for car-sharing garages and short-term logistics hubs. In the future mobility market represented by self-driving cars, parking lots will be the place responsible for the beginning and end of every movement. Kakao T Parking will serve as a future mobility hub.

Kakao T Bike

The Kakao T Bike service, which has played an important role in short-distance transportation, especially useful in areas where it is difficult to get around by car or taxi and is not reachable by public transportation, has just entered its third year of operation.

Kakao T Bike service, which started with only 1,000 bikes in a few areas in March 2019, has now been in operation all over the country in two years with more than 10,000 bikes.

A yellow bicycle decorated with cute Kakao Friends characters makes one want to ride it at least once when one passes by it. In addition to the convenience of mobility, it is used for various purposes in life, such as leisure and dating, beyond a means of transportation because of its friendliness.

Since COVID-19, people's interest in personal mobility with minimal face-to-face contact has increased at an explosive rate. In addition, the Kakao T Bike is operated in a dockless mode without a separate stand. As it is a pedal-assist system (PAS) electric bike, it has the added convenience of riding easily with little effort, which drew keen attention from users.

The Kakao T Bike is also an eco-friendly means of mobility. It does not emit any carbon dioxide when used. If one uses a Kakao T Bike instead of a car with an internal combustion engine for 15 minutes a day for one month, one can see the effect of keeping three pine trees alive.

Kakao T Bike is also making efforts to improve its service quality. By predicting the demand for and supply of bikes based on big data, we are improving the user's environment by inspecting and operating bikes to keep them in the best condition. With this, we want to position ourselves as a service that users can use our service more safely and in a more enjoyable way, going beyond a simple means of transportation that takes responsibility in the last mile.

Kakao T Business

Kakao T Business, an exclusive service for corporate members, offers services such as corporate designated driving, navigation, black (luxury taxi), and quick delivery, beginning with taxi services in February 2018. Kakao T Business supports 17,000 corporate members (as of September 2021) so that all business-related mobility needs such as business trips, working outside the office, and overtime work are conveniently satisfied.

In addition to the convenience of using the Kakao T app's advantages, Kakao T Business is characterized by a management system that reduces costs and saves corporate resources. Company managers can have the transparent usage history reports provided by Kakao T Business, allowing efficient and transparent payment settlement. Employees can use it conveniently without submitting separate receipts, thereby increasing work efficiency. Corporations can also benefit from reduced charges for causing urban traffic.

Kakao T Business is also preparing a quick delivery service for corporations in 2021. Corporate executives and employees can now use and manage the business mobility services that include moving things beyond the movement of people through the Business Home service. Going forward, we will strive to provide better services by carefully taking into account all the needs of the corporate employees and the movement of things for business purposes.

Kakao T Quick

Kakao Mobility, which has focused on making "movement of people" convenient, is now challenging the "movement of things" after four years of operation. Kakao T Quick launched its Quick and home delivery mediation service in June 2021. Within a month of enlisting Quick drivers, over 100,000 applicants submitted their applications, and by July 2021, the service area was expanded throughout the whole nation.

The way to use the existing Quick service is similar to calling a taxi before Kakao T appeared. After looking up a Quick service company, one has to call for the Quick service over the phone, pay without any information to compare the prices offered by the company, and check the location over the phone as well as the deliveryman picking up the package.

Kakao T intends to make the job of sending a package not such a burdensome work. So, Kakao T Quick provides a service experience that can be as easy and quick as when calling a taxi. The registration process has been reduced to three steps only: select package size - enter departure/arrival addresses - select delivery service option. We provide three options, express delivery, quick delivery, and courier service, depending on the required delivery time and price, and we set the optimal rate with the help of AI. Once the application is processed, the user can easily check the real-time location of the deliveryman through the app, as well as find out the estimated arrival time and delivery status, thereby doing away with the unnecessary effort of contacting the driver through phone calls.

Although it is a new service, our Kakao T Quick team has a dream to make sending and receiving packages the easiest thing to do in the world. We will continue our effort so that Kakao T Quick immediately comes to mind whenever there is something to send at work or at home.

KAKAO T TAXI
SPECIAL

Kakao T Taxi,
Begins

Kakao T Taxi, writing a milestone in the mobility business

It has been more than ten years since mobility platforms appeared in earnest across the world. With the onset of the mobile era, mobility operators began to appear one by one in various parts of the world, and major mobility platforms that became household names at around the time of 2012 started their services in earnest.

The era of mobility platforms opens up

Uber started out as a high-end limousine calling app in San Francisco in 2009, but has emerged as a synonym for the "sharing economy" with the launch of UberX, a ride-sharing service using non-commercial vehicles in 2012. Lyft, which has established itself as the second-largest mobility platform in North America after Uber, also made its debut in 2012. DiDi, which represents China's mobility market, and Grab, which has established itself as a super-app in Southeast Asia, were founded in 2012 and Ola Cabs, the No. 1 mobility operator in India, in 2011.

The world's major mobility platforms

	Uber	Lyft	DiDi	Grab	Ola
Year of Establishment	2009	2012	2012	2012	2011
Headquarters	US	US	China	Singapore	India
Service Areas	63 countries 700+ cities	2 countries 660+ cities	China 400+ cities Overseas 1,000+ cities	Southeast Asia 500+ cities	4 countries 150+ cities
Corporate Value	$75.2 billion	$16.8 billion	$41.2 billion	$39.6 billion	$3 billion

Capitalization as of the end of Sep. 10, 2021 (most recent corporate value for Grab and Ola Cabs)

Mobility platforms provide various types of mobility services depending on circumstances of each country, from taxi call brokerage to carpooling and private ride sharing. Still, the basic nature of services is all the same everywhere, in the sense that calling the car with a mobile app and mediating a lot of passengers and drivers through the platform. The digital transformation of taxis has been achieved by combining technologies such as big data, AI, and IoT with mobility services traditionally provided by taxis.

Taxis, which were the main feature of the city for the past 100 years, have changed abruptly in just ten years. Instead of hailing taxis on the street that symbolized the cityscape such as ones in New York's Yellow Cab and London's Black Cab, calling a car without a rooftop light through an app in downtown or airports has become a new urban landscape.

Generational change in on-demand mobility service
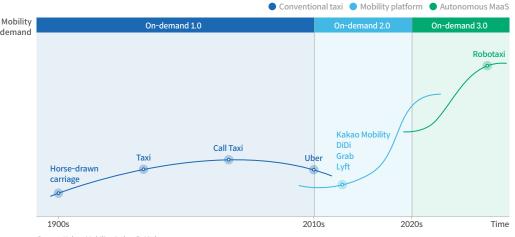
Taxis are the original form of on-demand mobility. On-demand mobility refers to providing a mobility service to the user's desired time and location in response to the user's needs. The characteristics of taxis as an on-demand mobility service become clear if one compares taxis to public transportation.

When using means of public transportation such as buses and subways, users must fit their schedules to the routes, timetables, and stops set by the operator. If the last train has departed or if one is far away from the bus stop, it is impossible to access. In contrast, taxis are different in that one can call them anytime they want to a location one wishes. From the end of the 19th century, when taxis started their business with a meter attached to horse-drawn wagons, to the present day, taxis have grown together with the city as the original form of on-demand mobility service that can be used regardless of routes, timetables, and stops. The spread of telephones made possible a new business form called "call taxi" for taxis that had only been available for operations randomly picking up fare customers. By combining communication with taxis, the status of taxis as an on-demand mobility service has been further enhanced.

The mobility platform, however, is transforming the status of taxis for the past 100 years upside down. If the call taxi was a "sustaining innovation" in the taxi industry, the mobile-based mobility platform may be called a "disruptive innovation." As a new form of on-demand mobility that uses a mobile app from calling to payment is rapidly spreading to people across the world, it has overtaken the existing way of hailing to grab a taxi or make a booking by phone. Online-to-offline service, which allows one to experience services searched and purchased online through offline, has begun to be widely available in the mobile field.

Arthur D. Little, a business consulting firm, stated this paradigm shift in the taxi market as a transition from on-demand 1.0 to on-demand 2.0. This is a generational change in on-demand mobility. The mobility platform, which has now become the protagonist of a new era, is expected to take one step further to on-demand 3.0 as it evolves into an self-driving car-based integrated mobility service, or "autonomous MaaS," according to the upcoming commercialization of self-driving technology.
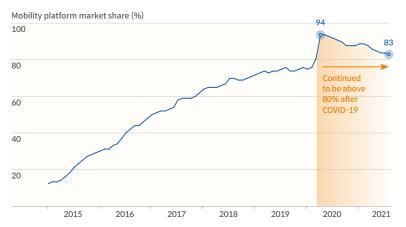
Paradigm shift in on-demand mobility service

Source: Kakao Mobility, Arthur D. Little

The generational change in on-demand mobility has occurred simultaneously and rapidly around the world, regardless of developed or emerging markets. In New York City, the largest metropolis in the United States, the number of trips made through major mobility platforms such as Uber and Lyft has long exceeded the number of trips made by taxis. December 2016 was a historic watershed moment. The number of trips using mobility platforms such as Uber and Lyft recorded an average of 348,000 per day, exceeding the average of 337,000 per day recorded by the 100-year-old Yellow Cap for the first time. This was only three years after the legalization of a new paid passenger service called the transportation network company (TNC), a mobility platform that connects drivers with passengers based on non-commercial personal vehicles, started in California in 2013.

Market share of mobility platforms in New York City

Mobility platform market share (%)

The number of mobility platform uses and the ratio of the number of mobility platform uses to the number of total taxi uses | Source: Taxi & Limousine Commission

Beginning in 2017, the gap between taxis and mobility platforms has widened even further, and since 2019, more than eight out of ten daily passengers in New York use Uber or Lyft. Even in a situation where the city was locked down due to COVID-19, the use of taxis declined far more than the mobility platforms, even when movement was sharply reduced.

It was the same in London. London's taxi market is composed of black cabs based on random pickups and mini cabs (PHVs) centered on call taxi services. Vehicles provided by mobility platforms such as Uber have been registered and operated as minicabs. As of 2020, the number of black caps registered in London was 68,000, but the number of minicaps is close to 231,000, three times more than that. It is the result of a rapid increase in minicaps as mobility platforms become the mainstream of the market while the number of black caps has gradually declined since the mid-2010s.

The growth rate of mobility platforms in emerging markets has already surpassed that of industrialized countries. DiDi in China and Grab in Southeast Asia are leading innovation as mobility operators representing their own country markets. Uber, which dominated the US market, entered these emerging markets and competed fiercely, but Uber China merged with DiDi in 2016, and in 2018, Uber's Southeast Asian unit ended up being merged with Grab. DiDi and Grab have grown into so-called "super apps " that provide various services such as fintech and delivery in one app beyond mobility, establishing themselves as indispensable apps for citizens of each country.

Change in mobility markets in the world's major cities: Seoul vs. New York vs. London

Mobility platform generally refers to a service that connects users (riders) who need mobility services and drivers who provide mobility services with mobile apps and online platforms. It is also called ride-hailing or ride-sourcing. Mobility platforms take various forms according to the regulations of cities around the world. These are classified into two types depending on the vehicle through which mobility services are provided.

Divided into private hire vehicle (PHV) and taxi call brokerage platform

The most common form of mobility platform is transportation network company (TNC). It is a call brokerage platform using private hire vehicles. In countries such as the United States and the United Kingdom, the taxi market has been operated in two tracks, one the general taxi market centered on services of randomly picking up passengers and the other the private hire vehicle market based on call taxis. Black Car and Livery in New York City belong to private hire vehicles, and minicabs in London are included in this category. In return for being banned from roaming, private hire vehicles were operated relatively free from taxi regulations such as those on vehicle exteriors, rooftop light, and meters.

Classification of vehicles in the mobility market in Seoul, New York, and London
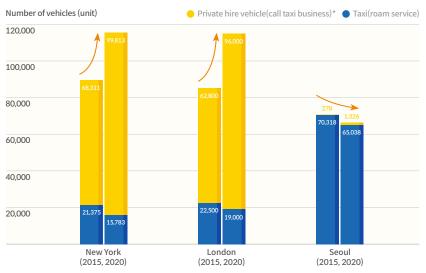
	Taxi	Private hire vehicles (PHVs)
Seoul	Mid-sized taxis, deluxe taxis	Large shared taxis, luxury taxis, etc.
New York	Yellow Cab, Green Cab, etc.	Black Car, Livery, Luxury Limousine, etc.
London	Black Cab	Minicab

* Taxi service based on call taxi operations in the case of Seoul.

TNC has grown rapidly by providing a service that connects calls from private vehicles for non-commercial use with mobile apps and platforms in addition to the private rental vehicles that were hired through phone calls. This trend has been accelerated since TNC was enacted into law in 2014, starting in the United States, and allowing paid transportation services when non-commercial personal vehicles are registered as personal hire vehicles. The most well-known mobility platforms such as Uber, Lyft, Didi, and Grab belong to the category of TNC.

The second type is a taxi-hailing platform that connects traditional taxi services with mobility platforms. In countries such as Korea where paid transportation services by private vehicles are strictly prohibited, services using mobility platforms are located within the existing taxi system. It is also called "app taxi" because it uses a mobile app as opposed to a call taxi using a phone call. Global mobility platforms provide not only private rental vehicles but also taxi call brokerage services depending on the area.

Changes in mobility market in Seoul, New York, and London

Number of vehicles (unit)   ● Private hire vehicle(call taxi business)*   ● Taxi(roam service)

* Taxi service based on call taxi operations in the case of Seoul.

Changes in the mobility market of individual countries are also different depending on the development of the mobility platform. In countries such as the United States and the United Kingdom, where TNC is active, taxis are on the decline, while private hire vehicles are on the rise. For the past six years (2015-2020) in New York City, the number of private hire vehicles increased 46% while the number of taxis declined 26%. During the same period, London saw the number of its taxis shrink 16% while that for private hire vehicles increase 53%. The share of taxis in New York and London is falling steadily, with their share remaining at 14% and 17% respectively as of 2020. This is the result of citizens opting for mobile services provided by TNC such as Uber over taxis.

In New York and London, where the number of private hire vehicles has increased at an explosive rate due to the booming business of TNC, the total number of mobility service vehicles including taxis and private hire vehicles per 1,000 people is nearly double that

of Seoul. New York has 13.1 vehicles and London has 12.8 vehicles per 1,000 people registered for paid transportation while Seoul has only 6.7 vehicles per 1,000 people. For a long time, there has been a view that taxis are in oversupply in Korea and in undersupply overseas, but market changes due to mobility platforms suggest that adjustments are needed even in these views.

Comparison of the number of mobility vehicles relative to the population by city

	Seoul	New York	London
Population*	9.91 million	8.8 million	9.0 million
Number of mobility vehicles*	66,364	115,596	115,000
Number of vehicles per 1,000 people	6.7	13.1	12.8

* Population and number of vehicles are as of 2020, the number of mobility vehicles is the sum of taxis and PHVs.

Roaming taxis are still a majority in the domestic mobility market

In contrast, mid-sized and deluxe taxis focused on roaming business still occupy an overwhelming majority of the domestic mobility market. As of 2020, the number of mid-sized and deluxe taxis in Seoul is 65,000, or 98% of the total mobility vehicles. Similar to privately owned vehicles overseas, the number of taxis (large taxis, shared taxis, and luxury taxis) that run a call-based business accounts for only 2% of the total market.

Even though taxis randomly picking up passengers, which account for an overwhelming majority of the domestic taxi market, can use taxi calling platforms such as Kakao T Taxi, most taxis still rely on roaming business. Although official statistics have not been made public, according to existing literature and media reports, it appears that roaming business accounts for 70-80% of the total taxi sales based on the Seoul taxi market. Call taxi service has increased significantly compared to call taxis, which accounted for less than 5% before the emergence of Kakao T Taxi. Still, it is a far cry from the trend of overseas mobility markets.

What's notable, however, is that the number of taxi services centered on calls is rapidly increasing in Korea as well. This is largely due to taxi services relying exclusively on calls such as Kakao T Venti and Kakao T Black. The number of taxis relying on calls is tallied as large, shared, and luxury taxis in statistics, and the number of these vehicles increased 377% from 278 in 2015 to 1,326 in 2020. In contrast, the number of mid-sized and deluxe taxis based on roaming declined 7.5% from 70,000 to 65,000 during the same period. As the "platform taxi" system is fully in place in April 2021, it is expected that the number of taxis based on calls will increase even more in Korea.

Kakao T Taxi takes first steps in digital mobility platform wasteland

It is not that there has been no change in the domestic front. Even though mobility platforms using non-commercial personal vehicles have not been active as in overseas, taxi calling platforms have emerged one after another. In 2012, foreign companies such as Easy Taxi entered the Korean market, followed by several domestic and foreign operators such as Limo Taxi and White Knight Call Taxi.

The launch of Kakao T Taxi ("Kakao Taxi" at the time of launch) was a bit late. Kakao T Taxi was a project that began to be reviewed in Kakao's "Life Exploration Task Force" in June 2014. Unlike in other countries, where mobility platforms were spreading in earnest, the domestic taxi market was close to the wasteland of the Internet and mobile at the time. People in the whole country were spending an average of 1 hour and 40 minutes a day to travel, but the way this time was spent was still stuck in the past. Both users and drivers are faced with questions such as "Is it necessary to make a landline phone call to call a taxi in the mobile era?" and "Is the information correctly delivered in the process of the passenger telling the dispatcher and the dispatcher to the driver?" The challenge of Kakao T Taxi started with the goal of creating innovation that can be felt both by the user and driver.

Still, innovating a market that had been calcified through decades-long practices was not an easy task. Regional taxi operators were taking the hegemony of the business ecosystem, and the call taxi market accounted for less than 5% of the total trips. It was not easy to communicate with individual taxi drivers, who accounted for 70% of all taxi drivers, and above all, it was also difficult for taxi operators who were accustomed to the past business practices that had been in operation for decades to pay attention the change under way in the digital environment.

Kakao T Taxi, which emerged as a latecomer, took one step at a time based on app development day and night and nationwide sales calls. The developers have created a senior-friendly app with an exceptionally large font and a very simplified interface for older drivers unfamiliar with mobile apps. It was also a symbolic episode that the new Kakao Taxi app was distributed in just three days in collaboration with Driver Kim (currently Kakaonavi) in order to supplement the navigation feature that was missing at the time of its initial release.

Even in cold weather, the salespeople ran to the places where the taxi drivers gathered. Based on family connections of colleagues, the salespeople looked for taxi drivers to listen to their opinions and persuade them to join Kakao T Taxi in early morning football clubs, taxi meter stores, and online bulletin boards. The salespeople who ran to the site even helped with basic registration processes, such as installing apps and shooting photos for driving credentials.
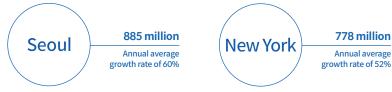
"This is a really great app."
Kakao T Taxi, which was first launched in March 2015, began to quickly establish itself in the favorable response of both users and drivers. Compared to the existing call taxis, it has spread rapidly across the country, gaining word of mouth from taxi drivers due to its many advantages, from efficient matching with passengers through the app to convenient functionalities. There were also drivers who put stickers on their car that said that Kakao T Taxi calls are available. Users also started responding favorably to the new experience of a taxi called through the app coming to their doorstep without going to the roadside, and being guided to their destination according to the navigator. Kakao T Taxi has grown at an explosive rate to the degree that it had to purchase a large number of additional servers within a month of its launch.

Pent-up demand explodes

The growth rate of Kakao T Taxi, which emerged as a latecomer, was as fast as that of major overseas mobility platforms. This is evident when comparing New York, the largest mobility market in the United States, with Seoul, the largest market in Korea. From March 2015, when Kakao T Taxi was launched, to December 2019, just before the spread of COVID-19, the cumulative number of trips was 885 million for Kakao T Taxi in Seoul alone. During the same period, the cumulative number of trips through all mobility platforms in New York, such as Uber, Lyft, Via, and Juno, was only 778 million. This is the result of an annual average growth rate of 52% in the number of mobility platform use in New York while the number of Kakao T Taxi usage in Seoul is growing at an average rate of 60% annually.

Cumulative trips through mobility platforms

| Seoul | 885 million
Annual average growth rate of 60% |
| New York | 778 million
Annual average growth rate of 52% |

Growth rate: The annualized average growth rate per month during the period of March 2015 and December –2019

The comparison result between Seoul and New York shows that the demand for new mobility services was very high in Korea as well as overseas. The result is even more unexpected in consideration of the fact that the popularity of domestic mobility platforms has been late compared to overseas, and taxi-based mobility services were relatively more heavily regulated than elsewhere. This is a point that can be interpreted as the result of an explosion in pent-up demand when services that were unavailable domestically spread late.

Technology changes taxi culture

What made the rapid growth of Kakao T Taxi possible? Some detractors say that there is no difference between a phone-based hailing taxi and an app-based taxi hailing service using a smartphone, and disparage Kakao T Taxi by saying, "What kind of innovation has it brought about?" But Kakao T Taxi had a huge potential to change the whole taxi-riding culture and industry. It was possible because it is not just a call taxi, but a technology-intensive mobility platform.
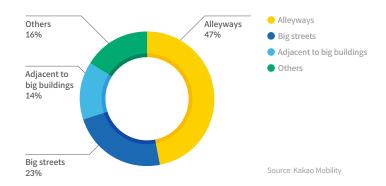
Creating a user-friendly taxi culture with mobile device

Kakao T Taxi has improved the convenience of users. This was possible because online and offline connectivity has been strengthened due to the spread of mobile, and mobile services could be provided more quickly according to the rising user demand. It thus was able to overcome the limitations of taxis that remained offline.

Even though taxis were the original form of on-demand mobility, users had to put up with the inconvenience of going to the roadside to catch a taxi. In the case of call taxis, there were many inconveniences that made it difficult to communicate the origin and destination in the complex communication process between users, dispatchers, and taxi drivers.

With the advent of Kakao T Taxi, however, taxis have become one step closer to the true meaning of on-demand mobility. That's because it has become possible to call a taxi to a desired place and to board a taxi at a desired place. Above all, everything has become easy. Now, one can easily set the boarding location using the GPS of the smartphone and take a taxi at the desired location by simply touching the call button. Thanks to this feature, it is now possible to call a taxi from indoors, and to take a taxi in an alley or back road instead of on the main road.

Based on the usage pattern of the actual Kakao T Taxi, one can set that "take a taxi on the roadside" is fast becoming a thing of the past. As for the boarding location of the called taxi, it was found that back road was the highest at 47%, roadside at 23%, and near the building at 14%. It means that three out of four riders took their taxis at a location other than roadside. This is in stark contrast to the fact that 53% of the boarding positions of roaming taxis occur on the roadside.

Kakao T Taxi boarding location by type

- Alleyways 47%
- Big streets 23%
- Adjacent to big buildings 14%
- Others 16%

Source: Kakao Mobility
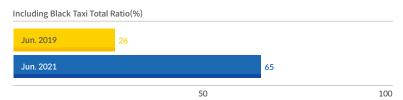
The culture of hailing taxis has changed significantly as people are free to call whenever they want and ride wherever they want. It has now become natural to call a taxi and go to the place before to board before leaving home or work. In places where vehicle access is restricted, such as apartment complexes or university campuses, there are cases in which it is used as a kind of a virtual taxi stand by designating a favorite boarding location such as the front door or back door. As a result, not only does it reduce the effort of finding a taxi and going to the roadside, but also users can freely use time calling and waiting for a taxi. As taxis are transformed into a means of user-friendly mobility, the convenience of users has also improved.

App payment, introduced in October 2018, significantly simplified the payment process that had to be done before getting off the taxi. One can check the payment status by viewing the app's e-receipt only when necessary. Even when one forgets to leave the wallet at home and take a taxi, there is no problem taking a cab and pay. Due to COVID-19, users' demand for "contactless" payments without physical contact exploded, and the number of users relying on app payment increased steeply. The ratio of app payment users stood at only 26% in June 2019, but rose to 65% of the total taxi users in June 2021. In less than three years since its launch, app payment has become an essential feature of the taxi service.

Comparison of monthly app payment call user ratios

Including Black Taxi Total Ratio(%)

Jun. 2019	26
Jun. 2021	65

Taxi total Comparison between June 2019 and June 2021, including Black | Source: Kakao Mobility

The user-friendly action of Kakao T Taxi has been expanded to "advance booking" and "calling on user's behalf." If taxi call allows the user to choose the desired boarding location, taxi booking is a service that allows the user to select the desired time of pickup. The booking service was launched for the needs of users that cannot be satisfied by real-time calls alone. In particular, in cases where punctuality is essential, such as airport and golf course pickups, and when there is a lot of luggage and movement of groups or VIP users is necessary, Kakao T Black (launched in November 2018) followed by Kakao T Venti (in June 2021) booking service was introduced. Since the introduction of the advance booking service, the number of reservations for Kakao T Black has grown by an average rate of 35% per month, and the number of users for Kakao T Venti has increased rapidly with an average rate of 102% per month for three months since its inception.

Call	Booking	Calling on user's behalf
Selecting a location user desires	Selecting a pickup time user desires	Selecting a passenger user designates

Calling on user's behalf is a service by which a user calls a taxi on behalf of another. A taxi is available for ride even if the caller and the actual user are different. Even when a user's parent has to go to the hospital, when her child needs to go to after-school, or when she is in a situation where she cannot accompany the child, she can still use Kakao T Taxi's call-on-user's-behalf service to check the location in real time through the app and mind her own business. It is also possible to use the same service when seeing off a friend by taxi late at night. As it is possible to check the route and final fare in real time, one can trust and make more travels than in the past. Since its introduction in July 2020, calling on user's behalf has been established as a service used by an average of 250,000 people per month.

Dispatch information and boarding completion information received by a passenger who actually boards

For users to trust and use various calling methods, it is important that taxis are dispatched quickly when they are called and arrive promptly to the boarding location. No matter how many different ways to call a taxi, once the negative experience of taking a taxi is accumulating, users may think that it is better to catch a taxi out on the roadside than to wait for a taxi that they do not know when it will arrive.

The dispatch waiting time and dispatch success rate are largely affected by the real-time supply and demand situation in each area. For this reason, Kakao T Taxi is making numerous technological investments in ways to enhance service capabilities to resolve the imbalance between the demand and supply of each area. In addition to efforts to expand the supply of taxis that can quickly respond to the call demand, Kakao T Taxi is upgrading the dispatch system as well.

In an effort to increase the supply that can quickly respond to the call demand, the brand taxi is expanding its scale. In the case of brand taxis, it is possible to effectively dispatch a call to the demand because it is operated through an automatic dispatch technology without ride refusal by combination with the platform.

It is also important that the vehicle dispatch system is continuously refined based on mobility data. The dispatch technology of Kakao T Taxi aims to increase service satisfaction (1) by minimizing wait time for users and (2) providing quick and comfortable transportation to destinations. User satisfaction is determined by various factors, of which, the time it takes from call to completion of dispatch, the time it takes for the dispatched taxi to travel to the user's location, the condition of the vehicle moving to the destination, and the service quality of the driver. Dispatching is carried out taking all these factors into consideration.

To efficiently handle a huge amount of calls while optimizing each element that affects consumer satisfaction, Kakao T Taxi uses an AI-based assignment system. Kakao T Taxi's dispatch system provides an optimal taxi service by combining various data such as the expected arrival time of the taxi to reach the user's location, as well as the service quality status based on the driver's driving pattern (assignment acceptance rate, driving pattern, driver evaluation, etc.). Since the shorter the expected pickup time for the dispatched taxi to reach the user's location, the shorter the wait time for the user, it is ideal that a taxi closer to the user is dispatched. However, it is not always feasible to dispatch a taxi closest to the user. For example, in the case of a taxi that uses the taxi platform's brokerage service only, even if the platform tries to dispatch a car, the call may be rejected for various reasons without fulfilling the call such as roaming for random customer pickup or using the brokerage service of another taxi platform.

As a result, even if there are many taxis close to the user, the request for dispatch may be continuously rejected due to various reasons even if the taxi is not on standby for dispatch. In this case, the time it takes to dispatch a vehicle after a user calls may be delayed or the dispatch may fail. In addition, during peak hours when there is a lot of mobility demand, there may be many users on the street, so the incentive to choose a roaming business is greater, and because there is a large demand for calling from other platforms, there is less incentive to accept Kakao T Taxi dispatch, which would reduce the assignment acceptance rate. Just like this, demand and supply meet in various offline and online contexts in the taxi market, and matching is being achieved in numerous combinations of cases.

Kakao T Taxi's dispatch system minimizes the time it takes to dispatch a car in consideration of the number of various factors that occur in the taxi market. To this end, it takes into account not only the expected arrival time and distance to the departure point of waiting taxis that can accept the dispatch, but also the acceptance rate of individual drivers. In addition, to provide a comfortable travel experience to the destination after boarding a taxi, it is trying to provide an optimal service experience by comprehensively taking into account the driver's ratings and users' preferences (i.e., not meeting the same driver again).

Considering the slightly complicated algorithms of the Kakao T Taxi dispatch system, it is possible to try to analyze various problem situations that occur in reality. Some of the Kakao T Taxi users often complain of the inconvenience that a taxi a little farther away rather than the one right in front of them is dispatched. Looking at the cause based on the algorithms of the Kakao T dispatch system, it is above all the case that a nearby taxi is not waiting to be called, or it is caused by a driver not accepting the dispatch even after trying to dispatch it. In other words, it is not in a situation where a nearby taxi can handle the call. The second possibility that can happen is when the acceptance rate of a nearby taxi is low, the arrival time required for the user may be long or a failure may be expected, or when the user's satisfaction with the service is low due to the driver's low rating. In this case, it is possible that a taxi other than a nearby one was first responding to dispatch, and was one that accepted the dispatch.

Through the continuous refinement of the data-based dispatch system, the indicators that can estimate user satisfaction are constantly being developed and improved. First of all, the wait time for dispatch is significantly reduced. The dispatch time is a measure of how quickly a taxi is assigned when a taxi is called. The time saved by Kakao T Taxi through the advanced dispatch algorithm (in terms of dispatch time) decreased 59% from an average of 19.6 seconds in 2017 to 8.0 seconds in 2021. That much time was saved for users. It also means that taxi users in 2021 will be able to use taxis more easily than those in 2017. Given that the cumulative number of Kakao T subscribers is over 30 million, the amount of time saved by users by reducing the time required for dispatch is truly massive.
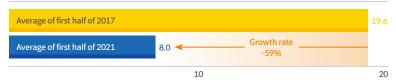
Trend of Kakao T Taxi dispatch time

Daily average dispatch time required (seconds)

Based on mid-sized taxis | Jan. 2017–Jun. 2021 | Source: Kakao Mobility

Changes in Kakao T Taxi dispatch time
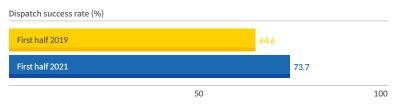
Based on first half of each year (seconds)

Average of first half of 2017	19.6
Average of first half of 2021	8.0

Growth rate −59%

Based on mid-sized taxis | Source: Kakao Mobility

The dispatch success rate for a user's call is also improving. The dispatch success rate refers to the rate at which the vehicle is successfully dispatched to the most optimal location at the time the user calls it. In other words, it implies that how many calls have been dispatched when 100 calls are made. The taxi calling app should be based on users' perception on the service, "They come when you call." That's because it is often necessary to avoid a situation in which the user has to call a taxi again or finds an alternative way to call a taxi.

As a result of continuous efforts to ensure that users can trust and keep using Kakao T Taxi, the dispatch success rate is steadily improving. This is thanks to its efforts in various ways to minimize the imbalance between supply and demand. In order to compare the before and after the launch of franchise-based taxis, which introduced automatic dispatching, we compared the success rate of dispatching vehicles over short distances (less than 5 km) in the first half of 2019 and the first half of 2021. The number of short-distance calls increased 45% in the first half of 2021 compared to the same period of 2019. Still, there was an improvement, which also increased the dispatch success rate by nearly 9 percentage points. In the first half of 2019, before franchise-based taxis began to appear in earnest, the short-distance call dispatch success rate remained at 64%. This was largely because of the limited supply of taxis that could perform short-distance services due to refusal to pick up customers or long-distance call-oriented operations. Since the system that can effectively handle short-distance trips was established with the automatic dispatch system of franchise-based taxis, however, the success rate of short-distance dispatches improved significantly to 74% despite the rapid increase in the number of short-distance calls.

Change in the success rate of short-distance dispatch less than 5 km

Dispatch success rate (%)

First half 2019	64.6
First half 2021	73.7

Based on mid-sized taxis | Source: Kakao Mobility

The effect of improving the dispatch success rate can be seen even during rush hour in Gangnam, Seoul, one of the most difficult places to call a taxi. In general, the dispatch success rate is higher for long-distance calls with lower incentives for refusal to ride or pick-and-choose calls. In Gangnam District, the success rate of dispatching in the first half of 2019 and the first half of 2021 by driving distance also shows that the longer the distance, the higher the dispatch success rate.

What's notable, however, is that the short-distance dispatch success rate is showing the steepest rise. In Gangnam District, the success rate of dispatching during peak commute times (8-9 am) has been increasing for all distances over the past two years, but the improvement in the short-distance dispatch success rate is the most notable. While long-distance calls greater than 10 km improved by 9 percentage points over the past two years, the dispatch success rates for short-distance calls less than 3 km and less than 3-5 km improved by 27 and 24 percentage points, respectively, over the two years.

Comparison of success rate of taxi dispatching during rush hours in Gangnam, Seoul(by driving distance)

Dispatch success rate (%)　　　● First Half 2019　● First Half 2021

Source: Kakao Mobility

Even though it appears that the automatic dispatch of franchise-based taxis contributes to increasing the success rate of dispatch, there are many practical challenges that need to be additionally addressed for the expansion of automatic dispatch. That's because traditional mid-sized taxis still occupy an overwhelming share of the taxi market compared to call-oriented taxis such as franchise-based taxis, large taxis, and luxury taxis. The behavior of mid-sized taxis is still mainly roaming, and there are many cases of using calling business as a secondary means. Under these circumstances, if the automatic dispatcher is fully introduced, side effects such as a decline in user convenience and deterioration of the platform service quality may occur.

First of all, there is a risk that the convenience of users may suffer as taxi drivers change their business behavior to result in the reduction of platform use. Platform-based calls are basically a user-oriented service that requires drivers to move to the user's location. During peak times when demand is high, it is possible for drivers to prefer roaming while avoiding call-based business where it is difficult to know the destination in advance due to automatic dispatch. In this process, there is a possibility that the drivers may return to the past business practice of asking the destination before allowing the user to board.

In addition, after learning the situation in which the user's destination is not displayed on the screen by the automatic dispatcher, as in the past roaming business, certain busy areas such as train stations and bus terminals are expected to generate a lot of selective acceptance from drivers. Therefore, the platform may be selectively used only during certain time of the day. As a result, the unique value of the platform that seamlessly connects taxis and users may be undermined due to the deepening imbalance between supply and demand. If that happens, it is possible to fall into a vicious cycle in which the platform collapses as it becomes difficult to handle long-distance calls which are being handled smoothly through the existing platform.

As disputes and frictions between users and drivers intensify, there is always a possibility that the quality of platform-based calls will deteriorate. That's because the incentives for drivers to refuse dispatch or pick-and-choose dispatch calls, which are caused by the imbalance between supply and demand, will be inevitable. Even with the sudden introduction of automatic dispatchers, there is a possibility that disputes between users and drivers will increase as the drivers would directly ask the destination to users and cancel calls or refuse to board, just like in the past roaming practice.

There may be concerns that the platforms will infringe upon the business discretion of the drivers. Currently, taxi drivers in Korea are able to freely switch between roaming and calling at their own discretion, and they can selectively fulfill calls received from the platform. Taxi fares are set within the limits governed by the law, unlike in ride-sharing services overseas. Unlike franchise-based taxis, which introduced automatic dispatchers through separate contracts, introducing automatic dispatchers to all taxis may face a backlash for forcing taxi drivers to run according to the platform's orders, If a taxi is dispatched far away from the home parking location, there is a possibility that a problem of liability arises due to a dispute such as violation of driver shift time.

A calling method that does not show a destination, such as an automatic dispatcher can contribute to improving the dispatch success rate. However, in order to expand the system across the board, it is necessary to consider the market environment centered on roaming to pick up customers randomly. That's because refusal for customers or pickup calls do not exist just because of showing the customer's destination in advance. Starting with franchise-based taxis, which operate call-oriented business through an explicit contract with the platform, it is necessary to take advantage of the benefits of increasing automatic dispatch. If the taxi market matures into one based largely on call business, as in other countries, a step-by-step approach is called for in ways to would minimize side effects while rolling it out nationwide.

A taxi you can ride with assurance thanks to the trust built by the platform

Kakao T Taxi is making the taxi market better by adding platform-based trust to the social trust built by regulation. The mobility platform can realize various safety devices that can strengthen trust based on software code and data. With this, it is possible to quickly and effectively improve safety and service quality that cannot be improved through the government-imposed regulatory system alone.

Customers can use taxis anytime and anywhere they want according to their convenience, but at the same time they are exposed to various uncertainties. That's because, unlike means of public transportation, users face unknown drivers, uncertain routes, and indeterminate fares whenever they use a taxi. As the freedom of movement through the use of taxis increases, these are the anxiety factors that may occur in return.

In spite of such uncertainties, taxis were able to survive for 100 years because they were supported by institutional trust. As a result of the government setting uniform pricing and vehicle appearance, and guaranteeing the identity and qualifications of taxi drivers, users were able to ride taxis they encountered for the first time on the road. The government has maintained trust in the taxi market by cracking down on illegal behaviors based on laws and by receiving and acting on complaints from users.

Still, there were limits to the government's administrative power. That's because taxi services are provided in geographically dispersed locations where users and drivers meet. Enforcing all these transactions one by one and responding to customer complaints that occur every second will inevitably face limitations even with an astronomical amount of government budget.
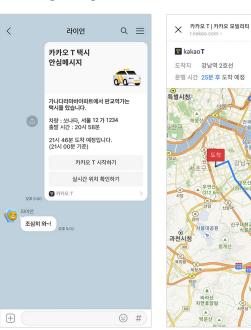
Mobility platforms can be an alternative that can overcome these limitations very efficiently. In other words, code and data take the place of law and administrative power. It is possible to quickly identify a problem through data and instantly disseminate the solution to it implemented through programming code to tens of millions of users. Through this way, Kakao T Taxi is steadily addressing users' concerns stemming from unknown drivers, uncertain routes, and indeterminate fares.

The anxiety that users feel about unknown drivers can be significantly reduced by showing information about the driver and vehicle in advance and allowing it to be shared. First, when calling with Kakao T Taxi, the user can preview the assigned driver's photo and vehicle's plate number. Only a driver who has been confirmed to have a proper taxi license can fulfill a Kakao T Taxi call, and the user can check the driver's name, photo, and plate number in advance. According to the regulations, by posting the credentials or designated attachments in the interior of the vehicle, it is possible to give more assurance and trust than the existing practice of showing the driver's identity and qualifications.

Furthermore, driver and vehicle information can be easily shared with the user's family and friends using the safe message sharing feature. While in transit, real-time routes can also be checked by family and friends. If a problem arises while in the taxi, even if the user is unable to deal with it for any reason, the person with whom the user shared the information will be able to handle it on the user's behalf. The number of real-time route information transmissions through Kakao Talk reached an average of 310,000 per month as of the second quarter of 2021. The practice of taking a taxi license plate while seeing off a loved one is now becoming a thing of the past thanks to Kakao T Taxi.

Reassuring message

Real-time route information screen

Kakao T Taxi also offers a variety of features to relieve users' anxiety about travel routes and fares. "I will take the route as the navigator tells me." These days, when taking a Kakao T Taxi, users often hear this utterance from the driver. It is no longer necessary to explain to the driver the destination and travel route as in the past since the navigator previews the optimal route according to the destination and route options set at the time of call. Even if it is the user's first trip, he or she can check route-related information at any time and ride safely and with assurance.

Complaints about fares have also been greatly reduced through the use of double or triple safety devices. When making a call, the user confirms the route and fare in advance, and the driver and the user can see the same real-time location information through the app while on the move, thus reducing the possibility of detour and fare disputes. Beginning in September 2021, a feature to select a route option was newly added to further strengthen the user's choice about fares and routes. When making a call, users can compare the estimated time of arrival and fare for each of the three options: recommended route, toll-free route, and shortest route, and select the route they want in advance. After getting off the taxi, users can check "Usage Records" to find out the departure and arrival locations, driving time and fares. That means the problem of rip-off charges that may occur every once in a while can be resolved relatively easily.

"Usage records" also relieves worries about items lost in the taxi. Kakao T Taxi allows the user to make a phone call to the driver through Usage Records even if the taxi leaves after getting off. Even when the user is unable to talk to the driver, an additional safety measure is in place that allows the user to check the driver and vehicle by sending the usage records to Customer Service Center. The experience of being at a loss by calling around after recalling an item left in the taxi is now a thing of the past. Furthermore, Usage Records can not only save users the trouble of collecting and keeping paper receipts, but also have the benefit of saving paper receipts from the driver's perspective.
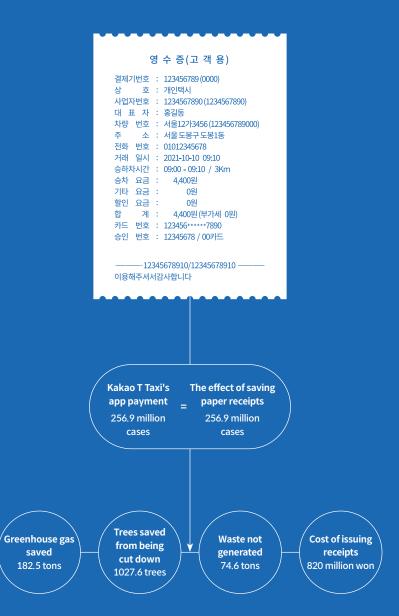
How much paper
does Kakao T Taxi save?

Kakao T Taxi is replacing the role played in the past by the paper receipt through Usage Records inquiry. How much paper does Kakao T Taxi save in a year? It can be estimated by looking at the number of "app payment" cases that did away with the need for issuing a receipt. Based on the estimate for calculating the environmental impact of paper receipts released by the Ministry of Environment in 2019, we came up with the environmental and economic impact of Kakao T Taxi by saving paper receipts. We took into account the fact that the length of taxi receipts is only 40% compared to regular paper receipts, which are about 20 cm on average.

