

Policies

Exclusive Median Bus Lane Network

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Writer

Shin Lee

Affiliation

University of Seoul

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Policy Implementation Period

Buses have been serving the general public in Seoul for decades as one of the most common public transport modes along with subways; however, irregular service intervals due to traffic congestion have caused inconveniences and led to citizens gradually avoiding using buses. As a consequence, the exclusive median bus lane system was introduced in the second half of 1986 as part of the bus priority policy, one of the ways of inducing the transition from private cars to public transport modes in the wake of a vicious cycle of the ever increasing use of private cars and worsening traffic congestion.

Since the first exclusive median bus lane system was implemented by installing roadside exclusive bus lanes on Wangsan Road in 1986, the total length of exclusive bus lanes reached 224.5km in 1999. The exclusive median bus lane system situated in the median lanes of roads was introduced to Cheonho-daero in 1996, and has been regularized since the reorganization of the popular transportation system by the Seoul Metropolitan Government (SMG) in 2004.

Since its introduction to Dobong-Mia-ro, Susaek-Seongsan-ro and Gangnam-daero in July 2004, it has been expanded by 15km per year on average - mainly on roads with heavy traffic congestion. By the end of 2014, 117.5km of exclusive median bus lanes had been built and put into operation, thereby providing fast and safe bus services by connecting major arterial roads while eliminating congestion.

As of 2016, 119.3 km of lanes designed for the exclusive use of buses are being operated throughout Seoul as part of an effort to increase efficiency and customer satisfaction.

Background Implementation

Until the 1960s, buses played a central role in public transportation. Thereafter, however, this role gradually declined due to the increase of private cars resulting from continuous economic growth from the 1970s onwards and the development of other public transportation systems resulting from the expansion of urban areas. The rapid increase in private cars caused traffic congestion in large cities. Among the traffic system management techniques that were introduced to solve this problem, the exclusive median bus lane system reaffirmed the importance of the bus.

The Traffic System Management Act, which has been enforced since the early 1970s, was a short-term, low-investment method designed to curb traffic demand and optimize the use of existing traffic facilities, while the existing method was a long-term, high-investment method focused on increasing traffic facilities. The exclusive median bus lane system, as one of these traffic system management techniques, was expected to anticipate the transition from demand for private cars to that for buses through the improvement of bus services, in particular, as a method of simultaneously reducing the demand and supply of traffic.

Such a system offers the same transportation capacity as light rail transit but at a much lower investment cost than a subway system; moreover, it can be easily improved or restored during operations. Above all, it is effective in encouraging the conversion from private cars to buses.

In Seoul, a total of 218.5km exclusive bus lanes have been installed in 59 sections since the exclusive median bus lane system was first introduced by installing a roadside exclusive bus lane on Wangsan Road in 1986.

Full-time: 23 sections, 46.1km (07: 00-21: 00)

Part-time: 18 sections, 44.6 km (07: 00-10: 00, 17: 00-21: 00)

Exclusive median lane: 12 corridors, 119.3km

The importance of the Policy

The importance of the exclusive median bus lane policy was first emphasized from a theoretical perspective by traffic researchers from the US and the UK (Downs 1977; Mogridge and Williams 1985). In other words, according to the theory, if a road is expanded or newly established to mitigate traffic congestion, it will have a short-term effect on improving the travel speed first. However, the capacity of the expanded road will encourage new traffic and the congestion will increase again in the long term, whereas the policy that increases only the travel speed of public transportation can have a positive effect on relieving traffic congestion by increasing the travel speed of both public transport modes and private cars by attracting private car users to public transportation.

In fact, it was observed that not only bus travel times but also speeds in normal lanes were improved by the exclusive median bus lane system, which was implemented with the reorganization of public transportation in Seoul. In other words, this policy is a case of exemplary policy implementation that realized the theoretically proven effect of increasing public transport speeds. As such, it is viewed as one of the main policies to have facilitated greater movement and mobility among the various means of transportation, which was at the time very restricted due to the ever increasing use of private cars. It is difficult to separate the effects of individual policies because public transport reorganization is being achieved through an overall blend of diverse policies; but in the absence of such a series of popular public transport policies, automobile owners would have continued to use their cars, and then, as in other cities confronted with a similar situation, the car-centered culture would have persisted as the ownership and use of cars continued to rise. Such a dependence on cars would have continued, making the conversion to alternative means of transport extremely difficult. This is an important policy that has contributed greatly to Seoul's particular style of transport flexibility, in which car owners do not rely solely on their cars but also on other modes of public transportation depending on the situation as a mixed result of the overall policies that have increased the competitiveness of the bus compared to the car – including the integration of bus routes and fares and the automation of traffic information.

Relevance with Other Policies

The establishment of exclusive median bus lanes in Seoul has made the most remarkable progress within the larger framework of the reform of public transport system, as is widely known. Therefore, it is closely related to major policy factors that constitute the public transportation system – such as the integration of bus service routes, the integration of fares, transfer centers, and traffic information integration and planning. In particular, the exclusive median bus lanes that were installed together with these means of 'integration' had a clearer effect than the previous roadside exclusive bus lanes - partly because of the physical difference between the median lane and the roadside bus lane. But this policy was related to a series of policies that enhanced the competitiveness of buses in general, in that a single policy that strengthens the competitiveness of buses when compared to cars has limited effects, and users are only able to perceive the effect when it is generated in combination with other policies. This policy is most closely and directly related to the policy measures that can shorten bus travel times.

