

## 01 Transportation Planning

### International comparative study of Seoul BRT system

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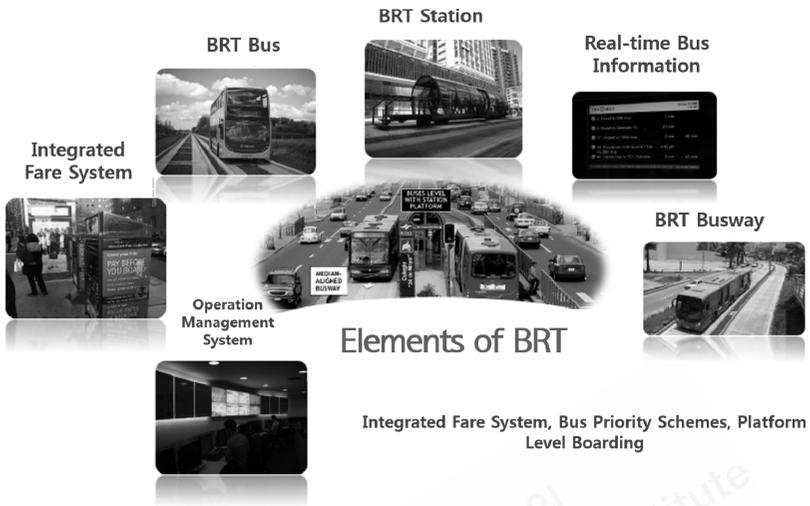
#### Summary

The ridership of the bus rapid transit system in Seoul is the fifth highest among 162 cities worldwide, but the system still needs more improvements.

#### 1. Introduction

##### **Bus Rapid Transit (BRT) sets a new global trend in public transportation**

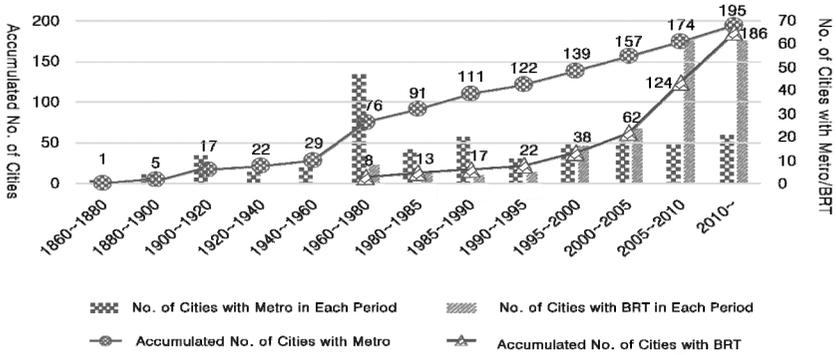
Since the 1970s, the worldwide adoption of Bus Rapid Transit (BRT) has continued unabated. Today, the system is recognized as the most widely used public transportation in the world. Following the trend, Seoul installed a BRT system on median bus-only lanes in 2004. The BRT innovatively combines various facilities, services, and technologies into an integrated system. As a result, efficient travel is possible. The system has two salient features: bus-only lanes and user-friendly bus stops. The bus lanes enhance the speed and punctuality of bus service. A carefully designed user-friendly bus stops can ensure the convenient boarding and alighting of passengers. A high-capacity vehicle is also deemed as the essential element of BRT. The same goes for the technologies that provide the public with easy fare payment service and real-time bus information. They are both requisites for user convenience.



[Figure 1] Elements of BRT

### Over 190 cities worldwide have adopted BRT

Despite the short history of BRT, it has become a mainstream in such a short period of time. Since the 1970s, cities around the globe increasingly have installed the system. Before long by 2014, the number of cities with BRT reached 191. By comparison, the metro system took more than a century to achieve the similar score: Since the system was first introduced in London in 1863, cities in other parts of the world have constructed subways and the figure of 195 was attained 2011, showing a slower pace than BRT. The rapid, widespread adoption of BRT largely attributes to its lower capital cost than that of rail transit. This has facilitated the construction of fast and high-capacity public transportation. This report analyzes the advantages and disadvantages of Seoul BRT compared to other cities worldwide.

