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Analysis of Transportation Mode Choice for Commuting To Campus (Case Study: Undergraduate and Graduate Students of the Faculty of Engineering Muhammadiyah University of Yogyakarta)

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Abstract. The parking lot density at the Faculty of Engineering, Universitas Muhammadiyah Yogyakarta (UMY), reflects students' high use of motor vehicles. Various factors, including demographic characteristics, travel patterns, and the availability and limitations of public transportation infrastructure, influence this. However, no specific research has analyzed students' transportation mode choices at the Faculty of Engineering UMY and their impact on the campus parking capacity. This study aims to describe students' demographic and travel characteristics and analyze the parking capacity at the Faculty of Engineering UMY. The methods used were descriptive statistics and cross-tabulation analysis by distributing questionnaires to 98 respondents. The results show that most respondents are male, within the age range of 19-23 years. Most students have an income higher than the Provincial Minimum Wage (UMP), enabling them to own a private vehicle or pay for transportation costs. The primary transportation mode used by students is motorcycles. Private motorcycles dominate the transportation choice due to their efficiency for short trips (0-15 minutes or 1-7 km). Parking capacity analysis shows that the parking capacity for two-wheeled vehicles at the Faculty of Engineering UMY has exceeded its capacity with a saturation rate 1.21 during peak hours. Meanwhile, the parking facility or four-wheeled vehicles has reached 100%, with a saturation rate of 1, indicating that it is complete but has not exceeded capacity during peak hours. The conclusion of this study emphasizes that the choice of transportation mode for students at the Faculty of Engineering UMY is dominated by private vehicles, particularly motorcycles. This condition results in high parking saturation, which calls for transportation management strategies such as improving public transportation accessibility, regulating private vehicle usage policies, and optimizing parking spaces.

Keywords: Transportation Mode, Parking Lot, Cross-Tabulation, Students

INTRODUCTION

Special Region of Yogyakarta (DIY) is one of the provinces with high societal activity and mobility. DIY is well-known as an educational hub associated with institutes and campuses. The dense activities conducted by its residents highlight the need for transportation development and the appropriate choice of transportation modes. According to Kompas.id, accessed on March 28, 2024, regarding the increase in citizen mobility, mobility to workplaces and schools has risen by 11.57%, mobility in public transportation hubs increased by 8.86%, and mobility in retail and recreational areas rose by 1.71% (Nababan, 2022). This increase indicates that transportation plays a crucial role in supporting public activities, necessitating the choice of suitable transportation modes to meet movement and societal needs.

The Special Region of Yogyakarta (DIY) consists of 4 regencies with varying road lengths. Yogyakarta City has 233.23 km of roads, Kulon Progo has 1,309 km, Gunung Kidul has 1,136.66 km, Bantul has 624.46 km, and Sleman has 699.5 km (Yogyakarta Transportation Department, 2022). This data shows that Bantul, where UMY is located, has fewer roads than other DIY regencies. This fact is supported by the high level of higher education activities in