A total of 256.9 million app payment cases have been recorded since the launch of Kakao T Taxi in October 2018 to the end of the first half of 2021. The total amount of greenhouse gas emissions saved by not using paper receipts amounted to 182.5 tons. This is equivalent to not cutting down 1027.6 trees and a total of 74.6 tons of waste not generated. It was also found that by sparing the cost of issuing receipts, a total of 820 million won in receipt issuance costs borne by taxi drivers or taxi operators were saved. From this, it is clear that Kakao T Taxi is not only environmentally beneficial, but also provides financial benefits to taxi drivers by saving money on thermal paper.

Reduced environmental impact due to app payment by Kakao Taxi

	Environmental impact per paper receipt*	Reduced environmental impact through Kakao T Taxi's app payment**
No. of issuance	Per receipt	256.9 million
Greenhouse gas emissions	1.776 g	182.5 tons
Trees cut down	0.00001 tree	1027.6 trees
Amount of waste generated	0.726 g	74.6 tons
Cost of issuing a receipt	8 won	820 million won

*Based on the Ministry of Environment figures ** Taxi receipt's length set at 40% of that of a regular paper receipt.

영 수 증 (고 객 용)

결제기번호 : 123456789 (0000)
상   호 : 개인택시
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합   계 :   4,400원 (부가세 0원)
카드 번호 : 123456•••••7890
승인 번호 : 12345678 / 00카드

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이용해주셔서감사합니다

Kakao T Taxi's app payment
256.9 million cases

=

The effect of saving paper receipts
256.9 million cases

Greenhouse gas saved
182.5 tons

Trees saved from being cut down
1027.6 trees

Waste not generated
74.6 tons

Cost of issuing receipts
820 million won
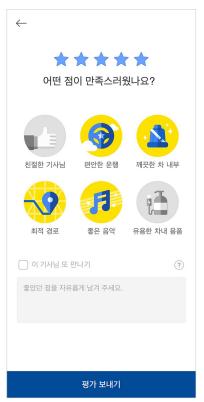
Creating a pleasant taxi based on driver evaluation data

Kakao T Taxi is actively using "data" for service quality improvement. To change the first impression of a taxi driver that was close to "unfriendly" to "polite," a sustainable and reliable service improvement process was required, and data could be a great alternative.

Such a process has been carried out in stages. First, evaluation data was accumulated through service feedbacks from users, and then the subjective service quality evaluation was switched through data in a more objective way. Currently, we are in the process of sharing insights on taxi service quality based on data with taxi drivers and actually reflecting them in our effort to improve services.

From the birth of Kakao T Taxi to the end of June 2021, about 200 million driver evaluation data have been accumulated. Beginning in May 2020, the driver evaluation system has been upgraded so that tags for major service items can be easily recorded in addition to simple ratings.

Service satisfaction evaluation screen immediately after using Kakao Taxi

The evaluation data of users clearly show what kind of taxi service users want and the mobility platform is aiming for. The most satisfactory areas that scored 5 points were in the order of politeness (29%), comfort (23%), optimal route (20%), clean car (18%), and good music (9%). To summarize, the taxi users want to ride is not just a means of transportation, but a taxi as a resting place where they can spend a comfortable time even while on the move.

Meanwhile, the most dissatisfying areas with a score of 1 were in the order of unprofessional driver service (35%), intentional detours (20%), unpleasant words or actions (18%), non-compliance with safe driving rules (17%), and vehicle cleanliness/bad odor (10%). In some ways, these are the most common problems of the service, which have been pointed out for a long time even before the appearance of Kakao T Taxi. These problems still exist and are not easily corrected.

In addition, in terms of service satisfaction, the hardware factors determining the comfort of a well-maintained vehicle or music are important, but the services provided differently depending on the driving inclination of the driver act as a very important factor in deciding whether a pleasant and satisfactory mobility is achieved, suggesting that the need for implementing a rating system and education for individual drivers is urgently raised.

Comparison of evaluation items by driver service rating

Rating	1 point	2 points	3 points	4 points	5 points
1	Driver service (35%)	Driving habit (33%)	Driving habit (34%)	No small talks (34%)	Polite driver (29%)
2	Intentional detours (20%)	Driver service (31%)	Driver service (30%)	Driving route (23%)	Comfortable ride (23%)
3	Unpleasant words or actions (Impolite attitudes, expletives) (18%)	Intentional detours (15%)	Vehicle cleanliness/ bad odor (13%)	Driver service (16%)	Optimal driving route (20%)
4	non-compliance with safe driving rules (17%)	Vehicle cleanliness/ bad odor (11%)	Intentional detours (11%)	Vehicle cleanliness/ bad odor (14%)	Clean interior (18%)
5	Vehicle cleanliness/ bad odor (10%)	No small talk (10%)	No small talk (11%)	Driving habit (14%)	Pleasant music (9%)

Based on compilation of June-July 2021 cumulative evaluation tags | Source: Kakao Mobility

Beginning in July 2021, we provide "Rating Reports" to drivers. The report summarizes the ratings and rating tags left by users and is provided to drivers in regular intervals. It is possible to objectively check the current service quality through the change status of the driver ratings and the rating tags that received most frequently, and it is an opportunity for the driver to improve the services that users feel most uncomfortable. This is a system that can effectively address problems such as impoliteness, speeding, and detours, which in the past had to rely on local authorities by reporting to them, through the data left by users as feedbacks.

Rating report screen provided to drivers

Spreading the standard of innovation beyond call brokerage

Kakao T Taxi has introduced various technological innovations to the taxi market, which was a digital wasteland. Mobile-based connectivity, refinement in vehicle assignment through mobility data and artificial intelligence, and trust built through platforms and rating data have allowed innovation comparable to that of industrialized countries that have introduced mobility platforms ahead of us. However, in order to really innovate the taxi market, which had long been established as a customary system, a role beyond a mobility platform that simply brokers calls was needed.

The taxi market that lacked incentives for innovation

It was a big deal in terms of social trust for customers to be able to hail a taxi on the road and ride in it safely for decades. Still, the government regulation that made this possible also caused the uniformity and down-leveling of taxi services. More specifically, many of the rules introduced during the taxi roaming era are no longer necessary in the age of mobility platforms, or sometimes pose as barriers to further innovation.

In both supply and demand fronts, the taxi market lacked incentives for innovation. In terms of demand, only medium-sized taxis, which are uniform from the user's point of view, dominated the market. Naturally, it restricted the choice of users. Even though the government encouraged market diversification through a new taxi system, it was not easy to resolve the already-established situation where mid-sized taxis relied on roaming to randomly pick up fare customers.

On the supply side as well, there was absolutely no incentive to differentiate services. That was because price, a key factor in service competition , was under the government's control. To discover the needs of users and build a business model around it, it is essential for entrepreneurs to think very hard and execute everything right. Especially when they want to differentiate the service, they must tolerate the risk of various attempts to bear fruit. The problem was, however, that there was no incentive to differentiate services in the uniformly standardized market. Under these circumstances, it was natural for business operators to maximize profits by minimizing costs rather than worrying about coming up with new and better services. The scheme of exacting a minimum payment out of the driver's daily earnings, which has long been pointed out as a chronic problem in the taxi industry, ended up aggravating this practice.

In a situation where only cost minimization was pursued and there was no positive change through competition, the taxi industry increasingly faced difficulties due to the decline in overall demand for taxis due to the development of public transportation networks, transfer discounts, the spread of private passenger cars, and the rise of designated driving. At the same time, as the expectations of users who directly experienced or heard the news of mobility services available overseas continued to rise, complaints from users about the existing taxi services such as refusal for ride and driver impoliteness were mounting.

It was thus natural that there was inevitably a certain limit to innovating the taxi industry by brokering taxi calls through a mobility platform alone. It was also difficult to introduce a ride-sharing service using personal vehicles, as in other industrialized countries, in consideration of various institutional constraints and social consensus. In the big picture of the taxi ecosystem, Kakao T Taxi went beyond a taxi call brokerage business and moved deeper into the taxi market in order to catch two birds with one stone that would provide services that meet the expectations of users while promoting a win-win growth with the taxi industry participants.

Kakao T Blue, the first step toward combination of win-win growth and innovation

The most decisive break came when Kakao T Blue launched a franchise-based tax business. The franchise-based taxi business was first introduced in 2009 when the Passenger Vehicle Act was revised. It was introduced for the purpose of more flexibly responding to the changing demand by integrating individually operated individual and corporate taxis into a franchise business and providing various additional mobility services. However, franchise-based taxis relying on calls appeared only sporadically in some areas and were unable to see the light of day shortly thereafter.

Still, with the advent of mobility platforms, new possibilities have emerged in the franchise-based taxi business. In 2019, Kakao Mobility launched "Waygo Blue" in partnership with Tago Solutions. It presented a different appearance of taxis than the incumbent ones by introducing an automated car dispatch service through a mobility platform, an app-based payment service, a friendly appearance and comfortable interior, and certified drivers who have completed specialized service training. Thereafter, Waygo Blue has been renamed as Kakao T Blue, leading a new change in the mid-sized taxi market. After Kakao T Blue, taxis affiliated with various platforms have appeared one after another, and membership taxis affiliated with platforms are establishing themselves as a new standard for platform taxis.
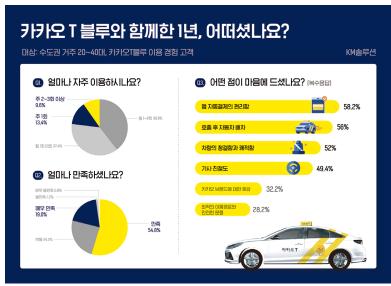
Kakao T Blue was also the first outcome of the "Great Social Compromise" reached in March 2019 whereby the government, taxi operators, and Kakao Mobility took part in for the win-win growth of taxi operators and platform companies. Kakao T Blue has a structure in which taxi companies and individual taxi drivers are enlisted as franchisees in the form of membership to disseminate innovation and share profits through various technical, marketing, and operational support. It was a strategy that

can promote win-win growth while using medium-sized taxis, which accounted for more than 90% of the existing taxi market, as a catalyst for innovation.

In this way, Kakao T Blue is improving user convenience. The results of the survey conducted in commemoration of the first anniversary of the launch of Kakao T Blue in 2020 were encouraging. In the area of service satisfaction, 19.0% and 54.8% of respondents were very satisfied and satisfied, respectively, indicating that more than 70% of users were satisfied with Kakao T Blue service. It was also noteworthy that the satisfaction level of women who had relatively a high degree of anxiety about taxis was high.

The main complaints, such as reckless driving, refusal for ride, impoliteness, unnecessary small talk, and unpleasant odor, were no longer issue for the brand taxis under the banner of "Kakao T Blue." Kakao T Blue, where Kakao Mobility can actively participate in improving service quality, has entered a stage where drivers' rating data are actually used for future education and evaluation. The brand taxi divided three evaluation groups based on their ratings and implemented differentiated and close-up management for each group. As of June 2021, two years after its launch, Kakao T Blue has grown to over 26,000 cars. Even though it is still a minority compared to the number of taxis nationwide, it is playing an important role as a catalyst for innovation.

Service satisfaction survey results for Kakao T Blue users

Source: Kakao Mobility, KM Solutions

Kakao T Blue is continuing its effort for innovating its services. Since May 2021, the Blue Light campaign has been under way on a large scale, and through the close working relationship with crews on site, we are striving to motivate and inspect for improving service quality. By visiting gas charging stations (Blue Light Zones), locations easy for inspectors to have in-person contact with taxi drivers, they regularly check the cleanliness of the vehicle, disinfect and deodorize the car, and provide refreshments and manuals to boost the morale of Blue drivers and encourage continued participation.

Blue Light campaign poster

In response to COVID-19, the company quickly moved to enhance the safe riding environment. By joining hands with Cesco, a professional environmental sanitation company, Kakao T Blue has established a quarantine system called "Kakao T Blue Virus Free." Currently, Cesco's skilled professionals are meticulously conducting sterilization services for Kakao T Blue cars nationwide. It allows users who are reluctant to ride taxis due to concerns about possible contamination in the taxis.

For a virus-free taxi, Kakao T Blue (above) is undertaking quarantine measures jointly with Cesco, and Kakao T Blue crew working in compliance with quarantine rules (below)

Kakao T Venti overcoming the limits of mid-size taxis

Following the footsteps of Kakao T Blue, a new attempt to break away from mid-sized taxis has also begun. Kakao T Venti actively incorporated the needs of users and the taxi industry participants from the planning stage . As large-scale vans and luxury taxis are run by calls instead of roaming to pick up random customers, it is possible to make various customer-oriented service improvement attempts compared to roaming-focused mid-sized taxis.

Kakao T Venti quickly responded to the rapidly growing demand for shared mobility services. It operated 9- to 11-seater vans such as Kia Carnival and Hyundai Staria and it was possible for users to move comfortably in a spacious environment. With added amenities such as free Wi-Fi and rear-seats entertainment (RSE), riders could have the pleasure of mobility. Venti cars are also run by automatic car dispatch and app payment, and its flexible rate scheme is contributing significantly to relieving the problem of excessive demand for taxis during peak hours.

The growth pace of Kakao T Venti is amazing. As of June 2021, the number of users (based on the number of passengers who have completed their trip) increased 319% compared to the same month of the previous year, and the number of calls and completed trips increased 249% and 457%, respectively. In addition to the increase in the usage rate, the service quality is also getting good marks. The service satisfaction score of Venti is 4.8 points on average, which is higher than that of conventional mid-sized taxis. Thanks to the high marks in satisfaction for both users and drivers, the Venti service, which was launched in Seoul, is starting to expand in earnest, including the adjacent province of Gyeonggi-do. Recently, in partnership with Hyundai Motor, it launched a taxi-only model, "Staria Lounge Mobility," and mobilized it in the Venti service.

Kakao T Venti expanding its areas to accommodate more passengers

Premium taxi expands consumer choice

There was Kakao T Black before the appearance of Kakao T Blue and Kakao T Venti. Kakao T Black is a luxury taxi launched in 2015 and the first form of "platform taxi." Kakao T Black operates only in limited markets due to the nature of luxury taxis, but its operational know-how has laid the foundation for the success of the subsequent Kakao T Blue and Kakao T Venti.

High-end taxis such as Kakao T Black are relatively free from regulations designed on the premise of roaming such as rooftop light, exteriors, and meters, instead of only being allowed to operate through calls . The taxis can be operated only with luxury vehicles of 2.8 liters or larger, and it is not subject to exterior restrictions except for yellow commercial license plates . The fare scheme can also be run at their own discretion after the operator's self-report. As there is no need for installing a meter or credit card terminal, it has been possible to estimate and pay with a smartphone like Uber since the launch of Kakao T Black in 2015. Kakao T Black raises the level of the taxi ride experience by providing high-end services that were not available previously to users by high-end vehicles and professionally trained chauffeurs. In fact, Kakao T Black showed the future of all taxis in advance.

Kakao T Taxi has joined forces not only in the luxury taxi category, but also in the conventional deluxe taxi market. That was Kakao T Deluxe. Kakao T Deluxe is an example of Kakao T being renamed due to the demand of drivers and the rapid change in the taxi market. In the case of existing deluxe taxis, there were many cases in which drivers felt somewhat alienated in terms of public recognition because there were many users who did not know whether it was possible to call a deluxe taxi on the taxi calling app and there were many cases where the taxis were hailed on the road.

From the planning stage, the project team keenly listened to deluxe taxi drivers. They enlisted some of the deluxe taxi drivers for in-depth interviews so that they can incorporate their needs more faithfully in service renewal. The renewed deluxe taxis were equipped with an automatic dispatch feature and can be called only when there is a deluxe taxi near the caller, significantly reducing the experience of dispatch failure, and it has been transformed into a service with improved public recognition by allowing it to be exposed on the call app's main screen.

The case of Kakao T's deluxe taxi renewal

Creating the era of platform taxis together

At a time when platform taxis such as Kakao T Blue and Kakao T Venti were gradually expanding, the amendment to the Passenger Vehicle Act to institutionalize platform taxis was implemented one year after the passage of the National Assembly on April 8, 2021. The institutional ground has been laid for taxis combined with platforms to appear in earnest. It also opened up the way for new and diverse types of taxi services to appear.

Although the institutional foundation has been laid, chronic problems from the past, such as the aging of taxi drivers and the scheme to require taxi drivers to pay a certain fixed amount from their daily earnings, still existed in the taxi market. Kakao T Taxi, together with taxi drivers and taxi business operators, is making innovations in how they run business required for the era of platform taxis. We are creating a strong service supply chain that meets the needs of users by enhancing the professional value of taxi drivers and refining industry practices. Efforts are also being made to create an innovation-friendly ecosystem by actively utilizing the regulatory sandbox.

Operational innovation 1.

Kakao T Taxi becoming younger and more diverse by lowering the entry barrier with technology

The most serious concern for the taxi industry is the aging of taxi drivers. According to data from the Korea Transportation Safety Authority, 40.9% of domestic taxi drivers, or 67,200, were over 65 as of 2020. This is up 77% from 37,900 in 2014.

The aging of the taxi drivers is causing driving safety problems. In 2019, as many as 3,056 cases, half of the individual taxi accidents, were caused by drivers aged 65 or older. In addition, the fact that individual taxi drivers' working hours are concentrated between 8:00 am and 7:00 pm, which are normal working hours for most people, is also a problem in the supply of taxis. In a situation where 66% of individual taxi drivers are senior citizens, the shortage of taxi supply on certain occasions, such as late night hours and bad weather, is becoming serious.

Kakao T Taxi lowers entry barriers for drivers with technology and brand taxis and promotes convenience in operation. It is at the center of the shift in taxi operations from roaming, where long years of experience are needed for passenger search, to

a call-based operation that can focus on safe driving and service. An environment is being prepared where technology and brands are replacing passenger search, while drivers can focus more on enhancing the quality of taxi service.

Before the advent of Kakao T Taxi, the know-how that required long experience posed as a barrier to entry in the taxi business. The ability to park in a "spot where there are likely to be a lot of people," "the ability to detect if a person on the roadside is willing to ride a taxi," and "experience in finding an optimal route that can minimize running without a fare customer" were a must. That meant one cannot be a good taxi driver just because he is equipped with excellent driving skills. Users hailed on the roadside, and drivers were roaming around to pick up customers, and it was only six years ago that they had to pay for their own search costs in this way. That was because there was no mobility platform to broker the right users and drivers at the right time.

Number of monthly trips made by drivers according to their experience
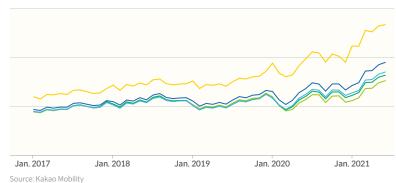
- Fewer than 5 years
- 5 to 10 years
- 10 to 15 years
- 15 to 20 years
- Longer than 20 years

Jan. 2017 Jan. 2018 Jan. 2019 Jan. 2020 Jan. 2021

Source: Kakao Mobility

Kakao T Taxi significantly reduces the burden of searching for passengers, which is the basic requirement of taxi operation. This can be understood in the fact that Kakao T Taxi is getting a more favorable response from drivers with less experience. In the case of high-skilled drivers with more than 20 years of experience, about 154 trips were made through Kakao T Taxi per month as of June 2021, while new drivers with fewer than five years of experience made 269 trips a month through Kakao T Taxi. Compared to January 2017, the number of Kakao T Taxi trips made by high-skilled drivers increased 1.7 times, while that of newbie drivers increased 2.3 times, widening the gap every year. In the case of low-skilled drivers who lack the know-how in picking up random customers, they are fulfilling more call-based operations as it is easier than searching for fare customers. Kakao T Taxi is providing new business opportunities for these drivers who would have been difficult to make a living in the past, when they were mainly roaming to pick up passengers.

Call-based operations have downsides in terms of time and fuel cost in the process of driving to pick up customers. One of the most common complaints the drivers had with call-based taxis in the past was that the user who made a booking canceled the

call in the middle or took another taxi without even canceling it. For the driver who was on the move after receiving a call, the risk of wasting not only time and fuel, but also other customer pickup opportunities was a big business cost. The so-called "no-show" risk was an important factor that made drivers avoid call-in customers.

Kakao T Taxi is effectively preventing no-shows, the biggest headache of call-based operations. First of all, a certain amount of penalty is imposed on a call that is canceled by the user for no reason. In the case of brand taxis such as Kakao T Blue and Venti, there is a cancellation fee imposed one minute after the call to prevent loss to the driver due to the user's unjustified cancellation. In the case of calls that cannot be assessed a cancellation fee, instead of imposing a monetary penalty, a time penalty is imposed by limiting the dispatch for 5 minutes if the user cancels after 5 minutes of dispatch. If there is no cancellation and the user makes a "no-show", a cancellation fee is imposed, and a system is in place to prevent further loss by allowing the driver to report separately within the Kakao T app.

In addition to the loss caused by the call cancellation or no-show, Kakao T Taxi has one more safety device to protect the driver's driving experience. There is a function such as "I don't want to meet this driver" or "I want to meet this driver again" depending on the star rating given by the user after driving a taxi. In the same way, there is a feature on the Kakao T app for drivers called "I don't want to meet this passenger." After this function is activated, the call does not appear on the driver's Kakao T app even when the same user makes a call next time. This is the minimal measure to protect the driver from the user's abusive behavior.

Brand taxi's automatic dispatch is making call-based operations much easier. For example, Kakao T Blue operates automatically, so it can be run easily without know-how. In the past, in order to drive a taxi, the barrier to entry was high because an individual driver had to have the know-how to search for users or find spots where potential taxi riders were gathered. As Kakao T Blue is growing at a rapid pace and being welcomed in the taxi market, the proportion of young taxi drivers in their 20s and 30s is increasing steadily.

As a function of the driver's Kakao T Blue app that further reduces the cost of passenger search, there is a service called "Back-to-Back Dispatch." Basically, a driver who is fulfilling a call cannot receive additional calls. "Back-to-Back Dispatch" is a service that assigns a taxi to the driver's destination when the taxi almost arrives at the destination of the user currently boarding, and dispatches the call to another user in the vicinity. This feature was introduced to the current driver's Kakao T Blue app.

The reason that the back-to-back dispatch is available on the driver's Kakao T Blue app only is a measure in consideration of safety driving. That's because, in the case of Kakao T Blue, the destination is not shown and calls are automatically assigned. This is a policy that considers the fact that there is a risk of an accident while the driver confirms the call while driving because the destination confirmation and call acceptance procedure are required for such calls.

Back-to-back dispatch appears to be contributing to improving the demand and supply of taxis. Taxi supply is inelastic relative to demand, depending on the number of registered vehicles and the business discretion of individual taxis. Back-to-back dispatch helps to improve the imbalance between the supply and demand of taxis as it can handle calls that occur during the same time period even when the number of vehicles is not increased.

In reality, it appears that the success rate of Kakao T Blue dispatch has increased since December 2020, when back-to-back dispatch was first introduced. Previously, users had been assigned with empty cars, but after December 2020, "taxis that nearly completed the current trip" are also available for fulfilling dispatches, which is believed to have contributed to the substantial rise in the dispatch success rate. There are various factors other than back-to-back dispatch that are involved in the success rate of taxi dispatches, but it can be surmised that back-to-back dispatch also contributed to reducing the cost of searching for passengers.

As barriers to entry have been lowered with technology and brands, the demographics of taxi drivers are getting younger and more diverse. The average age of new drivers joining Kakao T Taxi in 2017 was 58.1. In 2021, the average age was lowered by 2.6 years to 55.5. The new entry of the young drivers, who have long shunned the job of taxi drivers, is also encouraging. In 2021, the proportion of millennials and generation Z was 4.8% among Kakao T Taxi drivers. This is a rise of 4.1 percentage points from only 0.7% in 2017.

The average age of drivers newly joining in Kakao T Taxi

58.1	2017	55.5	2021

The requirements of drivers newly joining in Kakao T Taxi

Share of millennials and generation Z among Kakao T Taxi drivers

0.7%	2017	4.8%	2021

Based on applied drivers, Millennials and generation Z are those born after 1980

It can be seen that the average years of experience of newly joined drivers also tend to decrease as the years go by. The average experience estimated by the year of obtaining a taxi license was 13.7 years in 2017. This figure moved down to 12 years in 2021. It means that more and more young drivers are joining Kakao T Taxi.

Despite the aging of the taxi industry, the fact that the age and experience of new Kakao T drivers is declining suggests that the platform can somehow compensate for the lack of experience and know-how in taxi operation. The job opportunities have become wider than in the past thanks to technology and brands.

The call-based operation is also providing new job opportunities for the hearing impaired. It was difficult for hearing-impaired drivers to perform the job well with roaming or the conventional phone call-based business. Including receiving assignments in response to the call center's request, listening to the destination from the user on board, communicating with the user to check the route while on the move, and telling and receiving the fare to the user upon completion of the trip, the driver needed the "ears" and "mouth."

Kakao T Taxi is making it possible for hearing-impaired drivers to run taxis. This is thanks to the fact that it has become abundantly possible to minimize communication with users, receive dispatches, check destinations, and collect fares all through app payment. Essential communication between the driver and the user is possible in real time through a tablet installed in the car in collaboration with Coactus, a taxi company famous for running "silent taxis." Kakao T Taxis are becoming "ears" and "mouth" for hearing-impaired drivers. In addition, Kakao Mobility plans to support drivers by providing Kakao T calls to hearing-impaired drivers of Goyohan M run by Coactors.

The advantages of the platform, which reduce the burden of the role of drivers, apply not only to drivers with hearing impairment, but also to everyone. It has been six years since Kakao T appeared in this world, and the door to jobs is further widened with the spread of platform-based taxi business. It has become possible for those who have lived a life totally unrelated to the taxi business and those who wish to find a new job after a career break for whatever reasons to work as a taxi driver.

Kakao Mobility will work hard to lower the barrier to entry for drivers and create more jobs and opportunities in order to contribute to resolving the shortage of drivers in the taxi industry. To this end, the social responsibility of Kakao Mobility is to continuously improve platform features, expand the number of branded taxis such as Blue, Venti, and Black, and establish a taxi operation culture based on automatic dispatch.
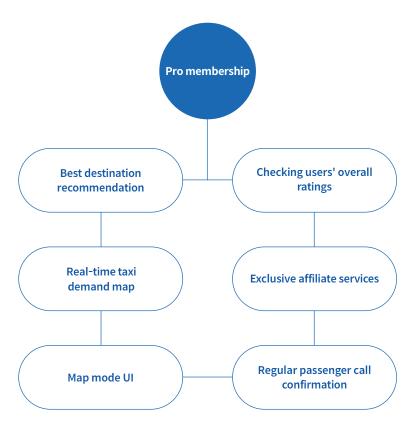
Operational innovation 2.

Pro membership: Tool to realize business innovation

Pro membership is a specialized service introduced by combining mobility technology and service ideas to improve the operational efficiency of taxi drivers. Even though brand taxis such as Kakao T Blue, Venti, and Black are quickly establishing themselves in the market, the existing mid-size taxi market is still in control of the majority of taxis. Brand taxis have a channel that can directly receive support for an efficient business environment through various tangible and intangible means, but drivers who use Kakao T Taxi's simple call brokerage service have no such support. In particular, among regular taxi drivers, there are those who prefer call-based operations over roaming, but the reality is that sales support for these drivers are non-existent.

Pro membership increases operational efficiency, helps drivers respond flexibly to calls, and provides various benefits. We are continuously improving services so that drivers' satisfaction can create a virtuous cycle that would ultimately improve users' service satisfaction.

Pro membership service composition

Pro membership

- Best destination recommendation
- Checking users' overall ratings
- Real-time taxi demand map
- Exclusive affiliate services
- Map mode UI
- Regular passenger call confirmation

Among the features provided by the Pro membership, there is a service called "real-time taxi demand map." It shows in real time in which areas the most Kakao T calls are generated in the app. If drivers can get to an area with a lot of calls in a short time, it can lead to more fare opportunities. Even if the driver is in an unfamiliar area, he or she can get a direction to move to the next appropriate location if the demand map is provided. This is helpful for drivers who wish to keep fare customers coming and make more money.

Real-time taxi demand map for Pro Membership

As shown above, the taxi demand map divides a certain radius into cells and displays the number of calls by color, helping drivers intuitively understand the real-time passenger demand status even while driving.

How popular is the taxi demand map with drivers? It was reported that about 40% of the pro membership drivers who went to work search the taxi demand map every day. It was also found that the more drivers used the map, the higher the number of completed trips. If one looks at the data for one month after the launch of the Pro membership in March 2021, it is clear that the number of completed trips almost doubled depending on the degree of usage of the map by the driver.

Of course, it is not always the case that "using the demand map frequently would guarantee more fare opportunities." That's because call-based operations are not everything. There are drivers who do not use the map and operate an average of 20 runs a day based on random pickups only. In addition, since drivers with high willingness to run call-based operations are more likely to look up the taxi demand map frequently, it should be seen as a correlation rather than a causation. However, one can conclude from this that the feature that allows drivers who want to run more call-based operations using the tool called Kakao T is the taxi demand map.

Kakao Mobility has partnered with many companies to provide drivers with necessary tools for safer and more convenient driving. For the first time among platform taxi companies, it introduced "peace-of-mind insurance" that pays medical expenses and consolation money in the event of an unfortunate incident such as violence against the driver while offering discounts on purchasing an electric vehicle and other accessories such as tires and electronic gadgets. Kakao Mobility plans to expand its affiliated services so that it can provide more benefits to drivers using Kakao T Taxi.

Peace-of-mind insurance for Kakao T Pro members

Kakao T Taxi taking the lead in introducing the monthly salary scheme for drivers

Due to the revision of the Passenger Transport Service Act, taxi business operators have since January 2020 implemented a scheme of taking 100% of drivers' daily earnings and paying fixed salaries to drivers. Unlike the scheme of demanding a minimum payment out of the driver's daily earnings, this scheme takes all of the driver's daily earnings and instead pays them a fixed amount of monthly salaries. In the existing scheme, the responsibility of business performance was passed entirely on to the individual driver, but under the new scheme, the responsibility to manage well falls largely on to the business operator. Accordingly, the need for tighter control of taxi operation income and management of vehicles and drivers has grown ever before for taxi business operators. How is Kakao Mobility contributing to the management efficiency of these taxi operators?

Manual control of taxi drivers by taxi companies (card slips and daily driving records) | Source: Jinhwa Taxi
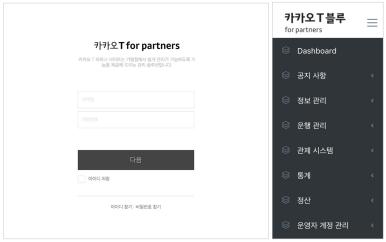
The taxi business operator has the obligation to do the bookkeeping of drivers' daily earnings and check whether the figures match the tachometer data. In addition, tasks to manage such as LP gas charging receipt processing, vehicle dispatch scheduling, cash deposit and card deposit balance tracking are quite significant for taxi business operators.

Nonetheless, taxi business operators have not computerized their books with the spreadsheet program as late as the 2010s and instead relied on manual bookkeeping. That was because it was practically difficult for individual taxi company to introduce a computerized system for their business tasks.

Another problem from the perspective of the taxi company was that it was difficult to manage the taxi fleet. Once corporate taxis started leaving the depot, it was not possible to know exactly where each taxi was until the car returned to the depot

at the end of the shift. Management tasks such as driver training or fuel cost saving would be possible only if there was information on vehicle location and driving routes, but such monitoring was not simply possible.

Kakao T for Partners

Kakao T for Partners login screen (left), Kakao T Blue for partners menu screen (right)

To address this problem, Kakao Mobility created Kakao T for Partners(Partner Admin), a dedicated system for taxi business operators affiliated with Kakao T. By accessing the partner admin system, the operators can check all the information including driver information, payment and receipt, real-time vehicle control, driving records and other vital statistics. In the driver information menu, for example, one can register drivers affiliated with a taxi company, manage the arrival and departure of the drivers, and check their Kakao T ratings. The payment and receipt menu shows the fares received by taxi drivers affiliated with the taxi company by vehicle and driver, and provides a feature to settle charges other than the fare such as cancellation fees or call charges. In addition, with the control system menu, one can check the location of the current vehicle in real time or look at past driving route records. One can also check the performance of these operational performances through statistics. Starting in November 2021, KakaoTalk Alerts have been sent on a daily basis so that taxi company managers can check the main points of Partner Admin more conveniently.

From the perspective of taxi companies, it is a great way to eliminate inefficiencies stemming from managing data with handwritten books or spreadsheet files and control the work patterns of drivers more comprehensively from dispatch to boarding, driving, getting off, and payment of daily earnings so that franchise-based taxis can be run more effectively through Partner Admin, a standardized sales management system.

Regulatory reform

Regulatory sandbox

Kakao T Taxi is also taking the initiative in harmonizing regulation and innovation by actively taking advantage of the regulatory sandbox prepared by the government. In consideration of the nature of regulations that lags behind changes in technology and consumer preference, we are actively uncovering regulations that keep the launch of new services from happening and resolving them together with the government through the regulatory sandbox. The number of regulatory sandboxes applied for by Kakao T Taxi is rising every year. It is striving for regulatory innovation in the supply side, from technology such as app meters to out-of-depot shifts and temporary taxi driver privileges. Let's take a look at the typical case of regulatory sandbox applied for by Kakao T Taxi.

Kakao T Taxi's performance in regulatory sandbox

Date	Regulatory sandbox	Major items (expected results)
Oct. 1, 2019	GPS-based app meter	An app-like taxi meter that charges fares based on GPS, geographic information, and map matching technology.
Jul. 7, 2020	Out-of-depot shift	A service that allows the platform taxi driver to remotely check the vehicle outside the depot, transmit driving records, change the driver's shift, manage dispatch. Currently negotiating with GS Caltex for shift sites and vehicle charging (Jan. 2021 - present)
Jul. 7, 2020	Platform-based temporary taxi driver license	A service that allows those who want to engage in taxi driving business to temporarily drive a franchise-based taxi before acquiring an official taxi driver license (valid for up to 3 months). The taxi business operator and headquarters are responsible for overseeing and controlling taxi operations.
Dec. 30, 2020	Pre-paid franchise-based taxis	When calling a taxi on the Kakao Mobility platform (franchise-based, luxury, large), the fare is determined in advance based on the app meter, and the taxi service is rendered once the passenger pays the fare in advance.

Case of regulatory reform 1.

The A to Z of temporary taxi driver qualification

Drivers who wish to drive taxis in affiliation with Kakao Mobility can first get a job and experience the taxi business even when they do not have a taxi driver's license. It was possible because Kakao Mobility's "platform-based temporary taxi driver license" was given a status as a special demonstration case as part of regulatory sandbox tasks from the Ministry of Science and ICT on June 30, 2020. Temporary taxi driver qualification is a special privilege that allows one to temporarily drive franchise-based taxis within a period of up to three months before acquiring an official taxi driver license. With this privilege, drivers are not permitted to drive regular taxis, but ones affiliated with platform companies.

The reason Kakao Mobility asked for a temporary taxi driver license from the government was because process for a person to get a taxi driver job is quite complicated. In the case of food delivery, designated driving, or package delivery, anyone with a driver's license can register as a driver, so the barrier to entry is very low. In contrast, applicants have to go through at least three steps to get a job as a taxi driver. First, they have to pass a full battery of driving aptitude tests. Afterward, they must acquire a taxi driver's license, and then complete the training for new drivers before becoming a full-fledged taxi driver. It costs money and time for every step of the way.

For individual taxi drivers, the process is even more complicated. Even though the requirements for taking over an individual taxi license have become much easier, making it possible to take over a license even when one had no previous business driving experience, the procedure is still far from easy. As of June 2021, applicants must pay a training expense of 520,000 won and attend the license handover training offered by the Korea Transportation Safety Authority for five days (40 hours) to be able to drive an individual taxi. It is thus difficult for potential taxi drivers to "try it once and get a different job if it doesn't work out."

Given this situation, there is no reason for job seekers to opt for taxi drivers whose barrier to entry is exceedingly high while they are given a lot of other career options such as package delivery, food delivery, driver, and the like. The difficulty of finding help, for which the taxi industry has struggled for long, has become more serious due to the diversification of driving-related jobs and the fast growing trend of the gig economy.

Certificate of completing the training for Kakao T Blue temporary taxi driver qualification

카카오 T 블루 교육수료증　　수료번호 00000-00000　가맹점명 OO운수

김카모 Krew

해당 카카오 T 블루 크루님은 '임시 택시 운전 자격증' ICT 규제 샌드박스 실증 특례에 참여하고 계신 크루님으로 범죄 경력 조회와 운전 경력에 대한 검증을 마쳤으며, 유효기간 내에 정식 택시 자격증을 취득 예정입니다.

2021.00.00. (유효기간: 2021.00.00.까지)

주식회사 케이엠솔루션

Why is the qualification to drive a temporary taxi limited to Kakao T platform-based taxis? Platforms have various means at their disposal to improve the operational quality of the taxi service, such as driver interview, training, operation performance, and driver rating monitoring. Since platform-based taxis can be run based on calls according to the Kakao T driver app navigator, even new drivers without taxi driving experience can do it as long as they have minimum driving skills. Kakao Mobility first performed the task after obtaining the permission to drive temporary taxis with up to 200 drivers. Thanks to the support of drivers wishing to find a job, the number of temporary taxi drivers was expanded to 1,000 from May of this year with a quota system running constantly.

Just like the opinion of the Ministry of Science and ICT in relation to the approval of the regulatory sandbox project, we hope that the "temporary taxi driver qualification" can contribute to relieving the long-term job shortage problem in the taxi industry and take roots as a system that provides opportunities for job experience to more applicants in the taxi industry.
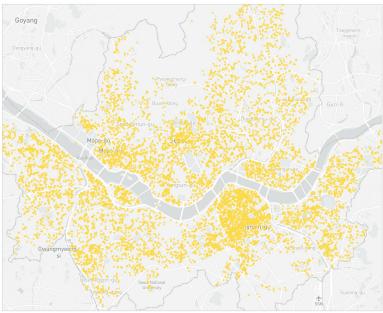
Case of regulatory reform 2.

How have the out-of-depot shifts become possible?

Taxi companies that run corporate taxis have had long-standing concerns. That was the "site." The companies must have a depot of a certain size and must change drivers to drive the corporate taxi in the depot. The depot must be located where it is possible for drivers to commute as easily as possible by public transportation or on foot, but it requires a fairly large site to accommodate dozens of vehicles. This necessarily caused the taxi companies to worry about the rental cost.

There is one more problem that arises from having to do shifts only at the depot. Normally, taxi shifts take place around 4:00 am or 4:00 pm, but the operation rate of corporate taxis declines substantially by about 2 hours before and after the shift time. On the way to the shift, it is nice for the driver to get a call by chance from a user whose destination is near the shift site. Otherwise, in order not to be late for the shift, the driver has no choice but to turn away from users on the road and users who call.

Driver location map

Distribution of origins of Kakao T Taxi calls

The reason that corporate taxis were allowed to change shift only at the company's depot was intended to prevent subcontracting and strengthen the role of oversight and control of the taxi company for drivers' DUI. Then, what if one can control the location of vehicles and the shift status of drivers based on platforms and technology anytime anywhere? Even in a place other than the taxi company's depot, it will be possible to set up a shift site and run corporate taxis. If a place other than the depot, such as a parking lot or charging station, can be used as a shift site for corporate taxis, the taxi company can benefit by reducing the site rental cost, and the driver can in some cases make the commute more conveniently than going to the taxi company. In addition, if the number of shift sites other than the depot increases, users are also less likely to experience the case of "empty taxis passing by them to go to shift."

Beginning in January 2021, Kakao Mobility, in partnership with GS Caltex, is carrying out a special regulatory sandbox demonstration project that runs the parking area of charging stations as a replacement for franchise-based taxis. For franchise-based taxis and drivers participating in "the out-of-depot shift demonstration project," it is possible to find out shift locations and whether the shift is properly made, and real-time remote monitoring on whether the driver is drunk before starting the day's work. The future that Kakao Mobility wants to realize through "the out-of-depot shift" is to open up technological possibilities so that any empty parking lot can become a shift site for taxis. We look forward to days when more boarding opportunities are offered for drivers and users, and savings in site rental cost for taxi business operators.

70   Kakao T Taxi Special

Kakao T Taxi, writing a milestone in the mobility business   71
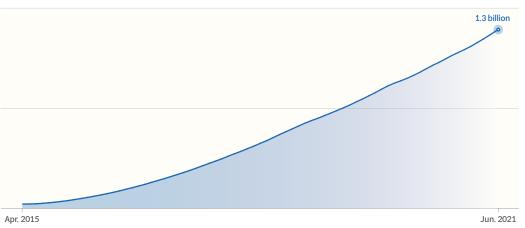
Kakao T Taxi's major records in numbers

In March 2015, six years have passed since the launch of Kakao T Taxi. In 2016, one year after launch, the number of subscribers to Kakao T Taxi was 8.6 million, and the cumulative number of calls was 97 million. At the time, 84.9% of respondents answered that Kakao T Taxi brought convenience to their lives. Now, five years have elapsed since then, let's look at the six-year record of Kakao T Taxi, how many users it took from point A to B and how far it ran, and what convenience it provided.

Kakao T Taxi's history of 6 years

1.3 billion
The number of trips Kakao T Taxi has logged

The cumulative number of taxi trips Kakao T Taxi has made is in excess of 1.3 billion. The number of calls was more than 2.22 billion. From April 2015 to June 2021, the number of trips steadily increased with an average monthly growth rate of 6.5%.

Total cumulative number of Kakao T Taxi trips completed

1.3 billion

Apr. 2015   Jun. 2021

30 million
The taxi half of Korean people experienced

As of the third quarter of 2021, as many as 30 million users are relying on Kakao T. In all, 58% of the 51.85 million Korean people and 79% of the 37.35 million economically active population[1] (ages 15 to 64) travel through Kakao T.

For reference, 69% of the US ride-hailing market is claimed by Uber. Of the total users, about 62% of users rely on Uber alone.[2] Uber offers a variety of services such as "Uber Black,' a luxury vehicle service, "Uber Pets," a pet transport service, and "Uber Eats", a food delivery service. It has maintained the No. 1 position in the US by meeting the people's mobility demand.

230,000
An app most taxi drivers use
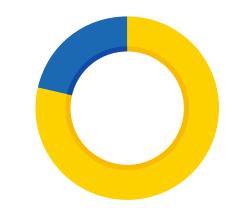
As of the end of June 2021, the number of drivers using Kakao T Taxi is 230,000. Of the 244,000 [3] taxi drivers nationwide, more than 90% are using the Kakao T Taxi app. Kakao T Taxi has now become an indispensable existence In taxi operation.

Just like most of the taxi market in Korea mainly consists of mid-size taxis, most of the Kakao T Taxi drivers are also regular mid-sized taxi drivers. The share of taxi drivers such as Deluxe, Blue, Venti, and Black, who are not regular mid-size taxi drivers, is gradually increasing and currently accounts for 21% of the total.