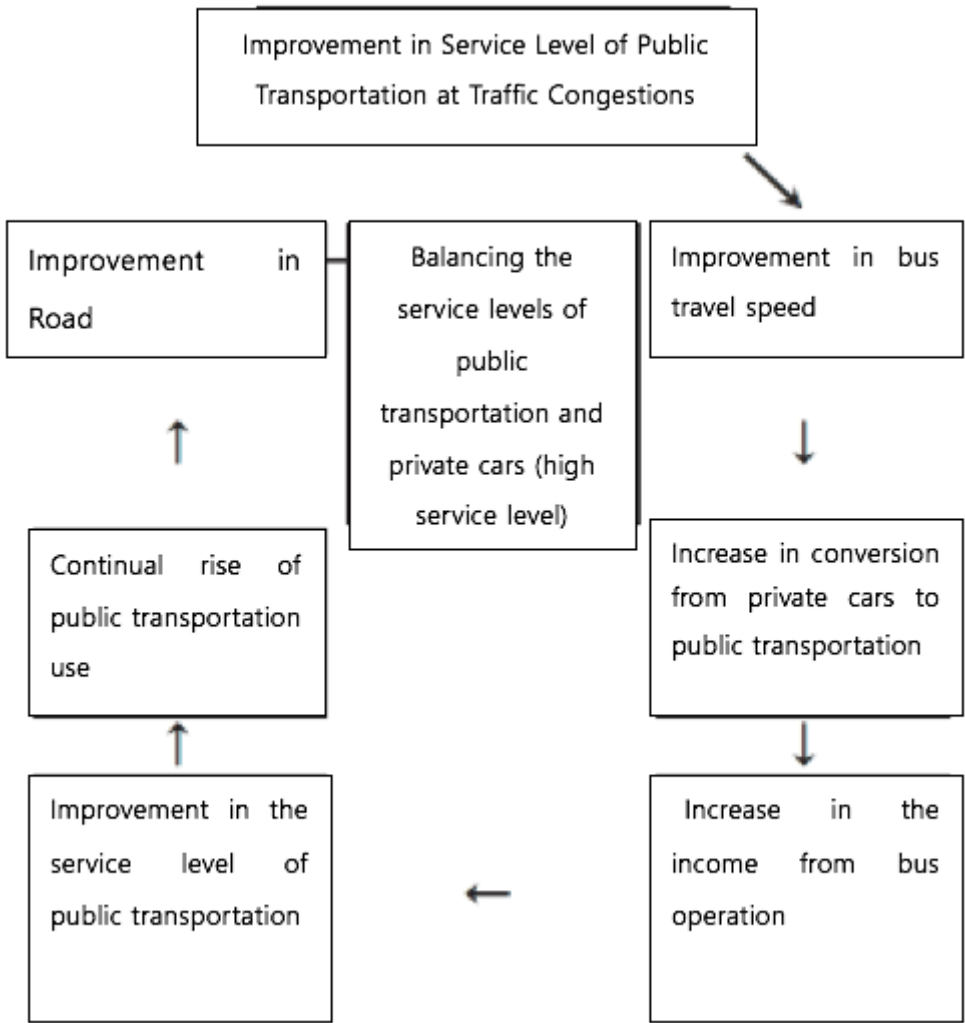
The direct policy objective of exclusive median bus lanes is to shorten travel times. This is the ultimate goal of car users when switching from car to bus. However, bus travel times from a user's point of view also include the time taken to get to a bus stop, the bus waiting time and the bus stop departure time, as well as the time actually spent on the bus. It may also include the time lost while the bus itself waits to comply with the bus timetable after boarding. In addition, exclusive median bus lanes (with the aim of maintaining relatively higher bus running speeds than those of other vehicles) are only effective in overcoming a drop in driving speed due to congestion; however, they cannot control other factors such as signaling systems and vehicle accidents. Therefore, this policy is closely related to the overall policy measures that can reduce the total travel time of buses, such as the integrated charge collection, in particular, electronic means of fare payment, service linkage with other public transport modes, bus stop connections, and the automation of public transport information, as well as having a close complementary relationship with a series of TSM (Transport System Management) factors such as signaling system synchronization, bus priority signal system, control and management of bus stops, and surveillance of illegal parking and illegal use of exclusive median bus lanes.

Policy Objectives and Processes

The main policy objectives of the exclusive median bus lane system are to secure lanes that can only be used by buses in regions where the average travel speed is habitually low due to traffic congestion, thereby allowing buses to maintain a superior travel speed to that of cars using the other lanes, and to actively encourage people who use cars to switch to buses.

The following conceptual flow chart clearly shows how the installation of exclusive median bus lanes can lead to the transition from cars to public transportation and contribute to improving the overall road conditions.

Figure 1. Improvement of Congestion by Introduction of Exclusive Median Bus Lanes



Source: Han, Sang-Jin (2007) Opinion

Installation Process of Exclusive Median Bus Lane by Year

The following three figures show the gradual expansion and distribution of exclusive median bus lanes.