Bantul. One of the reasons for the dense higher education activities in Bantul is the large number of universities in the region, both public and private. BPS Yogyakarta Data (2020) reveals that Bantul Regency has 25 higher education institutions, both public and private; this will, in turn, increase the activity of transportation mode choice. Universitas Muhammadiyah Yogyakarta, one of the largest educational institutions in Bantul Regency, attracts prospective students seeking to study DIY. The rising number of students is accompanied by an annual increase in transportation usage (Akbar, 2023). The significant student population leads to diverse transportation mode preferences. A study by Irjayanti et al. (2021) shows that socioeconomic factors influence transportation mode choice. According to Atika and Rasyid (2019), socioeconomic status reflects an individual's unique position within a community related to their dignity and rights. Nurwati and Listari (2021) describe socioeconomic status as a role held by an individual within a community group, tied to their ability to meet daily needs based on their achievements. Socioeconomic status determines an individual's position within a particular social stratum. Irjayanti et al. (2021) further assess economic status based on income or monthly earnings, and social factors are analyzed from the distance traveled from home to the destination. Economic factors are a key determinant in transportation mode choice. These factors relate to income, which represents the monthly funds received to meet individual needs (Sumampouw et al., 2022). Bastarianto et al. (2019) found that income or economic conditions significantly influence transportation mode choice. Individuals with higher incomes tend to prefer private vehicles, whereas those with lower incomes favor public transportation due to its affordability. Income plays an important role since each mode of transportation entails different costs. Private vehicles generally incur higher expenses due to fuel and operational costs such as maintenance and servicing. On the other hand, public transportation is often subsidized by central or local governments, making it more cost-effective (Supit et al., 2019). Distance is another factor influencing transportation mode choice, measured by the distance between home and the destination. Longer distances require greater effort and time, posing a high risk of time inefficiency (Aprilia et al., 2021). Irjayanti et al. (2021) demonstrated that travel distance significantly impacts transportation mode choice. Individuals with longer commutes tend to opt for public transportation due to its lower cost compared to private vehicles. The travel distance correlates with the time spent during the journey, making time efficiency a critical factor in transportation mode choice. Private transportation is often perceived as faster because it avoids the scheduled stops and specific routes typical of public transport, which results in longer travel times (Sugiyanto et al., 2021). The study by Irjayanti et al. (2021) and Aprilia et al. (2021) indicates that transportation mode choice involves considerations between using public transportation and private vehicles based on specific priorities. Different types of transportation can cover the distance between the starting point and destination depending on cost, time value, and flexibility. Public transportation may be the better choice if the primary priority is low cost and time value. Conversely, private vehicles may take precedence if faster travel time, high time value, or flexibility are more important. Another determining factor in transportation mode choice is the availability of infrastructure and facilities. Research by Sugiyanto et al. (2021) shows that infrastructure and facilities significantly influence transportation mode choice since people tend to choose transportation modes that ensure high levels of safety, security, reliability, comfort, cleanliness, and accessibility. Field observations show that UMY is a university with easy public and private transportation access. One type of public transportation frequently used is Trans Jogja, which began operating in 2008.The DIY government has provided Trans Jogja facilities, including 21 routes with 140 buses. Each bus can accommodate 41 passengers, with 22 seated and 19 standing. At UMY, the study's research site, a Trans Jogja bus stop is directly opposite the main entrance. UMY is on Trans Jogja Route 6B, serviced by five buses covering a 16.5 km route, with a waiting time of 30–60 minutes. As stipulated in DIY Governor Regulation No. 361/KEP/2022, the fare is IDR3,600 for the general public, IDR2,700 for cardholders, and IDR60 for student cardholders (Sunartono, 2024). Trans Jogja, as a public transportation facility for the community, has been optimized with affordable fares and relatively short waiting times. This has become a positive attraction for students at Universitas Muhammadiyah Yogyakarta (UMY) to consider public transportation as an appropriate choice. This differs from the observations regarding private vehicle usage at UMY. The use of private vehicles in areas with high activity requires adequate infrastructure, such as spacious parking lots and accessible roads.UMY has provided facilities for private vehicle users in the form of parking areas. However, the parking lots at UMY experience overcrowding due to the large number of students and high activity levels, indicating that the parking facilities at UMY are still insufficient, as seen from the parking congestion. This suggests that the majority of UMY students prefer using private vehicles over public transportation. Meanwhile, there has been no policy from the campus regarding the use of private vehicles at UMY, as evidenced by the continued overcrowding in the campus parking areas.On the other hand, the roads and access around the campus also play a role as infrastructure that needs attention in transportation mode choice. UMY has road access from several directions, from the east as the main route, the west, the north, and the south. The southern route, in particular, experiences the highest congestion because many students prefer using this route compared to others. This heavy congestion often causes traffic jams during peak hours, such as in the morning and afternoon.The problem