1 Statistics Korea as of 2020. Korea's total population 51.85 million.
  Economically active population 37.35 million
2 Bloomberg Second Measure, 2021, June ride-sharing market share
3 Korea National Joint Conference of Taxi Association, statistics on taxi drivers
  as of Jun. 30, 2021

People in their 50s
The main age group of taxi drivers

The taxi drivers whom one meets when using Kakao T Taxi are mostly in their 50s. About half of all drivers are in their 50s, and those under the age of 46 account for only less than 10%. What's noteworthy is that the share of taxi drivers under the age of 35 is less than 1%.

Kakao T Taxi driver classification status
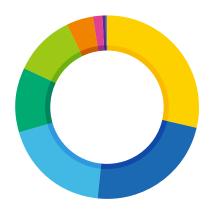
	Response	Ratio
●	Regular mid-sized	78.7%
●	Brand	21.4%

As of end of Jun. 2021

Age distribution of Kakao T Taxi drivers

	Response	Ratio
●	56-60	28.8%
●	61-65	22.9%
●	51-55	18.9%
●	66 or older	11.5%
●	46-50	10.7%
●	41-45	4.7%
●	36-40	1.8%
●	31-35	0.6%
●	30 or younger	0.2%

As of end of Jun. 2021

260,000 rounds of the earth
Cumulative trips made

If one connects the distance traveled by Kakao T Taxi, it will surpass 10.6 billion km. Assuming that one round of the earth is 40,000 km, this is equivalent to the distance that can go around the earth 260,000 times. After 35 round trips from the earth to the Sun, 100 million kilometers remain. What is the mileage per user in six years? It is about 480 km. Given the distance from Seoul to Daegu as the crow flies is about 240 km, and it is the same distance that can go back and forth between the two cities.

Time length of 36,000 years
Cumulative time on the move

If one adds up all the travel time on Kakao T Taxi, it is about 13,314,749 days, or 36,000 years. For reference, people lived in the Paleolithic Age 36,000 years. Just like the Paleolithic Age has developed into past historical moments such as the Bronze Age and the Iron Age, it is impossible to talk without Kakao T Taxi in the daily life of many people today.

12 trillion won
Cumulative estimated fare
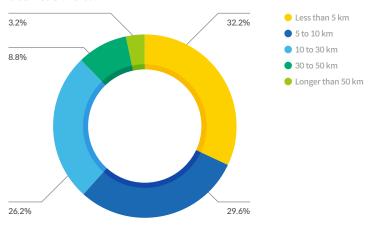
Kakao T Taxi is about 12 trillion won. For reference, the market capitalization of the 34th largest company on the KOSPI market is about 12 trillion won, and the second largest company on KOSDAQ has a market value of 10 trillion won.[4] The average fare per driver was about 34 million won.

4   Based on the closing price on Sep. 23, 2021

Less than 5 km
The distance most frequently traveled
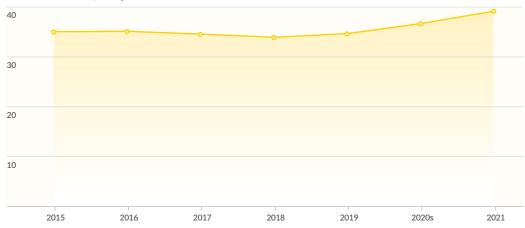
Each year, the share of short-distance users who use taxis for less than 5 km has been more than 30%. The share has started increasing since 2019, with the proportion rising as high as 40% in 2021. For reference, it is 5 km from the Seoul City Hall to Itaewon Station, about 10 km to Gangnam Station, about 30 km to Gwangmyeong Station, and about 50 km to Dongtan Station. Looking at the taxi usage records of users for six years, users of less than 5 km account for 32.2%. As of 2020, the number of trips driving less than 5 km was 145 million, which is a tenfold increase compared to 2015.

Distribution of Kakao T passengers by distance traveled

- 3.2%
- 8.8%
- 26.2%
- 32.2%
- 29.6%

Legend:
- Less than 5 km
- 5 to 10 km
- 10 to 30 km
- 30 to 50 km
- Longer than 50 km

The ratio of passengers who traveled less than 5 km

Ratio of short-distance passengers (%)

40
30
20
10

2015 2016 2017 2018 2019 2020s 2021

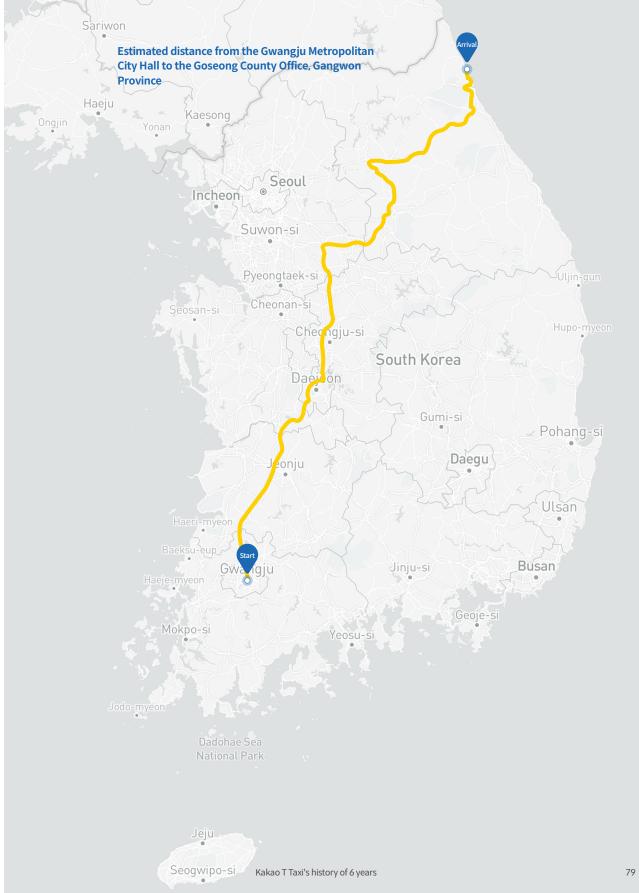# Kakao T Taxi's
Guinness book

For the past six years, Kakao T Taxi has seeped into people's daily lives in various ways. It is thus no exaggeration to say that everyone has at least one different story to tell related with Kakao T Taxi. Through the six-year Kakao T Taxi driving record, we'd like to share how users and drivers of Kakao T Taxi use the service in a variety of ways.

No. 1 in terms of driving distance, from Gwangju Metropolitan City to Goseong, Gangwon Province

How far can you reach with a taxi? The user who made the longest trip with Kakao T Taxi was one who traveled from Gwangju Metropolitan City to Goseong County, Gangwon Province. The travel distance was 500 km and it took 5 hours to get to the destination.

Given that nearly 40% of Kakao T Taxi users ride a taxi to travel less than 5 km, wouldn't this experience remain a special memory for both users and drivers?

Estimated distance from the Gwangju Metropolitan City Hall to the Goseong County Office, Gangwon Province

Arrival

Start

The most expensive mid-sized taxi fare, 500,000 won per ride

How much is the most expensive mid-size taxi fare in the history of Kakao T Taxi? Based on the app payment fare, there is a record of running up to 500,000 won at a time. In the evening time, the user who made an app payment call from Yeosu, South Jeolla Province, arrived in Seoul after riding about 360 km in 4 hours. Until June 2021, there was a total of four cases with fares running more than 500,000 won, an average travel distance of about 351 km, and an app payment fare of 504,500 won.

A driver who received 3,390 picks

Who is the Kakao T driver with the highest number of user rating "Meet this driver again"? Since this feature was introduced in May 2020, there is a driver who made 3,390 repeat customers. He is still with Kakao T Taxi since he joined the platform on April 25, 2015.

A driver who fulfilled the highest number calls (38,732)

The driver who fulfilled the most Kakao T Taxi calls completed 38,732 trips by June 2021. For reference, the average of the top-ten drivers completed cumulative 29,513 Kakao T Taxi calls, and to become Top-100 drivers, a cumulative total of 22,500 calls has to be made.

358 drivers who have been with us from the start of Kakao T Taxi

Who are the drivers who have been with Kakao T Taxi for the longest time? From the launch on March 31, 2015 to June 2021, 358 drivers have been working without a break even for a month. If we narrow the scope a bit down and list drivers with more than five years of experience, the number is 68,297. This is about 30% of the 230,000 taxi drivers nationwide. About a third of taxi drivers across the country have relied on Kakao T Taxi for over five years.

Kakao T Taxi's next destination: Future Mobility

Kakao T Taxi to open the era of eco-friendly mobility

With technology, Kakao T Taxi created a new taxi culture. By changing the way taxis are run and used in line with regulatory changes, we have taken the lead in diversifying services. Through Brand Taxi, we have continued to strive to disseminate the standards of innovation beyond simple call brokerage. Users have accepted more convenient and reliable taxi services based on a mobility platform faster than those overseas.

Now, thinking about the next destination for Kakao T Taxi, we look back at the evolutionary process of mobility. Mobility is a means of arriving at a destination, but it takes time and sometimes creates inconvenience and burden on the environment. Kakao T Taxi is taking one step further toward better mobility by cutting down or applying technology to taxis.

The full-scale deployment of LP gas-fueled taxis began in the 1970s, and it has been 50 years since LP gas has established itself as the most common fuel in the taxi industry. Since it is a commercial vehicle that travels long distances every day, it seems natural that low-cost LP gas became the preferred choice among fuel options such as gasoline, diesel, and LP gas. Above all, however, until low-cost LP gas was supplied to taxis, the government's energy policy, which took into account appropriate energy supply, national finances, and policy considerations for major consumers, had a major impact. Relatively low fuel tax compared to other energy resources, fuel tax exemption for LP gas taxis, and restrictions on LP gas use other than taxis, which were abolished in 2019, are the most notable examples.

Beyond the LP gas era of the past 50 years, a change in taxi fuel has now begun. Its main character is none other than electricity. Through the subsidy scheme reform in 2021, the government announced the subsidies for 121,000 electric vehicles, which is 20% more than in 2020, and additional subsidies will be applied to commercial vehicles with long mileage. Of these, in the case of electric taxis, a subsidy payment of up to 18 million won will be paid by putting together all the support programs of the central government and local governments. In step with the global trend, Kakao T Taxi participates in the revitalization of electric taxis and expects more than a change in energy source.

Freedom on the road driven by electric taxis

The popularization of electric taxis will above all liberate the urban environment. Since taxis have a daily driving distance of 7 to 13 times longer than that of regular passenger cars, it is estimated that the effect of improving the environment is high when a large-scale conversion to electric vehicles is realized. According to the Seoul Metropolitan Government, when a regular passenger vehicle are converted to an electric vehicle, the amount of greenhouse gas reduction is 1.6 tons. The greenhouse gas reduction effect of electric taxis, which will be introduced in the near future, is highly anticipated. The National Institute of Forest Science estimated that one cherry blossom tree planted as a roadside tree in Korea can offset about 9.5 kg of carbon dioxide per year. An arithmetic comparison shows that every time a taxi is converted to an electric one, it plays the same role as 2,200 cherry blossom trees. Still, there are voices that the environmental improvement effect is not significant from the perspective of "well-to-wheel" that encompasses the entire production and consumption process of electricity and electric vehicles. This will be the task for the next stage to overcome by all industries concerned.

Another appeal that can be expected from an electric taxi is that it gives the passengers a sense of comfort. The internal combustion engine requires mechanical movements such as that of the pistons within the engine, the transmission that delivers the engine's power to the wheels, and the action of the propulsion shafts. It inevitably generates engine vibration, engine noise, and mechanical noise. Meanwhile, in the case of electric vehicles, there is no such vibration or noise as the battery and electric motor perform this movement without any mechanical action, making passengers feel more comfort without vibration and noise. The absence of mechanical parts also contributes to making the interior space more comfortable, giving passengers a sense of freedom. Since there is no combustion process of LP gas or gasoline, there is no worry for the smell of fuel seeping into the interior. In other words, we are liberated from the auditory, tactile, olfactory, and visual elements that have kept us from enjoying our comfort on the move knowingly or unknowingly.

Drivers who operate electric taxis are also given special benefits, including freedom from vehicle rotation schemes that restrict the number of business days for taxis. Local governments in each jurisdiction are operating the rotation system by which they mandate holidays in certain intervals to maintain vehicles and prevent overwork of drivers. For example, Seoul has adopted a three-day rotation for individual taxis, which is a guideline to force taxi drivers to take one day off after two days of work. In order to encourage the dissemination of eco-friendly cars, however, it stipulated that no such rotation scheme be applied to electric and hydrogen taxis beginning in November 2020. This is an area in which one can expect a more flexibility in mobilizing drivers that meets the demand for taxis along with the faster spread of electric taxis.
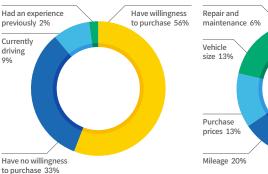
Platforms' struggle to lower barriers to entry

Despite these advantages, there was a high barrier to entry for drivers before the government decided to introduce electric taxis. Kakao Mobility preemptively reviewed the barriers to entry that were preventing the smooth transition to electric taxis. According to a survey on about 700 individual taxi drivers in December 2020, more than 50% of them said they had considered purchasing an electric taxi before, but it is estimated that the actual share of electric taxis as of early 2021 was less than 2% of the total.
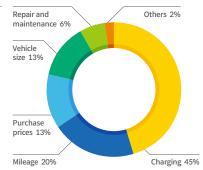
Electric taxis have begun to be part of an attractive option, but given the overwhelming concerns about charging and mileage, there is a widespread perception that they are not yet suitable for day-to-day commercial operation. Even though car makers are releasing new electric taxis with higher mileage, ample space, and high specs, the resulting resistance to high prices is expected to be the first thing to overcome.

It seems necessary to further raise awareness about the strengths of electric taxis. Drivers who do not yet own an electric taxi agree on the advantages of being freed from the rotation scheme and high fuel efficiency. But the superiority in ride comfort and driving performance experienced firsthand by drivers who do own an electric taxi is not well taken into consideration.

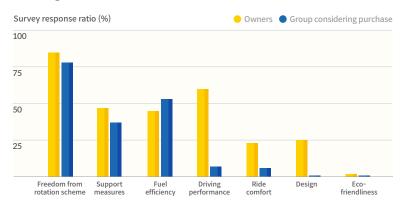**Willingness to purchase an electric taxi and driving experience**

Had an experience previously 2%
Currently driving 9%
Have willingness to purchase 56%
Have no willingness to purchase 33%

Considerations when purchasing an electric taxi

Repair and maintenance 6%
Others 2%
Vehicle size 13%
Purchase prices 13%
Mileage 20%
Charging 45%

Advantages of electric vehicles

Survey response ratio (%)   ● Owners   ● Group considering purchase

Chart categories: Freedom from rotation scheme, Support measures, Fuel efficiency, Driving performance, Ride comfort, Design, Eco-friendliness

What Kakao T Taxi first attempted at this point was to establish a dedicated distribution channel and spread the word about the benefits of electric taxis and related information. Although many drivers are accessing news about the taxi industry every day, it is still difficult for older drivers to quickly receive information through digital channels. It is a different story if it is the Kakao T Taxi driver app that one accesses every day. In March, the Kakao T Electric Taxi Store was opened, where information on electric taxis can be accessed through the driver's app, purchase applications are made, and even Kakao T Blue membership applications are available.

Special subsidies are provided to relieve the burden of purchasing an electric taxi for drivers who joined the Kakao T Blue membership through the electric taxi store and applying for an electric taxi. In addition to subsidies from the central government and local governments, through partnerships with domestic car makers that are contributing to the revitalization of electric taxis, we made sure that drivers can receive benefits at the time of initial purchase. Pro membership drivers can also benefit from affiliate services within the driver app. In addition, we are running a dedicated charging membership that allows convenient charging at a reasonable cost. Based on gas stations and LP gas filling stations, we guide drivers to affiliated rapid charging stations with good locations and convenient amenities, and offer a card that can be used to charge at a member price.

Such efforts are leading to results such as the expansion of the electric taxi market in Korea. As of October of this year, it is estimated that there are about 4,000 electric taxis in operation across the country, and more than 50% of them are driven by Kakao T Taxi platform drivers who are active as Kakao T Blue or Pro membership. In particular, it was found that the number of electric taxis more than tripled after the opening of the Kakao T electric taxi store in March. No doubt, it was the outcome of the concerted effort by the government, the electric vehicle-related industries, and the drivers that paved the way and accommodated the new technology and culture.

The change in energy sources that we faced in decades still demands a lot of tasks to solve for the taxi industry. First, the procedure to purchase electric taxis is still exceedingly complicated. It is difficult to compare at a glance electric vehicle models of domestic and foreign makers, which are being released one after another, and it is hard to gauge whether they are suitable for taxi operation. This is because it is not clear whether some parts are compatible with those of other taxis, and there are other factors to consider than other fossil fuel-based passenger vehicles, such as battery warranty period. If one extends the options to the LP gas models, it is even harder to compare the benefits of electric taxis, including subsidies, charging costs, and maintenance expenses. In addition, in order to apply for subsidies, which is indispensable for purchase, it is necessary to visit the car maker's sales office in person and submit an application, which makes the process one step more time-consuming.

Although the lifespan and residual value of electric taxi batteries are the key components of the projected operating cost, they are still in the dark. For business operators that deal with vehicles in large numbers, such as corporate taxi companies, it will be a very important area to control cost by understanding what the battery lifespan will be and what the market value is for each vehicle. Once these issues are cleared up, the optimal management plan or business operation plan can also be reviewed.

Even though the pace of EV charger installation is accelerating, an easy charging method like charging LP gas is still not in reality. Due to the lack of accuracy, real-time gauge, and predictability of charging information, drivers are forced to drive based on intuition, which is a huge barrier to entry for electric taxis. There is a trend toward integrating charging cards for each charging service provider to make them compatible across network stations, but the inconveniences that charging rates are different depending on membership status or card type still remains a task. In the case of corporate taxis, it is difficult to find an equilibrium point between cost and utility as charging must be made during the day and night shift time along with the burden of installing chargers in the premises.

It is a time when more friendly and intuitive electric taxi solutions are called for taxi business operators. Providing integrated planning across the purchase, maintenance, and charging of electric taxis can be a contribution to make as a mobility platform. Can electric taxis indeed become the next-generation leaders in the taxi market? The platform's struggle will continue until the moment when encountering an electric taxi after one calls a taxi it feels no longer strange.

Platform's challenge towards fare system optimized for context

In the first half of 2019, hundreds of taxis gathered on the roads in various parts of the country, including Seoul, Incheon, and Gyeonggi Province. That was because the newly changed taxi fare had to be manually adjusted on the meter. For this reason, electric meters are sometimes called "computers not connected to the Internet." In Seoul alone, it was reported that it took 4 billion won for the replacement cost of about 8,000 meters for 10 days. In addition, to computerize taxi operation records, to enable IC card payment, and to respond to simple repair needs, taxis had to give up their business and moved to a place where they could have their meters fixed.

In July 2020, a year after that, Kakao T Blue started running a software-based meter for the first time in Korea for medium-sized taxis. It has been the first time in 100 years since the first mechanical meter in Korea was used in taxis in 1921. It is a program that calculates fares through GPS-based location finder technology, and it can be run on a smartphone app without a separate metering hardware device. For this reason, it is also called a "mobile meter." Although it has been used in high-end taxis such as Kakao T Black for more than five years, it has a special meaning in that it was introduced in mid-size taxis, which account for 98% of all taxis. With the enforcement of related laws in February 2022, mobile meters are expected to create another new experience in the market.

The mobile meter of Kakao T Taxi, the first app meter for medium-sized taxis

The mobile meter of Kakao T Taxi is free from various restrictions from installation to operation compared to the conventional electric meter. First of all, there is no need to prepare a separate space within the vehicle for installing the meter or to connect unwieldy cables. In addition, there is no need for any separate operation as long as one receives a call, picks up a user, and then starts driving. This is because tolls, late-night and intercity surcharges are automatically counted through traffic information and real-time location data. Not only can the driver use it conveniently, but the user does not need to have any doubts about the rate.

It makes one quickly respond to changes in policies and industry environments, such as change in fare plans. The mobile meter can be updated and transmitted easily over the Internet just like a regular mobile app. In the event of a change in the rate plan or an error, it is possible to take action without a visit to the meter store or the calibration center as in the past.

The mobile meter is easy to manage data such as meter sales information. Taxi operators must check business information for book settling and transmit data to the national taxi operation information management system to comply with the scheme to take 100% of drivers' daily earnings. With the use of the mobile meter, there is no need to go through the personal computer storage process, and the risk of data loss due to the computer's mechanical errors can be reduced. With an appropriate level of smartphone data plan, one can use all these features without paying additional network equipment or data cost.

One of the major advantages of mobile meters is that one can freely check various information such as fares not only on the driver's smartphone but also on the user's device. Anyone who has ever ridden a taxi will remember that they looked up at least once to check the fare on the electric meter. In a situation where the meter runs too high or surcharges are suspected, both the driver and the user often feel a bit awkward when they look up at the electric meter. Now, the day is numbered when one can check the fare comfortably in the palm of one's hand.

The value of the meter, which is a taxi fare measuring tool, is directly linked to the way fares are measured in ways to maximize user utility, i.e., the fare scheme. Until now, the authority to set meter rates has been given to each local government and has been run within a uniform structure for each local government. However, through the amendment to the Passenger Vehicle Act, which took effect in April of this year, platform operators are subject to the self-regulatory rate reporting system not restricted by existing regulations. In order to implement these policy changes in reality, the mobile meter will act as the core component. It is difficult in reality for an electric meter that requires manual manipulation whenever a new rate plan is reviewed, but it is possible if it is the mobile meter that can be updated online and implement various functions.

Kakao T Taxi is considering various experiments to develop a fare scheme in response to users' needs based on mobile meters. One of these attempts is the pre-payment taxi service, by which the user gets on the taxi after determining the fare when calling a taxi and paying first. It aims to liberate itself from conflicts related to fares, such as doubts about overcharging, disputes over driving routes, and meter manipulation. In the case of the ride-hailing shared taxi service, which has recently been attracting attention, it will require intense consideration of the optimal fare determination and payment method.

Pre-paid taxi service that offers a more comfortable ride

The first priority to provide the special value of mobile meters to all users will be its popularization. Until now, electric meters have played an important role at the center of taxi business. In addition to measuring fare, it has supported the driver's book settling, driving record storage, and card payment records. In order to fulfill its role as an alternative to the electric meter, it is taking on the challenge in partnership with industry participants including taxi operators and the government. Now, there is no need to be alarmed if there is no meter in sight in the taxi one called. That's because the meter is already in the smartphone one is holding.

From RSE to PBV, imagining the next generation of transportation optimized for the platform

"Hello. Ryan. Thank you for using Kakao T Taxi."
A display welcomed me as I got on the taxi. The driver's information is shown on one side of the display, and the destination and travel route are shown on the other side of the display. When I took a taxi, there were many times when I was anxious about whether it would make a detour and run the meter, but it is reassuring to see the route right in front of my eyes. It also informs me in real time of the "estimated time of arrival" and the "road condition" to my destination. Fortunately, I think I will arrive on time.

When I am bored while on the move, I can enjoy entertainment contents Kakao offers through rear-seats entertainment (RSE). I can watch my favorite videos or listen to latest songs. If a child is on board, I can play customized kids content. Just like that, RSE started with a question, "What kind of taxi service is needed for pleasant, convenient, and smart mobility?" If so, in what way can RSE be used?

Imagining a better taxi experience

RSE can help with "communication." For example, after telling the user of the route in advance, the user can directly change the route to the desired one directly from RSE. By using the AI speaker Kakao i, it is more advantageous to communicate with the hearing impaired or foreigners by converting the conversation into a message and using the translation feature.

A safe and convenient payment system that more and more people are looking for due to COVID-19 can also be built using RSE. In this contactless era, one can pay by card or mobile payment app through RSE's payment system without exchanging the card with the driver. Foreigners can also use WeChat Pay or PayPal to make payments on taxi fares easily without changing money.

RSE can also be used to create the most suitable boarding environment for the user. For example, one can easily control the temperature of the air-conditioner, run the heated seat, and adjust the music volume all through RSE. In a moment of personal danger, extreme situations can be averted by pressing the emergency call button on the RSE to inform the outside of the situation in the taxi.

Although not all the features above have yet been implemented in RSE, we plan to introduce them one by one through service updates. The day when daily life using taxis will become smarter, more enjoyable, and more convenient will continue to be moved up.

RSE installed on Kakao T Blue (top), RSE map view installed on Kakao T Blue (left), and content service screen (right)

Kakao Mobility's effort to turn taxi into "data sources"

In order to create a new "mobile experience," it is necessary to convert a taxi into a data source. To do so, not only software but also hardware technology must be supported. Kakao Mobility does not simply stay in the form of an app, but is constantly changing the brick-and-mortar mobile device, or the taxi hardware itself, to fit the mobility platform. A separate "terminal" is installed on the meter for app payment made by users and data are transmitted to the cloud. Meanwhile, a separate device is installed for taxi drivers to acquire and deliver vehicle on-board diagnostics (OBD) and driving information. In order to show users the vehicle's route, "vehicle-driver-meter" is linked as a series of data through RSE.

In the future, the air quality sensor can measure the indoor air of the vehicle to manage the vehicle environment more smartly, and advanced driver assistance systems (ADAS) can help drivers drive safely. Through a special sensor, the driver's driving habits or vehicle riding comfort will be objectively measured and utilized for a better moving experience.

The evolution of Kakao Mobility that transcends hardware and platform boundaries

It is now the "era of great convergence between hardware and software." The major players on the cutting edge of information technology around the world are investing heavily in online platforms as well as offline hardware. Google, the world's largest technology company, recently announced that it would manufacture its own chipsets. It is a declaration that a technology company will not only go into smartphone manufacturing, but also the manufacture of semiconductor chips. New electric vehicle makers such as Tesla and NIO have strength not only in hardware but also in software technology capabilities. In response, conventional automobile manufacturers such as Volkswagen, GM, and Hyundai Motor are entering the platform business on their own. It implies that the boundary between hardware and platform is blurring.

Global mobility platforms are also making continuous efforts to improve their hardware. DiDi, one of the largest mobility platform companies in China, collaborated with BYD to develop a "dedicated purpose-built vehicle" (PBV) called D1. Already, they are actively moving to expand their business toward manufacturing, such as establishing joint ventures with various conventional manufacturers. Users of DiDi can adjust the air-conditioner temperature or select music through the app in advance before getting on the car, and all vehicles are equipped with automated doors.

Kakao Mobility is also moving fast to adapt to the change. Kakao T Venti announced its start. In order to maximize user satisfaction, a strategic collaboration was carried out with Hyundai Motor from the initial stage of the Staria model development, creating a separate trim for mobility service for the first time in the industry. Retractable running board, a 17.3-inch roof monitor, and smart power sliding doors were installed.

In addition to taxis, Kakao Mobility has already accumulated many hardware capabilities, such as self-driving, Kakao T Bike, and TCP parking system. Some of the team members complain that they have an identity crisis as they face too many hardware development projects in a technology company. Still, all doubts are cleared up if we think about our vision. Our challenges and evolution will continue without any limit given our vision is for everyone's enjoyable and smart mobility. Who knows? In a not distant future, a car manufactured by Kakao Mobility may crisscross the road and the sky.

The first challenge to commercialize autonomous mobility in Korea

For-fee autonomous mobility in Sejong

What comes to your mind when you hear the word "autonomous mobility"? A distant future, sci-fi movies, technology that is far off, or even the Korean drama, "Start-Up"? Still, there are many people who consider autonomous mobility are a thing of the distant future. Surprisingly, autonomous mobility service is currently available in Sejong City, Korea.

Since December 2020, Kakao Mobility has provided Korea's first for-fee autonomous mobility in Sejong City together with Autonomous a2z, a leading self-driving solution provider. Currently, it is being provided as a self-driving shuttle service, and it can be easily used with the Kakao T app.

The beginning of Korea's first for-fee autonomous mobility

Booking for autonomous mobility   **Booking completed**

There is a unique bus stop that can only be found in Sejong City. This is the stop where one can use the paid autonomous mobility. As of October 2021, the stops are installed near the National Sejong Library, the Ministry of Trade, Industry and Energy, the Ministry of Land, Infrastructure and Transport, the Korea Institute of Public Finance, and the Sejong City Hall. Since it is a pilot service, the autonomous mobility service is currently available for selected passengers only. After a brief maintenance period, we can expect the service to be open to the public.
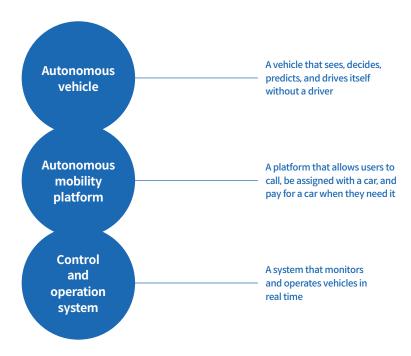
Sejong autonomous mobility stop

Autonomous mobility created by platforms, startups, and citizens together

The autonomous mobility system consists of ① a vehicle that can perceive, determine, and predict on its own; ② a dedicated platform for on-demand autonomous mobility service that allows for a seamless dispatch and payment; ③ and a monitoring system that oversees the autonomous mobility operation real-time.

With the experience of providing the first autonomous mobility in Korea based on its advanced technology, Kakao Mobility launched the Autonomous Mobility Alliance Program in September 2021. In partnership with high-caliber partners who have participated in the Autonomous Driving Alliance, Kakao Mobility is developing domestic self-driving technologies and services, and is growing the ecosystem.

Autonomous vehicle — A vehicle that sees, decides, predicts, and drives itself without a driver

Autonomous mobility platform — A platform that allows users to call, be assigned with a car, and pay for a car when they need it

Control and operation system — A system that monitors and operates vehicles in real time

Autonomous driving technology and services are being created together with partners, Safety Driver that makes autonomous driving safer, government officials who are building the autonomous driving service legal framework, and users who are interested in autonomous mobility. In the case of Sejong, it is under development jointly with Autonomous a2z, a domestic self-driving solution developer.

Han Jihyeong, CEO of Autonomous a2z
"Through collaboration with Kakao Mobility, we solved two problems at once: user accessibility and payment system. Recently, along with Kakao Mobility, we introduced a for-fee autonomous mobility for the first time in Korea in Sejong City. We look forward to making it easier for anyone to use autonomous mobility nationwide with the various autonomous vehicle platforms owned by both companies in the future."

Safety drivers, who are responsible for the safety of the passengers, are also at the forefront of the autonomous mobility industry. They receive a thorough safety training to prepare for any unexpected situations during rides.

Safety Driver, Im Miran, manager, Autonomous a2z
"Our self-driving cars are better at self-recognition, decision, and control in areas that humans might miss, and obey road traffic rules better than humans. Still, we encounter corner cases on the road where the car does not properly respond, and in that case, the safety driver manages the situation with the highest priority to the passenger safety, also giving explanation to the passengers so that they know what is happening. I remember a user who hopped into our self-driving vehicle and fell asleep shortly thereafter. It made us feel good that he trusted our safety technology and fell asleep comfortably."

Since its launch, we have received many honest feedbacks and generous support from many users. In fact, the voices of users who have used the service more than 10 times in Sejong are as follows.

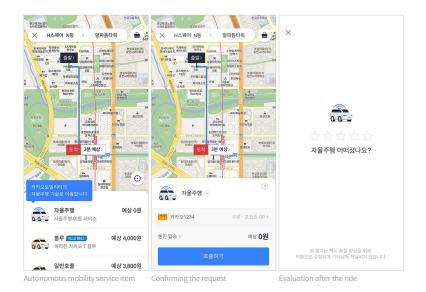Mr. Yoo, a Sejoing City citizen
"When riding a self-driving vehicle, it was more comfortable and stable than I expected, so I continue to use it. Personally, if autonomous vehicles are equipped with a massage chair in the future, it would be much better. Currently, the service is based on only a few number of stops, I think I will use it more often if I can call the service from where I live or work."

Based on users' interest in autonomous driving services, cooperation with excellent partners, and Kakao Mobility's technological capabilities and safety policies, we will strive to advance autonomous driving technologies and services.

Pangyo autonomous mobility, the future is here

Through the driverless service, Kakao Mobility is dreaming of a future where anyone can move freely without worrying about driving or choosing means of transportation. We plan to provide a mobility service that combines various services and entertainment contents so that the autonomous vehicle itself can become a multi-purpose private space for passengers. To fast-track the future, Kakao Mobility will continue to provide autonomous mobility to help technological advancement, while building close relationships with various service/content providers.

In the second half of 2021, Kakao Mobility Corp. is launching Korea's first fully flexible autonomous mobility service that does not have pre-defined stops and designated routes. Unlike in Sejong City, where passengers wait at a stop for the autonomous vehicle to arrive, the autonomous mobility in Pangyo can be used by anyone and without designated stops. The 'autonomous mobility service' icon will soon appear on the existing Kakao T Taxi.

Autonomous mobility service item   Confirming the request   Evaluation after the ride

Going beyond taxis to MaaS that will be a building block of smart cities

Kakao Taxi, which was launched in 2015, began to transform into a mobility platform with the release of Kakao T in 2017. Beginning in 2020, the connection with the metropolitan transportation system has begun in earnest, and it is taking a step forward as a mobility-as-a-service (MaaS) platform . Kakao Mobility continues to accumulate technology and service capabilities to make MaaS a reality that will lead the city of the future.

MaaS is becoming a reality

Blueprints have already been presented for MaaS, which means a service that provides an integrated means of transportation suitable for the optimal movement needs of users. It is still, however, a matter of the future to implement it so that users can actually feel it. In order to advance the future, Kakao T is launching services one by one that users can experience firsthand.

Mobility services for drivers such as Navigator, Driver, and Valet Parking began to be established in Kakao T, and the range of mobility services has been expanded to include shared bikes and shuttles. From 2020, Kakao T began to provide wide-area transportation services in earnest, moving forward as a MaaS platform that encompasses the end-to-end mobility.

The connection to wide-area transportation started with "Kakao T Intercity Bus" (launched in September 2020) and continued with "Kakao T Train" (launched in February 2021). The whole process, from booking to payment to ticketing, has become possible through Kakao T. MaaS, which can be used by organically connecting with various services within the Kakao T platform, before and after using trains and buses to the transfer process, has started in earnest.

In June 2021, the launch of "Kakao T Air" raised the level of perfection of the MaaS platform. By linking various means of transportation within Kakao T with airlines, it is possible to maximize the convenience of air travelers, and work with related mobility service providers to expand the market.

The linkage of wide-area transportation means is a process of integrating the fragmented transportation modalities from the perspective of information. In order to use wide-area transportation such as train stations, bus terminals, and airports, organic connection with taxis, city public transportation, and private

cars is essential. Currently, Kakao T provides notifications according to the departure and arrival times of trains and buses, and suggests connecting means of transportation such as taxis and public transportation. After integration from the perspective of information, booking and payment will be integrated to double the convenience of mobility.

Kakao T train alert talk screen

Kakao T flight link service screen

The MaaS platform to be created by Kakao Mobility will evolve to fit the future city that Kakao Mobility envisions. The future city that Kakao Mobility envisions is a smart city that evolves based on massive data and systems based on them rather than erecting buildings with bricks and mortar. More specifically, it is a city that is data-driven, minimizes unnecessary movements, and allows anyone to move easily and safely when a need arises.

The smart city envisioned by Kakao Mobility is one built on data. In other words, it is a city where optimal movement based on all data on the city has become routine. It also includes the accumulated data of Kakao Mobility such as Kakao T Taxi and Kakaonavi. By utilizing all data generated throughout the city, from all means of transportation, people and objects, to buildings, roads, weather, and even future prediction data, the optimal transportation service can be offered. Ultimately, as every movement in daily life is optimized, all users need is input a destination into the MaaS platform, and they will move toward a world where they can move anywhere they want.

For example, suppose that one travels from Seoul to Busan using Kakao T in the near future. Kakao T will suggest the optimal itinerary and means of transportation from home to the final destination. From home to the train station, take a self-driving taxi, and in Busan, where you arrive by a train, use the self-driving shuttle with dedicated lanes directly connected to the station to move quickly. After getting off the shuttle, one picks up an electric bike suitable for the uphill road to the destination. In this way, the movement from the origin to the final destination can be optimized. This is a future scenario that can only be possible after becoming a city built on data.

Future mobility service where things and services move

The next is a city where no movement is necessary. Mobility is only a means to achieve a purpose, but in order to move, many inconveniences must be tolerated. Kakao Mobility intends to realize ways that can achieve its purpose without moving.

To this end, Kakao Mobility is currently using its technology and service capabilities to minimize the need for movement. With the optimal matching system and the advancement in the navigation system, we continue to reduce the travel time. Recently, we are also collecting big data related to the movement of things by providing Navi's API to the logistics industry.

If the current direction of technological development continues, objects and services will move according to needs instead of people moving in the future. One can call the office to work, call the cafe if one wants to drink a tea, and call the gym if one wants to exercise. If there is something to buy now, one can call the store and pick it up right away. In this way, unnecessary time and worries about moving to a physical location will be reduced drastically, and one will be able to focus more on raising the quality of life.

Future mobility service where things and services move

Source: If Kakao 2020

Finally, it is a city where all residents can move easily and safely. Everyone can move freely and moving safely is close to catching two birds with a stone. For example, when safe transportation is costly, it can also pose as a barrier to entry for some, preventing access to the privilege of transportation. Therefore, the key to more universally providing safer services lies in technology.

Kakao Mobility dreams of being able to move easily and conveniently even for those who have difficulty accessing means of transportation, such as children, animals, the disabled, and the elderly. To be able to do this, it is essential to provide more efficient and smart mobility services using self-driving, AI, and big data technologies. Through the MaaS platform, self-driving vehicles, delivery robots, and personal aerial vehicles (PAVs) will become more common in the future, making it easy to use anytime anywhere. Smarter cities where no one is left behind will be possible through technology-based safer and more accessible mobility services.

Kakao T Taxi, which started as a taxi call brokerage service in 2015, has now grown into a mobility platform beyond taxis. To realize MaaS for a future city where everyone can move easily, conveniently, and safely, we will continue to accumulate technology and service capabilities.

Kakao T Taxi from the perspective of ESG

Kakao T Taxi, which has instigated numerous innovations in taxi service, is also pursuing innovation from an ESG point of view, producing considerable social achievements.

Kakao Mobility, in cooperation with the Gyeonggi Nambu Police Agency, has implemented a service called "Dong Report System" in some areas of the province since March 2016. When a missing person is reported to the police due to a situation requiring urgent rescue, such as a child or an elderly person with dementia, the police transmit information about the missing person to Kakao Mobility. It is a system by which Kakao Mobility provides missing persons information to taxi drivers operating in the area in question, and reports are made when a taxi driver sees the missing person.

Thanks to the system, the police were able to rescue three people, including an elderly person with dementia, in the southern region of the province within one year of implementation. Separately, there was a case in which a burglary suspect was arrested. In September 2020, a woman who had disappeared in Gwangmyeong was able to return to her family after a tip from a taxi driver who received a Dong Report message. The woman in question did not have a cell phone, so it was difficult for the police to locate her whereabouts. After 10 days have passed, the police requested Kakao Mobility to send a Dong Report message. Kakao Mobility complied and sent a Dong Report message to about 3,500 taxi drivers operating in the Gwangmyeong area, and was able to rescue the missing person with a taxi driver's tip within 5 hours.

Kakao Mobility's messages are not transmitted to all registered taxi drivers, but are sent only to the estimated missing areas based on the location-based system, so taxi drivers do not consider the message as a spam and thus increase the level of attention. The state-of-the-art platform technology was praised as an example of helping society to strengthen public order, and the Gyeonggi Nambu Police Agency won the Presidential Award at the Government Innovation Excellence Competition.

Recognizing the system's excellence, the National Police Agency signed an agreement with Kakao Mobility to deploy the system nationwide beginning in

January 2021. As a result, seven elderly people with dementia and children were rescued for six months after January 2020. By utilizing the coverage of the Dong Report system to prevent serious crimes that require an emergency response, three suspects were arrested, including perpetrators of robbery and attempted rape, and a runaway who broke an electronic anklet.

In the environmental area, Kakao Mobility is also making efforts for the planet. First of all, for the dissemination of eco-friendly electric vehicles, it signed a business partnership agreement with Kia Motors to promote electric vehicle sales and is operating an electric taxi-only store. It plans to pay subsidies upon purchase of an EV and provide customized solutions for electric taxis. It is also taking the lead in reducing paper receipts through an app payment system within the Kakao T application.

Kakao Mobility is continuously expanding its effort to improve the working environment of taxi drivers. It signed in April 2021 a business partnership agreement with Shinhan Bank to provide customized financial services, such as loans with preferential interest rates, to taxi drivers and employees of affiliated taxi business operators. Kakao Mobility plans to continue expanding its win-win growth effort with taxi drivers.

Epilogue

Riding on a taxi on the road in the early days | Source: Seoul Archives Digital Archive

Taxi is an industry in which various and very detailed regulations are imposed in the areas of business such as licensing, appearance, and fare. The reason the government has actively intervened in the affairs of the taxi industry is that it is the best thing for raising consumer welfare under the assumption that taxis are roaming on the street picking up fare customers.

It was a big deal in terms of social trust for customers to be able to hail a taxi on the road and ride in it safely, even though we took it for granted for decades. It was possible because the government made the appearance and price of taxi fare uniform and regulated the identity and qualifications of taxi drivers, which was the raison d'etre of government regulations.

Still, there are also downsides to this. The government regulation was unable to quickly catch up with consumer demand and technological change, resulting in the down-leveling of taxi services. Because of this, various problems have been accumulated without being resolved in the market. In terms of demand, the market was created mainly for medium-sized taxis that were uniform in terms of service, which limited consumers' choice in terms of price and service. Of course, in addition to medium-sized taxis, the government has introduced different taxis such as light, small, large, and deluxe taxis to encourage market diversity. The environment for riding taxis that users want was not created, however, and this acted as a limiting factor for establishing various taxi services.

From the supply side, there was absolutely no incentive to differentiate services because price, the key factor in competition, was within the government's control. To discover the needs of users and build a business model around it, it is essential for entrepreneurs to think very hard and execute everything right. Especially when they want to differentiate the service, they must tolerate the risk of preemptive investment to bear fruit. In a situation where business operators cannot expect extra profits from service differentiation, however, it is hard to expect such investments to be made. Under these circumstances, it was natural for business operators to maximize profits by minimizing costs rather than coming up with new and better services.

