

## **Analysis of Usage of Park and Bus Ride by Motorcycle in Hanoi - A Case Study of YEN NGHIA Station-**

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**Abstract:** In recent years, developing countries in Southeast Asia are considering introducing mass rapid transportation systems to solve various traffic problems. However, urban areas have already spread to low-density in most cities, and access to the station by walking is considered to be difficult. Then, P & BR by using a motorcycle as an access mode is considered to be an effective means. In this research, we conducted an interview survey with motorcycle users who access to YEN NGHIA station to take BRT (hereafter P & BR) in Hanoi, Vietnam. As a result, it was found that many users of P & BR make much account of travel time, cost, safety, comfortable and flexible. Especially, the result showed that even the travel time by P & BR is considerably long, they prefer to use P & BR because total travel cost is possible to be reduced in comparison with other traffic modes. Also, it was found that the security of motorcycle parking lots is highly concerned by the users.

*Keywords:* Asia, Hanoi, BRT, P & R, P & BR, Motorcycle

### **1. INTRODUCTION**

Traffic problems and environmental problems are getting worse due to rapid motorization in Southeast Asian cities so that mass rapid transport such as Bus Rapid Transit (BRT) has been planned to be introduced as a possible measure. However, it is impossible to introduce BRT to the developing cities because urban areas have already been spread in low density. For example, cities that succeeded in introducing BRT such as Curitiba in Brazil are carrying out Transit Oriented Development (TOD). Similarly, in the case of Hanoi, BRT was also introduced in 2016 as one of solution for the problem of traffic congestion, but the number of ridership has been low due to various problems such as low accessibility, etc.

Therefore, in order to solve the problem, it is an effective measure that the use of a park and bus ride (hereafter, P & BR) using motorcycles is considered as a mode of travel. Vietnam has the highest penetration rate of motorcycles in Southeast Asia. Especially, Hanoi has more than 90% of the modal share and is a major means of transportation. Thus, P & BR is suitably considered for motorcycles accessing stations. However, in the case of Hanoi BRT, the potential to use P & BR with accessing by motorcycle has been not clarified. In this study, we conducted an interview survey on P & BR users at the BRT station in Hanoi to clarify the state of use. And then, we revealed the reasons for their choice of P & BR with accessing by motorcycle from the results of the analysis of the survey.

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## 2. LITERATURE REVIEWS

Yoshida *et al.* (1996) presented an important proposal from the viewpoint of alleviation of traffic congestion from the road and ultimately from the viewpoint of conservation of the global environment in urban transportation policy by making automobile users to divert to public transportation. As a short-term countermeasure, they proposed an effective way which combines a car and a railway and/or a bus like Park & Ride, Kiss & Ride, or Park & Bus. However, they concluded that it was difficult to introduce BRT under such circumstances, because density in suburban area of Southeast Asia cities are very low. And, they proposed a strategy to enable the introduction of a BRT system in such developing cities by providing access service to the stations. Consequently, to develop an area, it is necessary to introduce paratransit feeder and P & R facility to a station. By doing so, they explained that BRT can play an important role to carry passengers from suburban residential areas to central urban areas as a rapid mass transit feeder.

As mentioned above, there have been many studies mentioned the importance to provide the access to the BRT stations in order to increase service level of BRT system. For example, Satiennam *et al.* (2006) proposed to apply the paratransit as being a feeder of BRT with a well-integrated design plan. They mentioned that feeder connections would not only increase BRT capacity, but also improve the accessibility of communities around BRT stations.

Also, several studies clarified the possibility to introduce access modes on BRT feeder. For example, Kinoshita (2013) developed the nested logit model based on the result of stated preference (SP) survey in Vientiane, Laos. Motorcycle and passenger car were included as choice sets on the lower level of this model. Hatakeyama *et al.* (2017) also did the same study in Da Nang, Vietnam. In this model, walking, motorcycle and feeder bus were considered as the choice sets as an access service to the BRT stations. In the both cases, distance and parking cost affected to motorcycle use as feeder significantly.

Khan *et al.* (2018) investigated the possibility to use paratransit for access to the BRT stations in the Rawalpindi-Islamabad Metropolitan Area as pre-study to introduce bus service as feeder service.