of full parking spaces at UMY reflects a widespread issue in higher education institutions. The increasing number of students each year and the tendency to use private vehicles such as motorcycles and cars has led to a significant demand for parking spaces. However, the available parking areas often cannot keep up with this surge, causing overcrowding and long queues in campus parking areas. The inability to expand these facilities due to land constraints creates a situation where parking capacity is always full during busy hours, such as in the morning to midday. This further exacerbates the pressure on parking facilities, especially for students coming from outside the area who are not accustomed to alternative transportation modes. When parking spaces are full, students often have to spend time searching for parking in areas surrounding the campus, which not only reduces their study time but also causes delays in attending classes. This issue creates a domino effect, leading to traffic congestion around the campus area. The analysis of parking space in this study is critical because it provides an overview of the parking occupancy rate, the pattern of private vehicle usage, and the effectiveness of the parking infrastructure provided. By analyzing the relationship between transportation mode choices and parking availability, this study aims to provide recommendations for campus policies related to student transportation. Additionally, this research can serve as a basis for the development of the campus transportation system, such as policies for limiting private vehicles, providing bicycle lanes, or optimizing shuttle bus services for students.A study by Moi and Yuliana (2022) titled "Analysis of Transportation Mode Choice for Traveling to Campus (Case Study: Academic Civitas of the Bali State Polytechnic)" used the AHP method with Expert Choice software to identify the most influential factors. The study found that the highest priority for the PNB academic civitas at the criteria level was the time, cost, and safety factors. Based on expert assessments through questionnaires, the most preferred transportation mode was motorcycles as the first alternative, followed by private cars, and public transportation as the least preferred option. This study uses cross-tabulation as an analytical tool, providing novelty in the methodological approach compared to previous research. The research focuses on students of the Faculty of Engineering at Universitas Muhammadiyah Yogyakarta (UMY), as it provides insights into transportation mode preferences in an area with high student density, making it relevant to transportation planning in DIY as a whole. Additionally, this study considers the specific relationships between variables using cross-tabulation, offering new insights into the interaction of variables that are not solely focused on priority factors, such as security in Ilham's study or time in Moi and Yuliana's research.This study is believed to contribute to campus infrastructure and facility planning by identifying the need for parking spaces, bicycle lanes, or shuttle bus services. It also enables the Transportation Department (Dishub) to review public transportation routes and schedules, ensuring good connectivity between students' residential areas from the Faculty of Engineering at UMY.

METHODOLOGY

This study employs a qualitative research design. Creswell (2014) states that qualitative research design is characterized by flexibility and is based on an in-depth exploration of meanings, experiences, or social phenomena. According to Lincoln and Guba (2015), qualitative research utilizes a constructivist paradigm, which emphasizes that reality is multiple, subjective, and socially constructed. Bogdan and Biklen (2012) explain that qualitative research design has five main characteristics: (1) the research is conducted in the field, with data collected directly from the participants' natural environment; (2) the data is descriptive, meaning that qualitative research uses words, images, or symbols as primary data instead of numbers; (3) there is an emphasis on process, focusing on understanding the process that occurs rather than just the final results; (4) inductive analysis, where research conclusions are drawn through inductive data collection and analysis without rigid hypotheses; (5) the goal is to understand the meaning individuals attribute to experiences or phenomena. Thus, it can be said that a qualitative research design is a plan or strategy designed to answer qualitative research questions. Qualitative research aims to deeply understand social or human phenomena, making the design flexible and adaptable to the dynamics of data in the field. This study employs cross-tabulation related to the demographic characteristics and travel characteristics of transportation mode choices among undergraduate (S1) and postgraduate (S2) students in the Faculty of Engineering at Universitas Muhammadiyah Yogyakarta.

RESULT AND DISCUSSION

Demographic Characteristics

The demographic characteristics include perceptions based on gender, age, income, and driver’s license ownership.

Travel Characteristics

The travel characteristics of the respondents consist of the type of mode used to go to campus, the reason for using transportation, the estimated travel time, the distance traveled, and the costs incurred.

Crosstab Analysis

According to Ghozali (2018: 21), cross-tabulation analysis is an analysis that essentially presents data in the form of a table consisting of rows and columns, with data for cross-tabulation presentation (nominal or categorical data scale).

Gender, Age, and Alternative Mode Choice

The following are demographic characteristics, such as gender and age, that are related to the choice of student transportation modes to the UMY campus.

Table 1. Gender, Age, and Alternative Mode Choice

Information	Car online transport	Motorcycle online transportation	Trans Jogja Bus (public transportation)	Private car	Personal motorbike	Total
Gender						
Man	1	3	6	11	39	60
Woman	2	6	6	5	19	38
Age						
19-27	3	9	12	15	57	96
28-32	0	0	0	1	1	2
Total	**3**	**9**	**12**	**16**	**58**	**98**