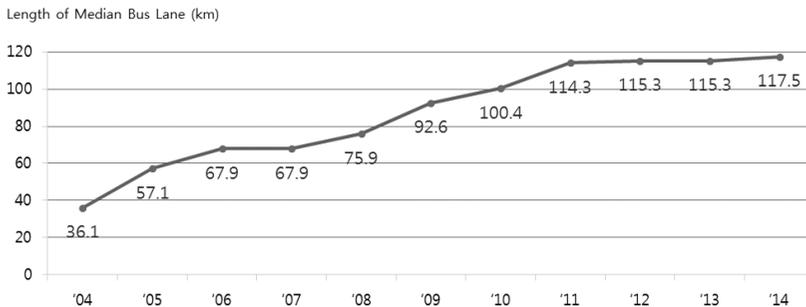


[Figure 2] Number of Cities with Metro/BRT in Each Period

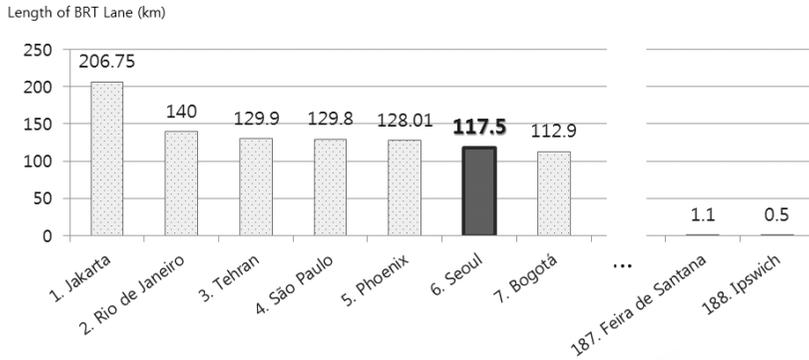
## 2. Main Findings

### Seoul has 6th longest BRT bus lanes in the world

Seoul has extended its BRT busways at a faster pace than most other cities worldwide. Seoul Metropolitan Government (SMG) undertook a public transportation reform in July 2004. The reform began with constructing 36.1 km-long exclusive median bus-only lanes spanning four segments. SMG has continued to further lengthen the busways. Now its exclusive bus lanes spread 117.5 km across 12 sections. It is the 6th longest bus-only lane in the world, with Seoul being just behind cities like Jakarta, Rio de Janeiro, and Teheran.



[Figure 3] Length of Median Bus Lane in Seoul Each Year

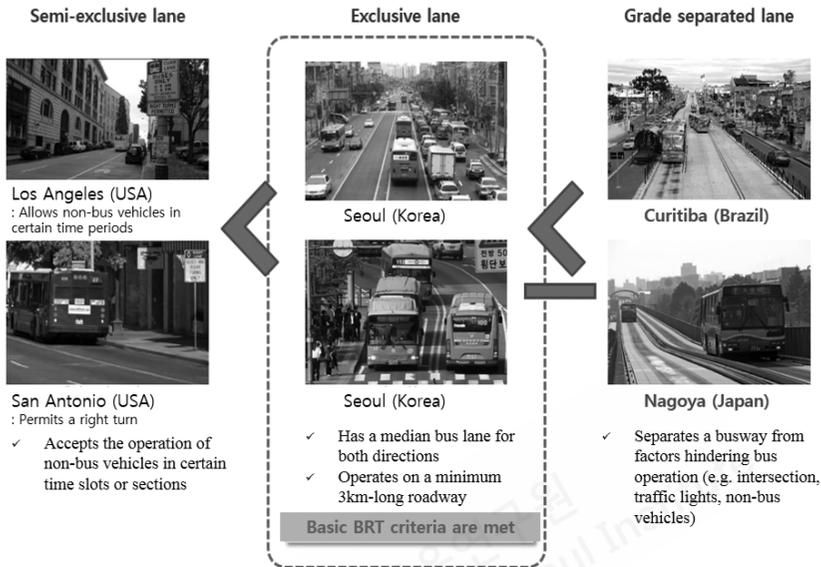


[Note: The data is based on the Global BRT Data (<http://brtdata.org>)]