Figure 2: Installation Planning Map of Exclusive Median Bus Lanes by the Seoul Metropolitan Government and the Ministry of Land, Transport and Maritime Affairs, 2004

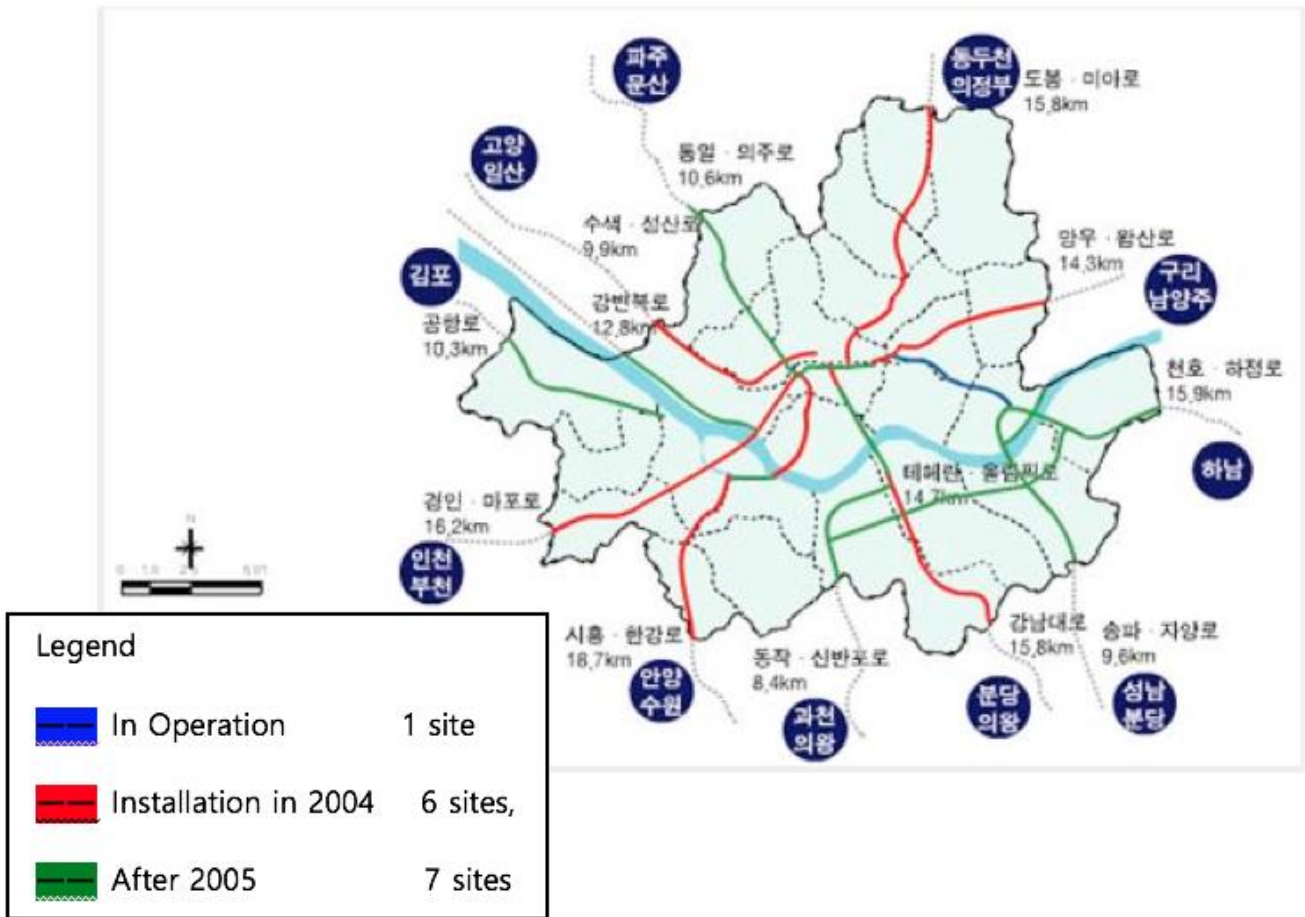


Figure 3: Installation Planning Map of Exclusive Median Bus Lanes by the Seoul Metropolitan Government and the Ministry of Land, Transport and Maritime Affairs, 2008

