Making the connection between accessibility and travel behaviour in university setting (Case study: Babarsari Area, Yogyakarta)

M K Devi¹, L M Fitria¹, M S Roychansyah² and Y Herwangi²

¹ Urban and Regional Planning Department, Sekolah Tinggi Teknologi Nasional Yogyakarta, 55281, Indonesia
² Department of Architecture and Planning, Universitas Gadjah Mada, Yogyakarta, 55281, Indonesia

Email: mutiasari@sttnas.ac.id

Abstract. Higher education in Indonesia, particularly Yogyakarta as City of Education, is continuously growing. Babarsari is one of higher education area with rapid growth and development in Yogyakarta. This area is surrounded by several universities which then form the agglomeration of higher education area. The influence of new activities as a growth pole like this educational activity has led to rapid change on land use and people’s activity. This encourages the potential for high daily movement, especially the movement of students who are the dominant actors in this area. The majority of students are live near the university. However, this not lead to higher use of sustainable modes in this area. This paper tried to reveal the connection between accessibility and travel behaviour in university area. By using samples from three universities in this area (Atma Jaya University, STTNAS Yogyakarta, and UPN Veteran Yogyakarta), result shows that living in university surrounded area did not ensure students to have sustainable travel behaviour, particularly for their campus travel. The lack of non-motorized transport facilities is indicated as the main barrier for students to travel in more sustainable way.

1. Introduction

Accessibility has been a well-known concept in transportation planning field since 1950, and was defined as the ease of reaching desirable destination [1]. In other words, accessibility reduces the function of the size of the availability of activities in each zone and the cost of accessing these activities. It has been defined as the intensity of the possibility of interaction [2] and is determined by the patterns of its activities; quantity, quality, variety, and proximity; and the connectivity among them as provided by the transportation system. In the context of built environment, accessibility plays significant roles, specifically in shaping travel behaviours. Former studies have confirmed that accessibility to reach desirable destination strongly influences trip frequency, destination choice [3], mode choice and trip or tour complexity [4].

Drawing insights from that idea, university has a significant role in urban and transport development [5]. It comprises mixed land uses with vibrant built environment characteristics and offers more opportunities to participate in different types of activities with an accessible distance [6]. As a higher education, especially university, is continuously growing, changing and developing, this condition leads
to higher traffic and denser population in university areas, where majority of the population is university students and commutes in surrounded area.

University students comprise a significant proportion of the travelling public [5] [7]. They have complex and distinct travel behaviours [7]. Therefore, it becomes vital to understand their travel behaviours particularly their accessibility to and from the campus. Former studies have found that, in term of spatial distance, access to universities matters since the spatial distance between residence of origin and the location where opportunities are located is regarded as an important factor in determining spatial accessibility [8]. However, since previous studies yield various findings and there is a little evidence whether the access to universities affects student travel behaviours, so this paper investigates how accessibility to the universities plays important roles in determining the patterns of student trips. This study expands former research by not only evaluating how the residential location affects travel behaviours, but also examining how the travel modes, such as bus, motorbike, cycling and walking, influence student desirable travel. This research also aims to assess how socio-economy moderates the relationship between accessibility to the universities and university student travel behaviours, specifically in developing countries, such as Indonesia.

This research was conducted in one of the most iconic cities in Indonesia, Yogyakarta. Yogyakarta has been known as the city of education. Currently, there is a growing number of educational institutes, especially higher education, and they attract thousands of students coming to this city. According to Yogyakarta Special Region’s Spatial Planning Document [9], only several areas in this city are appointed to be higher education region, and one of them is Babarsari.

Babarsari is very distinct communities where students of different backgrounds, household incomes, lifestyle, attitudes mix together to study, live and recreate. This area is surrounded by several universities, such as Universitas Atma Jaya Yogyakarta, Universitas Pembangunan Nasional (UPN) Veteran, Sekolah Tinggi Teknologi Nasional (STTNAS) Yogyakarta, Universitas Proklamasi 45, and many more. The existence of these university groups forms an agglomeration of higher education areas. As a growth pole of new activities has led into rapid change on land use and people activities, it leads to a high potential for daily movement, especially student’s movement as the dominant actors in this area. Therefore, this area can portray the university student travel behaviours and provide fundamental and valuable information regarding the relationship between campus environment and student travel demands.