[Figure 4] Length of BRT Lane in Cities Worldwide

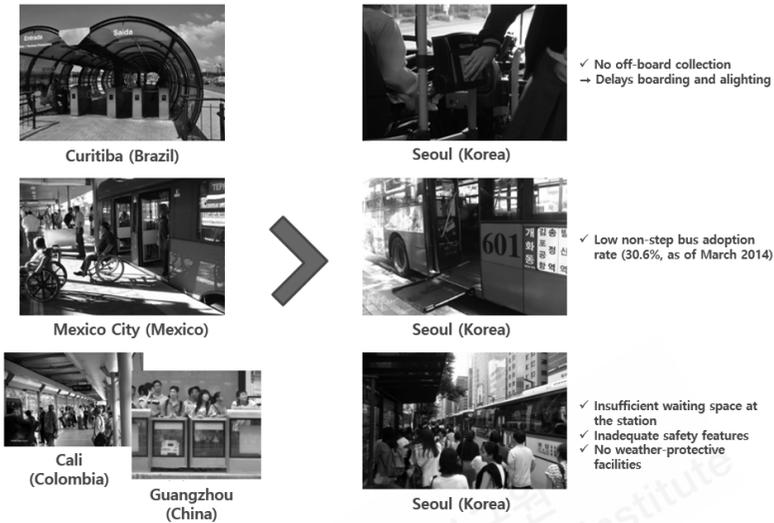
### Conditions of Seoul BRT infrastructures are just around the world average

Seoul touts the long length of its BRT busways. Yet, it would welcome improvement in several areas of the system including bus lane configurations. Seoul's bus only lanes operate on the road with a minimum length of 3km, ensuring a certain level of travel speed. The lanes operate in an exclusive manner, strictly prohibiting other automobiles than buses. This bus lane configuration is better than a semi-exclusive lane that permits non-bus vehicles in certain time periods or sections. Yet, it is not as effective as a grade-separated lane physically disconnected from other roadways. This alignment inevitably precludes the entrance of other cars even at the intersection and thus some cities adopt this system for better bus operations.



[Figure 5] Comparison between BRT Busways in Seoul and Other Major Foreign Cities

Bus stops are another area for improvement. First, there needs off-board fare collection. This will eliminate the delay caused by passengers paying on board, hence faster bus operation. Second, more low-floor buses should be provided. At present, Seoul has the non-step bus adoption rate of a mere 30 percent. This renders the bus transit inaccessible for the mobility handicapped (e.g. wheelchairs, disabled passengers, baby strollers). Third, passenger waiting rooms at the stop need to be enlarged. The current space is minuscule compared to ones in other foreign cities with a good BRT system. Lastly, safety features like a screen door are to be built more adequately.

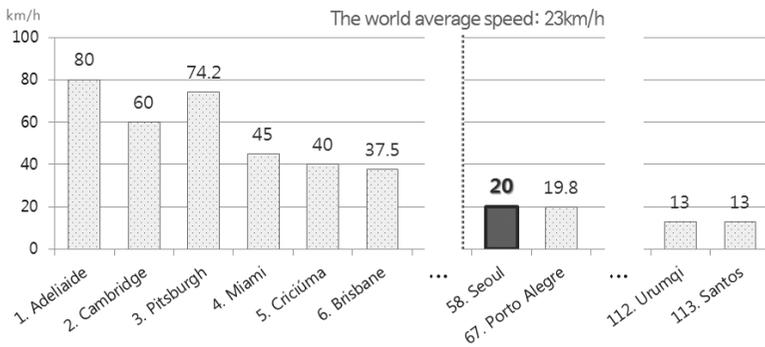


[Figure 6] Comparison between BRT Features in Seoul and Other Major Foreign Cities

### The speed of Seoul BRT buses is below the world average

In Seoul, buses operate at the average speed of 20 km/h on the median bus-only lanes. It is below the global average of 23 km/h. According to the Global BRT Data, Seoul sits at 58th place among 113 cities worldwide. Speedy bus operation is only possible when BRT lane is constructed on a freeway. High-speed transportation service is hindered since Seoul BRT is built on urban roadways. Nevertheless, Seoul can expedite the service by a certain extent thanks to the improvement made to its bus-only lanes.