A scene of corporate taxi company

In a situation where cost minimization was achieved and there was no active improvement through competition, the taxi industry increasingly faced difficulties. With the development of public transportation networks, transfer discounts, the spread of private passenger cars, and the rise of designated driving, the overall demand for taxis has declined. At the same time, as the expectations of users who directly experienced mobility services available overseas continued to rise, complaints from users about the existing taxi services such as refusal for ride were mounting.

The government was not sitting still with its arms crossed. The moves by the government for the past six years can be summarized as a "soft landing through the gradual introduction of a competitive system." Instead of introducing a competitive system overnight to the taxi market, which had been accustomed to the long-standing inertia, the system was reorganized in a way that minimizes confusion in consideration of the impact of the taxi industry on people's right to mobility and convenience. The key component of the competitive system was a "taxi that arrives after a call." With the rapid uptake of smartphones and the deployment of taxi platforms such as Kakao T, an environment in which users can select a desired taxi according to their respective needs has been gradually established.

While platform taxis such as Kakao T Blue and Venti were gradually expanding their business, the amendment to the Passenger Vehicle Act intended to institutionalize the transportation platform business took effect on April 8, paving the way for more diverse types of taxi services to emerge in earnest. The revision to the Passenger Vehicle Act newly defined the passenger vehicle transportation platform business, and classified the business into three types including platform transportation business (Type 1), platform affiliate business (Type 2), and the passenger vehicle platform transport mediation business (Type 3).

As the existing regulations were designed on the premise of roaming business, the revised bill laid the groundwork for the emergence of various services by significantly easing regulations on mobility platforms that gave users a choice of services. By accommodating new services within the system, however, rather than allowing new services without limit, a situation that may threaten public safety was averted in advance. In addition, the government made sure that it can intervene and make adjustments whenever deemed necessary to minimize conflicts between industry stakeholders.

Not only that, a new type of mobility means other than taxis was formally legalized, and the then actively expanding affiliated taxis were also reorganized into platform franchises, which significantly eased regulations on fares and tax exteriors. Through all this, it is expected that various services will be launched to address all the things necessary for users' mobility, such as the pre-paid rate plan, flexible rate plan, and subscription-based service, which did not exist before.

Even though the amendment took effect in April 2021, there were no sudden changes that anyone could feel right away. The inertia of the taxi market has been there for over 30 years, and it has only been about five years since mobility platforms such as Kakao T became a standard in Korea. It has been only about a year since "platform taxis " such as Kakao T Blue and Venti became readily available on the streets.

But the changing pace in the domestic mobility industry is getting faster by the day. As the system was reorganized, uncertainties in the mobility market have been greatly reduced, and as a result, various mobility operators are moving into the market. There are cases in which a global mobility platform joined forces with a large domestic corporation, and several companies such as a automaker, rental car companies, technology/platform companies, and start-ups have already entered or are preparing to enter the mobility market.

As the conditions for various types of services to appear within the system are ready, the competition in the mobility market will likely intensify in the future, and a new world of mobility will unfold out of this competition.

MOBILITY SERVICES FOR DRIVERS

Kakaonavi

2 years of COVID-19, how has people's lifestyle changed?

As the COVID-19 crisis prolongs, people's daily lives are also getting used to new patterns. Overseas travel was practically blocked, people use public transportation relatively less frequently , and opt to use private cars more. They tend to spend more time at home, change their consumption patterns, and look for new leisure activities to avoid the risk of contacting other people.

Here is an analysis of the lifestyles of people who have entered the second year of COVID-19, based on Kakaonavi data. We looked at the change in the amount of movement by six categories that can identify consumption and leisure life patterns such as retail, restaurant, leisure, culture, travel, and lodging.

Using Kakaonavi data, we compared and analyzed the amount of movement by category for each of the six months in the last three years, including March-August 2019, March-August 2020, and March-August 2021. Given that the full-scale COVID-19 impact started in March 2020, the starting month was set to March, and the last month was set to August, six months later. The rate of mobility increase in the first and second year of COVID-19 refers to the rate of increase in the volume of movement in March-August 2020 and March-August 2021, respectively, with March-August 2019, the pre-COVID-19 period, as the base.

Analysis method of movement change due to COVID-19

Analysis method: Calculated the change in movement volume by category based on Kakaonavi data as the rate of increase or decrease of movement volume in the 1st and 2nd years of COVID-19 compared to the reference point

· Reference point: Movement volume in Mar.-Aug. 2019
· First year of COVID-19: Movement volume in Mar.-Aug. 2020
· Second year of COVID-19: Movement volume in Mar.-Aug. 2021

Retail
Movement to meet the consumption patterns of the stay-home group increased, while duty-free shop sales for overseas travelers plummeted

Even in the second year of COVID, as the time spent at home increased, the consumer spending of those staying at home continued to increase. Retail store visits for people who spend their daily lives at home, such as convenience stores (106%, as of 2021), food sales (94%), and household goods (66%), have increased. As interest in home interior increased, visits to furniture stores (44%) and electronic goods stores (40%) continued to increase in the second year. As overseas travel has not recovered to the pre-COVID-19 level, the visits to duty-free shops (-57%) continue to decline. Meanwhile, big-box stores, department stores, and shopping mall complexes, which showed a negative trend in the first year of COVID, showed a recovery pace as visit numbers increased to a level of 6-16% compared to pre-COVID-19 period in the second year.

Restaurants
Visits to take-out restaurants increased, and visits to restaurants for group customers declined

The restaurant visit pattern is also clearly affected by the coronavirus. As we entered the second year of COVID, take-out restaurants were visited by more people than in the first year due to people's preference for convenience food. In contrast, visits to buffet restaurants (-41%), franchise western food restaurants (-11%), and food courts (-10%), which were mainly visited by group guests, decreased compared to the pre-COVID-19 period. The number of visitors to cafes (79%) increased more in the second year of COVID, due to the influence of an increase in domestic travel and telecommuting.

Change patterns in mobility in the 1st and 2nd years of COVID-19: Retail

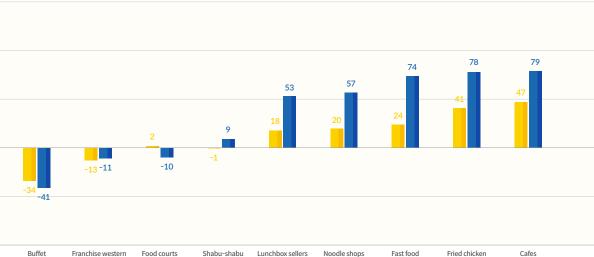Change rate against Pre-COVID-19 period (%)   ● 1st and ● 2nd years of COVID-19

	1st	2nd
Duty-free shops	-66	-57
Large supermarkets	-1	6
Department stores	-11	11
Shopping mall complexes	-4	16
Discount stores	3	16
Traditional markets	9	20
Electronic goods stores	21	40
Furniture stores	60	44
Dry goods stores	34	66
Sports goods stores	73	84
Food groceries	47	94
Convenience stores	35	106

Change patterns in mobility in the 1st and 2nd years of COVID-19: Restaurant

Change rate against Pre-COVID-19 period (%)   ● 1st and ● 2nd years of COVID-19

	1st	2nd
Buffet restaurants	-34	-41
Franchise western food restaurants	-13	-11
Food courts	2	-10
Shabu-shabu places	-1	9
Lunchbox sellers	18	53
Noodle shops	20	57
Fast food restaurants	24	74
Fried chicken restaurants	41	78
Cafes	47	79

Leisure
Golf, outdoor, and indoor exercise, which have emerged as the main trend, are still restrained

Leisure life was also affected by the coronavirus. Movement for outdoor activities such as fishing and mountain hiking, which are less likely to be affected the coronavirus, continued to increase, but movement to indoor sports facilities such as swimming pools, bowling alleys, and gyms continued to decline. Golf is in such a high demand due to the coronavirus. As overseas travel was practically blocked, the demand for golf abroad was also moving inward, and the number of visits to golf courses, driving ranges, and golf supply stores increased in the second year of COVID-19.
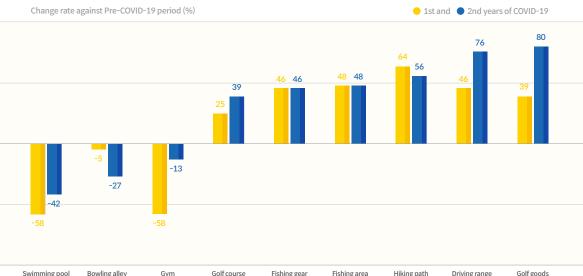
Culture
There are signs of a recovery in cultural life, but it is still below the pre-COVID-19 level, and drive-in theaters enjoy a niche boom
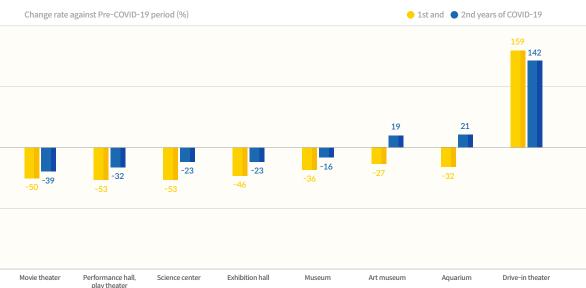
Although there are signs of recovery compared to the previous year, cultural life is still low compared to the pre-COVID-19 level. Some cultural venues, such as art museums (19%) and aquariums (21%), even surpassed the pre-COVID-19 level. However, movement to a number of cultural venues such as movie theaters, performance halls, science centers, exhibition halls, and museums is still below the pre-COVID-19 level.Meanwhile, drive-in theaters (142%) have continued to enjoy the so-called COVID-19 boom in response to the niche demand where visitors can enjoy a movie without stepping out of their car.

Change patterns in mobility in the 1st and 2nd years of COVID-19: Leisure

Change rate against Pre-COVID-19 period (%)   ● 1st and ● 2nd years of COVID-19

Swimming pool	Bowling alley	Gym	Golf course	Fishing gear	Fishing area	Hiking path	Driving range	Golf goods
-58 / -42	-5 / -27	-58 / -13	25 / 39	46 / 46	48 / 48	64 / 56	46 / 76	39 / 80

Change patterns in mobility in the 1st and 2nd years of COVID-19: Culture

Change rate against Pre-COVID-19 period (%)   ● 1st and ● 2nd years of COVID-19

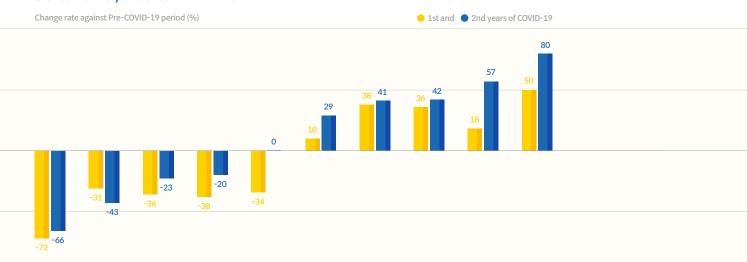| Movie theater	Performance hall, play theater	Science center	Exhibition hall	Museum	Art museum	Aquarium	Drive-in theater
-50 / -39	-53 / -32	-53 / -23	-46 / -23	-36 / -16	-27 / 19	-32 / 21	159 / 142

Travel
Away from crowded tourist traps, more toward quiet, contemplating spots

People's travel pattern has also been clearly affected by the coronavirus. The strength of domestic travels to calm the tired mind due to social distancing prolonged. Visits to scenic drives (80%), national parks (57%), islands (42%), beaches (41%), and arboretums (29%) are continuing in the second year following the first year of COVID-19. In contrast, travel destinations crowded with tourists continue to be avoided due to concerns over virus contraction. Visits to festivals (-66%), hot springs (-43%), folk villages (-23%), and theme parks (-20%) continue to fall below the pre-COVID-19 level and are unable to recover.

Lodging
Amid the strong domestic travel trend, camping and camper van rental emerged as the mainstream.

With the domestic travel demand rising instead of overseas travel blocked by the virus, the growth of camping sites (79%) among domestic travel destinations is noteworthy. It appears to be a result of the preference for camping, which allows one to have communion with nature and has a low risk of virus contraction. Visits to campgrounds are on the rise, regardless of the type of campground, including auto campsites where one can rent a camper van (69%), caravan (93%), or glamping site (123%). Meanwhile, among the existing lodging accommodations, there is a clear tendency to prefer far-apart lodgings over centralized rooms. The visit to guesthouses continued in the second year of COVID-19 following the first year. On the other hand, visits to resorts and hotels decreased in the first year, but are gradually recovering in the second year of the pandemic.

Change patterns in mobility in the 1st and 2nd years of COVID-19: Travel

Change rate against Pre-COVID-19 period (%)   1st and ● 2nd years of COVID-19

	1st	2nd
Festivals	-72	-66
Hot springs	-31	-43
Folk villages	-36	-23
Theme parks	-38	-20
Zoos	-34	0
Arboretums (botanical gardens)	10	29
Beaches	38	41
Islands	36	42
National parks	18	57
Scenic drives	50	80

Change patterns in mobility in the 1st and 2nd years of COVID-19: Lodging

Change rate against Pre-COVID-19 period (%)   1st and ● 2nd years of COVID-19

Sub-classification of campsites

	1st	2nd
Resorts	-6	2
Hotels	-17	7
Guesthouses	20	17
Campsites	71	79
Car campsites	61	69
Caravans	80	93
Glamping sites	113	123

Camping-fishing-golf, movement patterns of people who enjoy popular leisure activities these days

Camping, fishing, and golfing are among the leisure activities that have become most popular due to COVID. What is the mobility pattern of the three major leisure activity groups in the COVID-19 era? Let's find out the mobility patterns of campers, anglers, and golfers together.

Where do campers, anglers, and golfers visit the most frequently?

Top-ten destination categories for campers, anglers, and golfers

Rating	Camping user group	Fishing user group	Golf user group
1	Apartments	Apartments	Apartments
2	Parking lots	Fishing area	Golf course
3	Campsites	Parking lots	Parking lots
4	Buildings	Crossroads	Buildings
5	Car campsites	Elementary schools	Meat
6	Studios	Buildings	Korean food
7	Cafes	Reservoirs	Studios
8	Elementary schools	Studios	Driving range
9	Beaches	Traditional markets	Elementary schools
10	Meat	Subway exits	Entrances/exits (of a building)

Time period: Jul. 1, 2020 – Jun. 30, 2021 (1 year)

First, we selected the top-ten categories of destinations visited most frequently by campers, anglers, and golfers. Surprisingly, it turns out that the place they visited the most frequently are apartments. Studios, parking lots, and buildings that do not seem to have much relationship with leisure life were also ranked at the top ranks.

What does that mean? It is not that they often visit apartments, studios, parking lots, or buildings for camping, fishing, or golfing. It basically means that there is a lot of demand moving between home and work, which is why these top-ranked places to visit have come out. No matter how many campers, anglers, or golfers there are, they cannot ignore their homes and places of work.

If one looks at the other categories within the top-ten rank, their movement patterns for leisure are clearly different. The most visited places by campers were in the order of apartments, parking lots, and campsites. Car campsite (5th) and beaches (9th) were also selected as places frequented by campers. As for anglers, fishing spots came in second place and reservoirs seventh place. For golfers, golf courses were second place and driving range eighth place.

In the three groups, visits to elementary schools are common in the rankings. It was eighth, fifth, and ninth place for campers, anglers, and golfers, respectively. It can be indirectly surmised that people in their 30s and 40s with elementary school children enjoy camping, fishing, and golfing. It is interesting to note that while campers and golfers seem to enjoy eating meat, it is difficult to find restaurants that serve meat in the rankings of anglers.

Top-ten places visited by campers, anglers, and golfers

Rating	Camping user group	Fishing user group	Golf user group
1	Hanam Starfield	Sea fishing hotspot (Seosin)	Gimpo International Airport
2	Gimpo Domestic Airport	Gimpo International Airport	Lakeside Country Club
3	Goyang Starfield	Suwon Station	BA Vista Country Club
4	IKEA Goyang	Sea fishing hotspot (Manjung)	Jeju International Airport
5	Hyundai Premium Outlet Gimpo	Sea fishing hotspot (Dokdo)	Century 21 Country Club
6	IKEA Giheung	Wooil Energy Charging Station Seongbuk	Silla Country Club
7	Parking lot, Sokcho Tourist & Fishery Market	Sea fishing park (Seonjae)	Taegwang Country Club
8	Gwangmyung Station	Hwado fishing spot	Riviera Country Club
9	IKEA Gwangmyung	Hanteo fishing spot	Gwangmyung Station
10	Lotte Premium Outlet Giheung	Youngheung sea fishing spot	Sky 72 sea route

Time period: Jan. 1 – Jun. 30, 2021 (6 months)

In the previous analysis, we went a little further and picked out the places they visited the most frequently. First of all, there was no campsite in the top-ten places visited by campers. As the campsites are scattered in small numbers across the country, they did not appear in the rankings for campers. Outside the top ten, there were campsites such as Suju Palbong Campsite in 11th, Yeongok Beach Solhyanggi Camp in 12th, and Mukgye Pine Field in 18th.

In contrast, there were many fishing spots and golf courses in the top-visited places for anglers and golfers. By looking at their top-visited places, it is possible to estimate the rankings of the hottest fishing spots and golf courses nationwide. Gimpo International Airport was placed side by side at the top of the list of visited places in common for campers, anglers, and golfers. Even though there were cases where people used cars to move on land to enjoy their leisure life, it can be seen that there were quite many people who visited the airport to fly to Jeju Island instead of overseas travel. For golfers, Jeju International Airport was ranked at fourth place.

Where is the next destination for campers, anglers, and golfers?

After arriving at the campsite, fishing spot, and golf courses, we examined what the destination afterward would be like. For campers, we looked at the places they visited after departing from the campsite, while for anglers we started from the fishing spot and for golfers we looked at their destinations with the golf course as the starting point.

Top-ten next destination categories for campers, anglers, and golfers

Rating	Camping user group	Fishing user group	Golf user group
1	Apartments	Apartments	Apartments
2	Hanaro Mart	Reservoirs	Meat
3	Beaches	Fishing gear	Korean food
4	Parking lots	Elementary schools	Ribs
5	Traditional markets	Crossroads	Parking lots
6	E-Mart	Villas and townhouses	Noodles
7	Ports and piers	Studios	Studios
8	Camping suppliers	Traditional markets	Korean prix fixe meal
9	Guesthouses	Fishing spot	Seafood
10	CU convenience store	Subway No. 1 line	Chicken dishes

Time period: Jul. 1, 2020 – Jun. 30, 2021 (1 year)

The next on the list as the most visited place was apartments. Apartment was No. 1 for campers, anglers, and golfers. It seems that they came home after enjoying their respective leisure activities.

The ranking after the first place appeared differently for campers, anglers, and golfers. In the case of campers, retail stores (2nd place Hanaro Mart, 5th traditional market, 6th E-Mart, 8th camping goods stores, and 10th CU convenience store) were placed in the top ranks . It explains that there are many

people who shop for groceries nearby after arriving at the campsite. In addition, it appeared that they visit beaches or ports where camping is available or go to beaches near the campsite .

Fishermen were relatively prominent in cases returning home from the 1st place apartment, 6th place villas, row houses, and 7th place officetels. For anglers, coming back home took the largest portion, with apartments (No. 1), villas and townhouses (6th), and studios (7th) on the list. The frequency of visits to destinations such as the intersection (No. 5) and Subway Line 1 stations (10th) where one can drop off friends on the way home from the fishing trip was also high. It was notable that destinations related to fishing, such as reservoirs (No. 2), fishing goods stores (No. 3), and fishing spots (No. 9), were placed prominently in the rankings. It appears to be a case of moving to another spot while fishing or moving to purchase supplies.

For golfers, it was overwhelming to look for a restaurant. All the top-ten next destinations were restaurants for golfers: meat (No. 2), Korean food (No. 3), ribs (No. 4), noodles (No. 6), Korean prix fixe meal (No. 8), seafood (No. 9), and chicken dishes (No. 10). It shows that there are many people who visit the restaurant like a course set after playing golf.

Camping, fishing, and golf have emerged as major leisure activities enjoyed by many people to calm their tired minds in the era of COVID. Based on the result of looking a little more closely using Kakaonavi data, we were able to find various patterns of change between leisure activities that have emerged as main trends. Campers were very interested in grocery shopping, while anglers were characterized by returning home immediately after their fishing trip. It was interesting to find that many golfers go to restaurants after playing golf. Whether the camping, fishing, and golf craze will continue even in the era of "Living with COVID-19", and what kind of mobility pattern it will turn out remains to be seen.

The secret to find famous restaurants on TV with Kakaonavi data

When one watches a TV food program, one might be tempted to go visit the place. However, there are a lot of occasions where one has to wait for a long time in front of the restaurant. That's the power of TV that millions of people watch at the same time. When can you go to a restaurant featured on TV without waiting for a long time? How long will the so-called "TV effect" of famous restaurants that people talk about last? We looked at the best time to go to famous restaurants featured on TV without waiting in line, not through word of mouth or personal experiences of a few people, but through data from Kakaonavi.

Top-five TV food programs selected
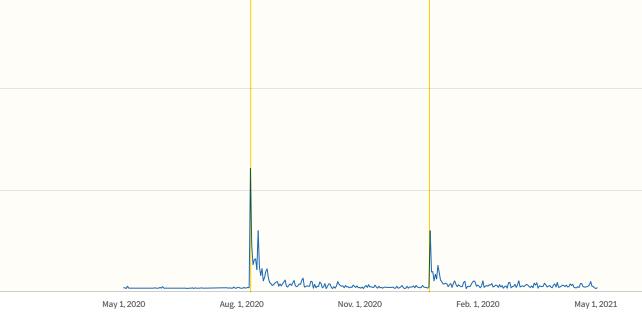
The targets of analysis were Live Info Show, Delicious Guys, Baek Jong Won's Alley Restaurant, Master of Living, and Huh Young Man's Food Travel, which were selected as five most-watched restaurant programs from major TV stations. The analysis period was about one year from June 2020 to July 2021. During the same period, there were as many as 1,349 restaurants covered in these five TV programs. The number of restaurants featured in each program was 818 for Live Info Show, 98 for Delicious Guys, 49 for Baek's Alley Restaurant, 137 for Master of Living, and 247 for Huh's Food Travel. We compared the number of Kakaonavi guides before and after the airing of these restaurants on TV. The TV effect was measured based on the difference in the maximum number of Navi guides after airing compared to the maximum number of guides before airing.
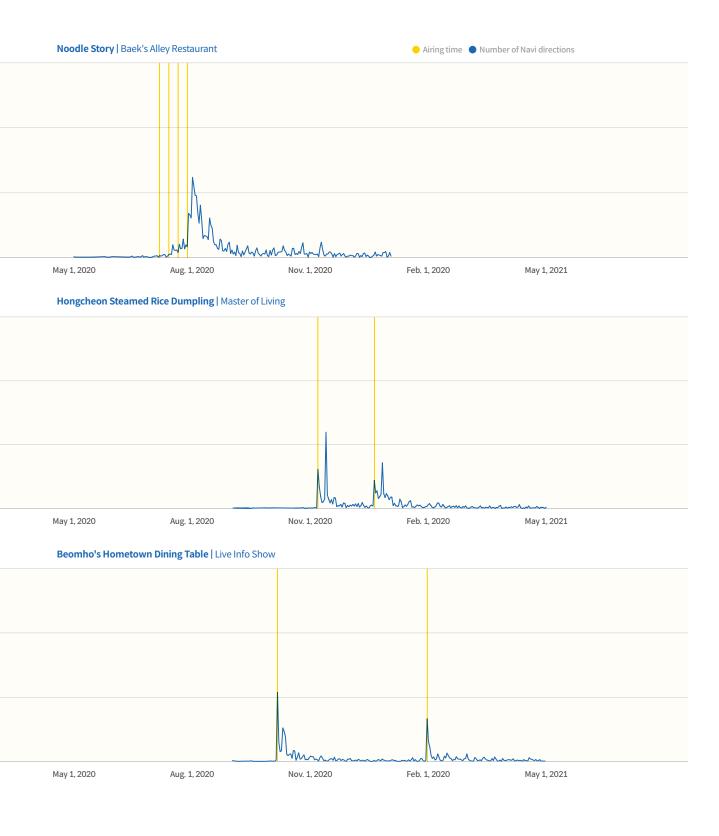
There were interesting facts were derived by analyzing data from 1,350 restaurants. It was found that there were some restaurants whose customer visits declined after TV airing. The number of restaurants that did not see an increase in the maximum number of Navi directions compared to before the airing was 260 out of 1,349, accounting for 19%. One in five restaurants featured on TV showed no effect at all, or even saw a fewer visitors after the program.

What has happened? Looking at the Navi guides of restaurants where the number of customers declined after the airing, two main types could be identified. The first type was ones that had been well known even before the airing. Regardless of the airing, they were famous and even after its appearance on TV, it did not matter a lot in terms of Navi directions. It was seen that the number of directions declined after the airing, as visitors came to these famous restaurants due to factors other than "saw it on TV."

Top-five differences in the number of Navi directions before and after TV airing

The Sinchons | Baek's Alley Restaurant

● Airing time ● Number of Navi directions

May 1, 2020   Aug. 1, 2020   Nov. 1, 2020   Feb. 1, 2020   May 1, 2021

Munjeong Sikdang | Master of Living

May 1, 2020   Aug. 1, 2020   Nov. 1, 2020   Feb. 1, 2020   May 1, 2021

Noodle Story | Baek's Alley Restaurant

● Airing time ● Number of Navi directions

May 1, 2020   Aug. 1, 2020   Nov. 1, 2020   Feb. 1, 2020   May 1, 2021

Hongcheon Steamed Rice Dumpling | Master of Living

May 1, 2020   Aug. 1, 2020   Nov. 1, 2020   Feb. 1, 2020   May 1, 2021

Beomho's Hometown Dining Table | Live Info Show

May 1, 2020   Aug. 1, 2020   Nov. 1, 2020   Feb. 1, 2020   May 1, 2021

The second type is a case where, unfortunately, there was no TV effect. In the case of some restaurants, even after appearing on TV, customers' visits were not significantly affected. It seems that the program's rating was low, or it was not dealt with very favorably in the program.

Despite the fact that there were some restaurants that saw no or little TV effect on guest visits, it was true that four out of five restaurants featured on the program benefited from the "TV effect." The top-five restaurants were selected among those that saw the TV effect and the best time to visit the restaurants without waiting in line was estimated.

After the airing, the top-five restaurants in the order of increase in the maximum number of Navi directions were as follows. The first place was "The Sinchons," which was featured in Baek's Alley Restaurant. After the first airing, the restaurant was filmed for the second time as stories about trademark rights became a hot topic. In addition to the popularity in the first airing, the trademark rights issue attracted people's attention, and after the second airing, it quickly became one of the hottest restaurants in Korea. Thanks to this effect, the number of Navi directions for "The Sinchons" recorded the highest among 1,350 restaurants featured on TV.

Following this, "Munjeong Sikdang" featured in Master of Living ranked 2nd; "Noodle Story" from Baek's Alley Restaurant ranked 3rd; "Hongcheon steamed rice dumpling" from Master of Living ranked 4th; and "Beomho's Hometown Dining Table" from Live Info Show ranked 5th. All these top-ranked restaurants had recorded a very small number of Navi directions before the airing, but afterward, the number increased at an explosive rate.

When is the best time to visit these restaurants? It turns out that most of the restaurants featured on TV are the busiest on the weekend of the week the programs aired. After the program, the number of Navi directions gradually increased, and peaked on the weekend immediately after the airing day. This is because there are many people who watch the program during the week and remember the place, then make time to visit it on the weekend. That means it is best to avoid visiting the place on the weekend of the week after the program is aired. It was found that the TV effect continued for at least three weeks although there was a slight difference depending on program.

Information on restaurants can be easily obtained through TV, but it is difficult to find information about when to visit a restaurant and enjoy the food without waiting. Kakaonavi's navigation data offers insights about it. Four out of five restaurants showed a clear TV effect. It was found that the most people visited on the weekend immediately after the airing, and the effect lasted at least three weeks. The most popular restaurants were found to be crowded with people up to two months after the airing. Kakaonavi will continue to work hard to glean new insights to minimize user inconvenience and time waste until the ultimate purpose of movement is achieved.
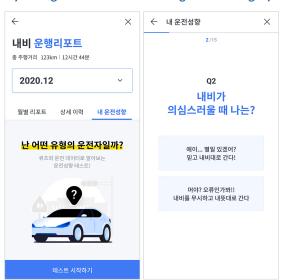
What driving habits do Kakaonavi users have?

Can't we look at the driver's "driving personality" like the MBTI, which tests personality types? Since December 2020, Kakaonavi has released the "Navi Driving Report" that tells drivers' driving patterns and habits based on data analysis. The report is a driver's version of MBTI that combines the massive mobility data accumulated through Kakaonavi and sophisticated analytics technology.

It consists of monthly report, detailed records, and my driving inclination. Through the monthly report, users can understand the total mileage driven, driving time, and number of speeding, etc. aggregated on a monthly basis. Through the detailed records, they can look at their daily driving record and data analysis results on speeding, rapid acceleration, and deceleration that occurred during driving in detail. Data on speed, rapid acceleration, and rapid deceleration can also be used to examine areas with a high risk of accidents.

My driving inclination test

In a similar way to the MBTI, the driving inclination test provides information on the driver type and driving tendency based on the user's answers to the 15-question questionnaire. It evaluates the driving inclination by describing the test taker as one of the movie characters depending on the results of the driver's survey.

My driving inclination test according to the driving report

What are the driving inclinations of Kakaonavi users? Based on the data accumulated for about eight months, it was found that about half of all drivers fell into the top-three categories. "Ki-woo" the son In the movie Parasite took the first place with 17.1%, followed by the female lead character played by Jeon Ji-hyun in My Sassy Girl came in second place with 14.0%, and a gangster capo Hyung-bae played by Ha Jung-woo in Nameless Gangster: Rules of the Time came in third with 11.5%.

User distribution according to driving inclination test

Rating	Character	Ratio	Rating	Character	Ratio
1	Ki-woo the son	17.1%	9	Dong-su	3.6%
2	My Sassy Girl	14.0%	10	Geum-ja	3.5%
3	Hyung-bae	11.5%	11	Chief Go	3.5%
4	Ki-taek the father	11.4%	12	Kwak Cheol-yong	3.2%
5	Cha Tae-sik	8.0%	13	Choe Ik-hyeon	3.0%
6	Nabdeuckyi	5.9%	14	Oh Tae-shik	2.5%
7	Ahn Sang-goo	5.2%	15	Jung Chung	1.7%
8	First Lieutenant Choi Jae-hyun	4.3%	16	Jung-gu	1.5%

Topic 1. "You have everything planned out"
[Parasite] Ki-woo the son who makes big-picture plans on what to do and where to go before every move
There is no instance where I take my car without an advance plan. You are a type to follow the navigator whenever you take your car. I get lonely a lot, but I hate being with many people, so only close friends and acquaintances get in my car. My personality is generally mild and very considerate, so I can put up with long-distance driving by myself. Maybe that's why I take my car with me whenever I travel, and make the people around me feel comfortable.

Topic 2. "Everyone, I am sorry··· I can't help but driving like this. Please forgive me"
[My Sassy Girl] The sassy girl who gets a lot of things to be sorry whenever she takes her hands on the steering wheel.
You are the life of the party! I love and take good care of my friends and family! So I like to hang out with people and love to play together! Still, I have worries! When we start out a trip, we have more fun than anyone else, turn on the music and all. But before we leave, what about an accident?··· I think it'll be okay, but I worry about things that may not happen... But only for a moment! If someone says nice things about my driving skills, I feel good instantly. I will take you home tonight.

Topic 3. I have no reason to take the wheel.
[Nameless Gangster] Hyung-bae who is calculating and cool-headed
A stubborn me who focuses on one thing only once a goal is set + a strict me who prefers something certain When I drive, I always have a plan, so I check the navigator in advance to see how long I think it will take to arrive and plan ahead. I am also very knowledgeable about cars as I love to learn everything. Even though I am an workaholic who can't stand still, I sometimes sing along to a song on a rainy day immersed in gloomy emotions.

Next, on which roads do drivers tend to speed, accelerate, and decelerate most? Just as the surrounding environment affects the formation of a person's personality, the driving habits of drivers are also affected by road conditions. We looked at which roads are experiencing a lot of over-speeding[1], rapid acceleration[2], and sharp deceleration[3], which are identified in Kakaonavi's driving report.

Top-ten roads with high speeding frequency and speed limits and average speed

Rating	Road location	Speed limit (km/h)	Average speed (km/h)
1	Mapo Bridge (south bound)	50	74
2	Hannam Bridge (south bound)	50	74
3	Entrance to Jayu Expressway	50	67
4	Hannam Bridge (north bound)	50	75
5	Mapo Bridge (north bound)	50	76
6	Route 47 near Imsong Exit	30	62
7	Exit from East Suwon toll gate	50	69
8	Exit from Janghang Expressway	50	65
9	Seogang Bridge (south bound)	50	75
10	Sangsu Bridge (north bound)	50	87

Time period: Mar. 1 - May 31, 2021

Location of top-three speeding roads

Roads in the Seoul metropolitan area were ranked at the top of among the roads with high speeding frequency. It seems that the possibility of speeding in the metropolitan area with a lot of traffic is taken into account. Six out of the top-ten speeding locations were found to be bridges over the Han River. It suggests that there are many vehicles surpassing the speed limit on the bridge where there are no traffic lights. Following this, highway access roads were found to be high-frequency over-speeding locations. The driving characteristics at junctions and highway entrances show that drivers move based on their instinctive response without any information on the speed limit.[4] In addition, there are no signs at the entrance and exit, which makes it easy for drivers to speed up.

Changes in average speed of top-ten roads with most frequent rapid accelerations and decelerations
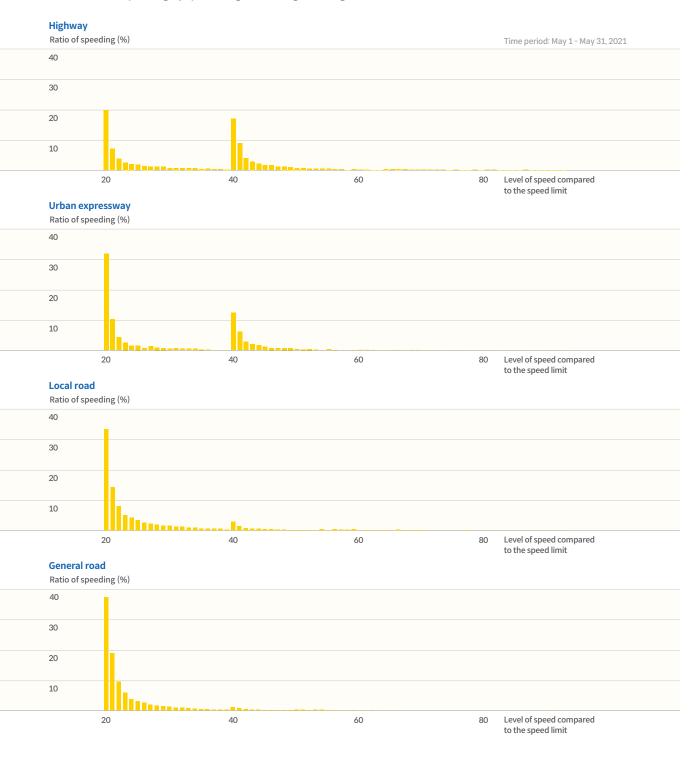
Rating	Abrupt acceleration		Abrupt deceleration	
	Road location	Speed change (km/h)	Road location	Speed change (km/h)
1	Near the exit from Guryong Tunnel (south bound)	+16.5	Exit road toward Olympic Expressway (National Assembly bound)	−15.1
2	Exit from Namsan No. 1 Tunnel toll gate	+14.7	Gwangan Bridge (Busan bound)	−19.9
3	Hannam Overpass (south bound)	+15.2	Near Songnae Exit on First Ring Expressway (north bound)	−16.4
4	Near Yanghwa Bridge on Gangbyeon Expressway (Seoul bound)	+15.9	Near Jayu Expressway (west bound) entrance	−15.6
5	Jeongreung Tunnel (Seoul bound) entrance	+17.3	Near Hannam exit of Olympic Expressway (east bound)	−16.3
6	Gwangan Bridge (Busan bound)	+14.4	709 Deungchon-dong, Gangseo-gu, Seoul	−16.7
7	Jeongreung Tunnel (north bound) exit	+16.9	Seoul-Busan Expressway	−15.6
8	Exit from Shin-Gwacheon Tunnel (south bound)	+16.9	Near Osan exit (north bound)	−17.4
9	Exit from Sapaesan Tunnel (west bound)	+18.4	Munemi Rd. near Suhyun Fork, Incheon	−16.1
10	Exit from Munhak Tunnel (south bound)	+17.2	Near Bojeong-dong on Seoul-Busan Expressway (south bound)	−16.2

Time period: Mar. 1 - May 31, 2021

It was also interesting to see that a number of tunnels was ranked at the top of the roads with a lot of rapid accelerations. Normally, cars move at a constant speed for safety, but it seems to accelerate rapidly when entering the tunnel. In the case of paying tolls with cash or card at the toll gate exit, it seems that there is a lot of rapid accelerations because cars have to stop to make payments.

Most of the rapid decelerations occurred near the cameras. What's interesting was Gwangan Bridge (Busan bound) was both ranked at the top ten for rapid accelerations and decelerations. This is because there are cameras in the middle of the bridge, so cars rapidly decelerate near the camera point and then accelerate again.

1 In cases where cars drive faster than the speed limit
2 In cases where the speed is accelerated by more than 10 km/h per second
3 In cases where the speed is decelerated by more than 10 km/h per second

4 H.B. Kim et al., An analysis on ways to improve driving safety in consideration of the driving characteristics at junctions and highway entry exit points, Korea Road Association, 19(4), 2017.

Distribution of speeding by speed range according to road grade

Highway
Ratio of speeding (%)

Level of speed compared to the speed limit

Urban expressway
Ratio of speeding (%)

Level of speed compared to the speed limit

Local road
Ratio of speeding (%)

Level of speed compared to the speed limit

General road
Ratio of speeding (%)

Level of speed compared to the speed limit

There are several characteristics if one looks at the distribution of users according to the road grade. First, the average of speeding/rapid acceleration/rapid deceleration was 25.71, 14.14, and 16.10 km/h, and it can be seen that the range of rapid deceleration is larger than that of normal sudden acceleration. If the driving patterns of users are classified by road type, more interesting points can be found.

If one looks at the distribution of speeding by road grade, it is shown as above. Most of the road types have 20 km/h speeding at the most, and over-speeding tends to decline as the speed increases. In contrast, a different trend can be gleaned in cases such as highways and urban expressways. Unlike any other roads, highways have the highest speeding ratios of 25 km/h and 40 km/h. Meanwhile, with urban expressways, the speeding ratio is the highest between 20 and 40 km/h. The reason for the high speeding ratio at 40 km/h is that the speed limit is suddenly lowered as a car approaches the junction, so it seems that drivers who are accustomed to the normal speed limit on the highway were unable to reduce the speed in time.

Speeding/rapid acceleration/deceleration are included in 11 dangerous driving behaviors designated by the Ministry of Land, Infrastructure and Transport and the Road Traffic Authority. In addition, the National Police Agency is using vehicle-mounted speed enforcement equipment to crack down on speeding through hidden patrol cars, even if it is not fixed or mobile enforcement cameras. We look forward to the day when Kakaonavi's "Driving Report" will show "0" in the number of speeding, rapid acceleration, and deceleration.

What changes did IVI make to mobile navigation users?

"When I was your age, I used drive based on an atlas without any problem." The history of navigation began with an atlas and evolved into a mobile navigation system through a portable navigation device (PND) and a built-in navigation device. Furthermore, the IVI system using the wide display on the vehicle dashboard is becoming widely popular. Kakaonavi also provides a navigation service using the IVI system.

IVI is an abbreviation of in-vehicle infotainment, and is a generic term for "entertainment and information systems that can be enjoyed in a car." It refers to a device or technology that provides entertainment features such as movies, games, TV, and social media, as well as various services linked to navigation and mobile devices.[1] In July and September 2018, Kakaonavi was launched on Android (Android Auto) and iOS (CarPlay) to provide navigation service through IVI. Let's take a look at how Kakaonavi, in the third year of IVI service, is evolving.

Similar patterns, but different if you look deeper.

Kakaonavi can be divided into mobile users and users based on IVI. (The number of IVI users are steadily on the rise.) The driving patterns of each user group appear slightly different. IVI users use Kakaonavi 5-10% more days than mobile users. Since there are other multimedia features in the IVI platform in addition to Navi, it seems that the usage of Navi is also more frequent because it is always connected.

If one looks at the usage rate by day of the week based on the Navi directions, there is a slight difference depending on the period of collecting data. Users who use Mobile Kakaonavi have a high usage of Navi in the order of Saturday>Monday>Sunday. In contrast, IVI Kakaonavi users have a higher usage of Navi in the order of Saturday>Sunday>Monday, and the usage of Friday and Sunday is much higher than that of Monday to Thursday than mobile Kakaonavi users.
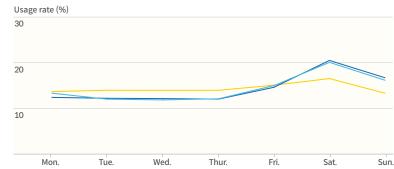
1   Geospatial Information System Glossary, 2016 1. 3. G.W. Lee and H.W. Son

Usage rate by day of the week (based on starting Navi directions)
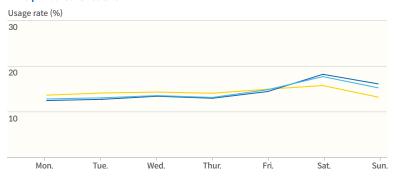
- Mobile Kakaonavi
- Android IVI (Android Auto)
- iOS IVI (CarPlay)

Time period: Jul. - Dec. 2018

Time period: Jan. - Jul. 2021

The reason for showing this type of pattern seems to reflect the lifestyle of users in their 30s who are tech-savvy and have activity-filled weekends. At the end of 2018, shortly after the IVI service for each operating system was made available, there was a greater difference in inclination with users who used Mobile Kakaonavi only. Due to the nature of IVI, which can be used after connecting to a vehicle and going through a few more steps, it can be seen that it was used a lot by young people representing early adopters in the early days of launch. As time passed and IVI became popular, however, the number of users increased gradually, and the difference in the characteristics between mobile navigator users and IVI users gradually narrowed.