The paper is organized as follows. The second section provides a literature review discussing the relationship between university and travel behaviour, the effect of residential location and travel mode towards student travel decisions, and the impacts of socio-economy in moderating the relationship between accessibility from and to campuses and university student travel behaviours. The third chapter describes methodology, including data collection and data analysis. The results of this study is presented in the fourth section followed by the potential discussion in the next chapter. Last section concludes the findings and proposes further research along with the limitations.

2. Literature Review

2.1. University and travel behavior

University population should be considered as a subpopulation with special travel behavioural characteristics in regional travel demand models. Cities which have higher population of university students will have a higher usage of public transportation, bicycle, sidewalk than cities that have lower number of university students [10]. A study which conducted at an urban university in Nigeria discovered that walking is the most common choice for students living on-campus and public bus is the most common choice for students living off-campus [11]. The proponents of this belief also argue that, in most developing countries, the actual condition is not common where most students reported commuting by motorized vehicles for their university trips [12] [13].
2.2. Residential location and travel mode
Residential location strongly affects people travel behaviour [14] [15] [16]. It is argued that most people who live close to their daily final destination will travel less by motorized vehicles [17]. In similar vein, people who stay near to the city centre where the main activities and attractions, tend to have simple pattern of movement, low use of motorized vehicles and high use of bicycle and walking [16]. University students come from different regions, thus the only option they have is to live in temporary residence. One of the main consideration in selecting the residential location is the distance to the campuses. This explains why there is a rapid growth of temporary residence, boarding house, apartments etc. because majority of university students are more likely to stay in university areas. Majority studies have reported that students who stay in the university area have a greater access to non-motorized transportation network than those who live far from the university [12] [18]. However, the lack of adequate infrastructure of non-motorized transports can be an indication that the access to more sustainable modes will be higher. This assertion will be addressed in the next chapter of this study.

2.3. Socio-economy and travel behavior
In addition to location elements, several theories also state that socioeconomic characteristics also influence travel characteristics [19] [20] [14] [21]. Daily community transportation activities depend not only on the relative distance of the location of the place of residence to the service facility. The destination location chosen to visit depends on the resources, needs, and interests of the traveler. The choice of modes of transportation is not only influenced by elements of the urban structure, but also greatly depends on the individual characteristics of each traveler, such as age, gender, economic conditions, family structure. In addition to the socio-economic factors mentioned earlier, one may have different perceptions of each mode of transportation and travel destination. This perception is generated from different levels of importance to several factors such as travel speed, comfort, flexibility of the mode of transportation or the district of the city [16].

3. Research methodology

3.1. Data collection
The purpose of this study was to focus on student travel behavior. Therefore, we conducted both primary and secondary approaches. First, in order to obtain students characteristics and their travel behaviors around Babarsari, we distributed questionnaires in three biggest universities, Universitas Atma Jaya Yogyakarta, Universitas Pembangunan Nasional “Veteran” Yogyakarta and STTNAS Yogyakarta. To represent student travel behaviour in Babarsari area, 300 questionnaires were collected from these three universities. Table 1 shows the sample size of the respondents in relative to their universities. The questionnaire has three sections. In the first section, questions related to socio-economy were asked. Next, the students had to answer their travel characteristics and followed by student residential location along with activity characteristics. Furthermore, we also observed pedestrian facilities in several spots around the universities to give the view regarding the quality of the facilities.

To support our primary data, we also derived relevant data regarding bus coverage service area together with its maps which shows public transport accessibility within the sub-district area of study from Department of Transportation Special Region of Yogyakarta and spatial planning documents along with its population distribution from Department of Land and Spatial Planning Special Region of Yogyakarta.

Table 1. Sample size of the respondents in relative to their university

| Students (%)                  |
|-----------------------------|
| Universitas Atma Jaya Yogyakarta | 33,5 |
| Sekolah Tinggi Teknologi Nasional Yogyakarta | 27,2 |
| Pembangunan Nasional “Veteran” University of Yogyakarta | 39,3 |

Source: Analysis, 2018
3.2. Variables and data analysis
Accessibility was measured by the distance between student residence and their universities, the number of walking and cycling facilities in university areas and the index of public transport accessibility in their campuses. The study used travel modes and travel frequency to describe student travel behaviours. Meanwhile, socio-economy characteristics could be defined from whether university students own motorized vehicles (car and motorcycle, respectively) and driving licensees. Since this study is descriptive, we examined these variables by looking at how strong and well they are related to each other.