Source: Survey results, 2024

Table 1 shows that in online car transportation, this mode is chosen by one man and two women. This low number shows that online car transportation is not the primary choice for students, because the rates are higher than other modes. Then, three men and six women were on the motorcycle online transportation. This mode is more prevalent among women, who prioritize comfort and safety when using app-based transportation services, especially on medium-distance travel. Furthermore, the Trans Jogja bus was chosen by six men and six women, showing a balanced use between the two genders. The popularity of Trans Jogja may be influenced by its affordable fares and routes that are integrated to various points, including the UMY campus. Students who want to save on transportation costs tend to choose this mode, while in private cars, 11 men and five women choose private cars. Private cars are an option for students who prioritize comfort, flexibility, and the ability to carry more goods. However, the number of uses is relatively small compared to private motorcycles due to limited access to these vehicles and higher operational costs. Finally, this mode is the primary choice for private motorcycles, especially for 39 men and 19 women. Private motorbikes dominate as the most widely used mode of transportation by students. This is because motorcycles provide flexibility, speed, and low operating costs, especially in the face of heavy traffic conditions.

It can be said that most men choose private motorcycles (39 people), followed by private cars (11 people), showing a tendency to rely on fast and flexible modes of transportation. Meanwhile, the choice of women's mode of transportation is more varied, although private motorbikes still dominate (19 people), followed by online transportation of motorbikes (6 people) and Trans Jogja buses (6 people). This indicates that women are more concerned about comfort and security. Private motorcycles are the most dominant mode of transportation among UMY students, both men and women. The factors of flexibility, time efficiency, and relatively low cost contribute to the popularity of this mode. Meanwhile, public and online transportation modes remain relevant, especially for students who do not have access to private vehicles or prioritize comfort.

Income, Driver's License Ownership, and Alternative Mode Choice

The cross-tabulation between income and driver's license ownership in UMY students is presented as follows:

Table 2. Driver's License Income and Ownership

Income (student monthly money	Driving License A	Driving License A, Driving License C	Driving License C	None	Total
Less than UMP (Rp.2,125,897.61)	0	1	21	17	39
More than UMP (IDR 2,125,897.61)	8	20	26	5	59
Total	**8**	**21**	**47**	**22**	**98**

Source: Survey results, 2024

The data above shows that of the 39 students with a monthly income of less than UMP, none have a driving license A. This is due to the higher costs of owning and operating a car, such as purchase, maintenance, and fuel. One student has a driving license A and a driving license C; this group's ownership of a dual driving license is very low, showing that low-income students rarely have access to private vehicles, both cars and motorcycles. Twenty-one students have a driving license C; this group shows the highest number for owning a driving license C, reflecting that motorcycles are the most affordable mode of transportation for low-income students. Seventeen students do not have driver's licenses, most of the students in this group are believed to be due to financial constraints and other factors that prevent them from obtaining private vehicles and driver's licenses. Furthermore, of the 59 students with an income more than UMP, eight students have a driving license A, and students with higher incomes tend to have a driving license A because they are more able to bear the operational costs of four-wheeled vehicles. Twenty students have driving licenses A and C; the ownership of dual driving licenses is also quite significant in this group, showing wider access to various modes of private transportation, both cars and motorcycles. There are 26 students with a driving license C, which remains the most owned in this group, indicating that motorcycles are still the first choice even though they have better financial capabilities. Five students did not have a driver's license, which is smaller than that of the low-income group, indicating that students with higher incomes tend to have at least one type of driver's license. Thus, it can be said that the level of monthly income of students greatly influences the ownership of a driver's license. Students with an income of more than UMP tend to have a driver's license, both for four-wheeled vehicles (driving license A) and two-wheeled vehicles (driving license C). Students with incomes less than UMP have more driving license C than other driver's licenses, showing that motorcycles are the most affordable mode. However, a high proportion of this group also does not have a driver's license, reflecting limited access to private transportation. Furthermore, the cross-tabulation between driving license ownership and choice of student transportation modes to the UMY campus is presented as follows:

Table 3. Driver's License Ownership and Alternative Mode Choice

Driver's License Ownership	Car online transport	Motorcycle online transportation	Trans Jogja Bus (public transportation)	Private car	Personal motorbike	Total
Class A driver's license	0	0	0	8	0	8
Class A, C driver's license	0	0	1	7	13	21
Class C driver's license	0	3	0	1	43	47
None	3	6	11	0	2	22
Total	**3**	**9**	**12**	**16**	**58**	**98**

Source: Survey results, 2024

The table above shows that private motorbikes are the most dominant mode of transportation, especially among students with SIM C and driving license A+C. Then private cars are more widely used by students with driving license A or a combination of driving license A and C. At the same time, Trans Jogja and online buses are the leading choices for students who do not have a driver's license due to limited access to private vehicles. Thus, it can be said that students without a driver's license tend to rely on public transportation and online transportation. The primary choice of Trans Jogja buses is a preference for more economical modes, while online transportation offers convenience even

at a higher cost. Interestingly, two students without a driver's license use a private motorcycle, which can show us without official permission.