Similar patterns on weekends, different patterns on weekdays

What about looking at the usage rate by time of the day on weekdays and weekends? Looking at the weekend pattern, there is little difference between the IVI group and the mobile group.
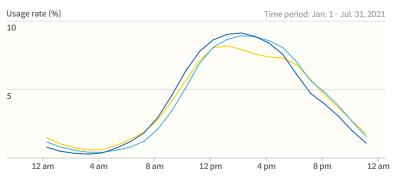
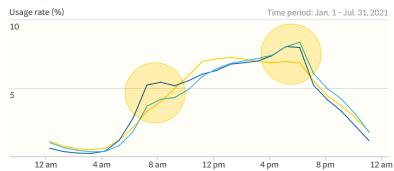### Usage rate by time of the day (based on starting Navi directions)

Weekend

Usage rate (%)   Time period: Jan. 1 - Jul. 31, 2021

Weekday

Usage rate (%)   Time period: Jan. 1 - Jul. 31, 2021

● Mobile Kakaonavi
● Android IVI (Android Auto)
● iOS IVI (CarPlay)

In contrast, weekday patterns are clearly different from weekends. IVI users tend to show more usage between 6-8 am and 4-7 pm compared to the mobile Kakaonavi users. Similar to the usage patterns by day of the week, the patterns of both groups of users are getting more similar. As for Android Auto users show an increase in usage patterns between 6 and 8 am. The difference in the pattern becomes more clear when looking at the point of interest (POI) rankings that each user group visits a lot during the two time periods.

Top-ten destinations (POI) during morning commute time by user group

Rating	Mobile Kakaonavi		iOS IVI (CarPlay)		Android IVI (Android Auto)	
	Category	Place name	Category	Place name	Category	Place name
1	Hospital	Asan Medical Center	Vocational training	Korea Specialty Contractor Financial Cooperative, Institute of Technology Education	Fusion Chinese	Legend of Bbong
2	Airport	Gimpo International Airport	Photo studios	Studio Logement	Seafood	Joseon Marinated Crab (Namcheon, Busan)
3	Hospital	Samsung Medical Center	Villas and Townhous-es	Hankyung Plusville	Info-tech	KT Songdo office
4	University hospital	SNU Bundang Hospital	Japanese restaurants	Coco Ichibanya (Lotte Mall, Gimpo)	Large supermarkets	Homeplus Express Bongcheon
5	University hospital	SNU Hospital	Apartments	Hyundai Apt. II	Public parking space	Andong Old Market
6	University hospital	Ajou University Hospital	School facilities	Dankook University Jukjeon Campus	Korean food	Dongwon Sun Valley
7	Entrance and exit	Yonsei University Severance Hospital parking space	Wedding hall	Starcity Art Hall	Urban living homes	Pravida M
8	KTX stations	Gwangmyung Station	Eup office	Namji-eup office	Software	Bit Computer
9	University hospital	Catholic University St. Mary's Hospital	Crossroads	Sindae Lake Intersection	Electrical supplies and parts	Olzetek
10	Airport	Jeju International Airport	Apartments	Central Xi Apartment, Seoul Station	Architectural design and consulting	Architecture Studio Yein

Based on 6-8 am | Period: Jan. 1 - Jul. 31, 2021

Top-ten destinations (POI) during evening commute time by user group

Rating	Mobile Kakaonavi		iOS IVI (CarPlay)		Android IVI (Android Auto)	
	Category	Place name	Category	Place name	Category	Place name
1	Airport	Gimpo International Airport	Plastic surgery	Cheongdam Line Clinic	Wedding consulting	Cho n Hill
2	KTX stations	Suwon Station	Shopping mall complexes	Starfield	Hotels	Ocean Spa Hotel
3	Shopping mall complexes	Starfield	Cosmetics	WeMe International	Convenience stores	CU Jingeon Hyundai
4	KTX stations	Gwangmyung Station	Daycare Center	Gamjeon Flower Garden Children's Daycare Center	Computer academies	Sunwoon Computer Academy
5	Airport	Jeju International Airport	Auto repair shops	Hyupseong Auto Repair	Apartments	Woojangsan i-Park e-Life Apartment
6	Shopping mall complexes	Starfield Goyang	Memorial halls	Democracy Park and Memorial Hall for Democratic Uprising	Hair salon	Lloyd Bomb Suyoung
7	Subway Line No. 2	Gangnam Station Line No. 2	Apartments	Jueun Cheongseol Apartment	Chinese restaurants	Tue., Wed., Thur.
8	Hyundai Department Store	Hyundai Department Store Pangyo	Campsites	Goraebul People's Campsites	Community centers	Galhyun 2-dong Community Center
9	KTX and SRT stations	Busan Station	Apartments	Imaechon Hanshin Apt. II	Communications devices	Inno Wireless
10	Subway Line No. 2	Sadang Station Line No. 2	Dance academies	JB Dance and Practical Dance Academy	Museum	Marine Natural History Museum in TtangKkeut

Based on 5-6 pm | Period: Jan. 1 - Jul. 31, 2021

If one looks at the daily average POI, some POIs pop out as the amount of usage is low. However, when looking at the overall trend, the mobile navigator user group shows commuting to and from work, such as medical, health (hospital), traffic, and transportation (airport/station), whereas the CarPlay and Android Auto groups show various characteristics (work, apartment, restaurant, academy, beauty salon, etc.). In the early days of release, IVI was considered a special feature, but as time passed and its mounting on the vehicle became more common, the number of users increased and it became a natural pattern. IVI was one big form factor change in the mobile navigation market, and it was able to provide a variety of services. We look forward to more diverse changes in Kakaonavi in the future.

How will it change when deep learning is applied to navigation?

Most people who use the navigation system decide the travel time by referring to the estimated time of arrival through the navigator. The estimated time of arrival is not always correct in reality, as it is literally an "estimated" time.

Perhaps even readers of this have had experiences where they sometimes get frustrated when trusting the estimated time of arrival on the navigator. To prevent this from happening on Kakaonavi, we are developing various ways to narrow the gap between the estimated time and actual time. Recently, Kakaonavi improved the accuracy of prediction by using deep learning algorithms, and we would like to discuss about this in a little more detail.

Deep learning is a technology of machine learning that uses artificial neural networks to train rules based on data. Supervised learning and unsupervised learning can be divided according to whether results are provided. Andrew Ng, chief scientist at China's leading search engine Baidu, and one of the leaders of the "Google Brain Project," put it this way about deep learning on the Wired magazine.

> "AI is like building a rocket, so it requires a huge engine and a lot of fuel. If the engine is big but low on fuel, it won't be able to get on orbit. Conversely, if the engine is small and carries lots of fuel, it will not be able to take off. In this analogy, a rocket engine is the deep learning model, and fuel is an enormous amount of data that can be fed to these algorithms." Andrew Ng (Source: Wired[1])

As such, in order to provide accurate predictions through deep learning based on real user data, good data, proper models, and an sophisticated "pipeline" that can continuously manage them are needed.

1.Andrew Ng (May 2015), "Why 'Deep Learning' Is a Mandate for Humans, Not Just Machines."
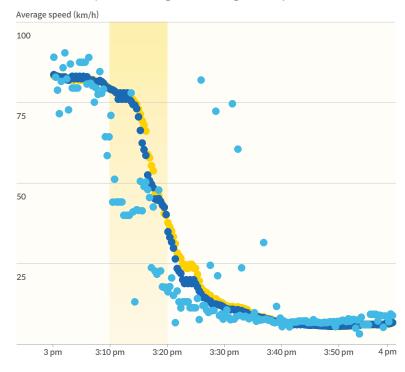
Good data make good predictions

Data is the most fundamental ingredient to providing predictions. Let us explain one representative example.

The speed data of users passing by the road is the most important and essential data in speed prediction. In the initial stage, each user's GPS point data are collected, and it is difficult to trust some of these data's location or speed because the GPS of a smartphone cannot always be expected to deliver accurate values. Therefore, it is necessary to proceed with a task to remove these unreliable data.

The next step is to convert the speed data collected from users into the speed for each road. Even though vehicles pass on the same road at the same time interval, the speed of passing through the road varies depending on the driver. Based on the speed of many users collected in this way, the speed by each road is calculated.

Distribution of speed according to the average velocity calculation method

Average speed (km/h)

- 🟡 10-minute arithmetic average speed
- 🔵 Time-based weighted average speed
- 🔵 User real-time average speed

The figure above shows the speed of real users at a specific interval of the road. In a short period of time less than 10 minutes, it can be seen that the travel speed of individual users is rapidly decelerating. In such a situation, if one simply calculates the travel time of individual users in the last 10 minutes as an arithmetic average, one gets a much higher speed than the current speed that can be expected, which leads to a low accuracy result. To address this problem, it is necessary to use a time-based weighted average method. The average is calculated by assigning more weight to the recent data than the past ones. Using this method, it is possible to obtain a speed value for each road that is similar to the current road speed.

In addition, data such as map data and traffic pattern information of specific dates are processed into high-purity data through various refining processes.

To use good data well, one needs a proper model

First, it is important to apply the most suitable model to obtain good prediction results. The prediction performance model was recently changed from the previously used "Gradient Boosting Tree" model to a neural network-based model. In this writing, we will skip any further explanation on the application of the model. For more details, refer to If Kakao 2021 as a related topic. Although a neural network model with the simplest structure is currently in use, there has been an improvement in performance, such as an average 9% reduction in errors compared to the previous model. Through this process, it was found that the deep learning model indeed improves the speed prediction performance, and additional research is under way to continuously improve the model.
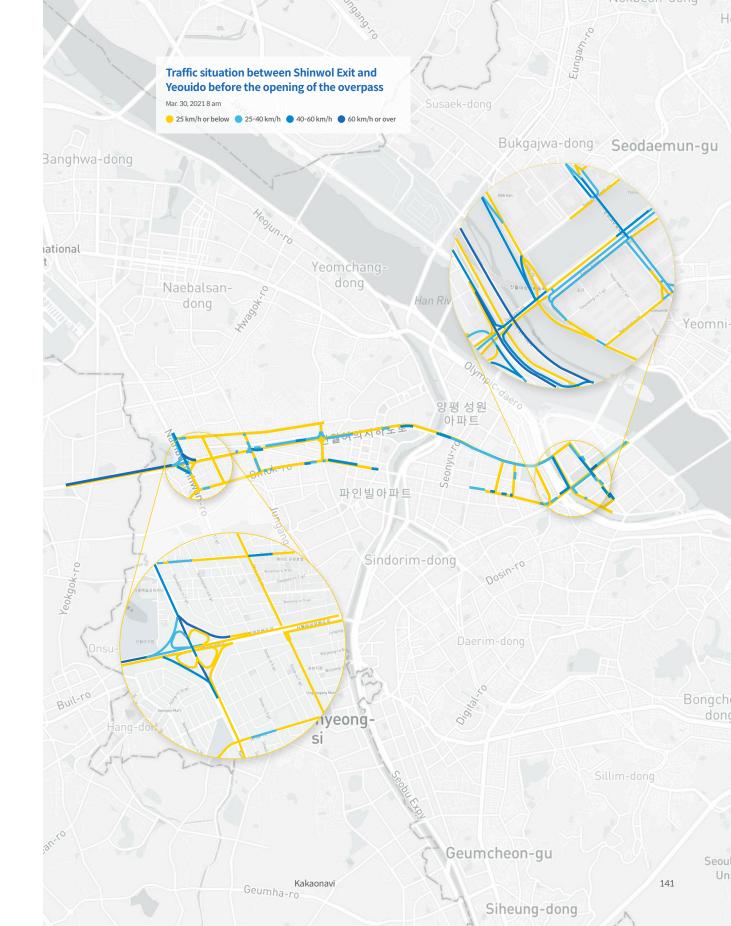
We have been able to provide better service than before, but we still have a bigger goal to achieve. At present, it is difficult to satisfy all users no matter what results are provided. That's because each user has different driving habits in different situations. Because of this, the ultimate goal of navigation guide is personalization that provides optimal results for each user.
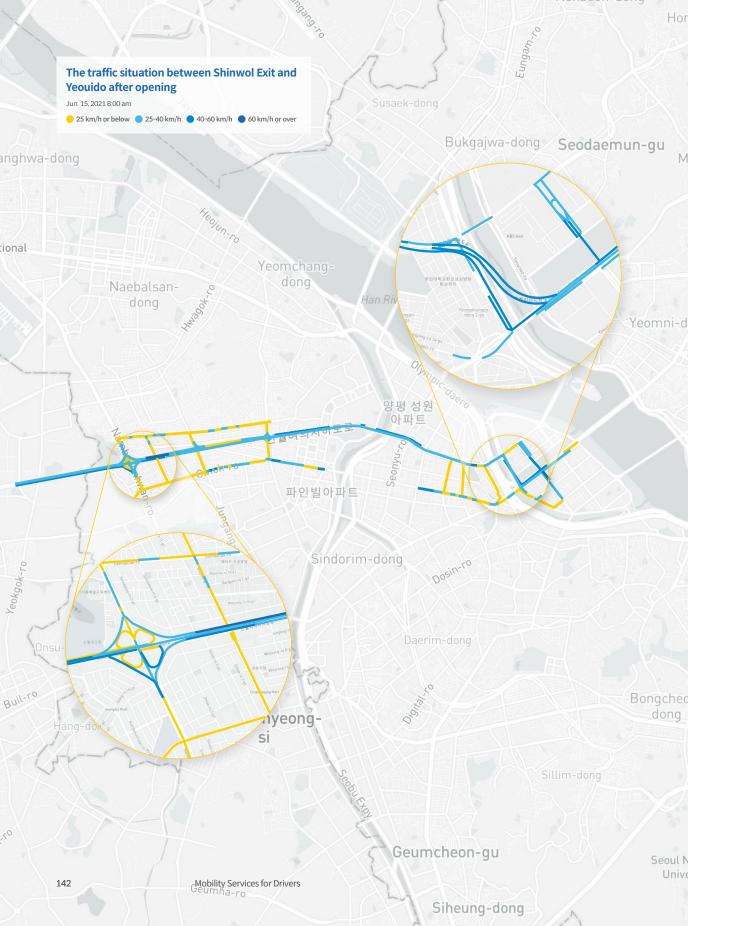
Through personalized route guidance, it is possible predict the driving time according to each driver's preferred route and driving habits. In addition, alternative routes may be suggested depending on the user's situation. This is because the directions on the way to work, where 1 minute or 1 second is important, and the directions on the way home from work, where one wants to get back home as early as possible or drive a little more leisurely, may be different.

What impact did the opening of the Shinwol Yeoui Underpass have on the overall traffic flow in Yeouido?

The Sinwol Yeoui Underpass is Korea's first urban deep underground road that runs through the section between Yeouido and Sinwol Exit on National Assembly Blvd. It was opened on April 16, 2021, five years and six months after construction began for the purpose of resolving chronic congestion. According to media reports at the time of opening, it was expected that the passage time for the same section would be reduced from 32 minutes to 8 minutes with the opening of the underpass. About six months after the opening, we looked at how the traffic situation in Yeouido was changed with the opening of the underpass based on Kakaonavi data.

The sections of chronic congestion before the opening of the Shinwol-Yeoui Underpass

First, we looked at the speed of each section of National Assembly Blvd. before the opening of the underpass. To examine the traffic situation during the weekday commute time, the analysis point was selected as 8:00 am on March 30, 2021 Tuesday. At 8 am, traffic congestion begins at the speed of 25 km/h or less in the vicinity of Shinwol Exit due to commuters heading toward Yeouido (yellow section). The congestion on the main road, National Assembly Blvd., spills over to the surrounding bypass roads, and when cars get out of Sinwol Exit, the congestion appears to be relieved. Once cars reach the section entering Yeouido, however, some congested sections reappear. This traffic congestion on the way to work on National Assembly Blvd. repeats itself in the opposite direction during afternoon rush hour, peaking at 7 pm, and being relieved only after 8 pm. This is a typical chronic congestion section.

Traffic situation between Shinwol Exit and Yeouido before the opening of the overpass
Mar. 30, 2021 8 am

● 25 km/h or below ● 25-40 km/h ● 40-60 km/h ● 60 km/h or over

Kakaonavi

The traffic situation between Shinwol Exit and Yeouido after opening
Jun. 15, 2021 8:00 am

● 25 km/h or below　● 25-40 km/h　● 40-60 km/h　● 60 km/h or over
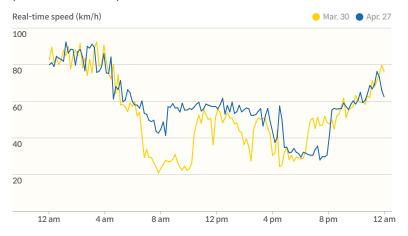
Improved traffic flow after opening of the Shinwol-Yeoui Underpass

How has the traffic situation changed after the opening of the Sinwol-Yeoui Underpass? We looked at the situation at 8:00 am on June 15, 2021 Tuesday, two months after the opening. Looking at the roads near Sinwol Exit first, the previously congested section with an average speed of 25 km/h or less has improved to a speed of 40 km/h or more after the opening. Even if it was not up to the 80 km/h speed limit of the Shinwol-Yeoui Underpass, the congestion has been significantly alleviated compared to before the opening. After the morning rush hour passed, the traffic flow was improved much better than before the opening.

Congestion at the Yeouido entrance section was also relieved compared to before. In particular, in Yeouido, it was found that the effect of resolving the bottleneck was relatively large as the traffic volume was dispersed as the access to Yeouido was diversified with the opening of the Shinwol-Yeoui Underpass.

The traffic flow also improved on the way home from work. In the Yeouido entrance section and the roads near Sinwol Exit, which had previously been congested sections at a speed of less than 25 km/h, there were noticeably more sections that improved to a speed of 40 km/h or more.

**Real-time speed by time interval near the Shinwol-Yeoui Underpass Exit
(toward Shinwol Exit)**

Real-time speed (km/h)　　　　　　　　　　　　　　● Mar. 30　● Apr. 27

Traffic congestion factors discovered after opening

It is found that the opening of the Sinwol-Yeoui Underpass helped improve the traffic flow across the area. However, factors of traffic congestion that need to be addressed for better traffic conditions have also been identified. The most visible example was the Shinwol-Yeoui Underpass signpost. If one looks at the sign near the exit of Gyeongin Expressway, it is not easy to see which direction one has to proceed to take the underpass. There is a fork on the road right after the sign, and it is difficult to get to the underpass if one does not follow the pink-color guide line on the third and fourth lanes in advance. If one is unable to change lanes from the first and second lanes, one will not be able to enter the underpass.

It is also inconvenient when starting from Yeouido and entering Gyeongin Expressway through the Shinwol-Yeoui Underpass exit. The exit of the Sinwol-Yeoui Underpass is connected to the third and fourth lanes, and one has to move to the first and second lanes to go to Incheon using the fork on the road. At the same time, vehicles that drove on the first or second lanes rather than the Shinwol-Yeoui Underpass exit had to change two or more lanes to move to the fourth lane in order to move toward Gimpo Airport. Since this cross-lane change has to be made within 200 m of the Shinwol-Yeoui Underpass exit, the section is repeatedly entangled with lane-changing vehicles.
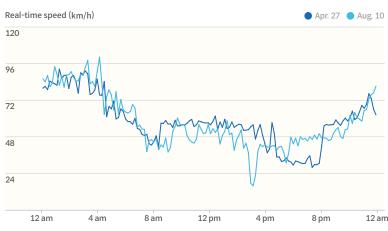
Shinwol-Yeoui Underpass road view | Source: Kakao Map

Kakaonavi quickly detects road condition changes.

During the analysis of the Shinwol-Yeoui Underpass, improvements were made to the lanes at Shinwol Exit, which experienced repeated congestion even after the opening. Was the lane improvement actually effective? We were able to quickly check it through Kakaonavi data. When checking the real-time speed for each hour at the Shinwol-Yeoui Underpass exit on August 10, 2021, the sharp drop in travel speed during the afternoon rush hour was much improved compared to before. At 3 pm on the same day, a slight decline in speed was detected compared to before, but special circumstances such as an accident occurred and were resolved immediately.

As such, Kakaonavi is quickly aware of changes in traffic conditions as new roads are opened and lanes change. These changes are quickly reflected in the Kakaonavi guide and provided to users.

**Real-time speed by time interval near the Shinwol-Yeoui Underpass Exit
(toward Shinwol Exit)**

Real-time speed (km/h)　　　　　　　　　　　　　　● Apr. 27　● Aug. 10

The opening of the Shinwol-Yeoui Underpass appears to have contributed to improving the traffic flow between Yeouido and Sinwol Exit sections of National Assembly Blvd., which was a section of chronic congestion. However, it appeared that traffic congestion occurred even after the opening due to the crisscrossing flow of traffic in the connecting road sections. Fortunately, it was also possible to see that severe congestion was alleviated through lane improvement. If we could check the traffic flow a little faster, we could also expect that the effect of improving the traffic flow on the newly opened road could be further maximized. Kakaonavi will continue to provide road guide by reflecting changes in road conditions quickly so that drivers can drive safely even on the unfamiliar road in the future.

Safe Speed 50/30,
the secret of a road
with a high compliance ratio

Kakao Mobility × Korea Transportation Safety Authority

"Safe Speed 50/30" has been implemented nationwide from April 17 of this year. Safety Speed 50/30 is a measure to lower the speed limit in urban areas where many pedestrians pass from 60 km/h to 50 km/h for ordinary roads and to 30 km/h or less for side roads used mostly as residential walkways. Kakao Mobility and the Korea Transportation Safety Authority analyzed the Safety speed 50/30 measure's effect together for the second time in 2020.

About four out of ten traffic accident deaths in Korea are pedestrian deaths. The number of pedestrian deaths per 100,000 people ranked 27th out of 28 OECD member countries, earning the reputation of a "dangerous city to walk." The 50/30 policy measure was started to move away from this and create a "pedestrian-friendly Korea." In a country where a vehicle-oriented culture is firmly established, it is true that the 50/30 measure had received many complaints before its implementation, but the awareness of consideration for the vulnerable to transport means is gradually rising and the safety improvement effect of the measure through various experiments has been proven. As a result, the number of people in favor of the 50/30 measure has increased to 82%.[1]

We suddenly became curious. Even if more than eight out of ten people agree, do people actually comply with the speed rule? If not, is speed enforcement the only way to keep drivers the speed limit? Even if they don't keep the speed rule, isn't it good enough as long as they don't get into an accident? We searched for answers to these questions by analyzing driving speed data of drivers using Kakaonavi.

"Complying with the speed limit." This means driving without exceeding the maximum speed set on the road. If the speed limit does not exceed 50 km/h until the driver has passed the 50 km/h section of the road, it can be said that the speed limit has been complied with. If there are 95 of these drivers when 100 vehicles pass, the speed limit compliance rate on the road is said to be 95%.

The speed data of Kakaonavi is based on GPS data collected from smartphones. To minimize errors, the average speed of each vehicle in a section was calculated, and if this speed was less than the speed limit, it was classified as a compliant vehicle, otherwise it was classified as a non-compliant one. In order to collect speed data, representative sections with a speed limit of 50 km/h with a length of 500 m or longer with three lanes one way were selected in 17 metropolitan cities and provinces nationwide (37 sections in total). We also investigated whether enforcement cameras, bus-only lanes, bus stops, and crosswalks were in place.

1 Korea Transportation Safety Authority, As of Oct. 2020.

Analysis target areas and road characteristics

Sequence	Area	Road name	Speed enforcement equipment	Bus-only lane	Bus stop	Cross walk
1	Dongsomun Rd.	Seongbuk-gu, Seoul	X	O	O	O
2	Saemunan Rd.	Jongno-gu, Seoul	X	O	O	O
3	Eulji Rd.	Jung-gu, Seoul	O	X	O	X
4	Saemunan Rd.	Jongno	O	O	O	O
5	World Cup Blvd.	Jin-gu, Busan	X	X	O	O
6	Gamcheon Rd.	Saha-gu, Busan	X	X	O	O
7	Duryu Park Rd.	Nam-gu, Daegu	X	X	O	O
8	Duryu Park Rd.	Nam-gu, Daegu	X	X	O	O
9	Gyeongwon Rd.	Michuhol-gu, Incheon	X	O	O	O
10	Baekbeom Rd.	Namdong-gu, Incheon	X	O	O	O
11	World Cup Semifinal Rd.	Seo-gu, Gwangju	X	X	O	X
12	Jangshin Rd.	Gwangsan-gu, Gwangju	X	X	O	X
13	Daejeon Rd.	Dong-gu, Daejeon	X	O	O	O
14	Daejeon Rd.	Hanbat Blvd.	X	X	O	X
15	Suam Rd.	Nam-gu, Ulsan	X	X	O	O
16	Suam Rd.	Jungang Rd.	X	X	O	O
17	Hanuri Blvd.	Sejong City	X	X	X	X
18	Hanuri Blvd.	Sejong City	X	X	O	O
19	Chongjang Rd.	Ansan, Gyeonggi Province	X	X	O	O
20	Hyangnam Rd.	Hwaseong, Gyeonggi Province	X	X	O	X
21	Hwojung Rd.	Goyang, Gyeonggi Province	X	X	O	O
22	Hoguk Rd.	Uijeongbu, Gyeonggi Province	X	X	O	O
23	Wondae Rd.	Gangneung, Gangwon Province	X	X	O	X
24	Roanoke Rd.	Wonju, Gangwon Province	X	X	O	O
25	Ring Rd. No. 1	Cheongju, North Chungcheong Province	X	X	X	X
26	Ring Rd. No. 1	Jikji Blvd.	X	X	O	O
27	Buldang Blvd.	Cheonan, South Chungcheong Province	X	X	O	X
28	Buldang Blvd.	Seobu Blvd.	X	X	X	O
29	Hyoja Rd.	Jeonju, North Jeolla Province	X	X	O	O
30	Hyoja Rd.	Ssukgogae Rd.	X	X	O	X
31	Yeongsan Rd.	Mokpo, South Jeolla Province	X	X	O	X
32	Jungma Rd.	Gwangyang, South Jeolla Province	X	X	X	O
33	Heemang Blvd.	Pohang, North Gyeongsang Province	X	X	O	X
34	Dongbu Rd.	Jinju, South Gyeongsang Province	X	X	X	X
35	Dongbu Rd.	Dongjin Rd.	X	X	O	O
36	Iljudong Rd.	Seogwipo, Jeju Province	X	X	O	O
37	Iljudong Rd.	Jungang Rd.	X	X	O	O

how much are Safety Speed 50/30 rules complied with?

As a result of examining the average compliance rate from June to July after the rules were implemented, more than eight out of ten drivers were compliant during the day (6 am to 6 pm) and more than seven people were compliant during the night (6 pm to 6 am the next day). The compliance rate was higher on weekdays (Mon.-Fri.) than on weekends (Sat.-Sun.). The compliance rate was higher on weekdays with high commuting traffic than on weekends, and fewer vehicles and pedestrians at night resulted in a tendency for drivers to speed, leading to a decrease in the compliance rate at night.

Compliance rate by hour

Item	Weekday		Weekend	
	Daytime	Nighttime	Daytime	Nighttime
June	84.4%	73.2%	81.7%	71.8%
July	84.8%	74.0%	82.7%	72.4%

What is the impact of road environment?

According to the average compliance rate collected during the daytime of the week, the road conditions affecting the compliance rate were examined by dividing them into four groups: high, medium, low, and very low. In two of the four sections belonging to the group with an average compliance rate of 50% or less "very low," no bus stops or crosswalks were installed (section A and B). In the case of section C with a crosswalk, it was located at the end of the road section, and the bus stop in section D was installed as a bay-like bus stop where the bus could leave the road and stop the vehicle without hindering the traffic flow. The fact that there were few factors that made drivers reduce their speed is indicated by the low speed limit compliance rate for the section.

Characteristics of roads with a low compliance rate

Item	Area	Road name	Average compliance rate	Speed enforcement equipment	Bus-only lane	Bus stop	Cross walk
A	Hanuri Blvd.	Sejong City	37.1%	X	X	X	X
B	Cheonan, South Chungcheong Province	Seobu Blvd.	48.7%	X	X	X	X
C	Gwangyang, South Jeolla Province	Gwangyang, South Jeolla Province	49.7%	X	X	X	O
D	Mokpo, South Jeolla Province	Mokpo, South Jeolla Province	46.2%	X	X	O	X

How has safety level changed depending on the compliance rate group?

Can we say that we are safe just because there are no accidents? That's not the case. When analyzing the level of traffic safety, we use direct and indirect indicators, and statistics such as the number of traffic accidents and traffic accident deaths that we are well aware of are direct indicators. Indirect indicators were developed to evaluate safety regardless of the occurrence of accidents, and the "standard deviation of speed" is used for this purpose. It is based on an idea that the greater the difference in speed between vehicles, the greater the likelihood of a traffic accident.

As a result of examining the standard deviation of speed for the group with a compliance rate of 50% or higher, the standard deviation (mean) of speed was low in the group with a high compliance rate, and the degree of spread (dispersion) between the deviations was also small. As the ratio of compliant drivers among those using the road increased, "speed harmonization" between vehicles in terms of speed decreased and the probability of a traffic accident was reduced, making it safer for everyone.

Results of speed deviation analysis between vehicles by compliance rate group

Compliance rate group	Speed standard deviation (mean)	Speed standard deviation (variance)	P-value
Low (50-80%)	19.9	7.2	1.19×10^{-16}
Medium (80-90%)	18.8	6.2	
High (more than 90%)	16.3	4.5	

The lower the mean and variance of the speed standard deviation, the higher the tendency to harmonize the speed between vehicles.

Safety Speed 50/30 that we all need to comply with

The Safe Speed 50/30 measure was introduced on a trial basis in some areas from 2016, was fully introduced in Seoul and Busan in 2019, and Daejeon in 2020, entering our lives in earnest. The main intention of this policy is to "go a little slower and protect pedestrians." As a result of looking at the average speed of the sections where the 50/30 measure was enforced last year, it was found that the average speed during the hours where there was congestion increased, rather improving the overall traffic flow of the road. According to recent National Police Agency data, the number of pedestrians who were killed for 100 days after the full enforcement (Jan. 17, 2021) of the measure fell 17% compared to the same period of the previous year in the areas enforced by 50/30, and dropped 4.5 times compared to those areas not enforced by 50/30. With a change of only 10 km/h, we may have saved more pedestrians.

Eight out of ten, this is our report card for safe speed compliance that protects pedestrians. In some sections, the speed limit was even lower than that. Through this collaboration between Kakao Mobility and the Korea Transportation Safety Authority, we were able to affirm from the data of Kakaonavi users that the higher the compliance rate, the safer it can be.

Kakao T Navi,
saving people and the planet

Golden hour It refers to the time that determines the life or death of a person who requires emergency response. The mobility of the 119 ambulance is of the utmost importance to transport the patient to the emergency room. If one sees an ambulance on the road while driving, he will get out of the way, but if one is aware that an ambulance is coming in advance, he can respond more quickly. In the case of an accident on the highway, the urgency of a quick rescue is even higher. To this end, Kakao Mobility started supporting emergency vehicles on highways in 2018 in collaboration with the National Fire Agency and the Ministry of Land, Infrastructure and Transport. It is an emergency notification that informs Kakaonavi users of accident information and approach of 119 vehicles.

Kakao Mobility is also participating in the "AI-based emergency medical system project" undertaken by the Ministry of Science and ICT from 2019. This project is to secure the golden hour by minimizing the patient's transfer time, and to provide customized diagnosis and treatment services according to the patient's condition. When there is a patient, paramedics arriving at the scene transmit the patient's data such as electrocardiogram, blood pressure, and pulse at high speed, and connect the emergency center that can best treat the patient. What matters most at this stage is to reduce the transfer time of the patient as much as possible. For this purpose, Kakao Mobility uses navigation data to provide information such as travel time and optimal routes to nearby emergency centers. It is developing a navigation system for ambulances.

Kakao Mobility is also taking the lead in pioneering the era of eco-friendly electric vehicles. Although electric vehicles are an eco-friendly means that contributes to reducing carbon emissions, one of the reasons users are reluctant to buy one is the inconvenience of charging. First, in a situation where the charging stations are few and far between, it is necessary for EV drivers to search for charging stations one by one. Second, even if one gets to arrive at a charging station, charging takes 30 minutes at least, and it may take longer if the charging spots are full. Third, there is the inconvenience of having to carry dozens of cards for different charging stations because charging payment has yet been standardized.

To address this problem, Kakao Mobility will provide services such as charging station location finder, advance charger booking, real-time alert on charger usage history, reporting on charger failure, and charger status display by linking public data shared by the Ministry of Environment, Korea Environment Corporation, and Korea Automobile Environmental Association to the "Kakaonavi" service.

In addition, the "Kakaonavi Smart Payment Service" will be linked to the chargers run by the Ministry of Environment. The QR code payment method applied to Kakaonavi will be linked first, and the near-field communication (NFC) tag method and plug & charge (PnC) method will be reviewed later to significantly improve the convenience of user payment. PnC is a payment method by which charging is made automatically by simply connecting a charger to the vehicle using the payment information stored in the vehicle.

If the satisfaction with the experience of using electric vehicle charging service improves, preference for electric vehicles will increase as well and the dissemination will be easier, which will ultimately help the environment. As such, Kakao Mobility will make its efforts relentlessly to save people and the planet.

Kakao T Driver

Who is your
Kakao T Driver driver?

If a customer calls a designated driver from Kakao T, the driver usually arrives within 7 minutes. The driver who took over the vehicle disappears without a trace through the darkness of the night after completing his work. At first glance, this seems natural enough, but if one thinks about it for a little while, questions ensue. Where did the driver come from? When does he go to work and go home? What should he do if he gets into a car accident?

Customers can call the designated driver with a few simple button touches. Just because of that, it seems like his identity is wrapped in a veil… By analyzing the driver and driving data accumulated throughout 2021, we carefully looked at the details of the designated drivers who are responsible for the safety of users on their way home.

The number of Kakao T Driver drivers is 170,000

Over the past year, more than 170,000 people have come to work as Kakao T Driver drivers. This is the most overwhelming number of drivers among Driver platforms, and it has become the driving force for Kakao T Driver to connect users and drivers in such a very short time. In fact, if one makes a Kakao T Driver call, most drivers who can see the request are within 3 km of the radius. From the perspective of users, it is an experience of connecting to thousands of drivers with just a few clicks on the app.

In every city, county, and district across the country

Kakao T Driver drivers are evenly distributed throughout the country. Even when one looks through the entire city/county/district, there is no area where there is no designated driver for Kakao T. (There are drivers even in Ulleungdo!) In the case of the densely populated Seoul metropolitan area, the largest portion of all drivers resides (56%). Drivers responsible for the demand for designated driving service between Seoul, Gyeonggi Province, and Incheon mainly reside in cities near Seoul, such as Suwon, Yongin, and Goyang.

The number of Kakao T Driver drivers is increasing steadily every year. For the past three years, the number increased by an average of 9% per year. The growth rate is particularly notable in non-Seoul areas. In 2021, the number of drivers outside the Seoul metropolitan area increased 51% compared to 2018. All regions of the country showed a steady upward trend. Thanks to the nationwide coverage, users can now conveniently use Kakao T Driver drivers anywhere in Korea.

4 hours and 30 minutes of work a day

When do the drivers go to work and go home? It is not that all drivers have the same commute times. Still, for veteran designated drivers who run more than 20 times a week, there is a relatively regular commuting time pattern.

Veteran drivers, on average, go to work a little past 8:00 pm. Based on stories told by the drivers, many of them get the first call while having dinner and go out into the night. Drivers work an average of 4 to 5 hours a day and head home by the time public transportation is cut off around midnight. Prior to COVID-19, many drivers worked until 2 or 3 in the morning or 6 at dawn and left work with the first train in the morning. These days, it is common for them to go home by the time the last train leaves at around 12 am.

100% peace-of-mind insurance

If there is one thing in common among these Kakao T Driver drivers with diverse backgrounds, it is that 100% of them is covered by designated driving insurance without exception. In any case of driving accident, users and vehicles as well as drivers are protected. Therefore, there is no possibility of dispute arising due to the absence of insurance by the driver.

Kakao T Driver at a glance
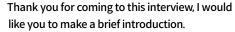
Total number of designated drivers

170,000 — Average growth rate of 9% a year

Working hours of designated drivers

4.5 hours — Daily average

Insurance coverage rate of designated drivers

100%

Distribution of designated drivers (in Seoul metropolitan area)

Suwon — No. 1

Yongin — No. 2

Goyang — No. 3

Kakao T has operated a Premium Driver driving service since August 2020. In order to provide users with a more luxurious riding experience, premium drivers, unlike regular drivers, ① have to pass face-to-face interviews② with five years of accident-free records ③ Completion of service training, and ④ wearing of a suit. We invited a premium driver who is currently active and listened to stories about his work.

Thank you for coming to this interview, I would like you to make a brief introduction.
Hello, everyone! My name is Yoon Yeo-hee, a 53-year-old designated driver. During the day, I work as corporate driver, and at night as a premium Kakao T Driver.

May I ask you about your driving experience?
It has been 32 years since I got my first license in 1989. After serving in the military as a driver, I continued to work as a corporate driver. I think I can say I am a veteran in this field because I have been driving for over 30 years with a verifiable career. (Laughs) Perhaps because of this experience, getting a job as a designated driver was easier for me than others. Maybe it's because I have a service mind naturally built into my body as I drive with executives in the back seat all the time. Designated driving is just a job I am used to, but customers really like it.

How did you get started as a Kakao T Driver driver?
I started Kakao T Driver naturally in 2018. In the beginning, I was unfamiliar and somehow afraid, so I wondered if I could receive a call from the Kakao platform. Once I got used to it, it was much easier and more convenient than the existing designated driving platforms. I think it is the most convenient among all the designated driving platforms so far. From 2020, I started working for Kakao T premium driving. As I take calls from corporate customers, it is a big help for my earnings.

Do you have any memorable customers?
I get to meet so many different people while working as a designated driver. I tend to not to speak first while driving, but if a customer wants to talk, I talk while driving. Not long ago, while talking to a customer, I found that he was a few years senior from the same high school. I remember having fun talking about my old school while driving. I was thankful for him for giving me a tip for the fun of having a conversation even though I refused.

What did you like best about working as a premium Kakao T driver?
One of the good things about it is that I get to see a lot of calls. In addition, most of the customers are gentle and polite. It seems that you never had unpleasant experiences because of customers. Of course, as a premium driver, it is not always easy to maintain a well-groomed appearance (Kakao T premium drivers must always wear a suit). Still, I think customers are more assured of professionalism from my neat appearance.

Please tell me about the most difficult part of your designated driving job.
Sometimes I have to drive drunk customers. Most of the customers who call through Kakao T Driver are well-mannered. Some of my colleagues said they take calls from Kakao T Driver only because of customers' good manners. Still, when I get to meet drunk customers occasionally... hmm It's hard. First of all, if the customer is too drunk, it takes a long time to wake him up after arrival. As a driver who has to make multiple calls during peak hours, this is a really frustrating moment for me. There was a customer who called a designated driver without knowing where he parked his car as he was too drunk. (Laughs) It's really exasperating when this happens.

Tell me about the reward of being a designated driver.
Is there any greater reward than money? (Laughs) It's hard to live in the world with just one job these days. The greatest reward for me is meeting people and earning the money as I do what I do best. In the case of Kakao T Driver, if you get a lot of calls in a week, you get a 5-10% bonus in addition to the basic pay. This is a great help from a driver's standpoint. There is no such privilege in any other designated driving platforms.

This is the last question. What is designated driving for you?
I'd like to say it's a companion on the night streets. As you already know, the older you get, the harder it is to find a job, especially for a professional driver like me. With Kakao T Driver, if you can maintain good service records, you can earn as much money as you work, so I am grateful for that.
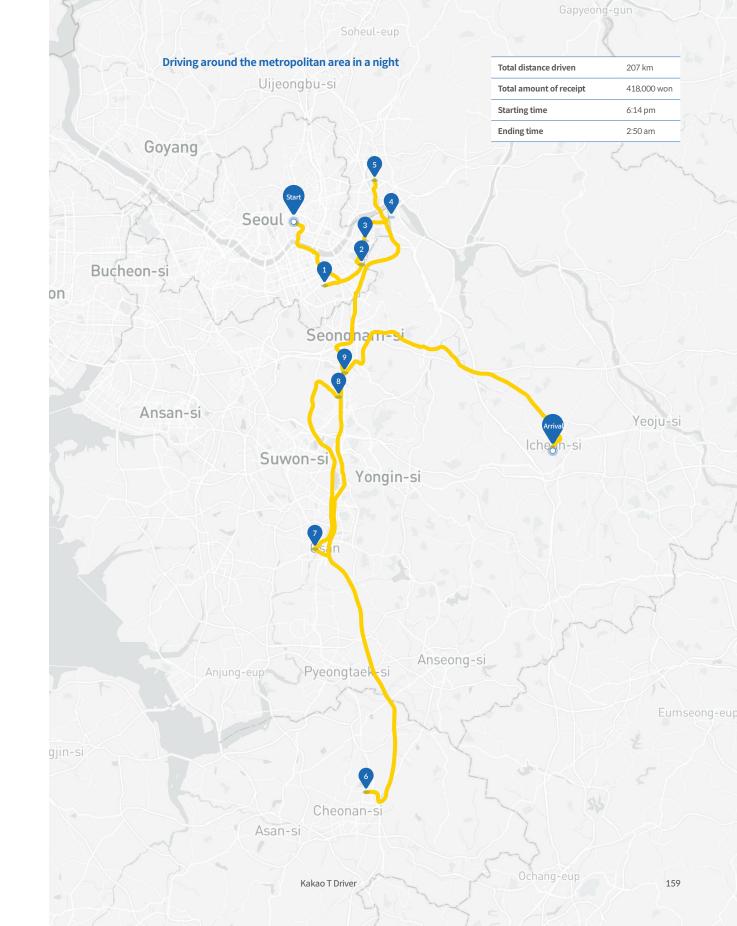
Various types of drivers!
4 different types of drivers of Kakao T Driver

If there are 100 people, there are 100 philosophies. In the same way, if 170,000 designated drivers go to work, there are 170,000 different work styles. Looking at the data of Kakao T Driver drivers, one can find a clear pattern even in the seemingly chaotic driving records. Most designated drivers fulfill three to four calls a night before returning home. Still, there are also very unique driving styles that make you wonder, "What kind of driver is that?" The following is a driver's work pattern, which was most uniquely driven among the Kakao T Driver team members over the past year.

Adventurous style: Driving around the metropolitan area in a night

Among the drivers, there are natural explorers who drive customers' cars through the night and travel all over the metropolitan area. These people have a unique ability for seamless call links. Call links refer to "receiving a new call from the area where the driver arrives through the previous call and departing for another area." For this link to continue, the driver must be able to design in his mind an effective route based on information from all regions and all times.

