

# Potential Use of Student's Travel Pattern for Integrated Transportation System Planning in Yogyakarta

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## Abstract

Yogyakarta is known as an education city because it has many high-rank universities, it leads to the high number of students living in Yogyakarta. The student who lives in Yogyakarta makes a significant contribution to the economy. However, the differences in activities and movement among the students causing high and varied transportation needs, leading to an increase in the number of vehicles that while the road capacity is still stagnant. This phenomenon is unavoidable because there is no effective and reachable mass transportation system. Identifying the pattern of weekly student trips can be used as one of the main considerations for this study. Identification of travel patterns can explain the flow, characteristic, and needed of commuters, so it can be used as a basic but precise reference to create a transportation system that suits their needs with high efficiency and occupancy rate.

**Keywords:** *Transportation Planning, Travel Pattern, Traffic, Student, Commuters*

## 1. Introduction

Transportation problems are often found in various cities in developing countries in the world, including Indonesia (Basuki, 2008; Miro, 2016; Zhang, Liu, Li, & Yu, 2013). Many cities in Indonesia experiences traffic congestion problems due to poor road infrastructure and public transportation system, one of them is Yogyakarta. Take a detailed look at, Yogyakarta is a relatively small city compared to other busy-economic cities such as Jakarta, Surabaya, Semarang or Medan, but has the same transportation problems caused by the increasing of population mobility (Browder, Bohland, & Scarpaci, 1995; Hairulsyah, 2013; Kiggundu & Mukiiibi, 2012; Talitha & Hudalah, 2014). Its predicate as a city of education and the rapid development of the tourism sector resulted in economic growth and supporting facilities to occur rapidly in this decade. However, the absence of adequate public transportation facilities in Yogyakarta is currently seen as one of the factors that will hamper economic growth in the coming years.

The development of public transportation facilities based on travel patterns has been carried out in various parts of the world (González, Hidalgo, & Barabási, 2008; Lerman, Rofè, & Omer, 2014; Li, Kido, & Wang, 2015), but with unique physical and social characteristics, Yogyakarta needs specific social parameters. Student activity is a factor that has a significant contribution to some economic and mobility activities (Utami, 2016). The use of travel patterns from students in Yogyakarta is considered to have the potential to be able to understand the development of good and efficient transportation in Yogyakarta.

## 2. Material And Methods

### 2.1. Research Area

Universitas Gadjah Mada (UGM) is one of the best and well-known universities in Indonesia. Every year no less than 9,000 new students are enrolled at UGM. Until 2015, there were 32,140 UGM students spread across 18 faculties. The use of private vehicles in the UGM and Yogyakarta campuses generally contributes to transportation problems. The spread of residential areas, as well as the heterogeneity of student activities, makes a difference in the interests of traveling that will produce specific travel patterns.

## 2.2. Data and Materials

### a. Primary Data

Primary data used in this study are the type of transportation, daily travel destination, economic background, and consideration of the use of transportation modes used by students every day. Primary data were obtained from a direct survey to obtain information from respondents spread across all faculties at UGM.

### b. Secondary Data

Secondary data used in this study is the number and distribution of students in each faculty at UGM. This research was conducted in 2016, so the data on the number and distribution of students used is the data of active students in 2015/2016.

## 2.3. Data Collection

Data collection was carried out with various sources and stages. Broadly speaking there are five techniques carried out to support this research, which are:

- (1) Literature study related to transportation problems, modal choice, and relations to economic conditions,
- (2) Arrange a questionnaire for direct data collection,
- (3) Obtaining secondary data in the form of the number and distribution of UGM students for each faculty in 2015 from the Directorate of Education and Teaching (DPP) UGM.
- (4) Collecting primary data using a questionnaire both directly and online using *Google Docs*.

