Understanding Student Travel Behaviour in Semarang City

by Okto Manullang

IOP Conference Series: Earth and Environmental Science

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Abstract. The highest movement in Semarang City is dominated by motorcycles, which reached 79% of the number of vehicles. Highest percentage movement use motorcycle caused the highest percentage accident by motorcycle users, which reached 66% and 9% involving high school students. This happens because of the dependence of motorcycles usage in fulfilling the needs of movement in the city of Semarang. Understanding student travel behavior based on their activities is used to know travel needs and the cause of dependence on motorcycle usage. Analysis method in this study use network analysis to compare the potential accessibility and actual accessibility **to** known why motorcycle chosen by students as the main mode. In addition, phenomenology analysis is used to explain the intent and reasons the data produced by network analysis. The analysis result indicates that the high use of motorcycles by high school students in the Semarang city due to the absence of other effective and efficient modes in fulfilling the movement needs. Even, the student which can potentially use public transport preferred to use a motorcycle. This mode is more effective and efficient because of its flexibility and lower costs.

Keyword: Motorcycle, Network analysis, Student, Travel Behavior

1. Introduction

In doing their activities, human has to travel, in other words, the need or desire to engage in an activity in different locations will illustrate travel pattern [1]. In addition to work activities, school activity is one of the highest contributors movement in the city [2]. To fulfill the needs of the school, students need to move from origin (home) to the destination (school) both motorized and non-motorized. Motorized movement in Semarang City is dominated by motorcycles, it can be seen from the population which reaches 79% of the total vehicles in Semarang City [3]. The dominance of motorcycle use is in line with the percentage of accident numbers involving this mode, which reaches 66% of 5,378 incidents in 2012-2014. These incidents have involved 9% of Senior High School students [4].

Students tend to use motorcycle because of the limitation in their movement [5]. The dependence of the motorcycle occurred on students based on three main points [6], are (1) the shape and structure of the city accompanied by the inability of the public transportation system provides the needs of the movement, and causing the dependence of private vehicles, (2) motorcycle has the highest utility than other modes because of more effective and more efficient for students, so that it is suitable for student's activities, and (3) the contract of transportation culture implemented by providing parking infrastructure in school tend to attract new motorcycle users. The dependency will increase while

teenager considered motorcycle usage as a lifestyle for traveling in a term to fulfill their social status [7]. Safety driving has not been a concern for motorcycle users, especially for students rider in Semarang City. Students use motorcycles with the permission of their parents, even though the student does not have a driver's license. All these factors aggravate transit culture. The lack of service of public transportation with existing travel demand cause motorcycles chosen as primary mode [6]. This study aims to understand travel pattern, travel behavior and causes of the dependence of high school students in motorcycle users. This study is expected can be the basis for recommending urban transportation policies that match with characteristics and needs of student, so it can be an effective and efficient solution and eliminate dependence on motorcycle usage.

2. Literature

At first, transportation approach was based on four stages modeling, but it was considered to be deficient in describing demand because it considered each trip was not related to other trip conducted by individuals because of the aggregate assumption [1]. Four stages modeling only accumulate the demand, while the movement is very complex where there is a trip chain from the origin to the destination [1]. According to Kitamura [8], there are some measurable indicators in travel behavior, there are:

a. Travel Distance
b. Travel Time
c. Travel Cost
d. Travel Frequency
e. Mode Use

The activity-based concept is a new development to analyze travel behavior, this concept will have a long series to understand the participation of a set activity. Indicators used in this concept such as area based measures, distance based measures, count based measures and duration based measures have all been used to derive travel patterns [9,10]. This research is focused on motorcycle users the mode use is not considered as an indicator. Measurable indicators that are used in this study is travel distance, travel time, and travel frequency.