For veteran drivers, it is possible to keep linking calls such as ① Pangyo to Gangnam at 9 pm, ② Gangnam to Mapo at 10 pm, ③ Mapo to Ilsan at 11 pm, and ④ Ilsan to Incheon at 12 am. If one meets these drivers and ask about call linkage know-how, they will answer that the secret is to search for information on YouTube or Internet communities, keep the record of their driving patterns on Excel, and study continuously.

The next driver spent the whole night in November 2020 and drove around the metropolitan area. He came to work a little past 6 pm and drove around until 3 am the next day, so he worked for about 8 and a half hours in total. He drove 207 km overnight on ten different vehicles and earned 410,000 won (!) a day based on the receipt amount. From the map on the right, one can see that the driver in question has succeeded in receiving unbroken calls.

Driving around the metropolitan area in a night

Total distance driven	207 km
Total amount of receipt	418,000 won
Starting time	6:14 pm
Ending time	2:50 am
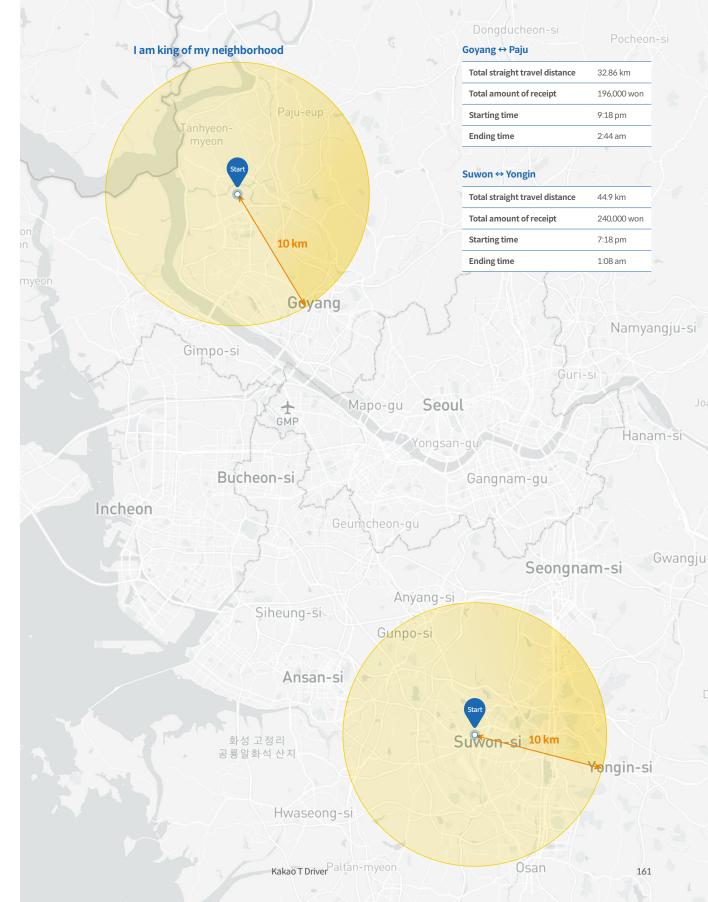
**Neighborhood style:
I am king of my
neighborhood**

Anyone has his own neighborhood that he knows like the back of his hand. Among designated drivers, there are "neighborhood specialists" who respond to calls only in areas familiar to them. These drivers avoid long-distance trips that are high in prices, and only repeatedly answer short-distance calls that occur near the neighborhood. As seen above, it is a work pattern that is the polar opposite of that of an adventurer-type driver who drives more than 200 km a night.

There are two major advantages of being a neighborhood driver. One is that the road is familiar to them. As they drive on the road they are used to drive, they don't have to worry about getting lost in an unfamiliar area. Another is that it is easy to go home after work. Most designated drives have difficulty returning home after fulfilling high-priced long-distance calls. That's because public transport is cut off during closing time, and it is not easy to find a call back home. In contrast, if one is a local driver, the road back home after work is far from difficult.

The next two drivers worked within a 10 km radius of the neighborhood where they lived. The first driver was a local in Paju, Gyeonggi Province, who processed ten calls a day only on roads in Goyang and Paju. According to his driving record, he drove 45 km a night and earned 240,000 won based on the receipt amount. The second case is a driver who is famous in Suwon, Gyeonggi Province, and answered a total of 11 calls between Suwon and Yongin. This means, while moving back and forth in the neighborhood, he made more than 190,000 won based on the receipt amount in one day.

I am king of my neighborhood

Goyang ↔ Paju

Total straight travel distance	32.86 km
Total amount of receipt	196,000 won
Starting time	9:18 pm
Ending time	2:44 am

Suwon ↔ Yongin

Total straight travel distance	44.9 km
Total amount of receipt	240,000 won
Starting time	7:18 pm
Ending time	1:08 am

10 km

Start

10 km

Start

Kakao T Driver
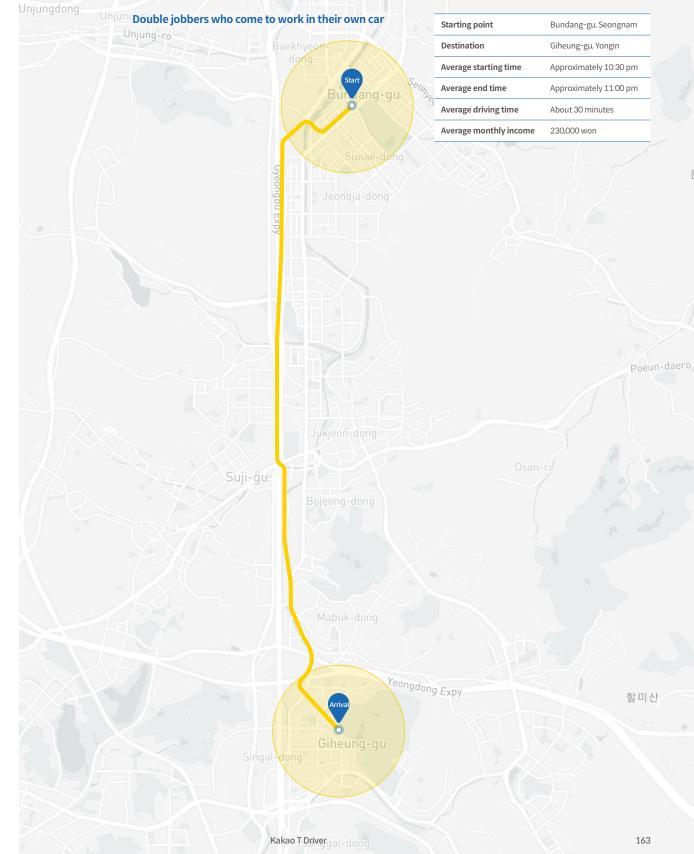
Double jobbers: Double jobbers who come to work in their own car

In an era where it is difficult to live with one job, there are many diligent neighbors who work two or three jobs for more earnings. As seen above, there are full-time drivers who boast a tremendous amount of work among Kakao T drivers. There are also a lot of drivers who have a day job and burn the midnight oil at the same time. Some of the drivers use their own commute time to work on designated driving.

The reason there are drivers on the way home from work is closely related to the nature of the office district. Office districts such as Euljiro, Gangnam, and Pangyo are densely populated with companies and restaurants. When it is 10 pm, when calls for designated drivers from restaurants pour in, these double-job drivers who worked overtime or self-employed in a business until then answer the calls heading home. Drivers on the way home from work usually fulfill only one call a day, and at most two calls a day.

The driver below is a typical case of designated driving for going back home at night. Every night between 10 and 11 pm, this driver received a call from his workplace located in Bundang-gu, Seongnam, and drove for about 30 minutes to return to his home in Giheung-gu, Yongin. The driver made an average of eight calls per month, but he never took a call away from the same starting point and destination. This driver earned ① an average monthly income of about 230,000 won; ② saved public transportation fares of 30,000 won or more per month; and ③ avoided crowded public transportation and instead enjoyed a comfortable way home from work by driving his own car.

Double jobbers who come to work in their own car

Starting point	Bundang-gu, Seongnam
Destination	Giheung-gu, Yongin
Average starting time	Approximately 10:30 pm
Average end time	Approximately 11:00 pm
Average driving time	About 30 minutes
Average monthly income	230,000 won
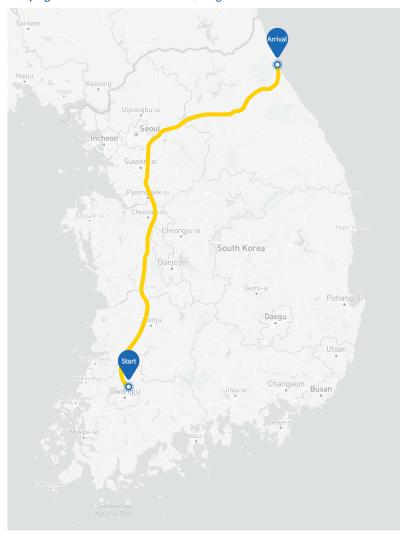
Ultra long-distance style:
A super long-distance runner who turns common sense in daily life upside down
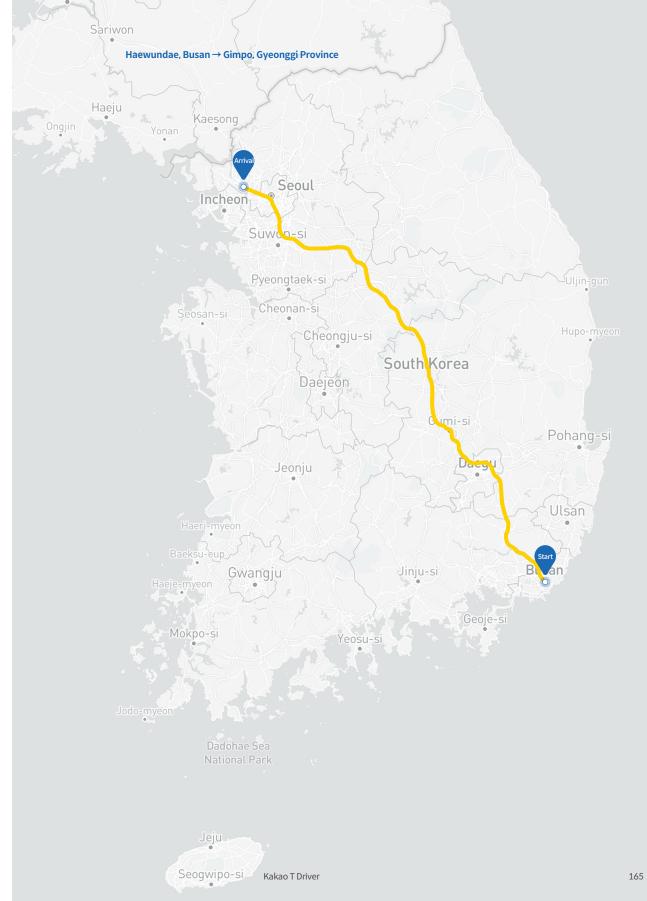
If someone asks, "Is there really anyone riding from Seoul to Busan by designated driving?" the answer is "Yes." Let's take a look at a man who traversed the country in someone else's car. The longest trip he drove in the first half of 2021 was from Busan to Gimpo, Gyeonggi Province, and ran a total of 355.68 km. From more than 5 hours of drive, he earned about 260,000 won (based on the receipt amount). Second place is the drive from Damyang, South Jeolla Province to Sokcho, Gangwon Province, which earned him 250,000 won for a 5-hour drive.

Super long-distance runner

Damyang, South Jeolla Province → Sokcho, Gangwon Province

Haewundae, Busan → Gimpo, Gyeonggi Province

At 10 pm,
when the restaurant closes,
designated driver starts

"Let's go to the second round! Second round!"
A cry from the food alley that is rarely heard in the era of COVID. Before the COVID-19 pandemic took over the world, the time the drinking party ended was all different. Some people went home at 9 pm after only having a light drink, while many guzzlers moved to the second and third round, and often returned home after 3 am. However, as the momentum of COVID-19 grew stronger and stronger, it was difficult to find such "let's go all the way" types for the time being. Even though the "Living with COVID" measure started in earnest in November 2021, it seems that more time is needed before returning to the daily life before COVID-19.
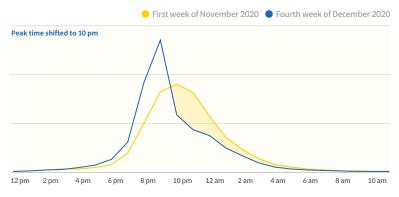
How much has the COVID-19 pandemic and the government's social distancing measure brought about in the use of designated drivers over the past two years? The biggest change began with the enforcement of a strong social distancing measure that mandated businesses to close their doors at 10 pm (or 9 pm). Overall, it drastically reduced the occasions for drinking, but people from unavoidable evening meetings poured out onto the streets at around 10 pm to go home. Due to this, there has been a huge change in the way drivers and users meet in the designated driving market.

What will happen to designated driving if the social distancing level is raised?

In 2021, there were two instances of the COVID-19 crisis. The first was the winter from the end of 2020 to the beginning of 2021 (December to January), and the second was the summer of 2021 (July to October). If the virus spreads at such a rapid rate, the government authorities raise the level of social distancing, and citizens respond to it to minimize private meetings. We looked at what changes occurred at the end of the drinking party according to the change in the social distance level (based on the metropolitan area).
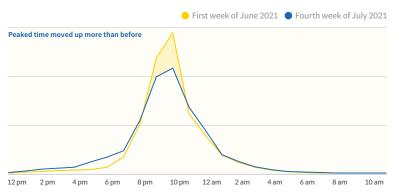
First, we examined the trend of winter 2020. In early November 2020, the daily average number of confirmed cases was maintained at around 100, so it was at Level 1 where there were no restrictions on restaurants' business hours and number of people. At the end of the year, however, as the average daily number of confirmed cases surged to more than 1,000, a stronger social distancing measure of 2 1/2 where restaurant business hours were set at 10:00 pm and the number of people limited to four. As the business hour restrictions began, calls for designated drivers started pouring in at around 10 pm.

Comparison of the distribution of social distancing calls in 2020

● First week of November 2020 ● Fourth week of December 2020

Peak time shifted to 10 pm

| 12 pm | 2 pm | 4 pm | 6 pm | 8 pm | 10 pm | 12 am | 2 am | 4 am | 6 am | 8 am | 10 am |

Next, we compared the before and after implementation of the fourth stage of social distancing in the summer of 2021. As of July 1, the government raised the social distancing level to Level 4, the highest. Restaurant hours are limited to 10 pm, and only up to two people can go to the restaurant after 6 pm. Comparing June and July, before and after the fourth stage upgrade, it can be seen that the peak time is slightly earlier than before.

Comparison of the distribution of social distancing calls in 2021

● First week of June 2021 ● Fourth week of July 2021

Peaked time moved up more than before

| 12 pm | 2 pm | 4 pm | 6 pm | 8 pm | 10 pm | 12 am | 2 am | 4 am | 6 am | 8 am | 10 am |

Changes in commuting time for drivers
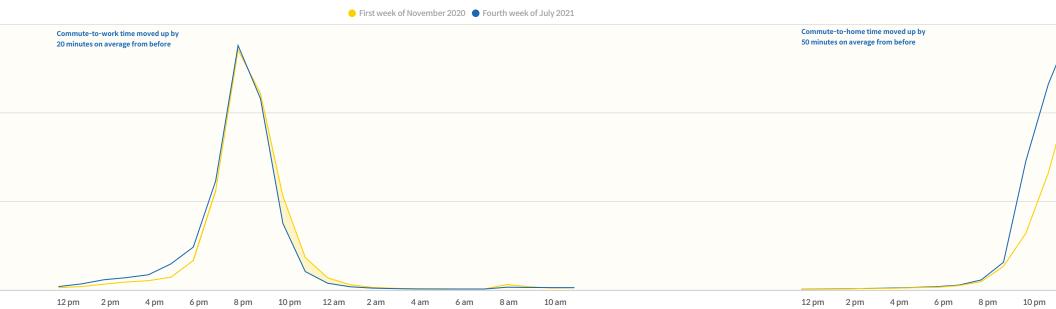
As the calling time of the users changed, the commuting time of the drivers also shifted. Designated driving is basically a job requiring to go to work at night and go home early in the morning. Before the pandemic, the peak time for designated drivers was between 9 pm and 3 am next day, when people finished their party and headed home, and designated drivers were also most active at this time. With COVID-19 prolonged, working until late like this has become increasingly a thing of the past. If so, how did the driver's commuting time change during the first phase of social distancing and the fourth phase of distancing?

First of all, their commute to work has moved forward about 20 minutes. In the first week of November 2020 (Level 1 of social distancing), the average time for drivers to go to work was around 8:10 pm. That was time for users to finish their dinner leisurely at the restaurant. In contrast, in the case of the fourth week of July 2021 (Level 4 of social distancing), the driver's commute time has moved up to around 7:50 pm. As the users' time to go home has been moved forward, the drivers' commute time has also moved.
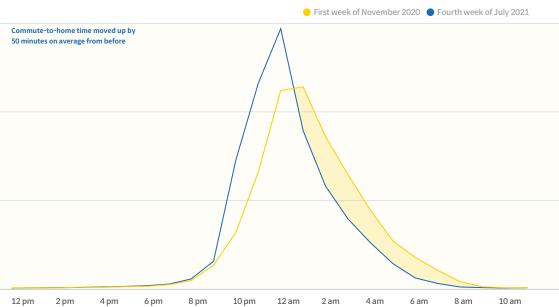
Changes in the drivers' time to get off work were much more dramatic than time to go to work. In the case of the first week of November 2020, the designated drivers left work at around 1:05 am. That was because there were no restrictions on business hours, and users continued to call for designated drivers until dawn. In July 2021, however, when the fourth stage of social distancing was in place, their time to go home was moved up by about an hour to 12:15 am. Now, even if drivers are waiting for calls, it is difficult to find customers going home after 12 am. This led to an early leave from work for drivers.

Social distancing, which has been going on for two years, has brought about significant changes in the way people gather and the way they go home due to business hour restrictions. Such changes could be found clearly through the data of the designated driving market. In line with the business hour restrictions, the commuting time for designated drivers was also moved up.

Comparison of drivers' commute-to-work time distribution

● First week of November 2020   ● Fourth week of July 2021

Commute-to-work time moved up by
20 minutes on average from before

Comparison of drivers' commute-to-home time distribution

● First week of November 2020   ● Fourth week of July 2021

Commute-to-home time moved up by
50 minutes on average from before

Why does the price of designated driving change?
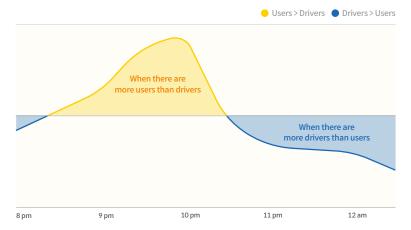
Kakao T Driver always thinks about the fastest and safest way for customers to return home. The result of the past five years is the AI recommendation rate. AI-recommended pricing is from the user's point of view, a "price worth paying" and from the driver's point of view, an "acceptable compensation." Without the recommendation system, it is difficult to find a price that both users and drivers can accept. In this case, a situation may occur in which a user waits endlessly on the road, but the driver has no work and has to leave work early.

One feature of AI recommendation rate is that the price keeps changing according to the demand for users and the supply of drivers. If there are more users who call for designated drivers than surrounding drivers, the price goes up, and conversely, if there are more drivers than users, the price goes down. For example, at 8 pm, there are more drivers who have just left for work than customers who are still at the drinking party. In this case, the rate is determined at a relatively low price. In contrast, when user calls pour in around 10 pm, the price naturally rises.

The graph below shows the ratio of users and drivers according to the time interval at the time of Level 4 of social distancing. As the line moves upward , it means that there are more users who call for designated drivers compared to the available drivers. For example, between 9:30 pm and 10:00 pm, when a significant number of drivers have already met users, it can be seen that the user/driver ratio almost doubles compared to the early evening. This situation begins to change rapidly after 10:30 pm and maintains a stable level at 11 pm.

Ratio of users and drivers by time interval when business hours are limited to 10 pm

Legend: ● Users > Drivers ● Drivers > Users

When there are more users than drivers

When there are more drivers than users

8 pm   9 pm   10 pm   11 pm   12 am

Should I make a designated driving call 30 minutes late under business hour restrictions?

Prior to COVID-19, the range of fluctuations in AI recommendation rates was relatively modest. This was because the end of the drinking party was evenly distributed from 9:00 pm to 12:00 am, so users did not rush their calls. As the quarantine authorities set the end of the business hour at 10 pm, however, the range of fluctuations in the rates became much larger than in the past. To use an analogy, all users called for designated drivers at 10 pm as if they were buying a concert ticket, and accordingly, the recommended rate jumped instantaneously.

 What are tips for calling a designated driver at a lower price during business hour restrictions? With the closing time of 10 pm as the base, one can either come out 30 minutes earlier or wait another 30 minutes. It is just like going to a restaurant 30 minutes before lunch time to avoid crowds at the start of lunch time or visiting a restaurant 30 minutes after lunch time starts. Through Kakao T Driver data, we looked at examples of actual rate fluctuations during business hour restrictions.
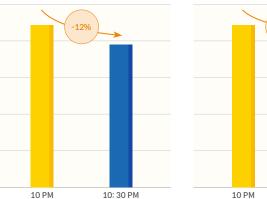
In the case of designated driving from Gangnam-gu to Songpa-gu in Seoul at the time, calling for a driver at 10 pm was 12% more expensive than calling 30 minutes later at 10:30 pm. It was the same for the Gyeonggi region. In the case of designated driving from Bundang-gu, Seongnam to Suji-gu, Yongin, the price at 10 pm was about 9% lower after 30 minutes. If the time when everyone else is calling for designated drivers can be avoided, it is possible to go home at a much more reasonable price.
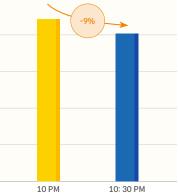
What other changes will "Living with COVID," which started in November 2021, bring about people's gatherings and returning home? Kakao T Driver will continue to work hard to ensure that people can return home safely and comfortably in line with the recovery of their daily lives.

Price change after 30 minutes of peak time

Gangnam, Seoul > Songpa, Seoul

-12%

10 PM   10: 30 PM

Bundang, Seongnam > Suji, Yongin

-9%

10 PM   10: 30 PM

See you at the time!
Designated driver booking

Even though Kakao T Driver has improved the safety and convenience of driving at night, it has many other unsolved problems at hand. The first is designated driving during the daytime. Most designated drivers usually sleep in daytime or come to work in the evening after another job during the day. As a result, during peak hours such as 2 or 3 pm, even when the user called for a designated driver, the number of drivers on the way to work was so few that acceptance was sometimes delayed.

The second is calls from the outskirts. Most drivers wait for their calls in crowded downtown areas. In remote places such as golf courses or suburban residential areas, even if one calls for a driver at a high price, there are no drivers around, so the call is not accepted or one has to wait for a long time. Kakao T Driver wanted to wisely solve the dilemma where users and drivers wanted each other but could not meet.

The solution thus developed was the designated driving advance booking service that was launched in June 2021. Kakao T Driver allowed more drivers to preview users' calls through the advance booking feature. For example, if one books a designated driver in advance to a time and place that would be difficult to access, such as a sleep endoscopy health checkup (daytime) or a golf course rounding party (outskirts), one can deliver a message to a driver who will decide whether to accept the call.

Tips for using designated driving booking

A drinking party whose end time is fixed

With the 52-hour week scheme firmly established, the end time for the dinner party has been moved much earlier. To boot, social distancing measures were strengthened to 10 pm, the situation where "one doesn't know when the drinking party will end" has disappeared. If one calls a designated driver in advance in time for the dinner party to be over, one will not have to touch the smartphone while intoxicated, and as soon as one leaves the restaurant door, one can face the pleasant situation of where the driver will be right in front of one's car. With just 20 seconds before starting a dinner meal, a comfortable way to go home will be guaranteed.
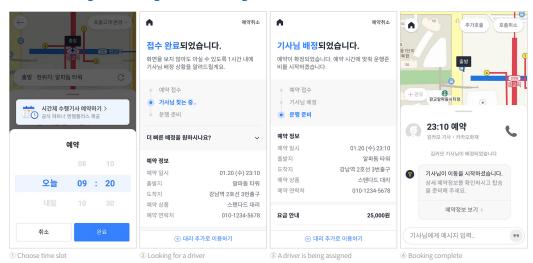
When you want to get out of the suburbs

Occasionally, a drinking party is held at a relative's house in the suburbs or a restaurant in a mountain valley. In this case, · even if any designated driving service is called, the price not only rises significantly, but · it also takes a very long time to arrive. The advance booking solves this problem nicely. As soon as the driver confirms the advance booking call, he calculates an optimal route to that point and answers the call. It is to use the calls of other users to approach the caller without a high cost. From the caller's point of view, it is possible to meet with the driver in a shorter time at a more reasonable price than otherwise, so it is good for both parties.

On a day when driving is infeasible

Even though one took a car, but driving is out of the question. Designated driving booking can be a new alternative. There are times when it is difficult to take the steering wheel even if one is not drunk, such as when one is tired after working all night, or on the days of drowsiness right after a sleep endoscopy. In these cases, it is much safer to call a designated driver rather than forcing oneself in the driver's seat. Even in times when there are not many drivers, if one sets the time to go home a little earlier, a driver who is more experienced than anyone else will visit and drive one home safely.

How to use designated driving advance booking

① Choose time slot ② Looking for a driver ③ A driver is being assigned ④ Booking complete

How do we predict the future price of designated driving?

The core component of the booking service does not simply lie in adjusting the time. The key is to find an "appropriate price" that will satisfy both users and drivers in the future. Even if the call is requested in advance, if the price is too low, the driver will not accept the call, and if the price is too high, the user will not call the driver for booking. It is the platform's role to convince both parties by finding a reasonable middle ground.
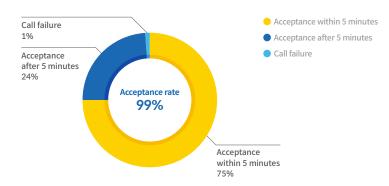
Predicting a booking price is more difficult than predicting the real-time designated driving price. Real-time designated driving is basically determined by the demand and supply situation at the time. On the other hand, much more data is needed for the booking price. • At the appointed time, whether there is a designated driver in the area; • It is necessary to consider everything including whether the arrival area is a preferred location for the driver. This is because with this information it is possible to predict a price that both users and drivers are satisfied.

For example, if a user calls a designated driver from Opo-eup, Gwangju (Gyeonggi Province) to SNU Hospital, Jongno-gu (Seoul) at 2 pm, Kakao T Driver comes up with an appropriate price based on the number of drivers available in the departure point, the attractiveness of the destination, and the user's price acceptability. This kind of calculation is possible using data accumulated over the past five years. Now that the booking service has been launched, the Kakao T Driver is discovering the optimal recommended price that can satisfy both users and drivers by analyzing new booking data.

Call acceptance rate 99%

The effect of the booking feature was immediately shown in the data. When a user makes a booking, 99% of calls are accepted regardless of the requested time and location. In particular, 75% of calls assigned the most appropriate drivers within 5 minutes. This is the case of resolving the mismatch between supply and demand with the concept of "appointment." Even though the call is canceled, the user does not need to worry. That's because Kakao T Driver's booking system constantly assigns new drivers to users until the appointed time.

Booking call acceptance rate for designated drivers

Call failure
1%

Acceptance after 5 minutes
24%

● Acceptance within 5 minutes
● Acceptance after 5 minutes
● Call failure

Acceptance rate
99%

Acceptance within 5 minutes
75%

Just like this, Kakao T Driver is absorbing demand from the market, for which the existing designated driving service could not address. Rather than aiming only for growth in the market that already exists, we are discovering user requests that could not be resolved due to a lack of suitable alternatives and connecting them with drivers. Kakao T Driver is still in the process of improving the service so that it can be used more conveniently in various situations such as hospital reservations and golf course rounds.

The social value created by Kakao T Driver

The awareness on drunk driving cannot be overemphasized. As laws and institution related to drunk driving have become more and more strict, the common sense that "you have to call a designated driver even when one drinks a sip" is now widespread. Users, drivers, and platforms who are participating in the correct behavior of designated driving are all working together to prevent a tragedy on the road. Can't we then estimate the social value that Kakao T Driver is creating with monetary value?

According to the results of a study published in 2018 by the Korea Legislation Research Institute, the social loss of one drunk driving case is 8.93 million won. This includes · superficial fines · reacquisition of the license due to revocation · the result of difficulties in living due to social stigma, which is a conservative figure that did not take into account the loss of drunk driving accident. The number of users whom Kakao T Driver helped return home safely was 63 million for the past five years . Even when only one out of 100 users was caught under the influence of drunk driving, an astronomical sum of more than 5 trillion won would have been prevented.

It is difficult, however, to say that Kakao T Driver alone created all this great value. That's because the amount of 5 trillion won is the outcome of all the stakeholders (users, drivers, and platforms) participating in the designated driving. As a platform that efficiently brokered the supply and demand, Kakao T Driver can claim only a portion of the total stake. In addition to the value created together, can't we think of the value created independently by Kakao T Driver's technology?

One of the indicators to pay attention to as an achievement made by Kakao T Driver's technology is the shortening of the "time for matching drivers to users." The reason this indicator is important has to do with the situation of the intoxicated user. When people get drunk, they feel exhausted and their judgment is clouded. Even users who initially called for a designated driver are more likely to fall into the temptation of drunk driving, "Should I just drive and go home?" if the drivers don't match quickly enough. Providing a designated driver as soon as possible when the user makes the right choice. That's the job of the platform.

As of 2020, Kakao T Driver reduced the time to assign drivers to users by 16% compared to 2019. The reason that the assignment time can be reduced

continuously is because the most appropriate driver is quickly assigned to each user by upgrading the AI recommendation rate through accumulated data. Even now, Kakao T Driver is improving the performance of the rate system by using the newly accumulated data and is helping more users make the right choice, even if it is just one person.

Shortening the driver matching time

Annual average of 2019	
Annual average of 2020	−16% ←

Changes in the designated driving ecosystem that are difficult to be translated into numbers

Are there any social benefits created by Kakao T Driver other than the values that can be estimated in numbers? Comparing the changes in the designated driving ecosystem before and after Kakao T Driver's appearance on the market, one can see at a glance the market practices improved by Kakao T.

First, Kakao T Driver rooted out uninsured drivers in the market. Until just five years ago, there were cases where the driver was not insured. The situation got worse when an uninsured driver caused a traffic accident. That was because the user had to bear not only his own vehicle's loss, but also the injury to the other party and damage to the vehicle. In contrast, in Kakao T Driver, non-insured drivers cannot accept calls from users from the beginning. The system eliminated the uninsured problem entirely.

Second, Kakao T Driver transparently disclosed the driver's information and made it as an industry standard. In the past, when a user called a driver by phone, an unidentified person arrived and was handed over the vehicle's key. For drunk users, especially for women, this situation must have been uncomfortable. From the beginning of the service, Kakao T Driver supported the feature of disclosing the driver's name, face, and insurance information and delivering the vehicle's operation status to the user's family and friends. The practice of providing driver information spread as an essential service throughout the designated driving market.

Third, Kakao T Driver also improved the parking practice of designated drivers. All drivers of by Kakao T Driver must complete parking after driving, unless there is a justifiable cause. In the past, it was quite common for drivers to drop users off at the entrance to an apartment complex or on the road near their house. If the communication to the destination was inaccurate, or if the driver wanted to save parking time and quickly accept another call, then the driver did not complete parking. In this case, users were forced to take the steering wheel for a while to finish parking and ended up paying fines for drunk driving. Kakao T Driver protects users by strictly prohibiting such incomplete services.

Fourth, there is no inconvenience of payment with Kakao T Driver. In the existing designated driving market, cash payment was common. For this reason, quarrels were not uncommon, such as negotiating an already set rate or asking for a tip. From a driver's point of view, it often escalated into an unpleasant emotional confrontation as money was exchanged with a drunk user. In the case of Kakao T Driver, the payment process was simplified by using the fixed rate proposed by AI as the default option. With the recent COVID-19 situation, these contactless payments are playing an even more important role.

Just like this, Kakao T Driver has improved the designated driving ecosystem toward a fast, safe, and reasonable direction. The deviant behavior of some drivers was strongly responded with the zero tolerance principle to protect the safety of users as well as the work of good drivers. We provide users with "the most perfect experience of entrusting their car", and provide drivers with "better service, resulting in higher earnings and a safer working environment." This is the destination Kakao T Driver is moving toward little by little.

**Positive changes
Kakao T Driver has made**

Kakao T Driver

**100%
insurance coverage**

**Provision of driver
information**

**Simplified
payment**

**Compulsory
parking**
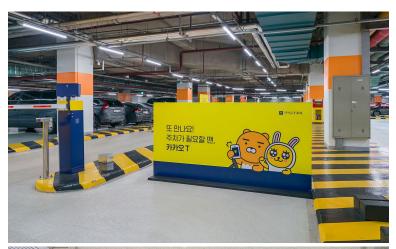
Kakao T Parking

Smart parking lot, a smart way to go beyond the limits of physical space

In January 2021, a total solution of Kakao T Parking was introduced in the parking lot of COEX, a landmark located in Gangnam District in Seoul. By connecting the parking lot existing in the physical space with online and applying technologies such as mobile and AI, more people can use it quickly and conveniently without increasing the parking lot. What kind of solutions were introduced in the COEX parking lot where Kakao T Parking transformed into a "smart parking lot", and what effect did it have?

With the introduction of the Kakao T parking service, it not only created a smart parking lot environment, but also added a bright and friendly image.

Dispersion of traffic through parking lot entrance and exit dispersion guidance

Kakao T Parking uses data to analyze the original role and purpose of parking lots, and proposes parking lot operation plans custom-tailored to the characteristics of individual parking lots. We derive solutions to use the parking lot more efficiently by inducing the most optimal movement plans through analysis of why people visit here, where they come from and where they are going, and what is around them. In the COEX parking lot operated by Kakao T Parking, parking dispersion was induced through data analysis.

COEX is a large-scale multi-use facility located in the city center. The size of the parking lot is huge as it takes up a vast area, and the entrances to the parking lot are opened in many directions from east to west, north to south. If users are not familiar with the information about the entrance and exit of the parking lot, they mostly use the entrance that is visible while driving. The problem is that in a situation where information is not provided adequately, there are often cases of herd behavior by which groups of people follow the actions of other people, and the situation where excessive vehicles are rushed to a specific entrance also occurs naturally. Eventually, the traffic flow slows down, causing inconvenience to all parking lot users.

Guidance in the navigator also contributes to the concentration of certain entrances. Before Kakao T Parking was introduced in the COEX parking lot, if one searched for COEX as a destination using Kakaonavi, one was mostly guided to the "East Gate Entrance," which are the most used by users. Naturally, there was a high tendency for traffic to converge in the "East Gate Entrance." This posed little problem when there were not many visitors. During commuting hours or during an event at COEX, however, a bottleneck often occurs in the process of entering or exiting the parking lot.
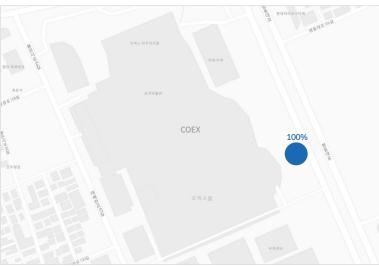
After Kakao T Parking took over the COEX parking lot operation, the dispersion of parking through data analysis began in earnest. The trend of visits by time interval and the purpose of visits were analyzed using the destination search data of Kakaonavi. With the license plate number reader, not only the analysis of the vehicle entering and exiting, but also the movement of the vehicle in the parking lot was analyzed to determine the exit of a vehicle entered.

Based on the analysis results, the prescription provided by Kakao T Parking was to divide the parking lot entrance POI displayed on Kakaonavi into nine. When Kakaonavi users searched for COEX, only "East Gate Entrance" was guided previously, but after the parking dispersion project, "East Gate Entrance," ASEM Tower Gate, West Gate Entrance, North Gate Entrance were recommended at the same time. Users will be able to select the best parking lot entrance depending on the starting point, destination, and the approach to COEX.
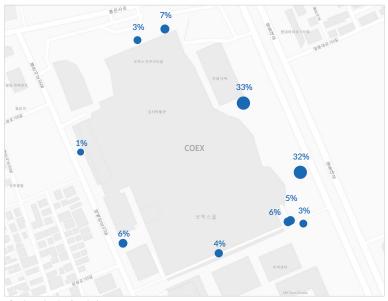
The outcome since Kakaonavi dispersed the parking lot entrances were astounding. According to the results of the Kakaonavi guide for each entrance of

the COEX parking lot for six months after its introduction, the share of visitors to COEX who used "East Gate Entrance" only dropped to 42%. Instead, the share of parking lot entrances that had not previously been guided, such as ASEM Tower gate parking lot (32%), West Gate (7%), and North Gate parking lot (6%), increased. Even though the parking lot and parking lot entrances were the same as before, it was possible to effectively disperse the traffic volume of parking lot entrances just by changing the provision of parking lot information based on data analysis.

Changes in COEX entrance usage rate before and after information provision of other parking lot entrances on Kakao T Parking

Before introduction | Period: Jan. – Sep. 2020

After introduction | Period: Jan. - Jun. 2021

Alternative parking lot information service when the parking space is full

There are many days at COEX where the number of vehicles entering exceeded the number of parking slots. In other words, there were many occasions where the parking lot was full. That's because, while located in the middle of downtown, there are many amenities such as exhibition halls, shopping malls, hotels, movie theaters, aquariums, downtown airport terminals, and office spaces.

The primary approach is to increase parking lot numbers by securing physical parking spaces in order to cope with the rush of vehicles at peak hours. However, securing an additional site for parking space in the middle of the city where COEX is located is a huge expense, and even if additional parking space is secured , there is no way to use it after the peak hours.

The second solution that Kakao T Parking has introduced into the COEX parking lot is an alternative parking lot information service. The alternative parking lot guide is a step forward from the dispersion guide for parking lot entrances. If the dispersion of parking lot entrance guidance is to disperse the use of entrances for vehicles heading to COEX, alternative parking lot guidance is to divert the parking demand itself outside COEX.

For alternative parking lot guide to be successful, it is necessary to notify to drivers in advance whether the parking is full. In September 2020, Kakao T Parking introduced an AI-based "parking lot availability prediction information" service for the first time among domestic parking app services. With this service, if the COEX parking lot is expected to be full, a nearby parking lot affiliated with the Kakao T parking service will be searched, and the real-time status of the parking lot will be analyzed and informed if it is suitable as an alternative.

Was the alternative parking guide effective? When the alternative parking lot information pop-up was exposed to Kakaonavi users visiting COEX according to the parking availability prediction, the rate of changing the destination to the alternative parking lot was 29%. This means that three out of ten vehicles visiting COEX avoided congestion and used the relatively empty alternative parking lot.
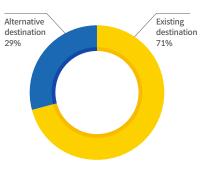
Were the users who received the information actually able to avoid congestion? We compared the speed of vehicles at the entrance of the COEX parking lot when being guided with the alternative parking lot against normal times. In normal times, the average speed at the entrance of the COEX parking lot was 10.52 km/h. When the alternative parking lot guidance was provided, in contrast, it was found that the speed decreased by an average of 5.2% compared to the normal speed at 9.97 km/h. In the worse case, the speed slowed down as low as 2.19 km/h. Given that the alternative parking lot information pop-up is exposed only when there are empty spaces in the alternative parking lot, choosing an alternative parking lot is a smart way to avoid congestion and save time.

The alternative parking lot information service can achieve the effect of catching three birds with a stone. COEX can achieve the effect of relieving parking lot congestion while providing visitors with an alternative to park faster by dispersing the parking demand. From the perspective of the alternative parking lot operators, it is possible to expect an increase in parking income by utilizing the idle parking spaces, and incidentally the effect of increasing the foot traffic due to the increase in the users of the alternative parking lot. From the local government's standpoint, it is possible to achieve the effect of alleviating road congestion caused by excessive concentration of cars, and furthermore, reducing the environmental burden caused by exhaust gas. Kakao T Parking will keep working hard so that the alternative parking lot selection rate becomes 100% so that parking lot congestion can become a thing of the past.

Average speed at the entrance to COEX parking lot

Averagespeed (km/h)

| In normal time | When alternative parking lot information is provided |

10.52   -5.2%   9.97

Time period: Jan. 1 - Jun. 30, 2021

Selection ratio when providing alternative parking lot guide

Alternative destination 29%

Existing destination 71%

Time period: Jan. 1 - Jun. 30, 2021

Alternative parking lot information service when the parking space is full
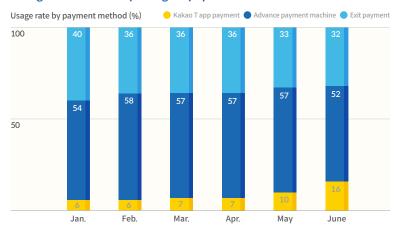
Improving exit speed through advance payment of parking fees

Congestion in parking lots is worse at the exit than at the entrance. That's because it is common to pay the parking fee when leaving the parking lot. When user complaints occur during the payment process and the exit flow is stopped, users behind are also waiting in line, further increasing user dissatisfaction.

Kakao T Parking actively promoted the use of automatic payment machines for Kakao T Parking as well as the use of advance payment machines to increase the exit speed in the COEX parking lot. Users accustomed to paying parking fees on exit were encouraged to use the 40 advance payment machines installed throughout COEX, and users familiar with Kakao T were strongly encouraged to use automatic payment. with automatic payment, the parking fee is automatically paid through an app when passing the parking lot exit just like Hi-Pass on the highway. It has the advantage of being extremely easy to use once registered on the Kakao T app.

Indeed, after Kakao T Parking started running the COEX parking lot, exit payments began to decrease rapidly. In January 2021, the initial stage of operation, 54% of COEX parking lot users were paying their parking fees through an automatic payment machine and 40% through exit payment. The share of users paying their parking fees through the Kakao T Parking was only 6%. Within six months since introduction, however, the share increased by 10 percentage points to 16%. At the same time, the proportion of exit payments showed a steady decline during the same period and declined to 32% in June 2021.

That means more than two out of three users of the COEX parking lot are paying the parking fee in advance before exiting. The number of exit payments that cause congestion in the exit process is on a steady decline. If the app takes over the role of the automatic payment machine, exit is expected to be a simple process that ends when only the license plate of the vehicle is recognized, just like when the vehicle enters the lot. As a result, not only will the exit speed of the parking lot increase, but also the operating cost for exit payment will be reduced significantly.