4. Results and discussion

4.1. Built environment characteristics

| Table 2. Summary of university characteristics |
|-----------------------------------------------|
| Established | Population | Course Programs |
| Universitas Atma Jaya Yogyakarta | 1965 | approx. 11.405 students | 12 undergraduate programs, 6 postgraduate programs |
| STTNAS | 1986 | approx. 4.840 students | 6 undergraduate programs, 2 diploma programs |
| Pembangunan Nasional “Veteran” University of Yogyakarta | 1958 | approx. 10.980 students | 1 diploma program, 20 undergraduate programs, 8 postgraduate programs, 1 doctoral program |

*Source: Kemenristekdikti, 2018*

Table 2 summarizes the built environment characteristics in three universities. Universitas Atma Jaya Yogyakarta and Universitas Pembangunan Nasional “Veteran” Yogyakarta have approximately 11,000 students, while STTNAS only has 4,840 students. In term of course programs, Universitas Pembangunan Nasional “Veteran” Yogyakarta has the most study programs among them. Its students are enrolled in 1 diploma program, 20 undergraduate programs, 8 postgraduate program and 1 doctoral program.

![Distribution of students by residential location and its distance](source)

*Figure 1. Distribution of students by residential location and its distance*

*Source: Analysis, 2018*

Figure 1 demonstrates the distribution of students by residential location and its distance from their residence to their campuses. It can be seen that 51% of students are living in Catur Tunggal, followed by 17% of students are living in Condong Catur. In this case, Babarsari is located in Catur Tunggal, so...
this result can represent the condition of student residential location in Yogyakarta. On the right side of the pie chart, it reveals that the distance from their residence to their universities, 40% of students are settling down between 1-3 km from campuses. Meanwhile, students who live less than 0.5 km and more than 3 km, 20% and 30% respectively. This finding support the argument for promoting the use of sustainable transportation, particularly walking and cycling, in university area as most of students live within walk and cycle distance to university.

The public transport service in Yogyakarta Special Province can be categorized into 4 type of services which are public transport (city bus and TransJogja), ojek, taxi, and non-motorized transportation (becak and andhong). TransJogja is expected to be the most reliable public transport services in Yogyakarta area which classified as Bus Rapid Transit (BRT) system. Accessibility towards public transportation service was measured through calculating the bus service coverage rate (BSCR) as the ratio between the length of TransJogja routes and total length of road within Babarsari area. According to the results of BSCR in all Yogyakarta urbanized area, we divided BSCR into three categories: low bus service coverage ratio (BSCR = < 0.1); middle bus service coverage ratio (BSCR = 0.1 – 0.3); high bus service coverage ratio (BSCR = > 0.3). As Babarsari area is located in Caturtunggal sub-district, the BSCR for this study use the value for this sub-district level. According to the value of BSCR, the public transport accessibility for the university area in this study is categorized as middle bus service coverage ratio with a value of 0.17.

Figure 2 describes the accessibility of TransJogja service in Caturtunggal sub-district area. Having middle bus service coverage ratio, this area has more than 30 shelters. However, even though this area was covered by good public transport service, but this type of mode still involves walking activity in which the pedestrian facilities are important for this context. Moreover, university students have high mobility throughout the day. The travel characteristics they might have were also a multiple trip which involve several transits before reaching their final destination location. Meanwhile, most of students live in university surrounded area. Thus, walking and cycling actually can be students travel mode choice to the university.

![Figure 2. Public transport accessibility within the sub-district area of study](source: Analysis, 2018)

Meanwhile Figure 3 shows the condition of walking facilities in university surrounded area. Actually there are pedestrian infrastructure within area. However, it is founded that at some point, the pedestrian
is not well connected in all of the area. Moreover, some spot was found to be used for other activities, making people cannot cross over in comfortable way. Vegetation was also not available all along the pedestrian, even it is considered as limit availability. The weather of Yogyakarta which is a tropical area with a high temperature particularly during the day, indeed will be the biggest barrier for student to walk around this area.

Figure 3. Pedestrian condition in Babarsari area
Source: Analysis, 2018

4.2. Socio-economy characteristics
Students who have higher pocket money and access to motorized vehicle are less likely to walk to university. It is obvious why greater vehicle availability as well as higher income would make walking less attractive relative to car travel. These two variables both individually and together may have strong enough influence on mode choice to overwhelm other factors favoring walk trips, such as a short distance to and from university. Students holding driving licenses are less likely to take public transport or even walking and cycling than those without driving licenses. Actually, students living far from university to walk or bike are prime candidates for public transport passenger if only their residential location have accessibility towards this type of mode. It is argued that students traveling through areas with sidewalks on main roads were also more likely to walk. Thus, this supports the arguments of improving non-motorized facilities to encourage walking and cycling.