Since most of BRT system have been under planning process, stated preference survey has been conducted to estimate future modal share mainly. Only few RP surveys have been conducted to grasp the actual situation of BRT use, especially feeder transport for BRT. Srisung *et al.* (2016) and Tagawa *et al.* (2018) clarified the actual situation of P & BR use of the intercity bus terminal in Khon Kaen city in Thailand and based on the result, the possibility of introducing P & R using a motorcycle to LRT station in future investigated. As the result of clarifying the distance traveled, P & BR users ride their motorcycles from 10 to 20 minutes away from the stations. Hai and Hiep (2013) presented a discussion on the possibility of using P & BR for motorcycles along Bus route No.6 and proposed a scheme for P & BR implementation and management in Hanoi city.

This study try to clarify the reason why the motorcycle user use P & BR and accesses to the station by a motorcycle. It may be useful for understanding modal shift behavior from a motorcycle to a P & BR, and it also may be used to alleviate traffic congestion in downtown Hanoi.

## 3. METHODOLOGY

### 3.1 Overview of BRT in Hanoi

In 2016, Hanoi BRT was introduced as an alternative to introducing a railway to connect the satellite city and the city center. This BRT has 14.5 km route of 23 stations as shown in Figure 1. Total time duration takes up between 40 and 50 minutes. The BRT fare is uniformly 7,000 VND/day. Although the BRT user is saturated at the peak of commuting to school or office in the morning, however, users are not much seen in other time zones. Also, the station with the parking lot is only origin station's YEN NGHIA station or terminal station's KIM MA station. In our survey, other stations could check the parking lot around the station, but we could not confirm whether the users parked for P & BR.

Before Hanoi BRT started operating, various surveys and studies were implemented. For example, Tan *et al.* (2009) proposed some important criterion such as routes, stations, and vehicles for the development of the BRT system in Hanoi. And then, they analyzed the cost-benefits of BRT operation based on their proposal.

