기본연구보고서 2017-12

차세대 교통기술 발전에 따른 건축 및 도시공간의 대응방안 연구

Architectural and Urban Implications of New Transportation Technology

오성훈 Oh, Sunghoon
성은영 Seong, Eun Young
이종민 Lee, Jong Min
강현미 Kang, Hyun Mi

Architectural and Urban Implications of New Transportation Technology

SUMMARY

Oh, Sunghoon
Seong, Eun Young
Lee, Jong MIn
Kang, Hyunmi

The transition of transportation system in the city leads to changes in urban space and urban organization. In most of the pre-medieval towns where most of the people walked, the only part of population such as exclusive nobles or soldiers were using the horses as a means of transportation. The boundaries and the spatial structure of the towns were based on the limits of human's walking ability. The land use pattern has been determined based on the physical properties and mobility of the means of transportation.

As the next generation of traffic technology developed, the traffic system in the city has been changed drastically. It will have significant impact on the development and change of architecture and urban space, and it can be applied in various aspects such as planning, design, and operation in relation to the spatial change caused by the next generation transportation technology. The temporal range covered in this study is set to be 5 to 10 years (near term) in the future.

1. Expansion and convergence of urban space for self-driving car

In order to ensure the safety and stability of autonomous vehicles, a separate lane for autonomous vehicles is expected to be provided for a considerable period of time during which people need to use the urban space together with the vehicles

they drive. These lanes' installation divides the area of human driving from the autonomous driving car, but the human segment will gradually disappear as the autonomous driving car expands.

2. Reasonable alternative use of parking space

As the urban space for cars are shrinking and roads can be used more efficiently through autonomous vehicles, areas of traditional automobiles, such as highways and public roads and other garages and parking lots, will turn into human spaces. Many of these parking spaces are expected to become unnecessary due to the spread of autonomous vehicles, and these spaces are likely to be used for commercial, or public use.

This change, of course, brings about the architectural design shift of existing buildings and the amendments of laws and ordinances related to parking lots. Therefore, it would be a chance to improve the current urban problems on functions and aesthetics in town. The effect of replacing a parking lot is expected to be various depending on city conditions, but most of the parking lots, especially in urban areas, are expected to disappear altogether unless there are special reasons. In addition, it is expected that the number of street parking can be further reduced as demand-oriented traffic services spread.

3. Changing spatial demand

With the increase of vehicle sharing system, the demand for collective public parking lot will be maintained until autonomous vehicles are generalized. Even if it is apartment house, it is easy to utilize the shared car because the private company can exclusively use part of the public parking lot if the company provides vehicles such as Car2go, Soka, and Green Car. In this regard, it is necessary to agree to manage parking lots for the operation of the vehicle sharing system at the apartment resident representative meeting. These problems are larger in existing single-family homes. This is because it is difficult to create a parking space for private operators because there is not enough parking space.

4. Driving / storage space for Personal Mobility Vehicle

If shared bikes are activated, the spatial demand for shared bikes on the roads can

increase. Alternatively, if personal mobility developed in various formats is used as a shared means of transportation for first-mile and last-mile trip, a storage place for these types of mobility needs to be provided at the public level.

The analysis of the next-generation transportation technology in this study was carried out to clarify how autonomous vehicles, Personal Mobility Vehicle, and demand-responsive transportation will affect urban space. Regarding the proliferation of autonomous vehicles, in Korea, sales of autonomous vehicles began in 2025 and the market saturation was expected to reach 2050 years.

In the case of Personal Mobility Vehicle, it will be expanded from 240,000 to 1 million by 2030. On average, it will reach 62,000, but it will be greatly influenced by the institutional and institutional aspects . In particular, it is expected that the Personal Mobility Vehicle means will replace the vehicle share of the short distance within 5km. It is expected that the share of the means will be 76% for 2.5km and 89% for 2.5 ~ 5km.

It is difficult to predict the timing of the diffusion of demand-type transportation because the technological base is already at the level of commercialization, but it will greatly depend on legal and institutional maintenance. Indeed, it appears that realistic constraints are more likely than technological constraints, such as Uber, which has been widely used in the West as well as in Southeast Asia.