Estimated Travel Time and Alternative Mode Choice

The cross-tabulation between the estimated travel time and the choice of student mode to the UMY campus is presented as follows:

Table 4. Estimated Travel Time and Alternative Mode Choice

Estimated Travel Time (minutes)	Car online transport	Motorcycle online transportation	Trans Jogja Bus (public transportation)	Private car	Personal motorbike	Total
0-15	1	4	0	6	38	49
16-25	2	4	12	7	16	41
26-35	0	0	0	3	3	6
36-45	0	1	0	0	1	2
Total	**3**	**9**	**12**	**16**	**58**	**98**

Source: Survey results, 2024

Table 4 shows that private motorbikes dominate in the estimated travel time of 0-15 minutes with 38 students, indicating that motorbikes are the top choice for those who live near campus. This mode allows for a fast and efficient journey. The use of private cars is also quite significant (6 students), reflecting a preference for comfort despite the proximity. A small percentage of students use online transportation, both cars, and motorcycles because it is in an urgent situation or for convenience. Meanwhile, the Trans Jogja Bus was not chosen, probably because this mode is more suitable for trips with longer travel times. The travel period of 16-25 minutes shows a more even distribution of transportation modes. Private motorbikes are still the primary choice, but the number of Trans Jogja Bus users has increased significantly (12 students), indicating that buses are more in demand for trips that take longer. Private cars are still used by students who prioritize comfort, while online transportation is a popular alternative. Furthermore, users in the travel time range of 26-35 minutes are limited to private modes, namely cars and motorcycles, with the same number of users (3 students). Students may avoid public transportation or online because longer trips require more flexible modes. Finally, in the most extended period of 36-45 minutes, the modes used are private motorbikes and motorcycle online transportation with one user each. Flexibility and time efficiency are the primary considerations for users of this mode. It can be said that private motorcycles are the most widely used mode of transportation in all periods, especially for short trips (0-15 minutes). Then private cars are also quite popular, especially for trips with a travel time of 5-25 minutes, showing a preference for comfort for students who have vehicle access. Furthermore, the Trans Jogja Bus is used mainly in the 16-25 minute time range, which shows that this mode is more effective for trips with medium travel times. Meanwhile, online transportation, both motorbikes and cars, is more widely used for short to medium trips, but the number of users is smaller than in private modes.

Distance and Alternative Mode Choice

The cross-tabulation between the distance traveled and the alternative mode of choosing the mode of students to the UMY campus is presented as follows:

Table 5. Distance and Alternative Mode Choice

Distance Traveled (km)	Car online transport	Motorcycle online transportation	Trans Jogja Bus (public transportation)	Private car	Personal motorbike	Total
1-7	2	6	1	6	42	57
8-14	1	2	10	9	14	36
15-21	0	1	1	0	1	3
22-28	0	0	0	1	1	2
Total	**3**	**9**	**12**	**16**	**58**	**98**

Source: Survey results, 2024

Table 5 shows that private motorcycles dominate students' choices within a distance of 1-7 km, with 42 users. This mode allows for fast and flexible travel with low operational costs. Private cars are also quite popular (6 students), showing a preference for comfort despite the relatively short distance. For online transportation, motorcycles (6 students) and cars (2 students) are alternatives for students who do not have a personal vehicle or are in certain conditions. As for the Trans Jogja Bus used by one student, it shows a low preference for this mode in short-distance travel. Transportation modes are more varied within a distance of 8-14 km. Private motorbikes are still widely used (14 students), but the number of users of private cars (9 students) and Trans Jogja Bus (10 students) is increasing. Then, the Trans Jogja Bus became more popular over shorter distances due to cost efficiency and broader routes. Meanwhile, online transportation (cars and motorcycles) remains an option for a small number of students. Furthermore, within a distance of 15-21 km, the use of transportation modes is more balanced with each mode (online transportation motorbike, Trans Jogja Bus, and private motorbike) used by one student. There are no private car users or car online transportation, perhaps because this trip requires higher operational costs or more extended time with the mode. Likewise, with a 22-28 km distance, only private cars and private motorbikes are used, each by one student. Students who live far from campus tend to use private transportation modes that provide better flexibility and comfort for long-distance travel. Thus, it can be said that private motorcycles are the most popular mode of transport in all distance categories, especially within a distance of 1-7 km. Trans Jogja buses are more widely used in medium distances (8-14 km), reflecting the effectiveness of this mode in medium-distance travel at an affordable cost. For private cars, it shows stable use, especially in short and medium distances. Online transportation, both motorbikes and cars, is often used over short distances due to its flexibility and ease of access. Over long distances (22-28 km), private modes of transport (cars and motorcycles) are preferred due to convenience and speed on long-distance travel.