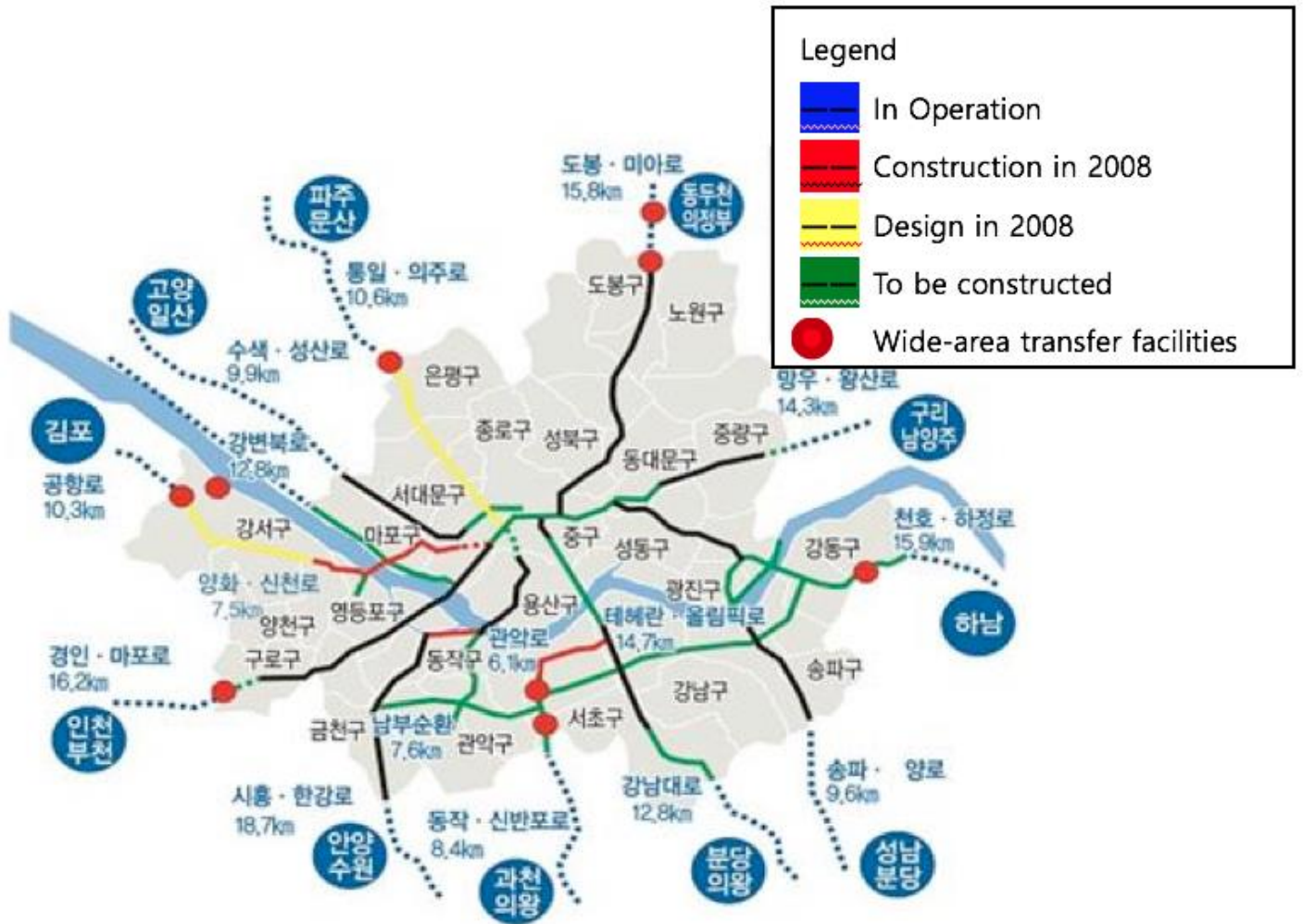
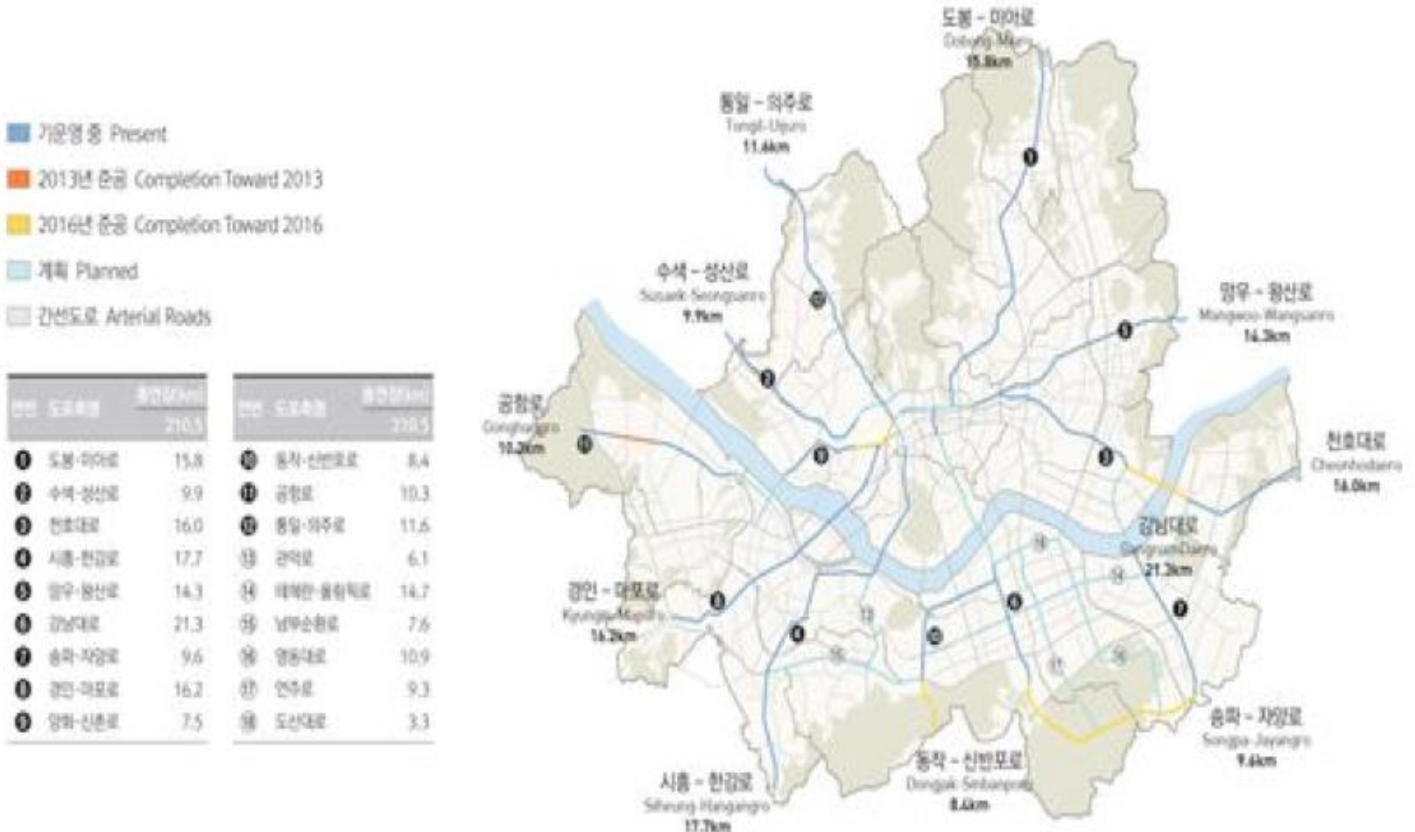