Table 3. Student mode choice based on motorized vehicle and driving license ownership

| Mode Choice | Motorized Vehicle Ownership | Driving License Ownership |
|-------------|-----------------------------|---------------------------|
|             | No | Car | MC | Car and MC | No | SIM A | SIM C | Both |
| PT          | -  | 1   | 1  | -          | -  | -     | 2     | -    |
| Walking     | 27 | -   | 7  | -          | 18 | -     | 16    | -    |
| Car         | -  | 2   | 2  | 3          | -  | -     | 3     | 4    |
| Bicycle     | 1  | -   | 1  | -          | 1  | -     | 1     | -    |
| MC          | 11 | 2   | 160| 6          | 12 | 4     | 112   | 51   |
Travel behavior can be described through several approaches. Travel mode, travel distance, travel time, and travel frequency are usually reported to be used in previous researches on travel behavior studies. For this study, travel characteristics of students are described through student travel mode choice to university and travel frequency to university within a week. We tried to relate the travel characteristics with other variables, particularly regarding built environment and socio-economic variables.

Table 4. Distribution of student mode choice based on residential location distance to university

| Residential Distance | MC | Car | Public Transport | Cycling | Walking |
|----------------------|----|-----|------------------|---------|---------|
| <0.5 km               | 27 | 0   | 0                | 0       | 18      |
| 0.5 – 1 km            | 19 | 1   | 0                | 1       | 3       |
| 1 – 3 km              | 73 | 3   | 1                | 1       | 12      |
| 3 – 5 km              | 32 | 3   | 1                | 0       | 1       |
| >5 km                 | 28 | 0   | 0                | 0       | 0       |
| Total                 | 179| 7   | 2                | 2       | 34      |

Table 4 shows that motorcycle is used by students almost in all residential location distance groups. Even those who live within 0.5 km of the campus choose motorcycle for commuting to the campus. Actually, walking is also quite popular among those who live close to university. This can be explained by both proximity and the social economy characteristics which forced them to choose other than walking. Indeed, there are several factors which influence students’ travel behavior, particularly their commuting choice to the university. It is not always about the distance they need to take. Other than this factor, several variables can be contributed to student decisions towards their travel mode. However, as the distance to the university increases, students are likely to use motorized vehicle for their university travel.

Figure 4. Statistical chart of student travel frequency in a week

Figure 4 shows the travel frequency distribution of students. The student travel frequency is categorized into 4 groups: 1 – 2 trips in a week; 3 – 4 trips in a week; 4 – 5 trips in a week; and ≥ 6 trips in a week. Most of students travel for 4 – 5 trips in a week which accounted for 39.3% of all students followed by 34.8% of students reported for travelling more than 6 times in a week to the university.
Table 5. Statistical information of student travel frequency regarding several categories

| Group categories                        | N   | 1–2 trips/week | 3–4 trips/week | 4–5 trips/week | ≥ 6 trips/week |
|----------------------------------------|-----|----------------|----------------|----------------|---------------|
| By year of admission                   |     |                |                |                |               |
| 1st year stage                         | 29  | 3              | 4              | 12             | 10            |
| 2nd year stage                         | 62  | 2              | 9              | 24             | 27            |
| 3rd year stage                         | 96  | 3              | 18             | 44             | 31            |
| 4th year stage or more                 | 37  | 7              | 12             | 8              | 10            |
| By motorized vehicle ownership         |     |                |                |                |               |
| Yes                                    | 185 | 11             | 39             | 74             | 61            |
| No                                     | 39  | 4              | 4              | 14             | 17            |
| By residential location distance       |     |                |                |                |               |
| <0.5 km                                 | 45  | 2              | 5              | 15             | 23            |
| 0.5 – 1 km                             | 23  | 3              | 4              | 9              | 7             |
| 1 – 3 km                               | 90  | 8              | 12             | 41             | 29            |
| 3 – 5 km                               | 37  | 1              | 11             | 12             | 13            |
| >5 km                                  | 29  | 1              | 11             | 11             | 6             |
| By multiple trips need intensity       |     |                |                |                |               |
| Never                                  | 5   | -              | 2              | 3              | -             |
| Sometimes                              | 93  | 7              | 20             | 33             | 33            |
| Often                                  | 65  | 6              | 11             | 30             | 18            |
| Almost always                          | 37  | 7              | 19             | 10             | 37            |
| Always                                 | 24  | 3              | 3              | 17             | 24            |