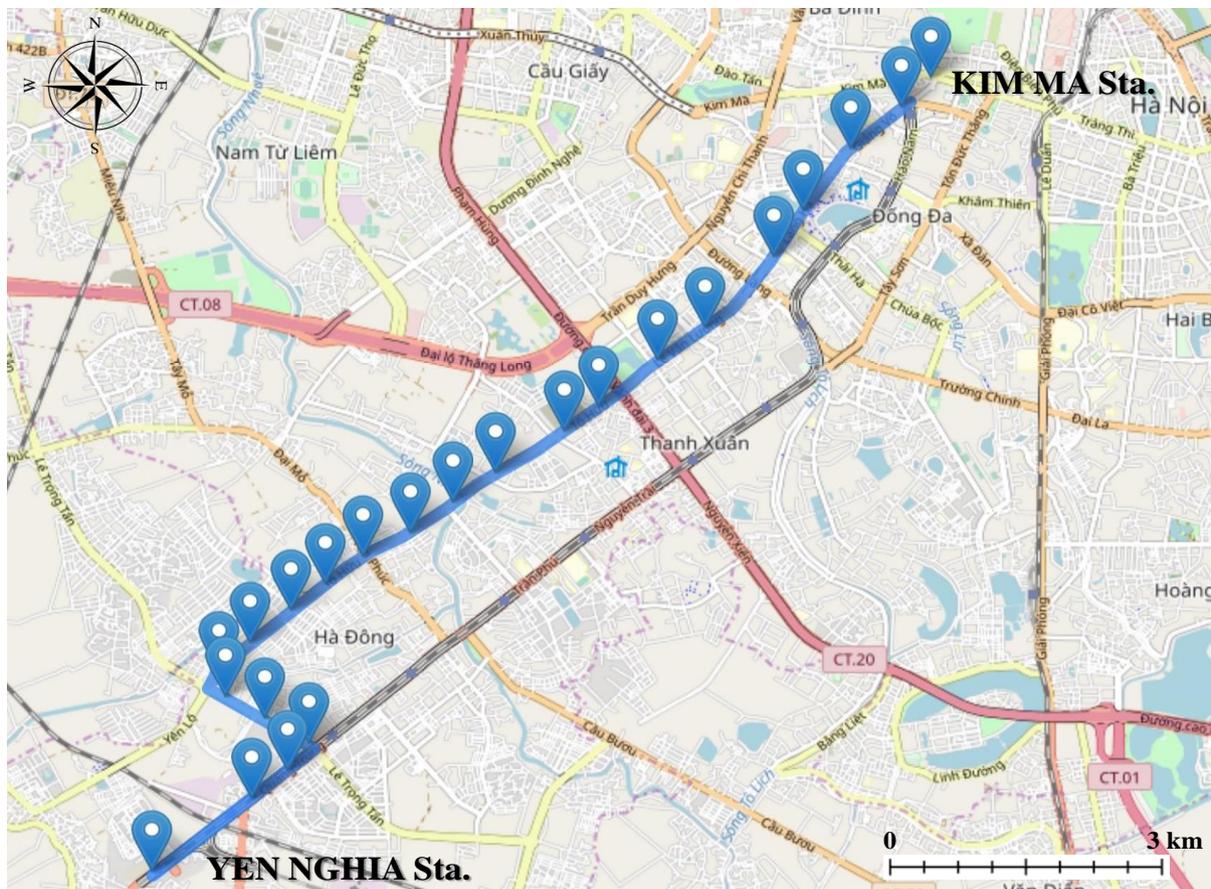


Figure 1. Route map of Hanoi BRT (Far East Mobility, 2019; Authors edited)

### 3.2 Interview Survey

As shown in Figure 2, the interview survey was conducted at YEN NGHIA station where bicycle parking lots are available for P&BR by motorcycle along the BRT route in Hanoi. Even motorcycle parking lots are provided at other BRT stations, but the interview was not conducted because we could not confirm whether people use BRT or not at other stations. The capacity for motorcycle parking lots at YEN NGHIA station is about 600 motorcycles, the parking fee is 5,000 VND/day.



Figure 2. Motorcycle parking lots and interview survey at YEN NGHIA station

On 13th December 2018, the interview survey was conducted at the entrance of the parking at YEN NGHIA station from 7 am to 5 pm, and got 250 samples. On this survey, the interviewer asked respondents to select the situation whether they were going to ride BRT or have just got off BRT. If they are going to ride BRT, the interviewer asked the origin point and the egress mode of transport. If they just got off, we asked the destination point and the access mode of transport. The reason for accessing to this station by motorcycle and the reason to use P&BR was rated on a scale of one to five. Then, we asked the main transportation method in the case where P & BR was not done to the target person and the traveling time and cost in that case (same starting and destination points). Since it is clarified in existing research that P & R users need "shortening of time" and "cost reduction" as a motivation for P & R users. And compare the cost and time in cases with and without P & BR. From that, it will clear what condition the user is doing P & BR. Finally, we asked personal attributes such as gender, age, occupation, income, ownership of cars and motorcycles.

### 3.3 Analysis of Questionnaire

After collecting the questionnaire sheets, we performed a simple collection and clarified the attributes of P & BR users. Indicates that the reason for using P & BR differs depending on the attribute of the user by going through the cross-tab for each item. Comparison of travel times and expenses at the time of selection of actual axis and selection of alternative means is performed by using a graph. The vertical axis shows the traveling time of the alternative means complemented with the actual traveling time and the horizontal axis shows the traveling expenses of the alternative means. In practice, the travel time when P & BR is done is shorter, and the cost is considered cheap. If the cost and time for alternative substitution become shorter, there may be other reasons to use P & BR. that case confirmed the reason for using P & BR of the corresponding sample again and performed simple tabulation.

## 4. RESULTS

### 4.1 Results of Interview Survey

First of all, in order to clarify what attributes the user who using P & BR belongs to, we asked the individual attributes in the questionnaire. In these results, the motorcycle P & BR is most frequently used by people who go to schools and school offices in their twenties every day (Figure 3). Because there are students, some users answered "No income". In addition to BRT, the ratio of the type of bus used is as follows. It can be seen that there are more users of BRT than users of intercity buses and users of urban buses. The left of Figure 4 shows the reason

for accessing the station by motorbike instead of using other means of transportation. As a result, it exceeded half of the satisfaction level in all respects. It became clear that the satisfaction level was high especially with regard to cost and travel time. However, the degree of safety was lower than the other items. This is considered to be affected by the bad road conditions to the station.

The main reason for using P & BR is low cost as shown in the right of Figure 5. By doing P & BR, it can safely arrive at the destinations. Although overall satisfaction with other items was high, some people seemed dissatisfied with the BRT's scheduling. This is thought to be caused by delay caused by general vehicle interrupting the dedicated lane.