Figure 4: Installation Planning Map of Exclusive Median Bus Lanes by the Seoul Metropolitan Government and the Ministry of Land, Transport and Maritime Affairs, 2013



Main Policy Contents

The exclusive median bus lane system was first introduced in Seoul under the Road Traffic Act in 1986, after which 218.5km of exclusive bus lanes have been installed in 59 sections, starting with Wangsan Road and Han River-daero.

Regarding exclusive bus lanes, there are roadside exclusive bus lanes and exclusive median bus lanes, of which the former have decreased in length from 224.5km in 1999 to 89.3km in 2011, while the latter have increased in length from 4.5km in 1999 to 121.1km in 2011, i.e. an increase of more than 30 times. The roadside exclusive bus lanes are installed on roadways next to the roadsides, divided into full-time (07:00 to 21:00 on weekdays) and part-time periods (07:00 to 10:00 and 17:00 to 21:00 on weekdays), and are not in operation on weekends and public holidays.

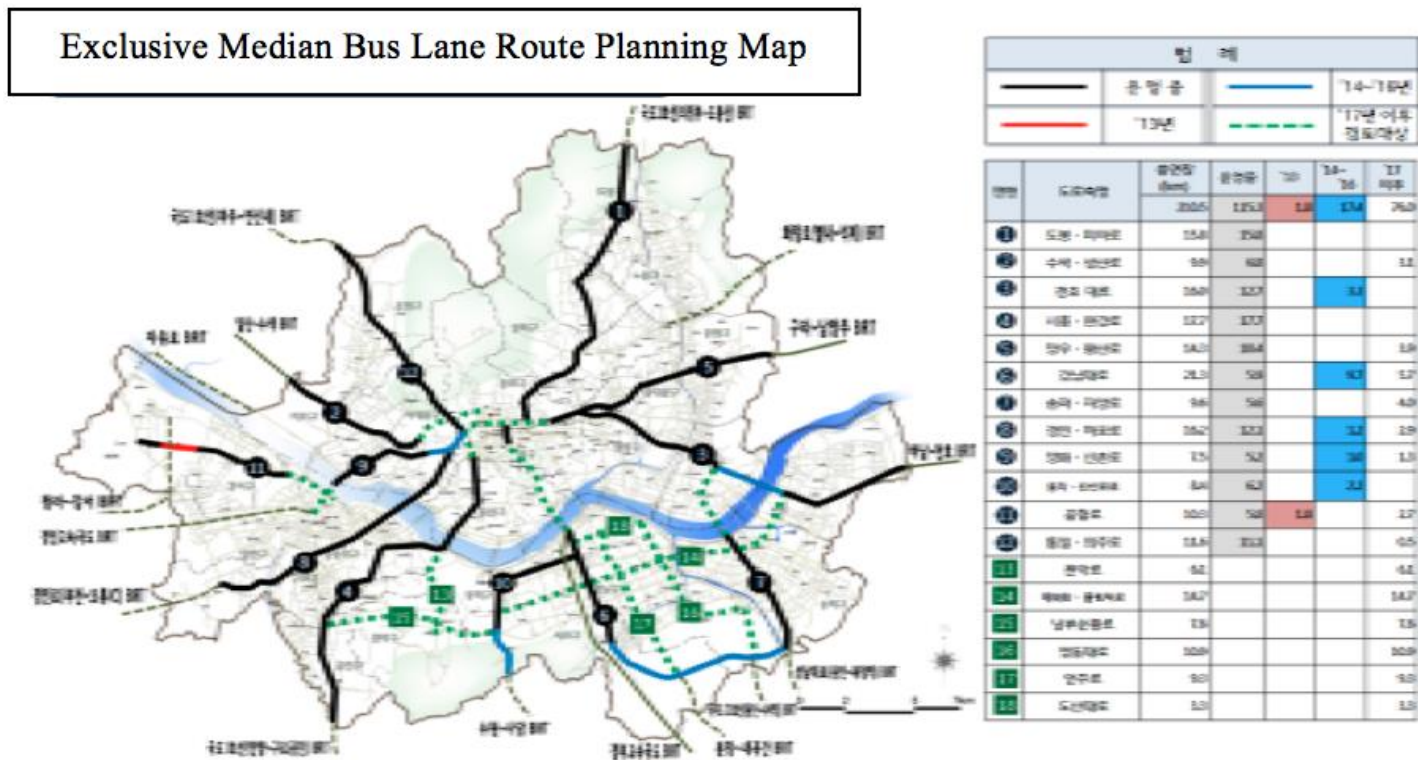
The exclusive median bus lane system consists in converting the median lane of existing roads into bus only lanes that can also be equipped with protective barriers to prevent other vehicles from straying into them. While smooth driving on the roadside exclusive lanes is often interrupted by parked vehicles or vehicles turning right, there is no need to reduce speeds while driving on the exclusive median bus lanes because there are far fewer interventions from other vehicles. Therefore, there has been a tendency to reduce the number of roadside exclusive bus lanes and to increase the number of exclusive median bus lanes because it is more likely to achieve the primary purpose of maintaining a superior driving speed. The first 24-hour exclusive median bus lane on the common road was opened on Cheonho-daero, and, in 2004, the exclusive median bus lanes entered into full-swing operation in Gangnam-daero etc. along with the Seoul Metropolitan bus reorganization.