According to the results of the survey on the next generation transportation technology for 1,500 people, 93.7% knew about autonomous vehicles, and 76.2% thought that autonomous vehicles were commercialized within the next 10 years there was. 44.6% of the respondents were willing to use autonomous vehicles, and only 7.7% said they would not use them. 48.7% of the reasons for rejection of autonomous vehicles were the most likely to be more likely to be accidents, followed by lack of confidence in technology levels. In terms of costs, 30.9% said that they would use the car at the current price level, and 59.4% said they would pay a considerable sum to 1.5 times below the level.

In the case of Personal Mobility Vehicle, 20.4% of them had experience of using it, 82.7% of them had used it for leisure purposes, 50.7% for walking distance, 30.7%). The average moving time of personal moving means is 38.9 minutes and the average moving distance is 11.2km, which means that it moves farther than expected.

The number of experienced respondents was 38.8% for the responding type of transportation. The users used it for 1 or 2 times a month, mainly for cultural life (31.8%) and commuting (18.9%). The average use time was 43.8 minutes and the moving distance was 20.9km on average. In the case of replacing public transportation by means of accommodating transportation, 89.7% of the respondents indicated that they would be willing to pay. The intention to pay was within the bus fare level (37.5%) and within the taxi fare level (42.1%).

In this study, we analyze the change of parking demand caused by the introduction of autonomous driving car. In this paper, we consider the possibility of future parking area change by constructing parking demand model using the logarithmic model. As a result, when the market share of autonomous vehicles reaches 5%, 1,000 ~ 9,472 parking lots is estimated to decrease in each Dong based on Seoul.

In order to estimate the spatial demand for Personal Mobility Vehicle, it was assumed that the demand for expansion of one area around the station area of Seoul occurred and the project volume was estimated at 468.6km, and the total construction cost is estimated to be about 238.7 billion won. These estimates were made on the assumption that access to the final destination around the station area is reached by the Personal Mobility Vehicle.

The results of numerical analysis can be said to be preliminary numbers that define policy objects, but many trial – and – error are expected if institutional arrangements for managing and utilizing urban space, especially public space, are not implemented.

Regarding autonomous vehicles in terms of architecture and urban space, institutional arrangements for the installation and operation of autonomously – driven lanes should be prepared, and the number of installed parking lots and physical design standards should be changed soon. Regulations for parking lots should also be considered. In addition, there is a need to improve the design criteria of existing roadside and intersection roads considering autonomous vehicles.

It is expected that the improvement of the design on the street will be closely related to the Personal Mobility Vehicle system in addition to the autonomous vehicle. In particular, the Personal Mobility Vehicle system is expected to have a system similar to the public bicycle sharing system. Therefore, the driving space

and the storage space for the Personal Mobility Vehicle must be systematically prepared.

Demand-responsive Transportation Services can have a relatively small number of visible changes, but the underlying change is likely to change the character of the bus stop place to the point where pick-up takes place. Also, since the center of transit-oriented stops seems to be relatively smaller than the existing stops, it is expected that the meaning of pedestrians' density and location centrality will decrease. These changes mean that the spatial structure of existing urban areas can be fundamentally changed, in addition to the changes in the location, spacing, facilities,

The rapid development of traffic technology is expected to change the conditions for the use of architecture and urban space differently from the previous ones. Among them, there is a need to consider the characteristics of space and the architectural environment in advance. This study shows a general viewpoint of how the changes of transportation system can affect the urban land use, the street space and the building environment, and how spatial standards should be improved and regulated according to the transportation change.

Although it is inevitable for a certain space change to occur due to the development of traffic technology, no one can offer a clear picture as to how the next generation transportation technology will be adjusted, converged and integrated into the current urban system. Therefore, it is urgent to clarify the direction and concept of the future transportation system that can be practically applied in Korea based on the present technology and development direction.

Keywords :
Autonomous Vehicle, Personal Mobility Vehicle, Demand-responsive Transportation Service, Spatial Change