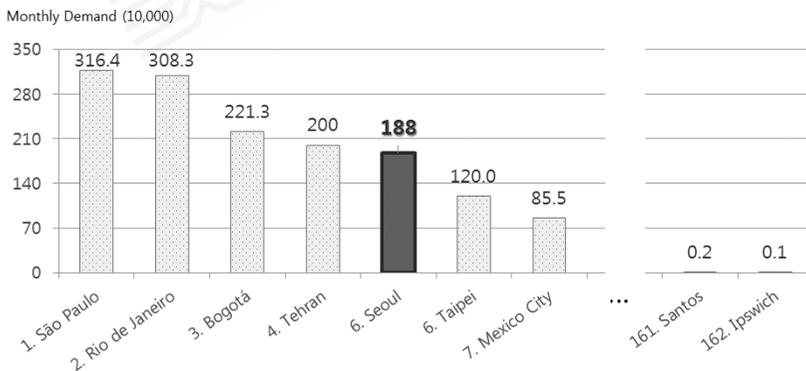
Besides the location, two factors hamper faster bus travel in Seoul; a lack of passing lanes is one. Currently, only 52% of median bus stop (i.e. bus stops alongside a median bus-only lane) have passing lanes. A study shows that buses generally operate 19 percent faster in a city with a host of passing lanes. Another impediment is the inadequate spacing of stations on a bus-only lane (measured in the number of stations relative to the length of a bus-only lane). This slows down bus operation.



[Figure 7] The Average Operating Speed of BRT Bus in Each City

### Seoul BRT has the high user demand above the global average

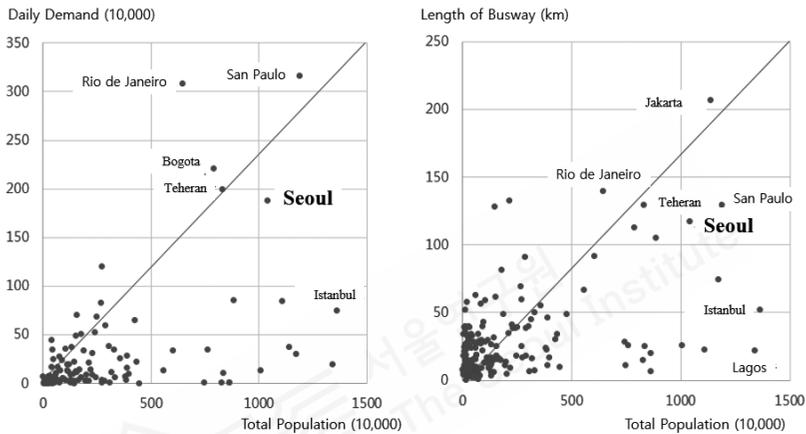
The pattern of daily BRT users in 162 cities worldwide was studied. The result has revealed that Seoul has the 5th biggest figure (1.88 million). The top four cities are Sao Paulo (Brazil), Rio de Janeiro (Brazil), Bogota (Colombia), and Teheran (Iran). The study indicates that the demand is greatly influenced by factors such as fare levels and whether an integrated fare system operates.



[Note: The data on the BRT demand in foreign cities is based on the Global BRT Data. The figure of Seoul represents the number of daily BRT users at BRT bus stops]

[Figure 8] Daily BRT Demand Rankings

As previously stated, Seoul has the 5th highest BRT user demand in the world. It is also the case when the demand is compared to the city population. Likewise, Seoul has a adequate length of median bus-only lanes relative to its population. It perches on 4th place just behind Jakarta(Indonesia), Rio de Janeiro(Brazil), and Teheran(Iran).