Source: Analysis, 2018

We believe that at some point, the accessibility towards motorized vehicle can be contributed to people’s mode choice. In this study, motorized vehicle ownership is used to represent student accessibility towards motorized vehicle. From Table 5, it is clear that more than 70% of students have own motorized vehicle. However, there is an interesting finding that not having motorized vehicle doesn’t make the number of travel frequency low. There are 75% of students with no motorized vehicle access reported for having more than 4 trips to university in a week.

Regarding the involvement in multiple trips, students who sometimes do multiple trips on their daily travel tend to have high travel frequency in a week in which they travel to university even more than 6 times a week. The results even show that majority of students who almost always have multiple trips on their travel reported to travel for more than 6 times a week.

4.4. Accessibility and Travel Behavior

Discussing about accessibility towards travel behaviour is actually derived from the concept of integrated land use and transportation which has been studied by many researchers around the world. It is found that built environment shows a positive effect on travel behaviour. However, the findings in these researches are varies regarding how this built environment will determine people travel behaviour. Accessibility actually has been defined as the intensity of the possibility of interaction [2]. It is determined by the pattern of activities; their quantity, quality, variety, and proximity; and the connectivity between them as provided by the transportation system.

In order to measure level of accessibility in this study, the distance to reach destination location is considered. The main destination location of students is university. Therefore, we tried to relate how residential distance will determine on student travel decision. It is believed that living near the university will make students to choose more sustainable transport such as walking and cycling. Students will experience minimum effort to reach the university by walking and cycling since close distance are considered as high accessibility. Increasing of the distance number will result on the high proportion of
motorized vehicle since students will find difficulties to travel to university by walking and cycling. However, the results in this study enrich the concept in which how this distance matter in university students travel decision, especially their travel mode choice. In fact, distance not always become the only factor to be considered by students in choosing their travel mode option. It can be seen through the findings that majority of student group who live close to the university chose motorized vehicle for their university travel. Students who travel by foot and cycle to the university don’t own motorized vehicle. The accessibility towards motorized vehicle which in this study is measured through motorized vehicle ownership, have some roles in student travel decision.

University students have such complex travel behaviour. In daily basis, they tend to visit different location which making them to have travel chain. This condition forces students to be involved in such multiple trips. The need to do multiple trips in a day is reported to be one of the factor to be considered by students in choosing their travel mode. Students who typically have a high mobility in a day, will avoid a travel mode in which give them difficulties. Thus, they tend to choose motorized vehicle since this kind of mode have a high flexibility.

The results in this study which show high used of motorized vehicle even for those who live close to the university, support the arguments in which distance is not the only factor in determining students travel mode choice. As mentioned before, that accessibility comprises several dimensional concepts. The university area has good public transport accessibility which is measured through the BCSR result. There are also a high number of shelter which spread over the university area. This give an ease for student to reach the university, particularly for those who doesn’t own motorized vehicle. However, the fact that majority of students live close to the university increase the concern that walking and cycling facilities within the area is important. An environment where there are a good walking and cycling facilities, will increase the willingness of its people to actively commute. Current condition of this facilities in the university area where several area is not covered by this facilities, could be the reason for the low used of active transport in this area.

5. Conclusion
Result of this study support the argument that at some point, residential location influences travel behavior, also when the socio-economy factors are taken into account. However, the choice of an individual is not only formed by one single factor, but it is usually formed through a combination of several factors. Among all of our respondents reported the high used of motorized vehicle for their university travel regardless their residential location distance. The variety of their socio-economy characteristics were assumed to be the reason for their travel mode decision. Moreover, the environment condition of university surrounded area, such as the availability of walking and cycling facilities, regional density, and public transport accessibility, are somewhat contributed to student travel decision, which in this context are the travel mode and travel frequency.

There are several limitations in data and methodical approach in this study. The first one, travel diary of student was collected for one day only in which there will be more fruitful findings if the data were collected on a different day within a week or even a year. Second, and most importantly, travel behavior data collected in this study did not report student origin and destination other than their residential location and university within a day in which understanding this information will elaborate how big the university area can generate movements and activities in surrounded area.