Changes in the share of parking fee payment methods at COEX

Usage rate by payment method (%)   ● Kakao T app payment   ● Advance payment machine   ● Exit payment

	Jan.	Feb.	Mar.	Apr.	May	June
Exit payment	40	36	36	36	33	32
Advance payment machine	54	58	57	57	57	52
Kakao T app payment	6	6	7	7	10	16

Time period: Jan. 1 – Jun. 30, 2021

Kakao T Parking is transforming the COEX parking lot into a smart parking lot through dispersion of parking lot entrances, information on alternative parking lots, and automatic payment. In the future, Kakao T Parking will continue to introduce new solutions are far from parking lots, such as data, artificial intelligence, mobile, and cloud, to increase parking space efficiency and further resolve road congestion and environmental pollution caused by parking.

Commercial district information can be gleaned from parking data.

"Have you parked? What is your plate number?"
This is a question we always hear when paying at the counter wherever we go these days. Web parking discount has that much become familiar in our lives. This web parking discount service is widely used by many stores regardless of industry, and we explored the movement of people through the data of the Kakao T Parking web discount service used in these stores.

Where do people visit mostly?

On average, more than 5,000 vehicles enter the COEX parking lot a day. Of these, the ratio of vehicles benefiting from a parking discount is about 30%, and the ratio of receiving a parking discount at two or more stores is about 38%. Due to the nature of large commercial complex facilities, there is a large number of users who visit two or more stores, and there are cases in which parking discounts are received in up to seven stores.

Then, which stores and business types do people visit the most? In Kakao T Parking, visit trends by store and business types were examined through web parking discount data.
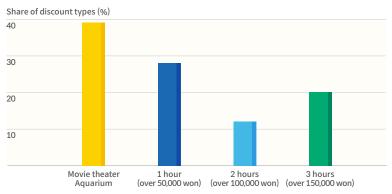
COEX Mall parking fee discount rules

Item	COEX Mall stores	Other stores (services, convenience)
Over 50,000 won	1 hour free parking	Discount criteria for some stores
Over 100,000 won	2 hours free parking	
Over 150,000 won	3 hours free parking	

Separate discount rules in place for movie theater/aquarium visitors | Source: COEX website

First, the application status by time of discount is as follows. The most cases of discount occurred in movie theaters/aquarium, and in the case of discount time, it was in the order of 1 hour, 3 hours, and 2 hours. The fact that the number of 3-hour discount is more than that of 2-hour discount indicates that there were more visitors who spent 150,000 won or more than that of those who spent 100,000 to 150,000 won. As it is a complex facility, it can be seen that the spending amount tends to appear large.
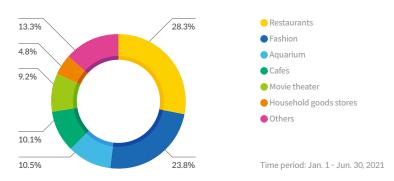
Status of web discount offers by hour at COEX Mall parking lot

Share of discount types (%)

Time period: Jan. 1 - Jun. 30, 2021

The current status of the number of discount cases by industry is as follows. It is in the order of restaurants, fashion, aquarium, cafes, movie theater, and household goods stores, and the number of discount cases in the top-six business types accounts for 87% of the total cases.

Status of COEX Mall web parking discount by business type

- Restaurants — 28.3%
- Fashion — 23.8%
- Aquarium — 10.5%
- Cafes — 10.1%
- Movie theater — 9.2%
- Household goods stores — 4.8%
- Others — 13.3%

Time period: Jan. 1 - Jun. 30, 2021

The current status of the number of discounts for each store is as follows. The number of discounts in the top-30 stores accounts for 60% of the total. By business type, it was in the order of fashion, restaurants, household goods stores, and cafes.

Number of web parking discounts offered by COEX Mall stores

Rating	Store name	Business type	Ratio
1	Aquarium	Aquarium	11%
2	Movie theater	Movie theater	9%
3	Zara	Fashion	6%
4	Youngpoong Bookstore	Books	4%
5	Åland	Fashion	2%
6	Uniqlo	Fashion	2%
7	Hadongkwan	Restaurants	2%
8	Artisee	Restaurants	2%
9	Nike Experience	Fashion	2%
10	Butter	Dry goods stores	1%

Time period: Jan. 1 – Jun. 30, 2021

Providing new insights based on people's movement data

Even if the buildings are located in similar locations, the number of people visiting and the length of stay vary widely. To find out in what areas this difference actually occurs, Kakao T Parking wanted to get some clues through the web parking discount data.

The main reason people visit department stores, large shopping malls, and commercial complexes is that they can visit stores of several types at once. COEX is Korea's best large-scale commercial complexes, and accordingly, there are a large number of visitors who shop in multiple stores. We investigated what kind of correlation there was in the movement of visitors who shop in two or more stores.

First, we looked at the web parking discount data by the number of stores to which a discount per vehicle is applied. The number of cars that received the discount at a single store was the largest, but the ratio of cars receiving from two or more stores also accounted for about 38%.

Number of stores allowing per-vehicle discount

Number of stores eligible for parking discount	Ratio	Average stay time
1	61.6%	2 hours 39 minutes
2	27.7%	3 hours 3 minutes
3	8.7%	3 hours 43 minutes
4	1.8%	4 hours 17 minutes
5	0.3%	4 hours 10 minutes
6	0.0%	4 hours 55 minutes
7	0.0%	6 hours 16 minutes

Time period: Jan. 1 – Jun. 30, 2021

We investigated what kind of stores people visit together when they visit two or more stores. The most common cases were visits to restaurants and fashion stores. Restaurants were included in 12 of the top-20 cases, and fashion was included in 11 cases. In other words, there were many cases of visiting other types of stores with restaurants and fashion stores as the anchor, and it would be an idea to think about store-to-store marketing campaigns based on it. The "eat and drink" at a restaurant and a cafe came in third place.

Next, we looked into which type of stores people stayed for a long time. In principle, the stay time was longer when they visited two or three stores than when visiting one store. When visiting a single store, the type of store where they stayed the longest time was cafes, followed by restaurants and movie theaters. It was found that the stay time was long even if the visitor had a clear purpose such as fashion/bookstore or household goods store. By identifying the types of long-term stay businesses, one can consider strategies for attracting types of stores according to the degree of building revitalization in the future.

Status of web parking discount given in two or more business types

Restaurant/Fashion
11.9%

Restaurant/Aquarium
11.0%

Restaurant/Cafe
7.2%

Restaurant/Movie theater
5.6%

Fashion/Cafe
3.9%

Target: Vehicles that received a web discount for parking in two or more business types out of cars that received a web discount for parking at COEX Mall | Time period: Jan. 1 – Jun. 30, 2021

Ranking status of vehicle stay time by type of stores visited

Restaurant/Theater
4 hours 15 minutes

Others
3 hours 52 minutes

Fashion/Bookstore
3 hours 50 minutes

Restaurant/Fashion/Aquarium
3 hours 42 minutes

Fashion/Theater
3 hours 39 minutes

Target: Based on visits that received a web parking discount at one or more stores | Time period: Jan. 1 – Jun. 30, 2021

Can parking data really affect people's decision making?

Every year on May 5, parents with small children start a guessing game of whether to take their children on an outing. One of the such places is Everland. Will a lot of people indeed go to Everland? Or aren't they? If too many people come, they may have to wait for a half a day in the car to get into a parking spot. What was the actual outcome of this guessing game? On Children's Day in 2015, the number of visitors to Everland was 34,000, which was relatively uncongested, but on the same day in 2016, 50,000 people flocked in.

Even if it is not Children's Day, one has to make a smart "choice" to visit Everland. Usually, the information that affects the decision making of whether to go out includes indicators such as weekend/holiday and weather. But if one can know the "parking lot" availability information in advance, wouldn't it be possible to know directly if Everland will be crowded? In this way, the Kakao T parking service helps people make "choice" of whether to visit major entertainment venues through parking lot data.

AI-based parking lot availability prediction service

It has been one year since the Kakao T parking service was introduced in the Everland parking lot in July 2020. Diverse parking solutions such as smarter parking payment and valet service have been introduced to create a more comfortable and convenient parking lot. Of the various solutions, the most refreshing is the parking lot availability prediction service.

This is a service that predicts whether a parking lot is full by time interval by using real-time parking lot entry/exit vehicle data and accumulated parking lot entry/exit vehicle data. Visitors can check the estimated time of parking lot congestion and the departure time recommended by AI through the Kakao T app in advance. The availability prediction service can be used at the Everland parking lot from September 2020.
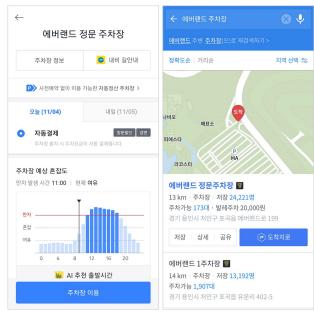
How did the availability prediction service actually affect the decision making of visitors? We analyzed based on the data of Everland parking lot, which has been over a year since the introduction of Kakao T Parking.

First, we looked into when the availability prediction service was used most frequently. For this purpose, we compared the number of visits to the availability service web page for the month of August 2021 and the number of vehicles entering the Everland main parking lot. Assuming that all who have used the availability prediction service have visited Everland, the percentage of full service usage has been calculated. The ratio of the availability service web page visit rate to the total number of vehicles entering was found to be an average of 64%. On national holidays, when parking congestion occurs, the percentage of availability service usage was also higher, and it exceeded 90% on Liberation Day, the highest ever. It shows that there is a clear tendency to use the availability prediction service more when congestion is expected.

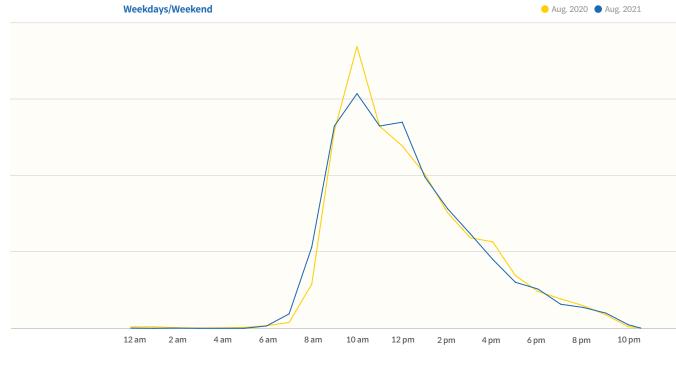**Everland parking lot availability prediction service page view**

Percentage of parking availability prediction service page view by time interval (%)

Time period: Aug. 1 - Aug. 31, 2021

One can check the parking lot situation and availability information through the Kakao T app before visiting Everland.

Dispersion of vehicle entering time after introduction of parking lot availability prediction service

Did the availability prediction service change the actual parking lot usage pattern? To find out, we compared the number of vehicles entering by time interval of the Everland parking lot in August of 2020, before the service was introduced, and August of 2021, after the introduction.
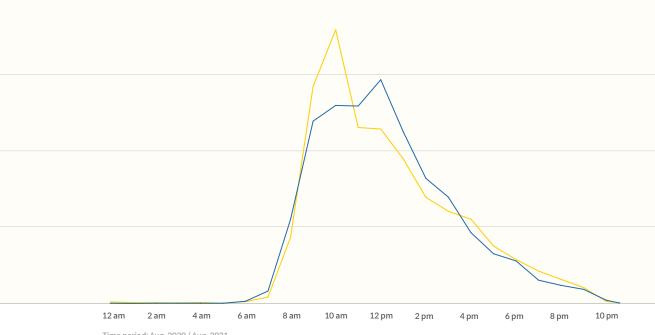
Prior to the introduction of the parking lot availability prediction service, the busiest time of day was 10 am, regardless of whether it was weekends and weekdays. That's because the opening time of Everland is 10 am. Many vehicles were entering the parking lot in time for the opening of Everland.

The parking lot availability prediction service has changed this visit pattern. In August 2021, when the availability prediction service was introduced, the number of vehicles entering by time interval was less crowded at 10 am compared to the previous year, and overall it was found that the number of vehicles arriving at different times was dispersed widely. This pattern was more pronounced on weekends when there are a lot of traffic. On weekends, as the peak time, which had been 10 am previously, was shifted to 12 pm, the ratio of parking lot occupancy at 10 am decreased by 5 percentage points and at 12 pm increased by 3 percentage points. In order to avoid 10 am, the full capacity expected by the availability prediction service, people either departed for Everland earlier or departed later, so it is interpreted that the vehicles entering are evenly distributed.

Comparison of vehicles entering Everland parking lot by time interval

Weekdays/Weekend   ● Aug, 2020 ● Aug, 2021

Weekend

Time period: Aug. 2020 / Aug. 2021

Donate blood
when parking at COEX

We have seen many changes due to the novel coronavirus outbreak. One of the negative changes is the sharp decline in the volume of blood donation. Health concerns due to COVID-19 and reduced movement owing to social distancing have led to a decrease in blood donation. Compared to January-August 2019, before the outbreak, the number of blood donations decreased by 130,000 cases during the same period in 2021. As of October 17, 2021, the blood inventory also recorded only 3.8 days' worth. The proper blood inventory is an average of five days, and when the blood inventory drops to less than five days, the blood supply crisis is at the "alert" stage. Until September 2021, blood shortages are becoming common to the extent that the number of days when the blood inventory was adequate was only ten days.

Kakao Mobility signed an agreement in July 2021 with the Korean Red Cross to encourage people to donate blood and undertake campaigns to raise awareness on the importance of blood donation.

As the first step, if one donates blood at the Blood Donation Center located at the parking lot of COEX in Seoul, a parking discount of up to 1 hour and 30 minutes is provided. Drivers can conveniently use the parking lot at the Seoul COEX Center through the Kakao T parking platform, and enjoy additional benefits as blood donors. Since July 1, when the campaign started, 113 people took part in blood donation for a month and a half and received parking discounts. Kakao T Parking plans to expand the parking discount privileges related to the Blood Donation Center in the future.

In addition, Kakao T made a pledge with the Red Cross to undertake various activities, such as campaigns to encourage people to donate blood and create a joint program to enlist blood donors in the post-COVID-19 era.

MOBILITY
SERVICES
FOR BETTER
MOBILITY

Special Contribution

Thinking about mobility in a humanities way during the climate crisis

Prof. Kim Soo-cheol
Konkuk University KU Academic of Mobility Humanities

What is the humanistic imagination on mobility? How can the humanities and social sciences approach automobiles, today's most visible mobility technology? What kind of changes will mobility technologies and industries, including autos, undergo in the era of climate change? This is written in response to this question from the perspective of the mobility humanities.

What is mobility humanities?

Mobility humanities is an academic discipline that considers the real or virtual movement of people, objects, and information that occurs with the development of various mobility technologies, such as automobiles, trains, airplanes, the Internet, and mobile devices, from the point of view of humans and technology. Mobility does not just affect technology and industrial areas as in electric cars and self-driving cars. Mobility technology does not stop as a mere means of transportation. Changes according to the development of mobility technology bring about significant changes in the concept of space and time, lifestyle, power and capital, social organization, and furthermore, in the identity and values of human being.

The attempt to approach mobility from the perspective of humanities and social sciences can be traced back to British sociologist John Urry in the early 2000s. Recognizing the fundamental importance of mobility as the building block of modern society, he advocated a paradigm shift in the humanities and social sciences, including sociology, to actively grasp and deal with future changes.

The 1895 Chicago Times-Herald Race, the tipping point

There was a very special event held in Chicago on the Thanksgiving day on November 28, 1895. It was America's first-ever car race event the Chicago Times-Herald Race. The total prize money of this race, which was organized by the Chicago Times-Herald at the time, was $5,000. It was intended to revitalize the American automobile industry, which just started out, and to increase the

newspaper's public awareness and newspaper sales. This race, which was also a media event that drew attention from many newspapers across the United States, was one of the tipping points for the future of the automobile industry in the country and the world, as well as the technological development for the next 100 years.

As a result of the race, the first place taken by a gasoline-fueled car manufactured by the Duryea Motorcycle Company, which was known for commercializing the first gasoline-powered engine car in the United States, and driven by Frank Duryea, and the second place was grabbed by one of the founders of Mercedes-Benz of Germany, Karl Benz. The car had been imported and customized in the United States. Of the 80-or-so cars that showed their intention to participate in the competition, only six arrived at the starting line on time, and only two of them completed the race. Of the six cars, three were Mercedes-Benz cars. At the time, Karl Benz had already succeeded in producing more than a thousand commercial vehicles with patent rights in Germany.

Watching this media frenzy in Chicago, the American press and related industries, engineers, and inventors at the time paid attention to the fact that cars, unlike horse-drawn carriages, could travel considerable distances in harsh conditions. Indeed, in a few years after the race ended, full-fledged commercial vehicle production began in the United States.[1] This is the reason the race can be called a tipping point for the development of the American automobile industry.

Behind the commercial production of automobiles at the time, there was an epoch-making change comparable to the transition of auto mobility from petroleum to electricity that's taking place today. That is, as a large number of oil fields were discovered during the time, the oil-based mobility system gradually established itself as the main energy source in all sectors of industry.

Electric vehicles existed before

America's first car race, planned as a media event for a newspaper company, was actually held after many twists and turns. After a cancellation and postponement of the race, two of the six cars that finally arrived on the starting line at the appointed time on November 28 were electric cars. The electric cars gave up on the race shortly after departure. That was because the cold weather in Chicago in late November caused the batteries to discharge quickly.

What if America's first car race, held in Chicago at the end of November, had been held in a warmer month or a warmer southern region rather than in the Midwest? And what if, instead of a gasoline car, one of the two electric cars took the first place in the race that got the attention of the entire American press? Since it was two out of six cars, the probability would have been one in three. Wouldn't the history of American (or the world's) cars be different from what it is today?

Still, even if an electric vehicle reached the finish line first, it seems unlikely. That's because few technologies and industries have as strong a lock-in effect as automobiles. In order to accurately understand the nature of the history of the automobile industry and technology, it is necessary to look beyond the automobile itself to a larger system and infrastructure. Today's automobile industry and technology, and diverse systems and infrastructures that closely make up the weave and warp of modern life centered on automobiles, and their behaviors— not only technological factors, but also economic, policy, institutional, and social practices are included—a very robust system that runs in close connection with each other to create a massive socio-technical system. Once this system—one can call it "automobility"—is in place, it does not allow the actors involved (producers and consumers) any other choice or contingent factors to meddle in.

There Will Be Blood: the lock-in effect of mobility systems

There Will Be Blood is a 2007 American film directed by Paul Thomas Anderson. Set in California, where there was an oil boom since the beginning of the 20th century, this epic film depicts the life of a self-made oil prospector (Daniel Day-Lewis) from a small-time silver miner to a tycoon in the oil industry. This film is known as an outstanding work of art that shows the unique perspective of a master director who sharply penetrates what kind of country America is all about and the history of the 20th century United States. In the film, there are two main characters who oppose each other, and they symbolize the two central axes that dominated the entire history of the 20th century United States, namely, Christianity and oil.[2]

The American oil industry began in earnest in the late 19th century. In 1870, John D. Rockefeller founded Standard Oil Co., which monopolized oil distribution throughout the United States. The rotary drill bit, one of the most important inventions in oil exploration technology, was first used in Texas in 1901. After that, large oil fields were discovered one after another in Oklahoma and California. It was during this period that all oil giants were born. Until the 1930s, when oil fields

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1 The Ford Motorcycle Company was founded in 1903. It was in Dearborn, Michigan, not too far from Chicago.

2. To Paul Thomas Anderson, Christianity and oil appear to be the key pillars that made America possible in the 20th century and America what it is today. Anderson's film was first released in 2007. At the time, the United States was engaged in the Iraq War (2003-2011), and then President George W. Bush announced a plan to mobilize more than 20,000 ground troops to Iraq in a live televised speech throughout the country in January 2007. Let's consider the real background that led the United States to the Iraq war, and the key constituents who supported President Bush who was the cheerleader of the war. Christianity and oil, and Anderson's insight into American history in There Will Be Blood, released in 2007, was valid even during the Iraq War, more than 100 years after that.

were discovered and developed in the Middle East, large-scale oil fields were discovered one after another in Southeast Asia, Central and South America, outside the United States, and crude oil production increased rapidly.

Approximately between the 1920s and 1940s, that is, between the two world wars, an oil-based civilization, a high-energy society based on an unlimited supply of cheap oil, was established.[3] The automobile and automobile mobility system, the most important mobility technologies of the 20th century, were growing in the midst of it. Even if an electric car took the first place in the race held in Chicago and became a leading model, one thing can be said with certainty: the energy source of the electric car battery would have been oil, not solar power as it is today. In other words, there has been no other vehicle energy source and distribution infrastructure that can substitute oil for the past 100 years.

To put it differently, one of the things we must remember when considering the changes in the automobile industry and the technological development direction is that mobility systems such as automobiles, once established, rarely allow other kinds of technological choice or industrial innovation. The automobile mobility system is the sum total of massive systems and infrastructures, and these systems exist as a group of social structures and practices organized around a technology. Once established, this system is locked in for decades, and once implemented, it constantly evolves and changes.

Today, we are living in a very interesting and important period in the history of automobiles, in which a system that has been solidly built over the past 100 years is slowly disintegrating and transforming. The transition from an automobile mobility system that made use of cheap oil as an energy source to a completely different automobile mobility system that no longer uses an engine using the explosive power of petroleum and instead generates electric power made from other alternative energy such as solar energy has indeed begun.

However, the history of Technology Innovation and innovation is not linear. In fact, abrupt transition and replacement did not occur very often in the history of technological development. This case is well illustrated by digital media technology. Old technology is not replaced by new technology overnight, but over a long period of time it changes as new technology takes over certain features and roles of old technology and at varying speeds and intensities during the social adaptation process. The pattern of change is also very diverse. The predictions that paper newspapers will disappear have still proven wrong a few decades later. In contrast, film-based cameras and cassette tapes disappeared without trace even though they did not vanish completely.

British sociologist John Urry said in his book Post-Petroleum (2021) as follows:

> [When talking about automotive mobility], it is always talking about the economic system, physical system, technological system, political system, and social system all at the same time. This is a socio-technical system in which numerous interacting elements meet and lock in each other. Today, such interactions occur due to interconnected software and networks. The way these system designs evolve over time is non-linear and unpredictable.[4]

Expansion of mobility and mobility humanities

The car mobility transition that John Urry spoke of can be summarized in two ways. First, it is about the strong lock-in effect of mobility systems including automobiles. Second, it is closely related with the role of digital technology in the development of the automobile industry and mobility systems such as today's electric vehicles and self-driving vehicles.

What is the role of digital technology in the transition of today's automobile and mobility industries? The core components of today's mobility innovation consist of two transitions. One is the conversion of mobility energy sources, as is appearing in electric vehicles . It is the transition from oil, which is gradually depleting past its peak, to other alternative energy sources. Electric vehicles are the best example. Another is the transition associated with the combination of digital technology and mobility. Today, self-driving vehicles are representing this digital transition of mobility.

The problem is that in this second transition the invention of self-driving vehicles is seen as everything of mobility innovation through digital technology. Why do we want to invent self-driving cars? When we talk about the transition and innovation of car mobility based on digital technology, we need to look back on whether we all tend to talk and think like Elon Musk. The combination of mobility and digital technology requires more balanced and open thinking.

Recently, through the cases of companies such as Amazon, the platformization of mobility systems is in full swing. Mobility system platformization means a new level of mobility through innovation in digital technology (e.g., big data, Internet of Things, cloud computing, and artificial intelligence); in other words, a change in the mobility system using a highly developed logistics network. Platformization of today's mobility systems, that is, the combination of mobility systems and

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3 According to American historian David Nye, between the events of the stock market crash of 1929, the Great Depression, and World War II, a high-energy system emerged that supported clothing, food, housing, mobility, fuel, climate control, and infinite growth. Post-Petroleum (John Urry, translated by Tae-hee Kim, 2021, Alfie), p. 29.

4 Ibid., p. 28.

platform technology is the key to enabling the expansion of mobility. In other words, not only the simple movement of people and things, but also the provision of necessary materials, services, and labor at the prescribed time and place, as well as the establishment of a mobility system that allows more sophisticated classification, storage, and deployment is driving the expansion of mobility.

Today, as John Erie remarks, behind the epoch-making change of mobility transition, there is a global crisis such as depletion of oil resources, environmental degeneration, and climate change. It is thus time to consider the scenario for a post-petroleum society. The mobility system that we have created and accustomed to in the 20th century is based on the assumption of unlimited oil supply. More mobility in this case inevitably means more carbon emissions and environmental degradation. What should a mobility system that can break out of this vicious cycle be like?

In this regard, it is necessary to find out whether the future prospect of intermodal mobility, which has recently been attracting attention in some countries in Western Europe, is not too underestimated or overlooked. Intermodal mobility is actually not a concept recently proposed. It is a concept raised in an attempt of solving the problem of how to provide better services by linking various existing mobility infrastructures (usually seamless connection of land, sea, and air transportation systems) in traffic, transportation, and logistics fields. Today, as the efficient use of existing public transportation systems such as railroads and logistics infrastructure, and the availability of shared mobility systems and micro-mobilities (kickboards, shared bikes, etc.) increases, it is not simply faster movement, but more energy-efficient (or less carbon emissions) mobility that matters more. That's why the possibility of intermodal mobility, which seeks to provide more energy-efficient mobility services, is attracting attention.

In this regard, intermodal mobility can be viewed as a direction toward mobility innovation that is more likely to be relatively more suitable to the original background and purpose of mobility transition than self-driving cars. However, mobility innovations such as intermodal mobility have significantly lower commercial incentives for innovation compared to self-driving vehicles. It is mainly an innovation that requires coordination and cooperation between various stakeholders through public means such as change in local government policy measures. In this case, digital technology, especially platform technology, plays a critical role. It is necessary to think about how to realize a mobility system that's more energy-efficient and can contribute to the public interest and improving mobility commons through the development of existing networks and software. The strategy of pursuing exclusive commercial profits only through the establishment of a monopoly position is likely to be far from the original purpose and necessity of mobility transition.

We must also reexamine the existing value system assigned to mobility. In the 20th century, we pursued faster, more, and more efficient mobility only. Does more mobility always mean personal freedom, successful life, and the good? We need to think from a new perspective mobility and immobility, or the meaning of moving and not moving. In the era of climate crisis, how should our approach to giving a meaning to mobility change change? This is another challenge that mobility humanities must face.
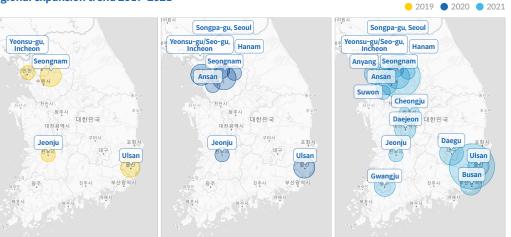
Kakao T Bike

Usage patterns by cities with Kakao T Bike data: Daily Life Type vs. Leisure Type

Kakao T Bike running as a nationwide eco-friendly means of transportation

Kakao T Bike service started in 2019 with 500 bikes each in Seongnam, Gyeonggi Province, and Incheon. Based on operational know-how and data analysis accumulated through the experience in Seongnam and Incheon, the service was expanded to Jeonju, Ulsan, Hanam, Ansan, and Songpa in Seoul, and in the first half of 2021, Kakao T Bike service in regional bases such as Daegu, Busan, Daejeon, and Gwangju started in earnest. In the second half of 2021, the service area was further expanded to include Anyang, Gyeonggi Province, and Cheongju, North Chungcheong Province, supplying a total of 17,000 bikes.

Regional expansion trend 2019-2021

● 2019 ● 2020 ● 2021

Daily Life Type vs. Leisure Type

Analyzing the Kakao T Bike data accumulated over the past three years, different usage patterns emerge by region. Basically, it can be divided into a daily life type used as a means of commuting by office workers and students, and a leisure type used for exercise in leisure time. The daily life type appears mainly on weekdays, and the leisure type on the weekends.

Data provide a clue to determine whether the riding route in the user's driving data is a daily life type or a leisure type. "From the subway station to the office," "from the bus stop to the school" In this case, a clear intention to travel the shortest distance is revealed from the route. In contrast, in the case of leisure use, the destination is not clear and it is highly likely that it is a route returning to the starting point after turning around from the turning point.

This can be explained by dividing it into a linear trip (daily life type) and a round trip (leisure type). In the case of a linear trip, the difference between the straight distance from the origin to the destination and the actual distance traveled is not large, and in the case of a round trip, the actual distance traveled becomes larger than the straight distance from the origin to the destination.

Straight-line trips

Shortest distance efficient movement

Starting point — Destination

The difference between the actual distance traveled and the straight line distance between the origin and destination is not large.

Roundtrip

Turning around or return

Starting point Destination

The difference between the actual distance traveled and the straight line distance is large.

Clustering based on the type of trip in the service area

The X-axis of the Kakao T Bike service area clustering graph below indicates the type of trip. The closer the city is to the origin of the X-axis, the more straight-line trips tend to be, and the more to the right, the more round trips. The Y-axis represents the proportion of commuting during the rush hour, and Ansan, Songpa, Hanam, and Seongnam have a high proportion of daily life type commuting to and from work. In contrast, Busan has a strong leisure type pattern, and Ulsan and Daejeon have a more pronounced leisure type pattern compared to other regions. In addition to recording a high rate of usage during commuting time on weekdays, the leisure type areas have a tendency to use long distances for a relatively long period of time, with usage rates exceeding weekday peak hours even on weekend afternoons.
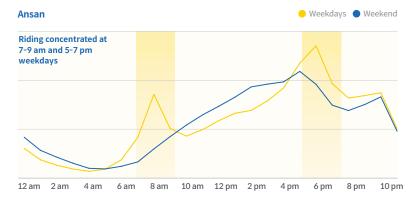
Kakao T Bike usage pattern by city

Commute concentration rate

● Daily life type city ● Leisure type city

Hanam Songpa-gu, Seoul

Ansan Seongnam , Wirye New Town

Jeonju Yeonsu-gu, Incheon

Seo-gu, Incheon

Ulsan Daejeon

Daegu
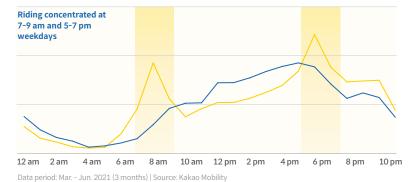
Gwangju Busan

Ratio of roundtrip (round index)

By looking into the operating volume by time of each service area, the difference between a daily life type city and a leisure type city becomes more pronounced. In Ansan and Hanam, which are daily life type cities, the operation is concentrated between 7-9 am and 5-7 pm, which are weekday commuting hours.

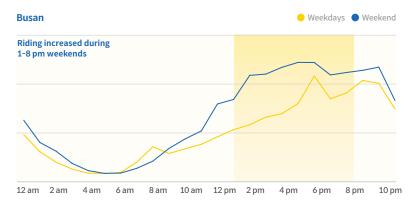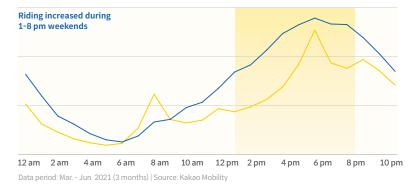**Riding pattern by time interval in daily life type cities**

Ansan ● Weekdays ● Weekend

Riding concentrated at 7-9 am and 5-7 pm weekdays

12 am 2 am 4 am 6 am 8 am 10 am 12 pm 2 pm 4 pm 6 pm 8 pm 10 pm

Hanam

Riding concentrated at 7-9 am and 5-7 pm weekdays

12 am 2 am 4 am 6 am 8 am 10 am 12 pm 2 pm 4 pm 6 pm 8 pm 10 pm

Data period: Mar. – Jun. 2021 (3 months) | Source: Kakao Mobility

In the case of Busan and Daejeon, the leisure type cities, the peaks occur during the commuting hours similar to the daily life type cities during weekdays. On weekends, however, between 1 and 8 pm, the bikes are used for a long time beyond the peaks on weekdays.

Riding pattern by time interval in leisure type cities

Busan ● Weekdays ● Weekend

Riding increased during 1-8 pm weekends

12 am 2 am 4 am 6 am 8 am 10 am 12 pm 2 pm 4 pm 6 pm 8 pm 10 pm

Daejeon

Riding increased during 1-8 pm weekends

12 am 2 am 4 am 6 am 8 am 10 am 12 pm 2 pm 4 pm 6 pm 8 pm 10 pm

Data period: Mar. – Jun. 2021 (3 months) | Source: Kakao Mobility

The riding pattern can also be identified through the average usage time of Kakao T Bike and the ratio of cumulative riding time. In Ansan, where the daily life type pattern is dominant, the bike rides on average were about 12 minutes, and 90% of the cumulative users completed the ride in about 20 minutes. In contrast, in Busan and Daejeon, where there are many leisure type users, they used bikes for an average of 18 minutes, and 90% of the cumulative users completed their ride in about 40 minutes, showing a tendency to use bikes for a longer period of time than those from daily life type cities.

What are the riding hotspots in Ansan and Hanam, the daily life type cities?

The following is a more detailed analysis of the main riding areas of the daily life type area and the leisure type area. In Ansan, a typical daily life type city, the usage of Kakao T Bike is concentrated near Gojan Station and Jungang Station on Subway Line 4. Users often move to the Hosu-dong commercial district and Hanyang University's ERICA campus with these two stations as the center. It is clear that Ansan citizens are using the Kakao T Bike as a means of transportation necessary for daily life such as work or study.

A similar pattern emerges in Hanam. Bike riding services to the surrounding commercial districts are concentrated around Misa Station on Subway Line 5.

Weekday

Weekday

Weekend

Weekend

Major bike riding areas in Ansan (Weekends and weekdays)

Time period: Mar. - Jun. 2021
Source: Kakao Mobility

Major bike riding areas in Hanam (Weekends and weekdays)

Time period: Mar. - Jun. 2021
Source: Kakao Mobility

What are the hot spots for leisure type cities in Busan, Ulsan, and Daejeon?

Leisure type cities are characterized by the fact that the main riding areas appear differently on weekdays and weekends. In the case of Busan, which is one of the main leisure type cities, riding occurs mostly in Nam-gu and Suyeong-gu, with Suyeong Station, Gwangan Station, and Gyeongseong & Pukyong National University Station on Subway Line 2 as the center. During weekends, as the leisure demand increases, the service areas from Waterside Park near Gwangan to the Suyeong River Bike Road are distributed at length.

On weekdays in Ulsan, the riding demand is widely spread in the Samsan-dong commercial district (Nam-gu) and the vicinities of Byeongyeong Five-way Intersection (Jung-gu), but on weekends, the usage of Kakao T Bike increases on the bike road along the Taehwa River. The major riding areas are the National Garden on the Taehwa River and the vicinity of Taehwa Pavilion.

Weekend

Major bike riding areas in Busan (Weekends and weekdays)

Time period: Mar. - Jun. 2021
Source: Kakao Mobility

Major bike riding areas in Ulsan (Weekends and weekdays)

Time period: Mar. - Jun. 2021
Source: Kakao Mobility

Visualization of roundtrip vs. straight-line trip

Next, the types of trips are classified by color. The yellow dots on the map are the areas where the straight-line trips occur, and the blue ones are the areas where the round trips occur. In places where the movement to a destination is strong, such as Ansan, the yellow dots dominate a large proportion. Except for the vicinities of Lake Park in Ansan, most areas appear in the form of straight-line trips that are related to daily life type.

In the same way in Daejeon, the weekday demand for commuting to and from work/school is concentrated in the areas that connect Chungnam National University, KAIST and Yuseong Oncheon Station, and in the Dunsan-dong commercial district. In contrast, there is a high demand for leisure type trips during weekends around Gapcheon, which runs through downtown Daejeon, and the Expo Plaza.

Weekday

Weekend

Major bike riding areas in Daejeon (Weekends and weekdays)

Time period: Mar. - Jun. 2021
Source: Kakao Mobility

Distribution of trips in Ansan   ● Straight-line trips   ● Roundtrips

Source: Kakao Mobility

In the case of Busan, blue dots appear mixed in various regions. It is interpreted that Busan's Kakao T Bike users appear to have a strong leisure tendency to not only move with a purpose to reach a destination, but also to enjoy riding. The round trip is pronounced in Sajik-dong, which has a well-maintained bike path, as well as Waterside Park and the banks of the Suyeong River where riders can enjoy the scenery.

Due to the urban structure, if there are many detour roads, round trips may appear frequently in daily life type areas, and straight-line trips may appear prominently in leisure type areas if there are many straight riverside bike paths. Therefore, by comprehensively considering various variables such as the main operating hours for each city, the regional differences in weekday and weekend usage rates, and the differences in major riding areas such as subway stations, schools, commercial districts, and riverside bike paths, it is necessary to identify "daily life type areas" and "leisure type areas." The regional characteristics identified through the data analysis can be used as reference materials for service improvement. It can also be used as data for redeploying bikes in advance by identifying the demand for each area within the service area, as well as data for improving the rate scheme. The following are examples of how the Kakao T Bike team is working to improve the service through data analysis.

Distribution of trips in Busan   ● Straight-line trips ● Roundtrips

Source: Kakao Mobility

Finding the standard for operating shared mobility services

For shared mobility services, it is essential to optimally deploy the means of transportation according to the needs of users, and to think about the best billing system so that more users can use it without burden. Kakao T Bike is continuously upgrading its service operating infrastructure by accumulating data and operational know-how through nationwide service.

In the early days of the Kakao T Bike service, users experienced inconvenience as the bike's battery capacity and durability was low, and it was frequently out of commission for recharging and repair. Based on the operational experience of the first-generation models, the maintenance manpower was increased continuously, while the charging time and repair frequency were shortened so that as many bikes could be put into service as possible.

The speed of the bike was also adjusted based on operational data and know-how. The legally permitted maximum speed for electric bicycles is 25 km/h. Even though Kakao T Bike provided services by limiting the maximum speed to 20 km/h, the probability of an accident increased and the brakes wore out quickly due to users' high-speed driving, resulting in a longer repair and out-of-commission time. Kakao T Bike sets the user's "safety" and "convenience" as its top priorities, so it is run by setting the speed to 18 km/h. As a result, user convenience and safety have been improved through smooth and stable acceleration, and the frequency of bike repairs has declined.

Service operation based on big data

With the popularity of the Kakao T Bike, we faced another difficulty. As the driving time increased, the number of cases of battery discharge increased. To address this problem, data was actively used. Instead roaming around the service areas to find and charge spent bikes, charging infrastructures were deployed by predicting the area and time with high discharge frequency through data analysis. Since Kakao T Bike exchanges information with the control center through real-time communication, it was possible to respond to the bike's battery capacity in real time. Thanks to such system improvement efforts, the charging rate, which remained at only 70-80% in 2019, has been improved to 95% in 2021, allowing users to enjoy Kakao T Bike more conveniently.

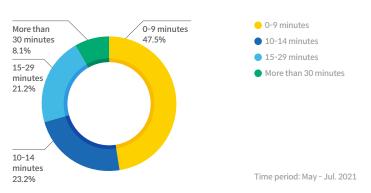**Kakao T Bike waiting for users**

Source: Kakao Mobility

We are using data actively in the deployment of Kakao T Bike. Since bicycles are run in a dockless way with no separate return location, it is difficult for the next user to find a bike if the service ends in an area outside the service area or in an alley. To address this problem, we are redeploying the bikes by predicting the area and time of high bike demand through an analysis of driving patterns of each area.

Effort toward an optimized rate plan

We need to think about the billing system to make Kakao T Bike available to more users. If the rate is set too low, there may be situations in which only a small number of users have the opportunity to use the bikes exclusively rather than sharing them. In contrast, if the rate is set too high, users may opt for other means of transportation such as taxis and buses instead of using bikes. How much is the optimal rate, which is neither too cheap nor too expensive? Kakao T Bike continues to think about the optimal price based on data and users' voices in the field.

Share of Kakao T Bike users by time interval

- 0-9 minutes
- 10-14 minutes
- 15-29 minutes
- More than 30 minutes

More than 30 minutes 8.1%

15-29 minutes 21.2%

0-9 minutes 47.5%

10-14 minutes 23.2%

Time period: May - Jul. 2021

The shared mobility billing system is usually a combination of the basic rate and the hourly rate. The basic rate for Kakao T Bike is 1,500 won per 15 minutes. If one uses the bike within 15 minutes, the rate is 100 won per minute. Given that the average price of an electric kickboard, a similar shared mobility service, is around 200 won per minute, it is on the cheap side. Depending on the usage time, however, there is a situation where the billing amount of the electric kickboard becomes cheaper. For example, if one uses a kickboard for 5 minutes, it costs 1,000 won. In comparison, if one uses a Kakao T Bike for 5 minutes, one has to pay the basic fee of 1,500 won. For users who want to use shared mobility within 15 minutes, the Kakao T Bike may be a little more expensive. Looking at the actual bike riding data, it was found that more than 70% of the users ride fewer than 15 minutes. There may be many users who feel that the price of Kakao T Bike is a little bit too steep.

To find the optimal rate plan, Kakao T Bike tested twice in December 2020 and in June 2021. In addition to data analysis for testing, market research was also conducted by directly interviewing actual users in the field. The burden for short-distance users due to the billing scheme was lowered, and the basic rate was lowered by 200-500 won to allow more users to access the bike, and the per-minute rate was also adjusted.

Comparison of test areas for changing bike rate plans

Change rate during the same period (%)

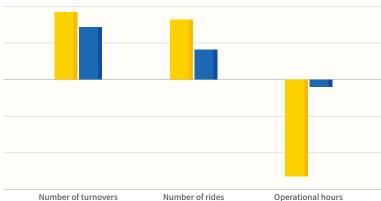● Regional average of changed rate plan
● Regional average of existing rate scheme

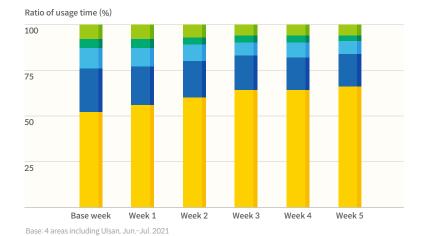| Number of turnovers | Number of rides | Operational hours |

The results of the rate plan reform test were encouraging. While the average ride time per user declined, the turnover rate of bikes increased. In other words, the time a specific user occupies a bike has decreased, but it appears that more people are using the bike than before. In particular, during the test period, the number of short-distance users of less than 9 minutes gradually increased, confirming the validity of the hypothesis on the need for a short-distance rate plan.