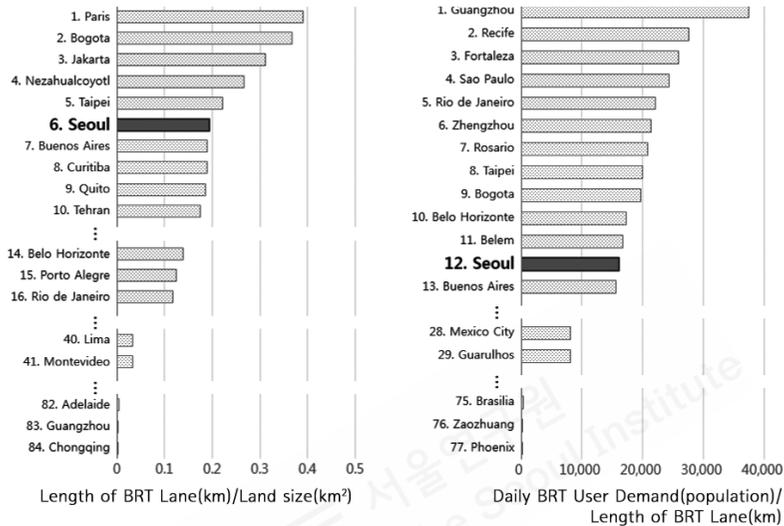
[Figure 9] Population, BRT User Demand, and Length of Busway by City

### **The length of Seoul BRT median bus-only lane is long, yet the relative user demand to the length is low among large metropolises**

The adequacy of each city's median busway length relative to the land size has been investigated. The study looked at 84 cities with a population of over one million. It has measured Seoul's median bus-only lane per square kilometer is approximately 0.2 km. This positions the city in the sixth place in the ranking.

Though Seoul BRT has the high-ranking median bus-only lane, the user demand is not as high. This time, the study analyzed 77 cities where over one million population dwells. It has found that Seoul has the 12th largest number of passengers (16,000) boarding on the median bus-only lane per km. Cities in a higher rank are

found to have high-capacity buses as well as physically segregated exclusive bus lanes, showing an importance of the BRT operation capacity for ridership.

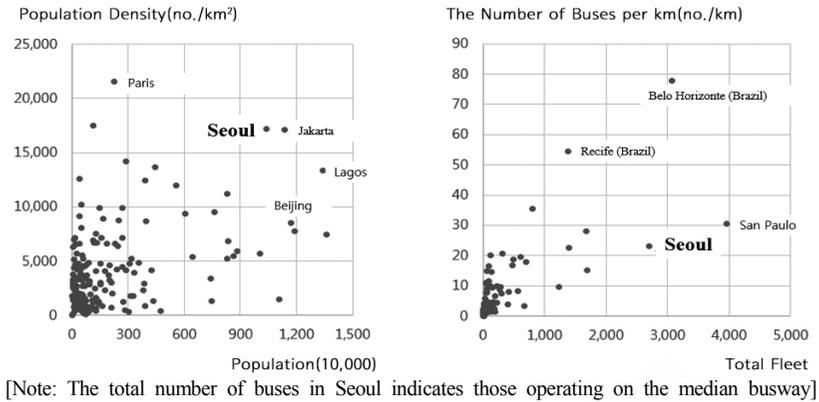


[Note: Only considered cities with a population of more than one million]

[Figure 10] (Left) Length of BRT Lane Relative to Land Size / (Right) Average Daily BRT User Demand per Unit Length of Busway

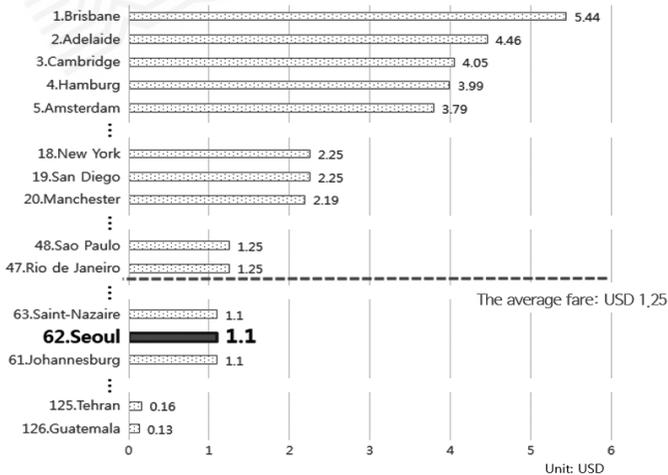
## Population and affordability are two major variables to user demand