In addition to work activity, educational activity is one of the highest trip generators [2]. Students' trip pattern has a fundamental difference between "heading towards" trip and "return" trip from school [7]. "Heading to school" trip has a simple pattern with fixed destination and arrival time while "return" trip has various complex patterns because of the various activities after school. The return trip from school has three trip patterns:

a. Immediate Return, the return trip from school after the last class straight to go home. Students from the suburbs are likely to have this pattern because of the public transport in their home requires them to go home during the peak hours. Besides, first year students are also likely to have this pattern.
b. Stay and Return, the return trip that is made after a certain period of time of staying at school for in school-activities. Besides immediate return pattern, first year students are also likely to have this pattern.
c. Indirect Return, the return trip made any time after the last class but have another destination before coming back home. This pattern is purposed to fulfill recreation, shopping, and extra lesson needs. Students in downtown are likely to have this pattern because they have more alternative modes and better operational time. Generally, senior year students will have this pattern because of the needs of an extra lesson or part time working.

3. Method

The method of data analysis used in this study was network analysis using ArcGIS and phenomenology analysis. Network Analysis (NA) collectively is a macro transportation modeling to see the relationship between objects connected by the transportation that forming travel pattern. Measures of accessibility from these transport models can be classified into potential accessibility and actual accessibility [10]. Network analysis used to analyze potential accessibility of various modes. Potential accessibility in this study is limited to walk, public transports using, and motorcycles using potential. The result of potential accessibility will be compared to actual accessibility so that the public transport route potential will come as the result.

Motorcycle potential accessibility was analyzed by choosing the fastest route with closest facility tools. Network dataset used in this study is the minimum speed in every road distinguished by the hierarchy. The minimum speed standard is according to SNI (Indonesian National Standard) 03-6967-2003 about general requirements of network system and street geometric assuming that each road in the same hierarchy will have the same speed.

Table 1. Minimum Speed Based on Roads Hierarchy

Hierarchy	Minimum Speed (Km/hour)
Primer Artery	60
Primer Collector	40
Primer Local	20
Secondary Artery	30
Secondary Collector	20
Secondary Local	10

Source: SNI 03-6967-2003 tentang Persyaratan Umum Sistem Jaringan dan Geometrik Jalan Perumahan

Potential of walking and -of transit accessibility were analyzed by using service area tools measured from the school location and BRT Trans Semarang's Shelter distribution. According to SNI 03-6967-2003 about general requirements of network system and street geometric, people in Indonesia only made it walk 400 meters in a hot weather, for shopping activities and carrying some goods they only made it walk 300 meters. According to that, service area distance from school to shelter is about 300 to 400 meters. Actual accessibility obtained by visualizing students trip chain based on their travel diary. Phenomenology approach as qualitative method used to understand the complexity of the travel behavior and the reason of students dependency of motorcycle usage in Semarang City.

4. Result and Discussion

4.1. Potential Accessibility

Potential accessibility on foot and public transport was analyzed by using service area tools measured from the point of the school location and the distribution of shelters with walk distance about 300 m and 400 m from that point. Potential accessibility by walking to school and public transportation based on normal walking distance can be seen in Figure 1. Based on the results of the service area analysis, only 1% of respondents have the potential to walk with common mileage. 19.6% of respondents have the potential to use public transportation BRT Trans Semarang. While 79,4% others have to use private vehicle to reach school. Potential accessibility of motor vehicle users is estimated based on the shortest route to the school, the distribution of the route can be seen in Figure 2.