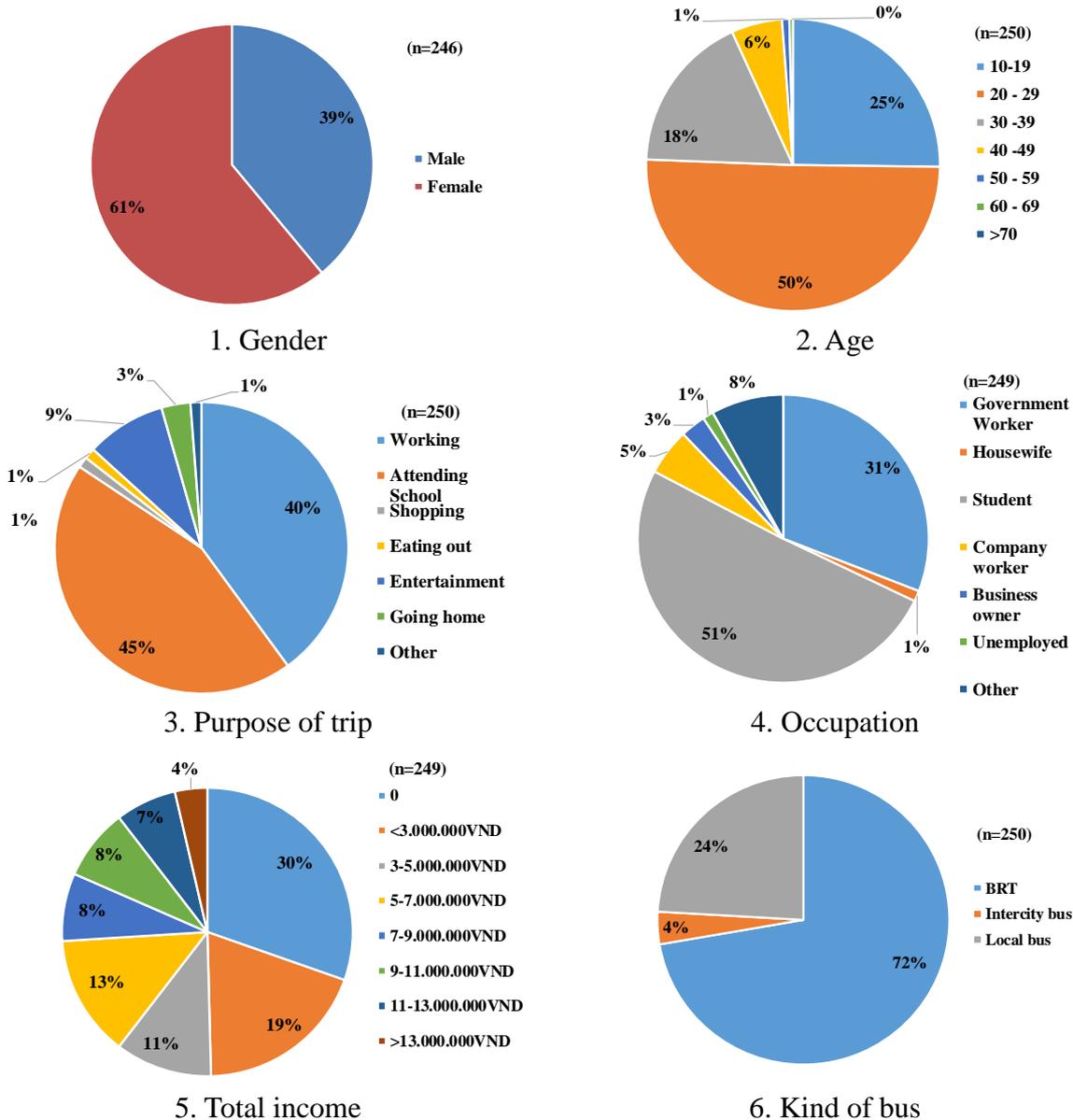


Figure 3. Personal attribute

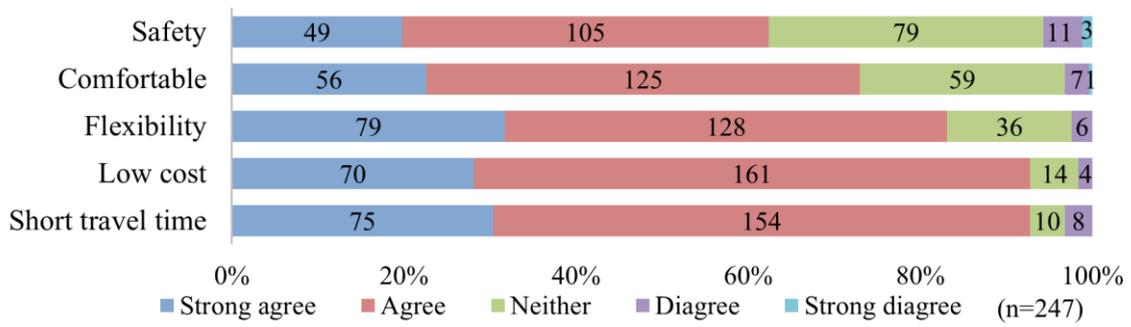


Figure 4. Reason why accessing to station by motorcycle

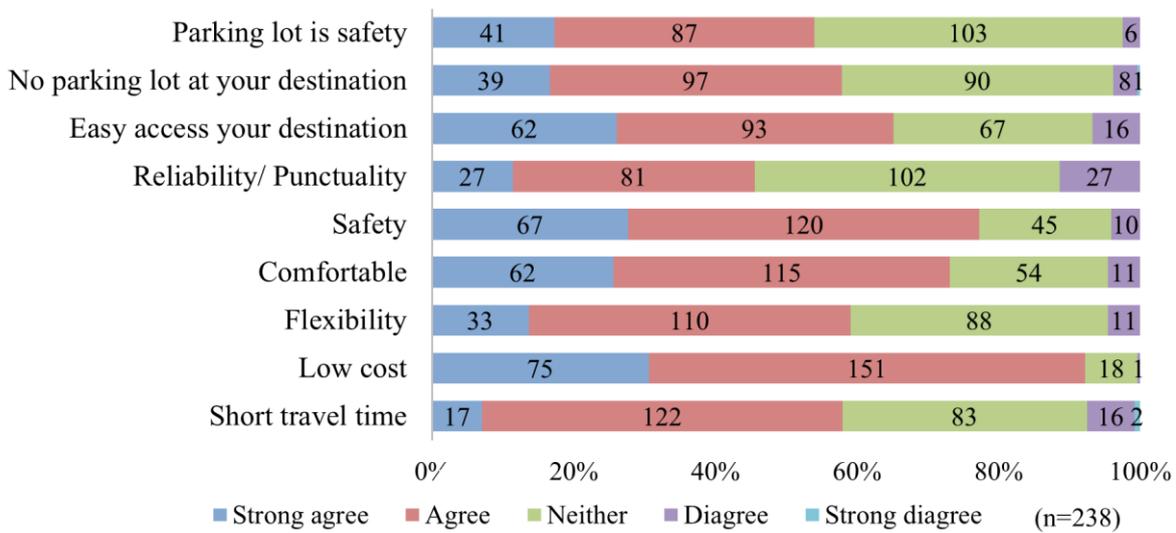


Figure 5. Reason why using P&BR by motorcycle

#### 4.2 Comparison with Travel Time and Travel Cost

In Figure 5, we clarified P & BR reasons for conscious, but in order to obtain a numerical basis, we compared the travel time and expenses in the two cases (with and without P&BR). A comparison between the travel time at actual transportation and the travel time at alternative transport mode is shown in Figure 6. The actual transportation is for a motorcycle user using P & BR whereas the alternative transport mode is for a motorcycle user without P & BR. The hypothesis was that the travel time when using P & BR was expected to be shorter than at the time of alternative means, but it turned out that it takes more time to do P & BR in actual results. Users are using P & BR to move from home to their destination for a minimum of 20 minutes and a maximum of 90 minutes.

Next, a comparison between travel expenses at actual transportation and travel expenses at alternative transportation is also shown in Figure 6. Many users can move P & BR at a lower cost than at the time of alternative means. As BRT's fare is uniform, there is not much difference in the cost of real transportation. However, the reason why the difference between the travel expenses at the time of alternative means is 3,000 VND at the minimum and 27,000 VND at the maximum is because respondents did not grasp the clear travel cost (fuel cost, parking fee, etc.) in their questionnaires. However, it can be seen that P & BR is used because it costs less.

We clarified P & BR users were given priority which of cost or time. The relationship

between travel time and travel cost when using P & BR and the alternative mode is summarized in Figure 7. For most users, the cost of moving cheaper than the alternative mode, but the traveling time has become longer.