The size and density of population significantly affect the BRT user demand. The quantity of buses operating on median busways is also important. Among cities that have implemented BRT, Seoul is the 5th most densely populated city. Moreover, it is one of the top three cities operating the greatest number of buses on median bus-only lanes. When this is reviewed relative to the length of median busways, Seoul stands near the 5th place. All of these implicate that Seoul is adequately handling the potential user demand (represented by the population size) by deploying a sufficient number of buses.



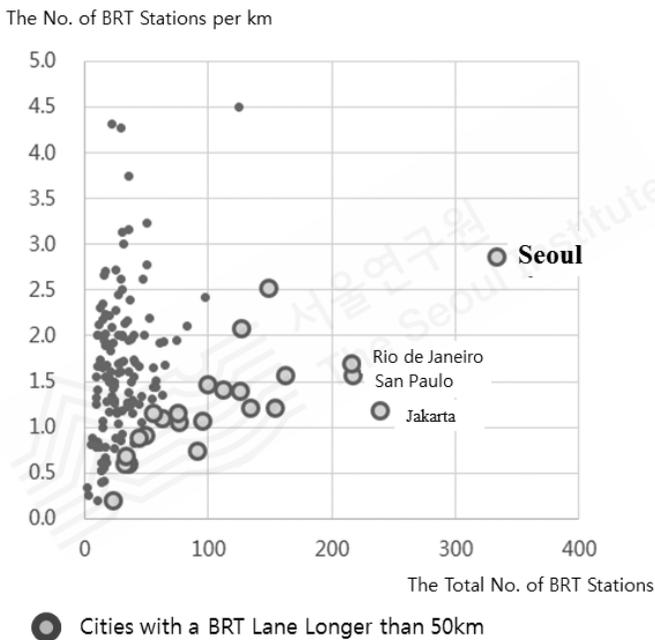
[Figure 11] (Left) Population Size and Density of Cities with BRT / (Right) Total Fleet and the Number of Buses in Operation

The lower bus fare levels and the number of stations positively affect the user demand. Besides demographics, these two factors have been conducive to the passenger demand. Seoul’s bus fare is below the average of other cities with BRT. Whether a citywide integrated public transportation fare system operates is another positive factor for BRT demand.



[Figure 12] Bus Fares of Cities with BRT

The number of stations alongside a median busway also has influence on the user demand. Seoul has the largest number of median bus stops in the world - 334 in total. The figure is much greater than 93 of Jakarta, a runner-up. Among cities that have minimum 50km-long BRT lanes, Seoul perches on the top with the highest station density (measured in the number of stations per km). The easy access to bus stations contributes to the rise of user demand.