6. References
[1] Hansen, 1959 in Iacono, M., Krizek, K. J., & El-Geneidy, A. (2010). Measuring non-motorized accessibility; issues, alternatives, and execution. Journal of Transport Geography, 133-140.
[2] Hansen, 1959 in Handy, S. L. (1996). Understanding the link between urban form and nonwork travel behavior. Journal of Planning Education and Research, 183-198.
[3] Handy, S. L. (1996). Understanding the link between urban form and nonwork travel behavior. Journal of Planning Education and Research, 183-198.
[4] Hanson, S., & Schwab, M. (1987). Accessibility and intraurban travel. *Environment and Planning A*, 735-748.

[5] Zhan, G., Yan, X., Zhu, S., & Wang, Y. (2016). Using hierarchical tree-based regression model to examine university student travel frequency and mode choice patterns in China. *Transport Policy*, 55-65.

[6] Daisy, N. S., Hafezi, M. H., Liu, L., & Millward, H. (2018). Understanding and modeling the activity-travel behavior of university commuters at a large canadian university. *Journal of Urban Planning Development*

[7] Khattak et. al., 2011 in Nguyen-Phuoc, D. Q., Amoh-Gyimah, R., Tran, A. T., & Phan, C. T. (2018). Mode choice among university students to school in Danang, Vietnam. *Travel Behaviour and Society*, 1-10.

[8] Turk, U. (2017). *Socio-Economic Determinants of Student Mobility and Inequality of Access to Higher Education in Italy*. Verona: Department of Economics, Universita di Verona.

[9] Dinas Pertanahan dan Tata Ruang Daerah Istimewa Yogyakarta. 2017. Revisi Rencana Tata Ruang Wilayah

[10] Santos et. al., 2013 in Daisy, N. S., Hafezi, M. H., Liu, L., & Millward, H. (2018). Understanding and modeling the activity-travel behavior of university commuters at a large canadian university. *Journal of Urban Planning Development*

[11] Olawole and Olapoju, 2016 in Searcy, S. E., Findley, D. J., Huegy, J. B., Ingram, M., Mei, B., Bhadury, J., & Wang, C. (2018). Effect of residential proximity on university student trip frequency by mode. *Travel Behaviour and Society*, 115-121.

[12] Devi, M.K., Malkhamah, S., & Friman, M. 2015. Active commuting to the university.

[13] Devi, M. K. (2017, June). Potential to increase active commuting level in university area (Case study: Universitas Gadjah Mada). In *IOP Conference Series: Earth and Environmental Science* (Vol. 70, No. 1, p. 012022). IOP Publishing.

[14] Muliana, R., & Kustiwan, I. (2014). Perilaku Pemilihan Lokasi Tempat Tinggal dan Karakteristik Perjalanan Mahasiswa di Kota Bandung. *Jurnal Perencanaan Wilayah dan Kota* 2, 37-43.

[15] Ulfa, I. M., & Suwandono, D. (2014). Perilaku Perjalanan pada Akhir Pekan oleh Rumah Tangga yang Tinggal di Daerah Pinggiran Kota Semarang. *Jurnal Pembangunan Wilayah dan Kota*, 343-354.

[16] Naess, P. (2005). Residential location affects travel behavior—but how and why? The case of Copenhagen metropolitan area. *Progress in Planning*, 167-257.

[17] Tran, M. T., Zhang, J., Chikaraishi, M., & Fujiwara, A. (2016). A joint analysis of residential location work location, and commuting mode choices in Hanoi, Vietnam. *Journal of Transport Geography*, 181-193.

[18] Lundberg, B., & Weber, J. (2014). Non-motorized transport and university populations: an analysis of connectivity and network perceptions. *Journal of transport geography*, 165-178.

[19] Bamberg, S., Fujii, S., Friman, M., & Gärling, T. (2011). Behaviour theory and soft transport policy measures. *Transport policy*, 18(1), 228-235.

[20] Novitasary, S. (2015). Analisis Karakteristik Perjalanan Mahasiswa Perguruan Negeri berbasis Spasial di Kota Makassar.

[21] Whalen, K. E., Páez, A., & Carrasco, J. A. (2013). Mode choice of university students commuting to school and the role of active travel. *Journal of Transport Geography*, 31, 132-142.

**Acknowledgement**

This work was fully supported by the Minister of Research, Technology, and Higher Education of the Republic of Indonesia.