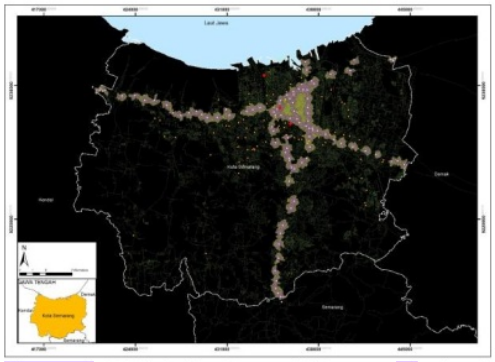

Figure 1. Walkability Potential Access of school and BRT shelter

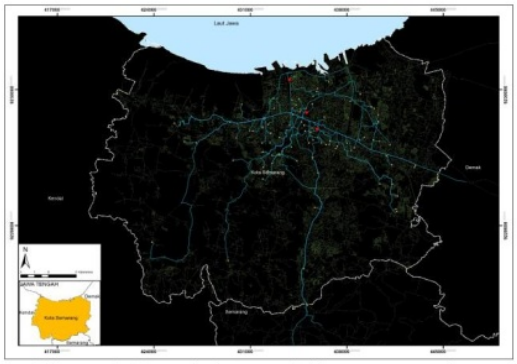

Figure 2. Potential accessibility motorcycle

4.2. Actual Accessibility

Actual accessibility of motorcycles in this study can be classified into three types of travel patterns, namely immediate return, stay and return and indirect return. Based on the visualization of trip chain data, the student's travel pattern has a fundamental difference between " to " and 'back' 'trips from' 'school. The " toward " school trip has a simple pattern with the goal and the arrival fixed time, this pattern is always through the shortest route to get to school. Meanwhile, the journey back from school has a variety of complex patterns because more activities take place after school.

Immediate Return and Stay and Return travel patterns have the same frequency, distance, travel time and travel route. The difference between these patterns is the type of activity and duration activity. 49.5% of students have immediate return pattern, in general, these students are first-year students or students who are not actively participating in the organization or extracurricular. 15.5% of students have stayed and return patterns, in general, these students actively participate in school organization or extracurricular that conducted in schools. Actual accessibility immediate return and stay and return pattern have the same route with potential accessibility because it has one travel destination so the route is the shortest route.

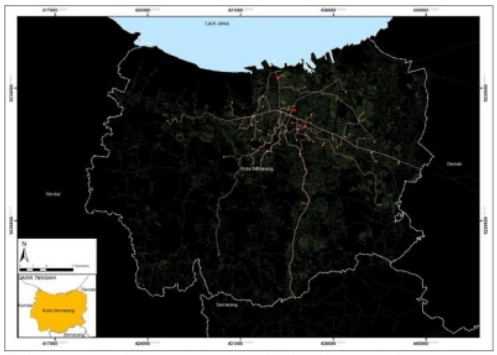

Figure 3. Actual Accessibility immediate return and stay and return pattern

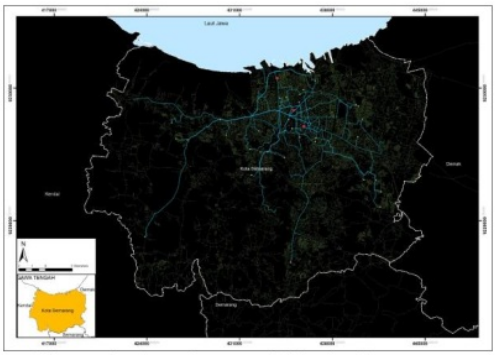

Figure 4. Actual accessibility indirect return pattern

Based on the results of travel diary questionnaire, 35% of students have Indirect Return patterns. Indirect return patterns occur on the way home, while the journey to school has a simple pattern that is the fastest and shortest route because it has only one destination. Indirect patterns occur due to the

need for course activities, part-time work, extracurricular activities, organizational activities, hang out, shopping and other activities after school.

Potential accessibility and actual accessibility of high school student's motorcycle users in Semarang have differences. Actual accessibility has a more complex route than potential accessibility, the difference in routes can be seen in Figure 6. Potential accessibility only predicts the route of the student trip directly to the destination so that this route only has a match with the travel pattern immediate return and stay and return.