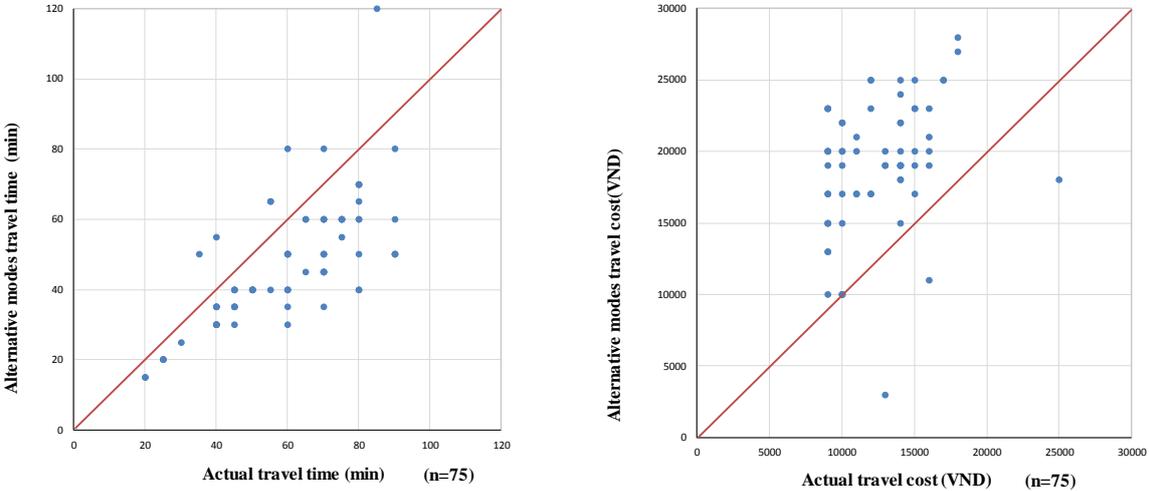


Figure 6. Travel cost and time for the two cases (with and without P&BR)

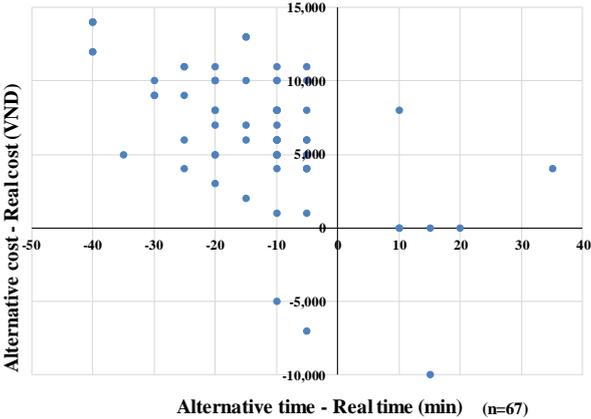


Figure 7. Comparison with travel time and travel cost

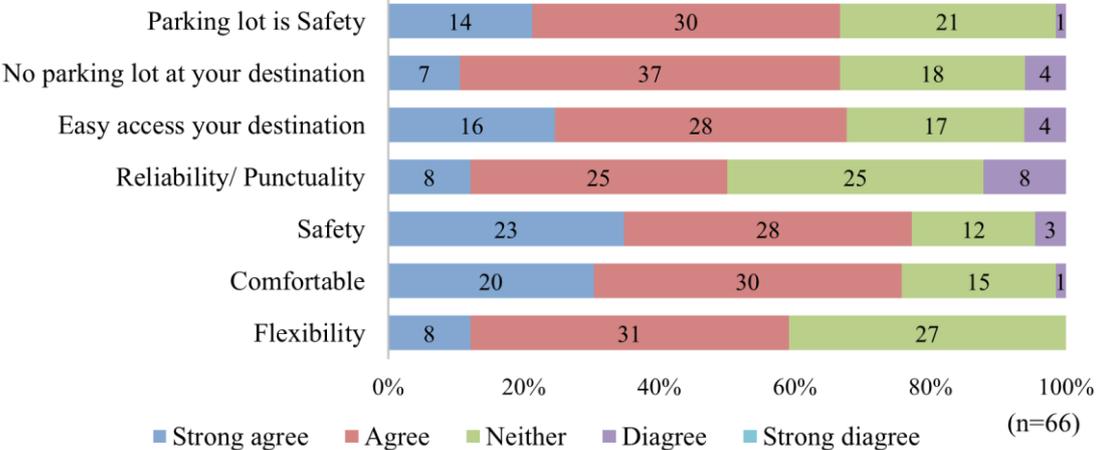


Figure 8. Reason why using P&BR by motorcycle (without cost and time)

Most users use P & BR because of the low cost, we clarified reasons other than cost and time. Figure 8 shows the reason for use only by users who answered that the use time is long but the cost is cheap. However, it became clear that the parking lot of YEN NGHIA station is safe and there are parking lots in the destination so there are people using it.