The exclusive median bus lane was introduced as part of the public transport system reorganization project in 2004 and has undergone continuous expansion for more than ten years.

The SMG has already been building radial-shape exclusive median bus lanes in central downtown, and will further establish an east-west connection system linking the sub-downtown areas. (See Figure 4)

Currently, the Seoul Metropolitan Government is working toward increasing the current distance of exclusive median bus lanes in operation in 12 corridors from 115.3km to 134.5km, i.e. by adding 19.2km by 2016. Moreover, it will also improve the connectivity of the median lanes by examining the construction of the exclusive median bus lanes on the arterial roads that connect the east and west sub-downtown areas.

Figure 5: Seoul Metropolitan Government Exclusive Median Bus Lanes Planning Map



Source: Traffic Operation Information Service, 2013

First, five additional sections will be installed by 2016, which will increase the efficiency of the existing exclusive median bus lanes by linking the disconnected sections among the already existing sections or by being built on the sections in the city boundaries and other areas linking the metropolitan BRT (arterial bus express system) routes planned by the central government.

As such, all sections of the exclusive median bus lanes on Gonghang-ro that connect Gimpo Airport to Yanghwa Bridge were connected for the first time.

In 2013, 1.8km of exclusive median bus lanes were installed in the Magok district section (Gonghang Telephone Station ~ Balsan Station), which had not previously been installed with such lanes. In addition, the connectivity of downtown section bus lanes was enhanced in 2014 by installing an additional 2.2km of exclusive median bus lanes only on Yanghwa-Sinchon-ro from the northern end of Yanghwa Grand Bridge to Ewha Womans University in order to extend them to the Seodaemun Intersection (Chungjeong-ro section).

○ Expansion of exclusive median bus lanes: Addition of 4 routes totaling 18.4km by 2017

- By 2017: 4 routes totaling 18.4 km

(Cheonho-daero 3.3 km; Hyeong-ro 9.7 km, Jong-ro 4.0 km, Namdaemun-ro 1.4 km)

In addition to these additional connecting sections, the Seoul Metropolitan Government plans to expand the exclusive median bus lanes for the corridors that link the east and west sub-downtown areas. In the meantime, the system has been configured with radial exclusive median bus lanes consisting of 12 road corridors extending in all directions with its center in the CBD. However, an examination of the feasibility of installing exclusive median lanes to connect sub-downtown areas such as Gwanak-ro and South Circular Road is scheduled to take place.

Table 1: Exclusive Median Bus Lane Promotion and Planning

Year	Name of Route	Extension (km)	Promotion & Planning	Remark
2013	Gonghang-ro Extension (Magok District)	1.8km	Dec. 2013 Opening plan	In connection with Magok district businesses
2014	Chungjeong-ro	2.2km	In connection with the dismantling of the elevated highway	Dismantling of the elevated highway in 2014

2015	Cheonho-daero Extension	3.3km	In connection with the extension of Cheonho-daero	Extension construction
2016	Dongjak-daero Extension	2.2km	Connecting the Namtaeryeong~Sadang Section	
	Heonreung-ro	9.7km	Promoted in terms of the Wiryae New City project progress status	
Total	-	19.2km	-	

Source: Traffic Operation Information Service, 2013

Technical Details

The Seoul Metropolitan Government currently uses the volume of bus traffic and the number of bus transportation passengers as the criteria for determining the types of new installations and the operation of exclusive lanes. The installation criteria are as follows:

For one-way three-lane roads:

- Roadside exclusive lanes considered when there is an excess of 60 cars per hour or more and 1,800 people per hour or more
- Roadside exclusive lanes considered or contra-flow exclusive lanes possible if there is an excess of 100 cars per hour or more and 3,000 people per hour or more
- Median exclusive lanes possible and overtaking lanes at the bus stops provided if there is an excess of 150 cars per hour or more and 4,500 people per hour or more

For one-way four-lane roads:

- Roadside exclusive lanes and overtaking lanes at the bus stops offered if there is an excess of 100 cars per hour or more and 3,000 persons per hour or more.
- It is possible to offer median lanes and overtaking lanes at bus stops when there is an excess of 150 cars per hour or more and 4,500 people per hour or more

Policy Effects

Bus travel speeds increased by about 30% compared to the period before the construction of the exclusive median bus lanes, while the average number of passengers increased by around 4 to 7%

According to the results of the analysis of the effects of installing median bus lanes in the Seoul city area, the speed of bus travel has been observed to differ slightly for each road. However, installation of the lanes was evaluated as having been effective in enhancing the convenience of users of public transportation due to the approximately 30% improvement in the average travel speed at peak times.