Travel Costs and Alternative Mode Choice

The cross-tabulation between the cost (cost) and the alternative mode of choosing students for the UMY campus is presented as follows:

Table 6. Travel Costs and Alternative Mode Choice

Fee (IDR)	Car online transport	Motorcycle online transportation	Trans Jogja Bus (public transportation)	Private car	Personal motorbike	Total
0-15000	0	0	12	1	44	57
16000-27000	3	7	0	1	14	25
28000-39000	0	1	0	8	0	9
40000-51000	0	1	0	6	0	7
Total	**3**	**9**	**12**	**16**	**58**	**98**

Source: Survey results, 2024

Table 6 shows that the travel cost of IDR0 - IDR15,000 is dominated by private motorcycle users (44 students), who generally have low operational costs, especially for fuel. Then, the Trans Jogja Bus is the second choice with 12 users, reflecting the popularity of this mode among students looking for economical transportation solutions. The use of private cars in this category is low (1 student), indicating that private cars are generally unsuitable for low-cost travel.

Furthermore, the travel cost is IDR 16,000 - IDR 27,000, and private motorbikes are still popular with 14 users, although the number is smaller than in the previous category. Online transportation (motorbikes and cars) is becoming the choice with 10 users, reflecting a preference for convenience even though it costs more than private modes. There are no users of the Trans Jogja Bus, which indicates that this mode is preferred for its very low travel costs. In the travel cost category of IDR 28,000 – IDR 39,000, private cars are the dominant mode (8 students), showing that cars are more relevant for students who are able to allocate more money for transportation. Online transportation for motorcycles (1 student) shows that this mode remains an option even though the cost is higher than private modes such as motorcycles. Furthermore, the travel cost is IDR 40,000 - IDR 51,000, and the private car is the primary mode (6 students), reflecting that students with more significant transportation expenses tend to choose modes that offer high comfort and flexibility. One student uses motorcycle online transportation, but other modes, such as the Trans Jogja Bus and private motorbikes, are not used, indicating that this mode is not economical for high travel costs. Thus, it can be concluded that private motorcycles are the most dominant mode of transportation, especially in the low-cost category (IDR 0 – IDR 15,000), due to their low efficiency and operational costs. Trans Jogja buses are popular among

students with minimal transportation budgets but are not used in the middle to high-cost category. Online transportation (motorbike and car) is an option in the cost range of IDR 16,000 - IDR 27,000, providing flexibility even at a higher cost. Private cars are used mainly by students in the higher cost category (IDR 28,000 and above), reflecting a preference for comfort and flexibility.

Reasons for Choosing Moda and Alternative Moda Selection

The cross-tabulation between the reasons and the alternative mode of student selection to the UMY campus is presented as follows:

Table 7. Reasons and Alternatives for Choosing Moda

Reason	Car online transport	Motorcycle online transportation	Trans Jogja Bus (public transportation)	Private car	Personal motorbike	Total
Safe and secure	3	1	0	8	0	12
Low cost	0	3	12	1	9	25
Ease of access	0	5	0	7	49	61
Overall Total	**3**	**9**	**12**	**16**	**58**	**98**