### 4.3 BRT Station Sphere of YEN NGHIA Station

By grasping the range of use by creating the station sphere, we clarified the possibility of using the motorcycle to access the station. As shown in Figure 9, in the result of the questionnaire survey, the person who accessed this station by the motorcycle from the furthest was about 7 km and the access time was about 10 minutes, but most of the people access from the area within 2.0 km from the station. Therefore, the area with a radius of 2.0 km can be defined as the station range of YEN NGHIA station. Even though P & BR users are accessing by motorcycle, the station sphere is narrow.

Many users came from the southeastern district from YEN NGHIA station because there are high-density residential areas here. Also, since the main road extends to the suburbs and it is easy to access by motorcycle, it seems that the range of use is extending the southwest from the station.

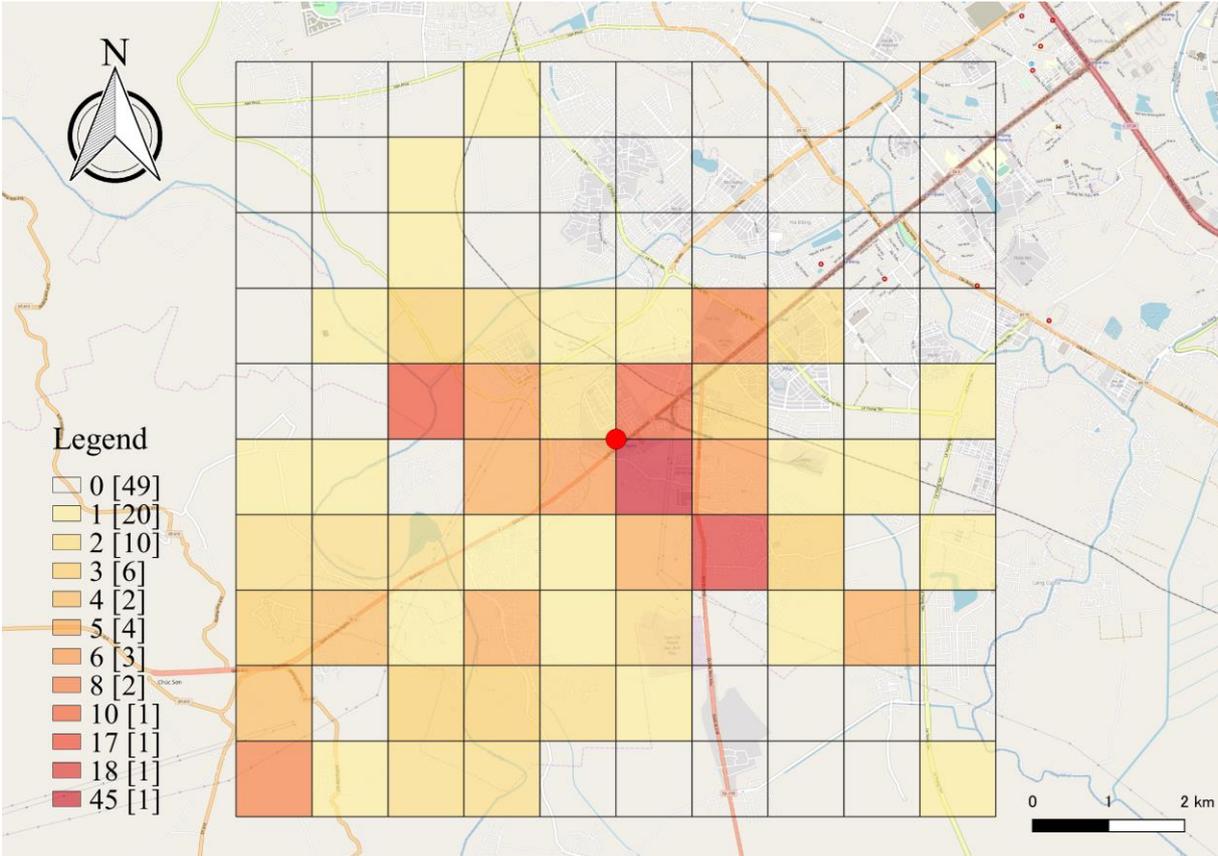


Figure 9. Station sphere of YEN NGHIA station

In order to clarify to what extent P & BR users are riding on the bus, we calculated riding time. Since we did not ask the destination of BRT users in the interview survey, we could not observe the usage of BRT. Thus, travel time by BRT was estimated by subtracting the access time from the total travel time. As shown in Figure 10, since travel time by BRT from YEN NGHIA station is 60 to 70 minutes so that it can be estimated that most BRT users

are riding to Kim Ma station which is the end of BRT line. P & BR would not probably be done unless the riding time is around 20-30 minutes including egress time.

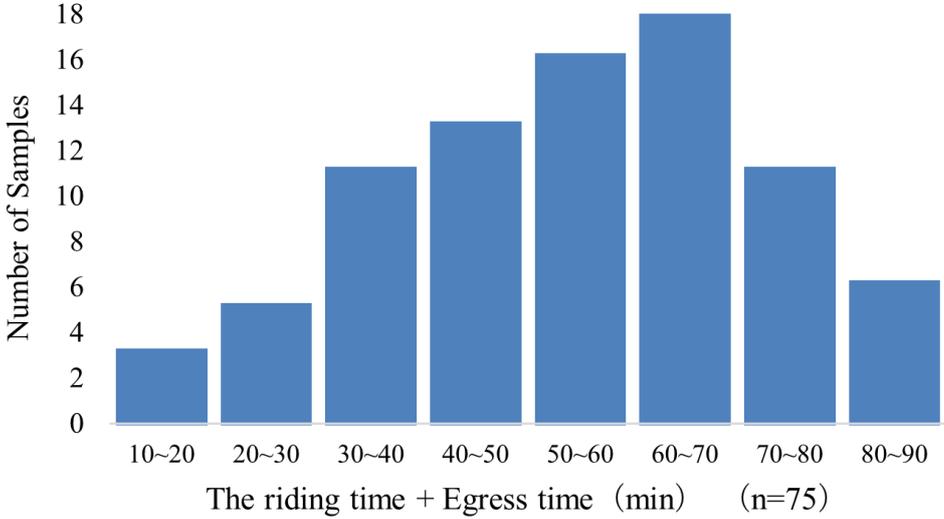


Figure 10. Travel time to destination