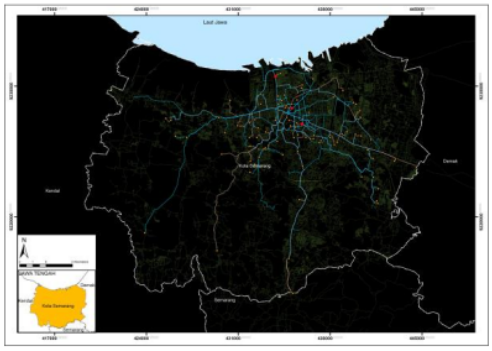

Figure 5. Actual accessibility motorcycle

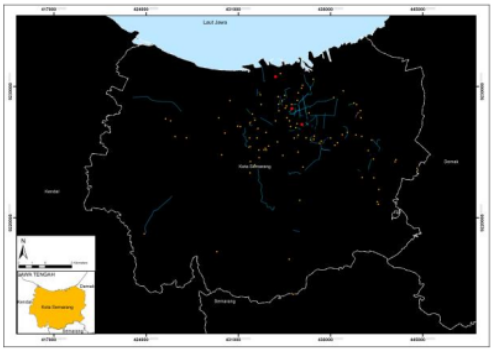

Figure 6. Different potential accessibility and actual accessibility motorcycle

Based on the results of questionnaires and depth interviews of students motorcycle users in Semarang City, students decided to use motorcycles because motorcycles are considered more flexible in determining routes and travel time and more efficient in cost. In addition, the absence of public transportation and family members who can lead the students makes the reason for parents to initiate their children to use a motorcycle even though they do not have not a driver's license, even 88.9% of respondents do not have a driver's license. Most students learn driving techniques at the age of 12-15 years when the physical conditions are met. Although the student's origin location has another potential accessibility mode, the student still keeps the motorcycle as the main mode of movement. Another mode of use occurs when compulsion can not use a motorcycle as it has not been allowed by parents to carry motorcycles, motorcycles are damaged, and when the school establishes policies only two- and three-years student that are allowed to take the motor to school. The average daily travel frequency conducted by the learner is 3.55 or about 4 trips per day with average travel cost is Rp.18.762,89 per week or approximately Rp.3.752.58 per day. When compared to travel expenses using BRT Trans Semarang then the required daily cost is Rp.4.000,00 per day or Rp.20.000,00 per week.

5. Conclusion

The high use of motorcycles by high school students in Semarang City due to the absence of other modes of choice are considered more effective and efficient in traveling. In fact, students who have the potential for accessibility to use public transport modes still make the main choice motorcycles in movement. Motorcycles become the most effective and efficient mode because it is more flexible in determining the route and travel time. Even not significant, the costs incurred will be cheaper than public transport. Hence, the provision of transportation system should be based on user activity, not only on the main activity but also consider the supporting activities. The provision of public transport must be matched with the needs of users and become the first choice to trip.

6. Acknowledgement

The authors are grateful for the funding of DIPA FT Undip 2017 from Engineering Faculty of Diponegoro University. It is a support and would enrich research of travel behavior in the developing country.

7. References

[1] Philip M 2013 Activity Based Travel Behavioural Study and Mode Choice Modelling **2** 181–190
[2] Dharmowijoyo D B E, Susilo Y O and Karlström A 2016 Relationships among discretionary activity duration , its travel time spent and activity space indices in the Jakarta Metropolitan Area , Indonesia *JTRG* **54** 148–160
[3] BPS 2015 *Kota Semarang dalam Angka 2015* (Semarang)
[4] Polrestabes 2015 *Laporan Laka Lalin Kota Semarang Tahun 2014* (Semarang)
[5] Kamargianni M, Polydoropoulou A and Goulias K G 2012 " Teenagers ' Travel Patterns for School and After-School Activities ." *Procedia - Soc. Behav. Sci.* **48** 3635–3650
[6] Setiaji R W 2011 Pembentukan Ketergantungan Sepeda Motor Siswa SMA/SMK Kota Ungaran
[7] Alemu D D and Tsutsumi J G 2011 Determinants and spatial variability of after-school travel by teenagers *J. Transp. Geogr.* **19** 876–881
[8] Kitamura R 2010 Life-style and travel demand 679–710
[9] Kamruzzaman M, Hine J, Gunay B and Blair N 2011 Using GIS to visualise and evaluate student travel behaviour *J. Transp. Geogr.* **19** 13–32
[10] Ardiansyah S and Rakhmatullah A 2014 Model Spasial Statistik Kepemilikan Sepeda Motor di Kecamatan Banyumanik, Kota Semarang *Geoplanning J. Geomatics Plan.* **1** 56–64
[11] Becker U and Gerike R 2008 Background-Needs as the focus of transport planning. In How to Define and Measure Access and Need Satisfaction in Transport 5–24

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