The average speed of buses was improved by around 30% - from about 15km/h before the opening of the lanes to about 20km/h.

In the case of Dobong-Mia-ro, in particular, which used to suffer from serious traffic congestion, the average bus travel speed was improved by 9.0km/h (81.8%) from 11.0km/h before the installation of exclusive median bus lanes to 20.0km/h.

Table 2. Increase / Decrease Ratio of Median Bus Lane Travel Time

Opening Date	Road Name	Extension(km)	Speed before Lane Opening (km/h)	Speed after Lane Opening (km/h)	Rate of Increase/Decrease of Travel Time (%)
Jul. 2004	Dobong-Mia-ro	15.8	11.0	20.0	81.8%
	Susaek-Seongsan-ro	6.8	13.1	19.9	51.9%
	Gangnam-daero	4.8	13.0	17.3	33.1%
Jul. 2005	Mangwu-ro	4.8	17.6	20.9	18.8%
	Gyeongin-ro	6.8	14.3	19.3	35.0%
Dec. 2005	Siheung-Daebang-ro	9.4	15.5	20.7	33.5%
Dec. 2006	Hangang-ro	5.5	17.4	21.9	25.9%
	Mapo-ro	5.3	14.5	19.1	31.7%
Jan. 2008	Songpa-daero	5.6	17.1	20.3	18.7%
Apr. 2009	Gonghang-ro (Level 1)	2.5	16.5	18.5	12.1%

May 2009	Noryangjin-ro	2.8	16.4	21.6	31.7%
Jun. 2009	Sinbanpo-ro	3.5	18.4	20.9	13.6%
Nov. 2009	Dongjak-daero	2.6	17.2	21.0	22.1%
Dec. 2009	Yanghwa, Sinchon Road	5.2	16.2	18.6	14.8%
Aug. 2010	Gonghang-ro (Level 2)	2.3	14.8	19.6	32.4%
	Mangwu-ro Extension	2.2	18.7	21.2	13.4%
Dec. 2010	Tongil-Uiju-ro, (Level 1)	3.3	18.6	20.9	12.4%
Mar. 2011	Cheonho-daero (BRT)	5.1 (excluding Hanam-si Section)	17.9	18.7	3.9%
Dec. 2011	Tongil-Uiju-ro, (Level 2)	5.4	12.3	19.0	55.1%
	Wangsan-ro	3.4	15.8	18.7	18.4%

Source: Traffic Operation Information Service, 2013

Secondly, it was shown that the exclusive median bus lanes contributed greatly to ensuring that buses arrived on time. The travel time deviation of buses passing through the exclusive median bus lanes turned out to be in the range of $\pm 1 \sim 2$ minutes, which means that there was much less deviation when compared to vehicles traveling the same distance using regular lanes. For example, in the case of Dobong-Mia Road (15.8km), where the average travel time for buses is 44.3 minutes, the buses have a travel time deviation of ± 2.7 minutes, while that of private cars is in the region of ± 15.3 minutes.

As a result, buses using the same route did not move around in groups, and were properly scheduled according to the bus stops, thereby eliminating the jagged arrival intervals and making it possible to provide the public with more convenient public transportation services at regular time intervals.

Table 3. Travel Time Deviations of Bus Median Lanes

Name of Road	Extension (km)	Average Travel Time of Vehicles (min)	Deviation of Travel Time (min)	
			Bus	General Vehicles
Dobong-Mia-ro	15.8	44.3	± 2.7	± 15.3
Susaek-Seongsan-ro	6.8	18.1	± 1.2	± 15.6
Gangnam-daero	4.8	16.7	± 1.3	± 4.6
Mangwu-ro	4.8	14.8	± 1.4	± 4.9
Kyeongin-ro	6.8	16.9	± 3.1	± 9.2
Siheung-Daebang-ro	9.4	22.7	± 1.2	± 4.6
Hangang-ro	5.5	15.1	± 1.1	± 5.4
Mapo-ro	5.3	16.4	± 1.0	± 5.6
Songpa-daero	5.6	15.7	± 1.6	± 4.1
Gonghang-ro (Level 1)	2.5	5.8	± 0.4	± 0.7
Noryangjin-ro	2.8	6.8	± 1.2	± 3.0
Sinbanpo-ro	3.5	9.0	± 3.0	± 6.2
Dongjak-daero	2.6	7.7	± 0.9	± 1.8
Yanghwa, Sinchon Road	5.2	13.4	± 1.8	± 3.4
Gonghang-ro (Level 2)	2.3	15.1	± 1.4	± 1.8
Mangwu-ro Extension	2.2	6.3	± 0.9	± 1.0
Tongil-Uiju-ro, (Level 1)	3.3	10.9	± 1.0	± 1.6
Cheonho-daero (BRT)	5.1 (excluding Hanam-si Section)	30.2 (including Hanam-si Section)	± 2.1	± 1.0
Tongil-Uiju-ro (Level 2)	5.4	15.3	± 2.8	± 5.4

Wangsan-ro	3.4	10.3	± 0.4	± 1.4
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Source: Traffic Operation Information Service, 2013

The number of bus passengers increased by 4 - 7% on average compared to the period before the construction of exclusive median bus lanes, although there were still some slight differences depending on the road.