## 3. Discussions

Compared to other major cities in Indonesia, Yogyakarta is relatively small, but still dense and continues to grow is one of its own challenges in developing modern, efficient, inexpensive and well-targeted transportation facilities (Jen & Hu, 2003; Joewono & Kubota, 2007; Lai & Lu, 2007). The presence of students in Yogyakarta, especially Universitas Gadjah Mada (UGM) has a significant role in shaping the mobility flow and has a role in the dense traffic flow in Yogyakarta (Utami, 2016). In contrast to workers, student activities have unique and specific characteristics, as well as selected transportation mode preferences and the underlying economic conditions. The social and economic conditions of students who have these unique characteristics can be used as a reference study for the development of efficient and suitable public transportation, especially in crowded, but small education-based cities like Yogyakarta (Utami, 2016). The framework to study this problem begins with the process of data acquisition, both primary and secondary, to the potential output, and the possibilities for its use in the policymaking, and development process (Figure 1.).

### 3.1. Travel Pattern

A study conducted by Dian Wahyu Utami (2016) shows detailed characteristics of the travel patterns of UGM students. There are five main patterns of travel patterns formed by the daily activities of students during the week (Table 1.). The pattern of the trip depends

**Table 1.** Travel Pattern of UGM Students

Pattern	Explanations
A	Almost no travel.

B	Travel from the residence to UGM campus
C	Economic activity purposed travel
D	Social activity purposed travel
E	Long-distance travel (Airplane based)

on the number of destinations and also time. The most frequent travel pattern carried out by UGM students on weekdays (Monday - Friday) is type B, or only one destination trip to campus, while for weekends it is dominated by type A which without traveling at all. There are many factors that are likely to influence the pattern of travel like this, but one that is quite dominant is UGM campus and the surrounding area environment, which is directly adjacent to the area of meeting the needs of student life. These conditions make students do not need to travel long, far or complicated to meet their daily needs and desires.

### 3.2. Method Chosen

The same study from Dian Wahyu Utami (2016) shows the dominance of private vehicles as the main choice of transportation mode. As much as 96% of UGM students travel by using private vehicles, especially two-wheeled vehicles. Effective, practical, faster, more cost and time-saving, and flexible are the main considerations of the choice of personal transportation mode chosen as the backbone of travel by students. This is also a reflection of the condition of public transportation in Yogyakarta which is identical to the old bus-based which often has to stop randomly so that it takes a relatively longer time than private vehicles. Also, another factor that makes two-wheeled vehicles is the most popular transportation mode is Yogyakarta until now doesn't have any highway, and expressway, only ordinary road which only some of it has more than 2 lines.

### 3.3. Economic Background Relations

Related to economic conditions, Dian Wahyu Utami (2016) explains that there is a correlation between economic conditions, in this case, the family's economic background of students, and the chosen mode of transportation. However, economic factors do not have an influence on the number of destinations made while traveling. This gives an interesting finding that economic factors have two very contradictory relations, but they are still related. If you look back at the environmental factors of both the campus and around the campus of UGM which has many supporting facilities, it is not surprising that the need to do multi-destination or long-distance travel is less needed by UGM students today.