Changes in the share of usage time according to the rate plan change test

Ratio of usage time (%)

● Less than 9 minutes
● 10-14 minutes
● 15-19 minutes
● 20-24 minutes
● 25-30 minutes

Base: 4 areas including Ulsan, Jun.-Jul. 2021

Based on this, we prepared an improved rate reform plan so that more users can use the Kakao T Bike as an efficient means of transportation without the burden of the basic rate. The main purpose of the rate plan reform was to reduce the burden of unnecessary expenses of the basic rate of 1,500 won. We introduced a rate scheme that lowered the basic rate by 200-300 won (depending on the region) and reorganized it to a per-minute billing scheme. We predicted that short-distance users, who account for more than 50% of Kakao T Bike rides, will enjoy a cost-saving effect. In addition, it was expected that more people could use the shared mobility service by lowering the psychological barrier by cutting the basic rate.
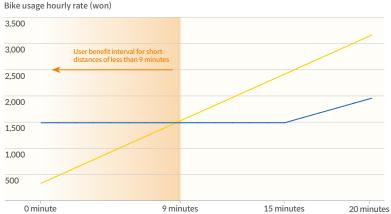
Comparison of charges for each hour of use under the existing rate plan and the short distance-centered rate plan

Bike usage hourly rate (won)

● Short distance-centered rate plan
● Existing rate plan

To offer reasonable rates even for leisure type users who use the service for a long time, the implementation of the revised rate scheme has been postponed for a while, and new rate plans such as a fixed rate plan are under preparation. We are also looking for ways to improve the chronic parking problem of shared vehicles through user participation, such as providing incentives for returning bikes to the Kakao T Bike parking location. In the future, Kakao T Bike will keep making efforts to establish a shared mobility culture in society.

The Kakao T Bike service is evolving constantly. In the process, we are witnessing synergies occurring through partnerships with local governments. We had an interview with a person in charge of transportation policy in Ansan City, where the bike service has been firmly in place.

Please provide a brief introduction of yourself and a description of what you are doing.
I am glad to meet you here. My name is Seong-gon Jo, manager of the Transportation Policy Division responsible for overall transportation affairs in Ansan City.

Do you have any experience of riding the Kakao T Bike in Ansan? If you do, please tell me about what you think about this.
I don't use it often because I have my own car. When I have dinner appointments or just want to get around a relatively short distance, I often use a Kakao T Bike instead of a car. It is a good way to move around because it is a cheaper than taxis, but the most attractive is that it is an eco-friendly means of transportation. It may sound a bit grandiose, but I believe that changing the world starts from small actions, and as a public official, it is more desirable to make a choice in consideration of the environment even a little. From that point of view, I think Kakao T Bike is a better option for me.

Ansan City and Kakao Mobility signed an agreement in September 2020 and are jointly running Kakao T Bike in Ansan City. When signing the agreement with Kakao Mobility, a private operator, are there any business factors that Ansan City judged advantageous about Kakao T Bike?
As I said earlier, the fact of eco-friendly means of transportation acted as the most important factor in our decision. In addition, Kakao is one of the most familiar brands to many people. There was an aspect where the high brand awareness increased accessibility, and the convenience of not having to return the bike to a separate rental location based on the door-to-door method was very attractive from the user's point of view even considering the fee. We decided to introduce it by comprehensively taking into account these various requirements.

After the Kakao T Bike sharing e-bike business, what kind of positive impact did Ansan have on the city and its citizens?
Ansan City had operated a public bike service called "Pedalo" in the past. The city paid for most of the operating costs, and above all, it was based on a scheme where users had to return the bike to designated locations only, which made it inconvenient to operate in densely populated residential areas. Kakao T Bike was able to solve this problem because it adopted a dockless policy that does not keep a separate return location. The fact that one can experience a sense of utility while using an eco-friendly vehicle from the user's point of view seems to be attractive. In terms of cost, it has the advantage of reducing the financial burden from the city government's point of view because it is run in a user-funded manner.

What is the reaction of the citizens of Ansan to the Kakao T Bike?
Kakao T Bike is provided in major cities throughout the country. When analyzing the usage data, it appears that the usage rate of Ansan citizens is quite high. This seems to be able to represent the reaction of citizens. Of course, the road condition and excellent infrastructure of Ansan City, which are well built so that it is not inconvenient to ride a bike, are also one of the factors that drove the high usage rate. In addition to that, I think the high usage rate is due to the combination of various factors such as the convenience of access based on the Kakao T mobile app, the efficiency of the e-bike, and the convenience of returning it.

What would you like to see to create further synergies between Ansan City, a local government office, and Kakao T Bike, a private operator?
Kakao Mobility is Korea's largest mobility company, and the Kakao T Bike service is growing rapidly with support from various cities including Ansan City. In Ansan City, which has received the most positive evaluation, I believes that the convenience of citizens should be given priority over profits. More specifically, it would be nice if the operation of Kakao T Bike could be actively promoted even in areas remote from major transportation hubs, such as Daebu Island or the outskirts of Ansan.

What kind of effort do you think is required for Kakao T Bike to become an efficient means of transportation for Ansan citizens?
Yellow bicycles are highly visible and easy to spot. This is good because it can be easily spotted from a distance, but on the other hand, it has the disadvantage of being easily seen when the bikes are left on the streets in disorderly manners. As this is highly likely to cause civil complaints, the company needs rearrange the bikes to an appropriate location while visiting the site from time to time. Kakao T Bike charges a higher usage rate than "Pedalo" run by Ansan City, and the same rate scheme is applied nationwide. I think there is room for differentiating the rate plan for different regions based on data on actual usage.

The bike parking zone created with the cooperation of Ansan City is being used for parking and rearrangement of Kakao T Bike. Nonetheless, bike parking problems such as mixed parking of electric kickboards in bike parking zones and bike parking in areas prone to civil complaints are issues that need to be addressed. If you have any comment on improving the bike parking practice, please do so.
Even though there are Kakao T Bike parking zones, the usage rate is low compared to the service usage rate. We can't just appeal to people's civility to make our city streets neat and orderly. If policy measures such as parking zone incentives are introduced, it is likely to bring about a positive effect that can increase the parking zone usage rate. All other problems will be resolved without difficulty in the process of establishing the Kakao T Bike parking culture.

In conclusion of this interview, please make your final comment.
I would like to say thank you to Kakao Mobility for its efforts to ensure that the Kakao T Bike can be established quickly, despite the fact that there was "Pedalo" that had been in operation for a long time in Ansan City. With Kakao Mobility, Korea's most well-known technology company, I look forward to the day when I can travel anywhere in the country with a Kakao T Bike. Ansan is the center of the Fourth Industrial Revolution in the West Coast. I hope that Kakao and Ansan can grow together in more diverse areas. Thank you.

Kakao T Bike's hardware that even bike engineers admire

Kakao T Bike has not only been expanding quantitatively for the past three years. After launching the first service, in order to achieve the goal of "safer and more convenient," we are doing our best to improve the quality. As a result, the Kakao T Bike went through two evolutions in just two years, and the third-generation model was released.

The journey of the Kakao T Bike begins at the launch center. The launch center, which can be referred to as the central logistics center, has a capacity of launching 24,000 bikes per year, procures new bikes, and every bike in its inventory is inspected for quality before being placed in the field.

Kakao T Bike arriving at the launch center
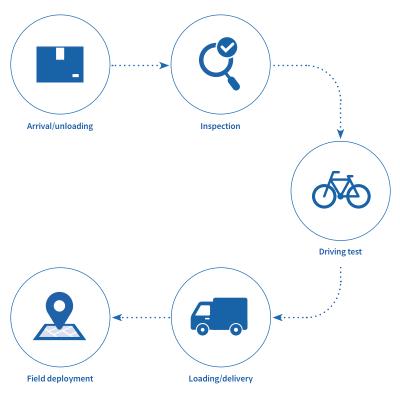
Stringent quality inspection and performance test

Our quality inspection is very strict and exacting. For example, ① brake inspection directly related to braking performance ② tire inspection that's important for securing driving safety ③ electric motor output and noise inspection, etc. After going through basic and essential performance tests for a vehicle, the suitability as an e-bike such as top speed and climbing ability is verified through actual driving tests. In addition, the possibility of other safety defects, driving feel, and appearance are checked additionally. Since the quality of the bikes is directly related to the user safety, it is necessary to pass 100% in all check items to be put into actual service.

Inspection does not end at the launch center. Once the bikes are put into the service area, the final inspection is performed again on site. If a defect is found during the on-site inspection, no matter how small the defect is, the bike is immediately collected and repaired at the launch center.

Once all inspections for user safety are completed, it is finally registered in the Kakao T Bike operational system. It is only at this stage that the bikes are available to users through the Kakao T app on their smartphones.

Kakao T Bike arrival and inspection process

Arrival/unloading → Inspection → Driving test → Loading/delivery → Field deployment

Safer and more secure! Relentless effort toward safety

The launch center is also responsible for developing the Kakao T Bike models to be put into service. The e-bikes used in the Kakao T Bike service is a device composed of more than 200 parts. Through the process of disassembling and assembling all parts, the durability is checked and the parts where failure is expected are identified in advance. As the bikes are always exposed to the elements, a waterproof test is conducted in cases of rain or heavy storm. By spraying high-pressure water on the bike, we check whether moisture enters the interior of the parts, and find out for possible corrosion or damage to the main parts.

Sample bike disassembly and assembly inspection

In a climate with four distinct seasons, we take into account cold spell to heavy rain

Korea belongs to a climate zone with four distinct seasons. E-bikes likely to have problems in winter cold weather. In response to this possibility, the battery output performance is measured in a refrigeration chamber at 20 degrees Celsius below zero. In addition, since plastic parts are highly prone to damage at low temperature, impact resistance tests are also undertaken by applying impact after freezing the parts.

Waterproof test, refrigeration, and impact resistance test using high-pressure water in preparation for heavy rain

Kakao T Bike applies its own design standards that go beyond Korea Certification standards from the design stage. Frame and parts durability tests are added, and driving ability evaluation goes beyond simple mileage measurement to create and evaluate comprehensive indicators such as ride comfort, fatigue, and durability.

The beginning of Kakao T Bike generation shift

Our Kakao T Bike team is developing a constantly evolving Kakao T Bike models based on data accumulated through numerous tests and evaluations. As a result, three generational changes are under way during the three years since the introduction of the service.

The first-generation model introduced in the initial service in 2019 was not an in-house-developed model. It was a simple form with a lock attached to a regular e-bike. With the actual deployment, however, major parts deteriorated rapidly, and problems such as reception errors in GPS, a key feature of the shared mobility system, continued to occur. The Kakao T Bike Team made up for the hardware defects found while operating the first-generation bikes and designed a bike optimized for the shared mobility service in response to various demands. The second-generation Kakao T Bike was the first dedicated model developed in house, and is currently being used most actively in most service areas.

The Kakao T Bike Team was not satisfied with this success and continued to upgrade the second-generation model. The battery capacity has been upgraded so that it can run for 40 km when fully charged, and an injection-mold basket made of polypropylene was installed instead of the existing aluminum wire basket to enhance user convenience. Due to the nature of the material, the aluminum wire basket mounted at the front of the bike becomes heavier as its size increases, thus throwing off the overall balance, which may reduce driving stability. In addition, it had a disadvantage of being easily dented by external impact.

In contrast, the injection-mold basket made of polypropylene is light and durable, so driving stability has been improved. In particular, it had an added advantage of being convenient for users to load their belongings as it was in a rectangular shape. Changing a basket may be a small change, but it is the outcome of various trials and efforts, paying attention to even the smallest details to improve user satisfaction.
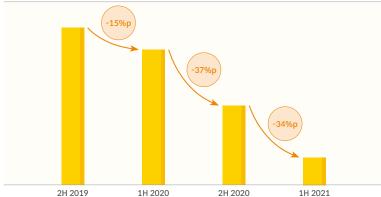
Another big change was the wheels. The classic 24-inch wheels were replaced with sporty 20-inch magnesium wheels. In the existing wheel, there were 32 spokes across the wheel, which often interfered with the latching the smart lock at the end of use. After the replacement with 20-inch magnesium wheels the problem of inconvenience was resolved overnight. Durability has also improved.

In terms of functionality, it was constantly upgraded. Even though it is not visible to users, the key parts that affect the overall operation, such as brakes, motors, chains, and frames, have also been continuously improved. As a result of these efforts, driving safety has been improved.

The loss ratio due to actual accidents began to drop rapidly. The loss ratio fell by 15 percentage points in the first half of 2020 alone, followed by a 37 percentage points drop compared to the first half of 2000, when the second-generation bikes were put into commission. In the first half of 2021, when continuous upgrades were made, the loss ratio fell by an additional 34 percentage points compared to the first half of the previous year. It was the result of continuing R&D effort, with "safety" as the highest priority, which steadily reduced users' accidents.

Change in accident loss ratio of Kakao T Bike by year

Accident loss ratio (percentage points)

2H 2019	1H 2020	2H 2020	1H 2021

-15%p · -37%p · -34%p

Source: Kakao Mobility

More comfortable, farther, full-change third-generation bikes equipped with a large-capacity battery

The second-generation model was satisfactory enough, but Kakao T Bike presented a full-change third-generation model in the Fall of 2021. The third-generation model has undergone significant changes compared to the second generation from design to functionality. The biggest change was the large-capacity battery. By increasing the battery, it can travel up to 50 km when fully charged. Although it is rare for users to drive 50 km at a time, the service mobilization time has become longer, allowing more users to use Kakao T Bike.

In addition, the previous model had a high risk of short circuit because the brake and light cables were exposed to the outside. The third-generation model, in contrast, improved the design and increased durability by putting the cables inside the bike frame. A polypropylene basket that has been proven to improve user convenience, durability, and stability through the second-generation model upgrade was also adopted.

Structurally, a low ground clearance design that minimized the height difference between the bike frame and the ground was adopted. With the frame closer to the ground, the convenience of getting on and off has been improved, and the possibility of fall when stopping suddenly in an unexpected situation is reduced. In addition, the center of gravity was moved to the rear by moving the battery position toward the seat post to match the newly applied frame shape according to the low ground clearance design. Thanks to this, driving safety has also been significantly improved.

Kakao T Bike second-generation model (top) and third-generation model (bottom)

**Interview:
The first is safety,
and the second is
also safety**

To provide Kakao T Bike service, crews from various fields of expertise such as planning, development, and strategy participated. Of these, the hardware part was in charge of the overall work of the real equipment. On behalf of the whole hardware part, which is constantly working to improve the performance and safety of Kakao T Bike, an interview was held with the part manager Tim.

Please introduce yourself briefly and a describe your job.
This is Tim in charge of the bike team's hardware part. I am responsible for the e-bikes needed for the Kakao T Bike service, and are in charge of overseeing the launch center.

What motivated you to join the bike team?
I was working in the future development team at a bicycle company that develops and manufactures bikes. The future development team was a department that develops key products that are expected to lead the market in the next few years. In my previous job, I was responsible for the development and delivery of the first version Kakao T Bike. The Kakao T Bike team offered me a job, and I have been working in the hardware part of the Kakao Mobility Bike team ever since.

What is the main task of the hardware part in the bike team?
For the Kakao T Bike service to operate smoothly, we comprehensively perform tasks related to the e-bikes used by actual users. The tasks of the hardware part can be divided into four major categories as follows. ① Procurement: In order to procure bicycles, we evaluate and select companies, manage contracts, place orders, and manage warehousing. ② Launching: We run the launch center for a stable supply of bicycles. All bicycles are subject to inspection for safety. ③ Operation: We set up a maintenance infrastructure in the operation areas and conduct systematic maintenance training. We also classifies all bicycles and manage the index. ④ Disposal: We undertake the disposal of bicycles whose lifecycle has been terminated.

In the hardware part, you design your own bicycles and source parts. What elements do you focus on?
There are many important parts, but I believe the most important thing that we focus on is "safety." That's because we believe that anyone who uses our Kakao T Bike service should not be threatened with their safety due to bike defects. Our Kakao T Bike team designs the bike with high durability in mind, based on the highest quality standards in the bike industry. In addition, only bicycles that have passed strict quality tests are procured. In order for the Kakao T Bike to be well established as a fun and comfortable means of transportation, we believe that our business must be based on trust in safety.

What were the most difficult challenges while working?
As the Kakao T Bike service area gradually expands, the number of bikes required for service operation is also increasing rapidly. For this reason, I feel sorry that I won't be able to see all the bikes in operation out in the field. It would be nice to see with my own eyes and see if there are any problems or malfunctions, but there may be bikes that are outside the scope of our team's supervision. To make up for these deficiencies, we are constantly providing regular training sessions to the operation managers in each region to maintain the condition of the equipment.

What are the advantages (in terms of devices) of the Kakao T Bike compared to other shared means of transportation?
There is a misunderstanding sometimes remarked by those who are not familiar with electric bikes. It is a question of whether it's a motorcycle-like device that's devoid of the "fun of riding a bike." The Kakao T Bike is an electric bike, but it also offers the pleasure of cycling. Compared to the acceleration and speed that occur in actual bike driving, the motor was set to help the vehicle run naturally so that the user does not feel a sense of difference while driving the e-bike. It took a lot of testing and tweaking to get to this point. In fact, when you ride a Kakao T Bike, it feels as if you step on the pedal and move forward with your own power; in reality, the motor is used as the main power source without using much manual force. The Kakao T Bike is designed with the center of gravity behind the rider. A bike designed in this way significantly reduces the chance of a fall accident while driving, and provides high stability when riding. It may be difficult for general users to feel it while driving, but there is a difference in design details that anyone can see while using a Kakao T Bike from using another bike.

What are the best places to ride Kakao T Bike recommended by bicycle experts?
First of all, I would like to pick the Busan Gwangan-ri Beach Road where you can ride while looking at the sea view. If you ride a bike with the beach and Gwangan Bridge in the background, you will feel refreshed. In addition, Tancheon in Seongnam, Sincheon in Daegu, Central Park in Yeonsu-gu (Incheon), Taehwa River in Ulsan, Deokjin Park in Jeonju, and Daejeon Expo Plaza are also great places to ride a bike. It is nice to ride a bike as a means of transportation to get to a destination, but I think it would be nicer to run at a moderate speed and enjoy leisurely time with the Kakao T Bike.

As a manager in charge of sourcing and providing Kakao T Bike, do you have any messages you would like to convey to users?
The first is safety, the second is also safety. Nothing is more important than safety. To provide bikes in a safe condition at all times, we do our best to maintain them, but it is more important for users to use them safely while driving. Additionally, it would be nice to establish a culture of parking safely in a visible spot for the next user.
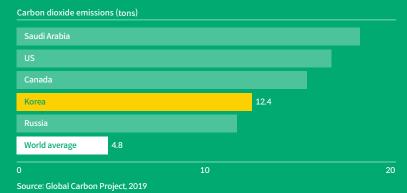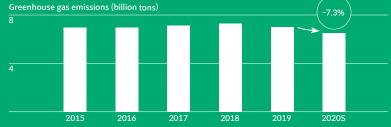
3 years of Kakao T Bike, planting 810,000 pine trees

Climate change has become the greatest challenge for us humans. Due to the rise in global temperature after industrialization, extreme weather events such as heat waves, severe snow storms, tropical storms, and forest fires are occurring all across the world. The international community recognized the seriousness of the problem of climate change and launched a joint effort for humankind for a carbon-neutral society.

Korea is the 14th in the world to make carbon neutrality a legally binding goal, and started policy efforts for carbon neutrality to achieve by 2050. As of 2019, Korea ranks fourth among OECD member countries in per-capita carbon dioxide emissions. It is on a downward trend after peaking in 2018, but there is still a long way to go to become carbon neutral.

Per-capita carbon dioxide emissions

Carbon dioxide emissions (tons)

Saudi Arabia	
US	
Canada	
Korea	12.4
Russia	
World average	4.8

0　　　　　　　10　　　　　　　20

Source: Global Carbon Project, 2019

Domestic greenhouse gas emissions trend

Greenhouse gas emissions (billion tons)
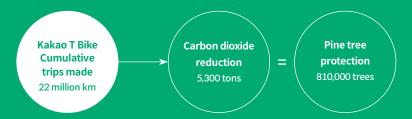
8

4

-7.3%

2015　2016　2017　2018　2019　2020S

Source: Ministry of Environment, 2021

Efforts to reduce carbon emissions are urgently needed in response to climate change that's felt through our skin. It may not be possible to reduce carbon emissions overnight, but it is time when small, everyday efforts are needed to achieve long-term goals.

The Kakao T Bike is one of the easiest ways to reduce carbon emissions in our everyday life. That's because it can be easily used anytime, anywhere for daily mobility needs, and it is a way to move without worrying about carbon emissions. The easier, faster freedom of movement afforded by e-bikes lowers the threshold for actions to protect the environment.

How much has Kakao T Bike contributed so far as an eco-friendly means of transportation? Kakao T Bike has run a cumulative distance of 22 million km from the service launch in February 2019 to September 2021. Converting this to the distance traveled by the car shows that a total of 5,300 tons of carbon dioxide emissions have been reduced. To absorb this much amount of carbon dioxide, approximately 810,000 pine trees are needed.[1]

Conversion of carbon dioxide reduction effect of cumulative distance traveled by Kakao T Bike

Kakao T Bike Cumulative trips made 22 million km → Carbon dioxide reduction 5,300 tons = Pine tree protection 810,000 trees

It is estimated that 18.1 kg of carbon per person can be reduced in a month if a short distance of 15 minutes is traveled by a bike instead of a car every day. This is equivalent to the amount of carbon dioxide absorbed by 2.7 pine trees. Just like this, the bike is one of the eco-friendly means of transportation that will receive the most attention in the future. There is no need to say about the e-bike that can travel longer distances and with less effort than the bike. Kakao T Bike will continue to strive until the day when it becomes the leading eco-friendly means of transportation for the nation in the face of climate change.

1　Korea Climate & Environment Network (based on Carbon Footprint Calculator)

Kakao T Business
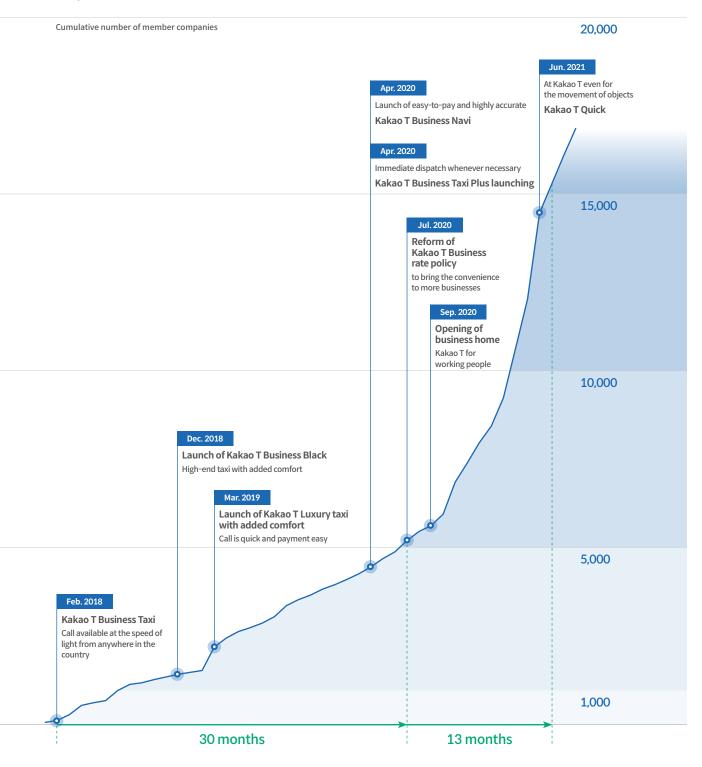
All transport for working people

"Isn't it possible to relieve the trouble of having to take receipts and paste them on a piece of paper every time one uses a taxi for working out of the office, business trips, or overtime work?"

Kakao T Business is a mobility service for corporate members launched to address the inconvenience of traveling for business purposes. It has grown at a rapid pace since its launch and has grown into a service used by more than 17,000 corporations within a short time of three years. Kakao T Business continues to innovate to become a "total business platform" that can enhance corporate work efficiency beyond simply providing a means of transportation for work.

Members of Kakao T Business can use the Kakao T app installed by 30 million users as it is. One can use it directly at "Business Home," which provides mobility services for corporate work in a menu on the Kakao T app. By using the "Easy Registration" feature, not only Kakao T Business members but also users who are not affiliated with a company, such as freelancers, can pay for work-related transportation expenses and manage their details. As payments are handled with the app and usage history is also managed with the app, the need to take care of separate payment cards or receipts disappears.

Kakao T Business provides a convenient solution for managers who oversees business mobility. The manager can easily register a large number of employees through the management system and classify them into groups according to desired criteria such as department, job group, and purpose of use. In addition, whenever employees use Kakao T, usage details such as departure and arrival destinations, call time, driver information, and purpose for use are automatically organized, eliminating the need of having to check receipts. Conditions can be set according to the call policy of each company, including the days and times permitted for use for each employee group, and the departure and arrival locations. With these features, it is possible to prevent in advance the improper use of corporate expenses by employees away from company policy. In addition, when using Kakao T Business Taxi, one can enjoy the benefits of reducing the traffic-causing levy (tax imposed on large organizations that cause traffic congestion), so from the corporation's perspective, it can reap the effect of catching two birds with a stone.

The path that Kakao T Business has taken

Cumulative number of member companies

Feb. 2018
Kakao T Business Taxi
Call available at the speed of light from anywhere in the country

Dec. 2018
Launch of Kakao T Business Black
High-end taxi with added comfort

Mar. 2019
Launch of Kakao T Luxury taxi with added comfort
Call is quick and payment easy

Apr. 2020
Launch of easy-to-pay and highly accurate
Kakao T Business Navi

Apr. 2020
Immediate dispatch whenever necessary
Kakao T Business Taxi Plus launching

Jul. 2020
Reform of Kakao T Business rate policy
to bring the convenience to more businesses

Sep. 2020
Opening of business home
Kakao T for working people

Jun. 2021
At Kakao T even for the movement of objects
Kakao T Quick

20,000
15,000
10,000
5,000
1,000

30 months
13 months

Kakao T Business is launching new services every year in order to constantly observe and address inconveniences caused by the movement of working people. One of such services is the Premium Driver service. Kakao T Business Black Driver, launched in December 2020, is a high-class designated driving service that adds a premium to mobility. The service is run by fully suited drivers who have completed professional training, and are responsible for moving corporate customers with the same level of service as dedicated chauffeurs, including AI-based optimal dispatch and 24-hour dedicated consultation center, as well as departure valet service, boarding and disembarking door service, and carrier service.

What kind of companies are using the Premium Driver driving service? As of September 2021, the industries that use the Premium Driver driving service the most are in the order of IT, business consulting, and financial services. IT companies accounted for 15% of the total number of use cases. It was closely followed by business consulting firms at 14%. The third place was taken by financial services firms at 5%. It appears that companies in industries with high interest in business efficiency based on IT are more actively introducing Kakao T Business, especially Premium Driver driving services.

Top-three industries using Kakao T Business Black Driver

IT 15%   Business consulting 14%   Financial services 5%

As of Sep. 2021

Regions using Premium Driver services also appeared similar to the distribution of industries using our services. The concentration of calls was most pronounced in Euljiro, Yeouido, Gangnam, and Pangyo. Euljiro and Yeouido are densely population by major companies in areas such as business consulting and finance. In Gangnam and Pangyo, major large technology companies are concentrated, so the use of Premium Driver driving services is more pronounced.

Near Seoul's Euljiro area

Near Seoul's Yeouido area

Near Seoul's Gangnam area

Near Gyeonggi's Pangyo area

Kakao T Business is entering the stage of providing all the mobility needs for work, beyond providing means of transportation for business purposes such as the movement of goods. Kakao T Quick was its start. Furthermore, we will strive to be reborn as a total business platform provider based on the insight that there is mobility behind the improvement of business efficiency.

Kakao T Business home

Kakao T Quick

Kakao T's new challenge, the movement of objects

Beginning Kakao Taxi, Kakao Mobility has worked hard to make the movement of people more convenient. The recently added trains, buses, and airlines, as well as taxis, navigator, designated driving services, and parking provided by the Kakao T app, are mobility services focusing on the movement of people.

Now, we will go a step further and ask a question about the context in which we need to move to another level. The existing Kakao T service is useful for the experience of moving people, but what can Kakao Mobility do for moving objects? Kakao Mobility aims to create another innovation after the movement of people by making the movement of objects more convenient. When one needs to move things, the service brings them to where they are needed without a person having to move to fetch them. The first of such a service is Kakao T Quick, which started service in June 2021.

Kakao T Quick has a number of differences from the motorcycle-based express delivery service we are used to. As with the difference between a call taxi and an app taxi, Kakao T Quick uses an app to connect users and drivers, and delivers goods fast and accurately while allowing users to track delivery progress and precise rate information.

It has also expanded the scope of users. While the existing express delivery service was a business-to-business solution catering to office workers and self-employed people who wanted to deliver documents and small items quickly, Kakao T Quick makes it easy for the general public to access and use it for personal use as well. That's because market changes that stimulate individual demand for delivery, such as the thriving business of second-hand goods transactions, are rapidly becoming visible.

Five differences about Kakao T Quick

	Existing express delivery service	Kakao T Quick
Users	White-collar workers, self-employed	White-collar workers, self-employed, general public
Order receipt channel	Phone	App
Delivery item	Express delivery	Express delivery + delivery
Additional charge	Occurs frequently during shipping	Advance notification
Delivery progress check	Phone confirmation	Real-time ETA* check with Notification Talk + app

* ETA: Estimated Time of Arrival

Kakao T Quick for your workplace and your home

There are two industrial sectors that have grown at an explosive rate in the era of COVID-19. One is online commerce and the other is the food delivery market. These two services are based on two mobility systems, namely parcel delivery and food delivery. We are now familiar with the package delivery boxes and food delivered at the doorstep. Still, we are less familiar with "Express Delivery Service," which is a similar mobility service. We know what kind of service it is, but it is rare for us to use the service. That's because it is mainly used for moving documents and samples back and forth between companies.

Contrary to our stereotype, the express delivery service is a mobility service with infinite scalability. With the express delivery service system, delivery can be made in 2 hours within the Seoul metropolitan area, and it is possible to handle a variety of goods as different vehicles from the Damas, Labo, and even 1-ton trucks are used. There is no need to restrict the express delivery service to corporate document delivery only. Kakao Mobility is breaking the stereotype of the existing express delivery service and adding new imaginative solutions. We started the challenge to build a system that anyone who needs to move things around can always rely on easily, conveniently, quickly, and safely.

Users are responding to the imagination of Kakao Mobility. When one can't go directly to buy something on a used good site, when it is hard to get a new Kimchi jar from mom's house, and when one has to pick up a laptop left at home, more and more Kakao T users turn on their app by touching the "Quick" icon.

Under what situations do individual users use Kakao T Quick? During the month of July, we collected cases where individuals experienced moving goods using Kakao T Quick.

How much have you tried Kakao T Quick?

"I lost my smartphone, so I bought an unregistered device at the xx market. I needed it right away, but the appointment with the seller was not made. Incidentally, I had a Kakao T Quick first-user coupon, so I proposed a express delivery deal to the seller. The seller was also notified in real time, so it was not difficult to receive the item, and I got the device in 50 minutes and opened it at a nearby telecom store and started using it on the same day." (Mr. A, 34 years old)

"I rented a wedding dress for a photo shoot. I had to return it the next day. I had no time to return the dress on the photo shoot day as I was so busy and I had to go to work the next day. So, I hung the dress on the doorknob and called Kakao T Quick before going to work. I set the pickup location to "in front of the door" and called Quick on my way to work, and the driver took it up in a contactless manner, so I was able to return it without any problem." (Ms. B, 29 years old)

"I went to work for the first time in a long time after working from home. I found out I had left my laptop at home. I couldn't go home to pick up the laptop, and my wife can't do that because she works from home. I asked my wife to send me the laptop with Kakao T Quick. About an hour later, I was able to receive it." (Mr. C, 33 years old)

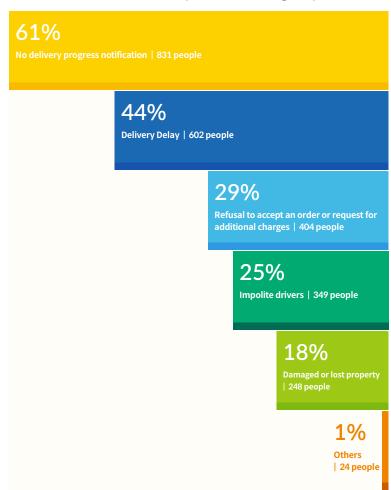Contactless delivery using Kakao T Quick The pickup location was set to "at the door."

Sending a quick shouldn't be a job

Is quick service hard to use?

In order to lower the barrier to using the service, Kakao T Quick is detecting and resolving the difficulties that occur during the order reception process. What made the quick service feel so unfamiliar and cumbersome? We asked in 2020 1,353 corporate business support managers what inconveniences they felt when using the quick service.

What was the most inconvenient experience while using the quick service?

61%
No delivery progress notification | 831 people

44%
Delivery Delay | 602 people

29%
Refusal to accept an order or request for additional charges | 404 people

25%
Impolite drivers | 349 people

18%
Damaged or lost property | 248 people

1%
Others | 24 people

1,353 managers in charge of corporate business support in 2020

Before: Unclear delivery status

61% of respondents pointed out there was no notification on the delivery progress. When asked about the circumstances in which users would like to receive notifications, they answered in the order of delivery completion (87%), assignment of a delivery driver (51%), and departure after pickup (41%). Users need to know whether delivery is started and whether the customer on the other end received the goods safely in order to keep the trust with the user. Still, the existing way of receiving orders is dominantly by phone, so there is no notification. There is no way for users but to call the quick reception desk and check it every time.

After: Delivery status tracking is one step ahead by notification talk

In contrast, Kakao T Quick informs users about situations they may be curious about when moving goods. The person who calls, the person who sends the goods, and the person who receives the goods all get notification messages whenever delivery is in progress. Even if the recipient is not a T app user, he or she can track the delivery details and progress by pressing the "Check Delivery Information" button on Notification Talk.

Before: Difficulty of estimating the arrival time

Dissatisfaction with delivery delay accounted for 44%. It is interesting to note that in the same survey the most necessary information while using Quick was the pickup and delivery completion time (44%). Quick service users do not receive delivery time information properly. That's because it is difficult to estimate the delivery time because the driver bundles orders with similar origins and destinations, and the delivery order is based on the specific know-how of the driver. The recipient must wait for the driver's arrival to hand over the item, and the corporate customer must also wait for the driver's arrival to receive the item, but the quick delivery company is unable to provide the exact arrival time. That's why the wait time for delivery feels even longer.

After: Checking the estimated arrival time according to the delivery driver's location

In contrast, Kakao T Quick provides real-time progress of the driver to move for each user's order. Kakao T Quick drivers leave a record when they depart to the pickup location for each order and when they depart to the destination. For this reason, even if the driver bundles several items, it is possible to notify the time the driver travels for each order. The real-time ETA is reliable because it is the real-time location of the driver, and the actual travel time based on the navigator to the pickup location and destination. Kakao T Quick's real-time ETA is available by the minute in the usage history menu, and we are preparing to provide the driver's location through a map.
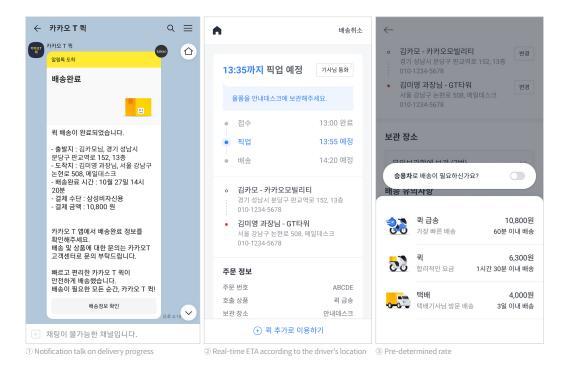
Before: Not fixed delivery charge

29% of respondents said about experiences of surcharges or refusal to deliver. The existing quick service does not specify the standard of deliverable goods and transparent pricing. Quick prices are set based on the discretion of the one who receives the order based on the unit price table, and the additional fee imposed on site is set depending on the judgment of the driver and the control center. For this reason, it is hard for the one who places an order to predict whether the item can be shipped and how much the charge will be until the order is received.

After: Pre-determined rate plan that can be checked even before ordering

In contrast, Kakao T-Quick notifies in detail the range of items that can be shipped, and offers the most reasonable rates through machine learning algorithms. The list of items that can be shipped through Kakao T Quick and items that require additional charges are available in the "Service Usage Guide" menu before submitting an order. Once the user has found out the item can indeed be shipped, he or she can also check the delivery cost in advance. The charge includes a surcharge in consideration of the real-time labor cost and weather conditions, and this rate does not change during delivery.

① Notification talk on delivery progress ② Real-time ETA according to the driver's location ③ Pre-determined rate

The launch of the Kakaonavi SDK/API, a complete tool for moving things and services

Kakao T Quick started with the insight that it could change the movement of things smartly beyond the movement of people. Kakao Mobility is also launching services that allow users to have more free time and less trouble by moving services instead of moving users such as visiting car wash and on-site maintenance. Recently, we have gone one step further and have entered a stage of providing sophisticated route guidance of Kakaonavi for the movement of things and services.

Introduction to Kakaonavi SDK/API service

On September 1, 2021, Kakaonavi API and built-in SDK services were launched. The core technology that Kakao Mobility has accumulated while providing Kakaonavi and Kakao T services is the dispatch and route guidance. The Kakaonavi API and built-in SDK were released so that partner companies in various industries can also use Kakao Mobility's core technology.

Even though SDK and API are terms familiar to developers, they may sound new to the general public. SDK, or software development kit, is a collection of software development tools. With the Kakaonavi SDK, developers outside Kakao Mobility can easily apply Kakaonavi's navigation functions to their own service. In the same way, if Kakaonavi API (application program interface) is used, external developers can easily apply Kakaonavi functions into their apps or web services.

If partner companies use Kakaonavi SDK and API, it is possible to implement from simple routing functions to more complex routing functions in their services. With these tools, partners can easily use routing fuction from the starting-point to the destination, which is the core technology of Kakaonavi, to find directions considering sequential waypoints, and to know the estimated arrival time based on the predictive traffic. Based on the newly launched Kakaonavi SDK, one can implement the Navi feature with minimal development in the apps run by partners themselves. This is the way to significantly save time and money for developing core navigation technology on their own, and introduce advanced navigation technology into the app. If the previously provided Navi SDK was a service-to-service connection function that calls the Kakaonavi app, which was installed separately, now an option to provide a more integrated user experience has been added.
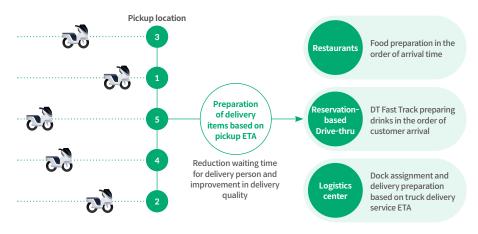
The number of places that can be set for each Kakaonavi API and information provided

API	Starting point	Destination	Waypoint	Time of departure	Information provided
Direction for driving	1	1	Up to 5	Currently	Detailed route information for each interval or summary route information
Direction via multiple waypoints	1	1	Up to 30	Currently	Detailed route information for each interval or summary route information
Direction from multiple origins	More than one	1	Up to 30	Currently	Estimated time required, distance traveled
Direction to multiple destinations	1	More than one	Up to 30	Currently	Estimated time required, distance traveled
Predictive Traffic Routing	1	1	Up to 5	Future	Detailed route information for each interval or summary route information

The Kakaonavi API reveals not only Kakaonavi, but also features used in actual mobility services such as Kakao T Taxi and Kakao T Parking. Of these, the multi-starting-point Routing, which allows one to know the estimated arrival time from multiple starting points to a single destination,is a function that is actually used for dispatch of Kakao T taxi. In addition, the multi-destination route finder, which allows one to know the estimated arrival time for multiple destinations from one departure point, is a feature used to search for the nearest parking lot on Kakao T Parking. It is the first in the industry to provide some of the core algorithms used in actual services in the form of APIs.

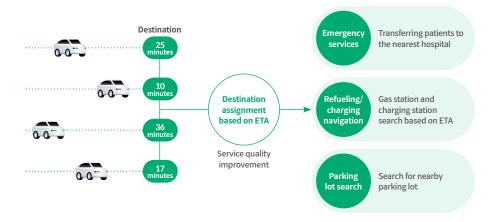### Direction for multiple starting points

With the help of the new Kakaonavi API and built-in SDK, developing new services became a lot easier for companies in the mobility and logistics field, including startups. Currently, through the Kakao Developers site (https://developers.kakao.com), one can easily install and use the Kakaonavi API and built-in SDK services along with sample codes and guides.

Value contributing to movement of things and services

The Kakaonavi API and built-in SDK service is expected to be a catalyst for spreading the technology accumulated by Kakao Mobility throughout the mobility ecosystem. We can expect that it will be making contributions to not only in moving of people but also in moving goods and services. In the existing delivery and logistics industry, the estimated arrival time was calculated based on the straight distance rather than the actual distance traveled. With the Kakaonavi API and built-in SDK, on the other hand, one can easily calculate the estimated time of arrival based on the actual distance for each departure time. It will likely to contribute to realizing moving distances and service sophistication in related fields such as quick commerce, which is gradually expanding.

Indeed, the partners who introduced Kakaonavi API and built-in SDK services relatively early as part of an Early Partnership Program are showing positive outcomes. Partners in the food delivery sector expect to be able to estimate the delivery charge based on the actual distance traveled through the ETA calculator included in the Kakaonavi API service. In addition, it is expected to enhance food delivery competitiveness by making a more efficient dispatch using the Multi-starting-point Routing.

Multi-destination routing

A partner in the logistics sector expect that by using the navigation in the built-in SDK within their own app will greatly improve their functionality in terms of usability. The company had relied on the existing Navigation SDK to run the Kakaonavi application separately every time, but the frequent switch caused a lot of inconvenience to their drivers. With the use of Kakaonavi API and the built-in SDK, the inconvenience will fundamentally be eliminated.

Partners in the field of PropTech showed high expectations that the actual needs of customers could be incorporated in the search for properties. This became possible thanks to Kakaonavi's ETA function, which allowed for searching for properties that were within reasonable commuting time.

Kakaonavi API and SDK provides opportunities for new value creation to partners in various industries such as delivery, logistics, and PropTech. We will continue to do our best to advance technology and improve services so that Kakaonavi's technology can be used more efficiently to help the movement of things and services, which are increasingly important.

KAKAO
MOBILITY
REPORT
2021

kakaomobility