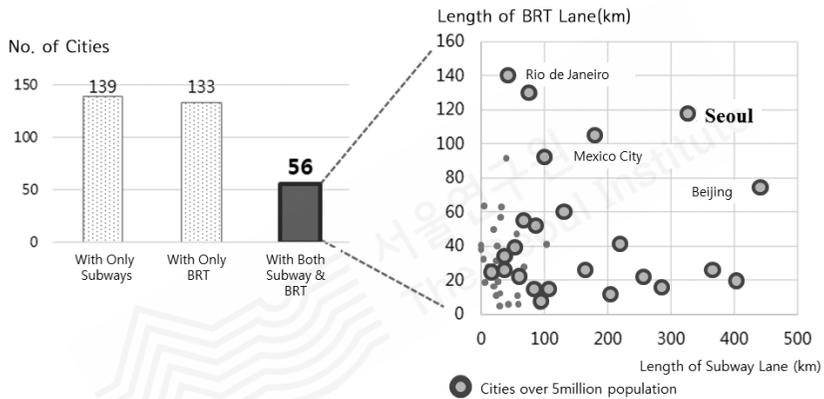


[Figure 13] The Number of BRT Stations

### 3. Conclusions & Policy Recommendations

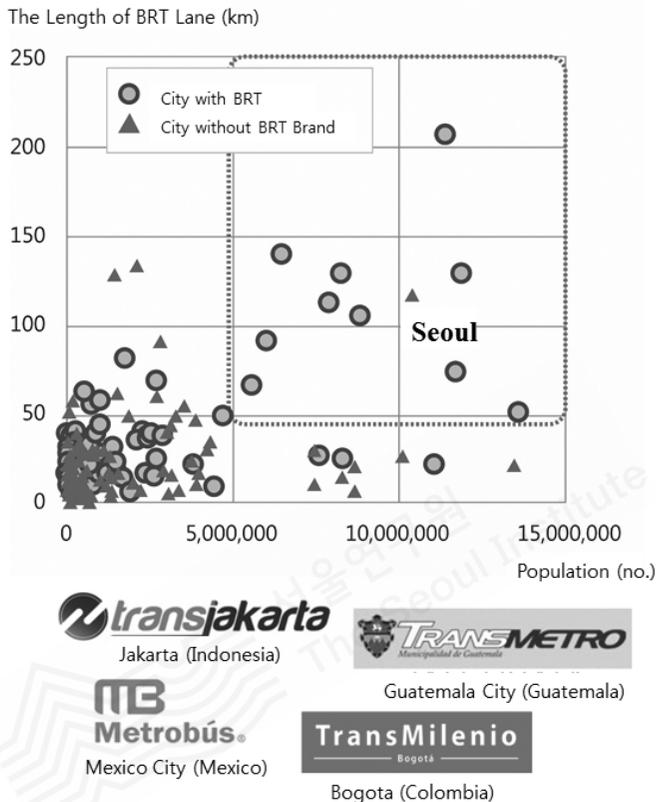
#### Strong systematical connection with subways, but no prominent brand

Seoul BRT is adequately and effectively connected to the metro system. Only a few cities worldwide have successfully established both metro and BRT systems at a large scale. Today, there are 189 cities operating BRT. Among them, just 56 cities including Seoul, Mexico City, and Beijing run subways as well as BRT.



[Figure 14] Cities with BRT and/or Subways & the Length of each System

Seoul BRT has no prominent identity, while 77 out of 191 cities worldwide own a unique and distinctive brand for their BRTs. This study's survey revealed that Seoul is the only city that does not have its own BRT brand among the 11 cities which have a population of more than five million and BRT lanes longer than 50 km.



[Figure 15] (Top) Presence of BRT Brand Relative to Population and the Length of BRT Lane / (Bottom) BRT Brands of Major Cities.

### Introduce a unique identity and special vehicles for its BRT system

As mentioned earlier, major cities with a large-scale BRT have distinctive images for their systems. Seoul is the only exception. As a first step to improve its BRT, SMG should create a prominent identity, reflecting the system's distinctive qualities.

## **Continue to expand the BRT network, while enhancing connection with the subway**

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In Seoul, the present number of median bus stops accounts for only 5 percent of the total number of bus stops. The number of passengers boarding at the median bus stops, however, takes up as much as 34%. The ridership of BRT buses which operate mostly (50% of the route length or more) on the median bus-only lanes tends to be much higher than that of non-BRT buses. Overall, the ridership of BRT routes is twice greater than other routes.

It is crucial to fully utilize the superior passenger capacity of BRT. To do so, the current BRT network should be expanded. This requires the expansion of median bus-only lanes, particularly over trunk roads. The process should take the user demand and road conditions into account. Overall, the improvement plan needs to revise the system from various angles. For instance, it should consider creating passing lanes and widening the scope of real-time bus information.

The system improvement also asks for enhanced connections between BRT and the metro system. It is especially true considering that Seoul has large-scale networks for both systems. Here, convenient transfers between buses and between buses and subways are crucial. Moreover, the efficient integration of public transportation fare is necessary. Needless to say, a convenient fare collection system should be installed. Currently, SMG is planning on expanding its bicycle sharing program. This should also be factored in the plan for improving connections with BRT system.