**5. CONCLUSIONS AND DISCUSSIONS**

In this research, the interview survey was conducted at YEN NGHIA station in Hanoi and the actual usage of P & BR was observed. As a result of the survey, travel time to the destination of most P & BR users is for 60-70 minutes. And the majority of P & BR user is a student or young employee who goes to a school or an office. Even the travel time by P & BR is considerably long, people prefer to use P & BR because total travel cost is possible to be reduced in comparison with other traffic modes.

The reasons for selecting a motorcycle to access to the BRT station are short travel time, low cost, safety, comfortable and flexible. And, many P & BR users are accessing from the area along the main road extending to the suburbs, especially from the Southwestern area of YEN NGHIA station. Even people ride a motorcycle from their home to the YEN NGHIA station, the range from the station is very narrow. It is mainly within four kilometers. One of the reasons to take P & BR is that the parking lot at YEN NGHIA station is a high-security performance because administrators are permanently stationed. Since parking lots in Hanoi are not secure generally without administrators, people prefer to park a motorcycle at the high-security parking lot of YEN NGHIA station. Thus, it is concluded that P & BR at YEN NGHIA station is suitable for BRT users because they can access easily and satisfy a high-security of parking lots. This result will imply that it is important to disseminate the homogeneous to other BRT stations.

We conducted a questionnaire only for P & BR users at the terminal station in this research and the usage of a motorcycle as feeder transport at other stations in the Hanoi BRT has never been observed. For further study, we need to clarify for more detailed use of P&BR by motorcycle as one of a future alternative. And then, by clarifying the current situation of P & BR from actual usage, it will contribute that it will be useful for planning the introduction of orbital public transportation to sprawling to low-density cities such as Hanoi city in near future.

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