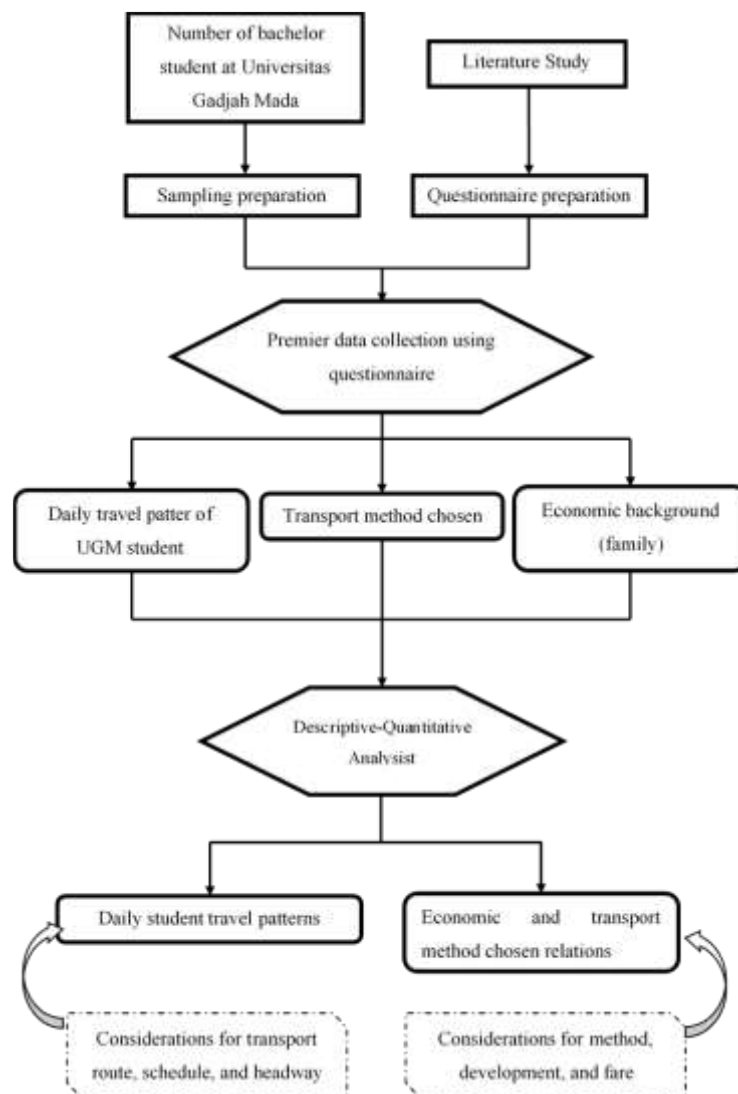
### 3.4. Transport Planning

The travel pattern data from a group of people such students could be used to conduct transportation planning especially in urban areas. We could learn from another country such Hongkong that already made their transport system according to community's activity. This method more likely efficient to build a good transportation system include cost, time, also places. Indonesia, especially Yogyakarta which the transport system hasn't provided yet by the government should considerate this travel pattern in order to understand where and why the citizen movement and from the economic background of the respondent, the government also could determine how much the best cost for each transportation system.

Currently, the development of a transportation system based on communities is developed in several countries such as China which source of the movements from the big data. This is in line with the development of the Internet of Things that happened in all aspect including transportation. In general, this concept is same as the travel pattern in

this research which is planning the transportation system according to the people's movement that could be traced by their smartphones or internet (Li et al., 2015). This research also developed by The United States Environmental Protection Agency which has published a guidebook that describes how the transportation system is measured against environmental, economic, and social sustainability (US EPA, 2011). Furthermore, knowing the travel pattern or people's movements in several areas such as in Yogyakarta will not only beneficial for the development of transportation facilities but also to create a transportation system that sustainable.

The use of big data in transportation is increasingly widespread (Ben Ayed, Ben Halima, & Alimi, 2015) and it is also used to evaluate the existing transportation system. The travel pattern data and people's movements also can be used to reduce the number of transport crashes as did by Ouyang & Bejleri (2014), which road density has a relationship with the number of road accidents.



**Figure 1.** Framework for Student Travel Pattern Studies

#### 4. Conclusions

Transportation problems that occur in Yogyakarta cannot be separated from the mobility activities of students dominated by private vehicles. Poor transportation conditions are a major problem in Yogyakarta. Based on the results

of studies related to student travel patterns, the transportation network that needs to be developed needs to reach not only the campus student residence area but several areas around the campus that are the basis of student activity outside of campus. Headway or travel frequency needed can adjust the difference in travel rates between weekdays and weekends, even daily. In addition, other problems such as the relatively small condition of the existing road section can be another consideration for the transportation mode chosen to be developed, but still primarily a matter of comfort, timeliness and affordable costs.

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