Table 4. Transition Trend of Bus Passengers on Exclusive Median Bus Lanes by Road (those opened since 2009)

(Unit: 1,000 persons / month)

Name of Road	Extension (km)	Before Lane Opening	After Lane Opening	Increasing Rate of Passengers
Dongjak-daero	2.6	2,491	2,679	7.0%
Yanghwa-Sinchon-ro	5.2	16,228	16,342	0.7%
Gonghang-ro (Level 2)	2.3	11,072	13,743	24.1%
Mangwu-ro Extension	2.2	11,023	11,501	4.3%

Source: Traffic Operation Information Service, 2013

In particular, as a result of comparing the numbers of bus passengers in Tongil-ro (Eunpyeong New Town –Seodaemun Intersection, 11.1km), which was fully opened in December 2011, the number after its opening was observed to have increased by about 15% compared to before its opening.

Table 5. Transition Trend of Bus Passengers on Tongil-ro Exclusive Median Bus Lanes

(based on weekdays, unit: persons)

Before Opening (Apr. 2010)	After Opening (Apr. 2012)	Variation
78,218	89,304	11,086 (15.1%)

※ Average No. of daily passengers on five routes (701,703,704,706,720) from Gupabal to Seoul Station

Source: Traffic Operation Information Service, 2013

The total number of daily bus users in Seoul stood at 4.78 million in 2004 during the early stage of the introduction of the exclusive median bus lanes; however, this figure increased to approximately 5.8 million (average increase of 21% on a daily basis) in 2011. Therefore, the Seoul Metropolitan Government regards the establishment of exclusive median bus lanes as having been effective in invigorating the use of public transportation.

Challenges and Solutions

Transient Increase in Traffic Accidents

In the early days of the exclusive median bus lane system, traffic accidents tended to increase temporarily due to unauthorized crossing by pedestrians and public transportation users who had not yet adjusted to the newly changed traffic system and the improved speed of buses. However, the number of accidents has been decreasing every year along with the continuous expansion of exclusive median bus lanes as a result of rising public awareness and the establishment of an orderly traffic culture due to continuous promotion of the exclusive median bus lane system.

In addition, in order to reduce traffic accidents, the installation of safety barriers around the exclusive median stops and crosswalks, shock absorbers at road junctions, photovoltaic rechargeable raised pavement markers for lane guidance, and speeding prevention facilities at the stops was carried out along with regular safety education programs for bus transportation service workers.

Insufficient Capacity of Exclusive Median Bus Stops

For some bus stops and general traffic congestion points where build-up occurs due to the concentration of passengers getting on and off buses since the introduction of the exclusive median bus lanes, the Seoul Metropolitan Government will strive to resolve the inconvenience of bus users and drivers of general vehicles by executing projects to enhance the capacity of bus stops and traffic improvement projects to relieve traffic congestion. It will also continue to improve upon factors that inhibit traffic safety and obstacles to communication by observing the traffic situation on sections within the exclusive median bus lanes.

Measures for Overcoming Problems and Implementation Status

In the early days of the system, traffic accidents on the exclusive median bus lanes tended to increase temporarily due to unauthorized crossing by pedestrians and public transport users who had not yet adjusted to the newly changed traffic system and the improved speed of buses. In the meantime, the number of accidents has been decreasing every year along with the continuous expansion of exclusive median bus lanes as a result of rising public awareness and the establishment of an orderly traffic culture due to continuous promotion of the exclusive median bus lane system.

Since 2009, the Seoul Metropolitan Government has been improving 40 exclusive median bus lanes in the city – including the expansion of exclusive median stops (11 places) on Gangnam-daero – by promoting the 'Project for the Improvement of Exclusive Median Bus Lanes.'

In 2011, the exclusive median stops (11 places) on Gangnam-daero, where extremely crowded with bus users, were extended, with stopping phases increasing from 4 to 5 and platform width, from 3m to 4m. Also, a bus stop was newly established in front of Suyu Station on Dobong-Mia-ro to enhance the ease of transfer with Subway Line 4.

In the future, the Seoul Metropolitan Government will continue to improve the operational efficiency of the exclusive median bus lanes in accordance with changes in the local environments and traffic conditions by promoting such improvement measures as optimizing the intersection signal times and promoting bypass routes in order to alleviate congestion in the exclusive median bus lane on Wonsan-ro, which runs from Sinseol-dong to Cheongyang-ri. It will also consider expanding the stop of the exclusive median bus lane in front of Gyeongin Road dome stadium following its opening in the southwestern region.

In order to reduce traffic accidents in other sections, the installation of safety barriers around the exclusive median stops and crosswalks, shock absorbers at road junctions, photovoltaic rechargeable raised pavement markers for lane guidance, and speed prevention facilities at the stops was carried out along with regular safety education programs for bus transportation service workers. In addition, for some bus stops and general traffic congestion points where build-up occurs due to the concentration of passengers getting on and off (buses) after the installation of the exclusive median bus lanes, the Seoul Metropolitan Government will strive to resolve the inconvenience of bus users and drivers of general vehicles by carrying out various projects to enhance the capacity of bus stops and traffic improvement projects to relieve traffic congestion. It will also continue to improve upon factors that inhibit traffic safety and obstacles to communication by observing the traffic situation on sections within the exclusive median bus lanes.

In the future, the Seoul Metropolitan Government plans not just to construct exclusive median bus lanes, but also improve their functions by continuing to identify points on the sections currently in operation where traffic congestion and inconveniences in using the buses occur.

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