Source: Survey results, 2024

Table 7 shows that private cars are the top choice for safety and comfort reasons (8 students), reflecting that these vehicles provide a more comfortable travel experience and privacy. Then, online transportation cars (3 students) are also in demand for the same reason, showing that application-based transportation services provide convenience even though they are not private. Meanwhile, private motorbikes and Trans Jogja buses were not chosen for this reason, due to limited space and comfort. Trans Jogja Bus is the primary mode of transportation for students who consider low costs, with 12 users. This is in line with the relatively low fare of the Trans Jogja Bus. Private motorcycles are also quite popular with nine users, showing that motorcycles are economical in daily operations. For online transportation, three students use motorcycles for cost reasons. In contrast, modes with high operational costs, such as private cars and online car transportation, only have one or no users in this category. Furthermore, private motorcycles dominate, with 49 users, for ease of access, reflecting this mode's high flexibility. Students can rely on private motorbikes to reach campus locations without relying on public transportation schedules. Seven students also chose Private cars because of easy access, although their use was lower than motorbikes due to cost factors and parking needs. Motorcycle online transportation attracts five users for easy access, providing flexibility without needing a private vehicle. There are no Trans Jogja Bus users for this reason, which may be due to route limitations and a fixed schedule that is less flexible. Thus, private cars are the most dominant mode of transportation for safe and convenient reasons, followed by online transportation by car. Then, for low-cost, Trans Jogja buses and private motorbikes are the main choices, with most users looking for economical modes of transportation. As for ease of access, private motorcycles are the most popular mode of transportation, outperforming all other modes due to their high flexibility and accessibility.

Parking Lot Capacity Analysis

The researchers collected data on December 9, 2025, from 08:00 to 12:00 WIB at the Faculty of Engineering, Universitas Muhammadiyah Yogyakarta. The total motorcycle parking area was 800.23 m², and the car parking area was 500.12 m². During the peak hour, the number of parked vehicles was 650 motorcycles and 40 cars. To calculate the parking lot capacity based on the total area and the standard parking space per vehicle, the following minimum parking space standards were used:

- Parking space for motorcycles: 0,75m × 2 m = 1,5 m² per motorcycle
- Parking space for cars: 2.5 m × 5 m = 12.5 m² per car

1. Maximum Parking Capacity for Motorcycles
Given:
Parking area for motorcycles: 800.23 m²
Parking area per motorcycle: 1,5 m²

$$C_{motor} \frac{motorcycle\ parking\ lot\ area}{area\ per\ vehicle}$$

$$C_{motor} \frac{800,23}{1,5} = 534\ vehicle$$

2. Maximum Parking Capacity for Cars
Given:
Parking area for cars: 500.12 m²
Parking area per car: 12.5 m²

$$C_{mobil} = \frac{car\ parking\ lot\ area}{area\ per\ vehicle}$$

$$C_{mobil} = \frac{500,12}{12,5} = 40 \text{ vehicle}$$

3. Comparison of Capacity with Peak Hour
For motorcycles:
Given:
Parking lot capacity for motorcycles = 534 vehicles
The actual number of parked vehicles = 650 vehicles

Utility:

$$motorcycle\ utility = \frac{actual\ amount}{capacity} \times 100$$

$$motorcycle\ utility = \frac{650}{534} \times 100\% = 121,7\%$$

Cars:
Given:
Parking lot capacity for cars = 40 vehicles
The actual number of parked vehicles = 40 vehicles

Utility:

$$car\ utility = \frac{actual\ amount}{capacity} \times 100\%$$

$$car\ utility = \frac{40}{40} \times 100\% = 100\%$$

Thus, it can be concluded that the parking lot capacity for motorcycles is 534 vehicles, with an occupancy rate of 121.7%, indicating congestion. Meanwhile, the car parking lot capacity is 40 vehicles, with an occupancy rate of 100%, meaning it is fully occupied but has not exceeded capacity.

4. Calculation of Degree of Saturation (DS)

$$DS = \frac{V}{C}$$

$$DS = \frac{650}{534} = 1,21$$

$$DS_{car} = \frac{40}{40} = 1$$

The degree of saturation for motorcycles is 1.21, which exceeds the capacity. This indicates the need to expand the parking area or reorganize the parking management. Meanwhile, the degree of saturation for cars is 1.00, meaning the parking lot is fully occupied, but it remains stable and has not exceeded its capacity.

CONCLUSION

Based on the analysis, it can be concluded that the majority of students at the Faculty of Engineering, UMY, are male, within a young age range, still in education, or just starting their careers. Most have an income above the Provincial Minimum Wage (UMP), indicating sufficient purchasing power to use private vehicles or pay for transportation costs. It was also found that most students at the Faculty of Engineering, UMY, use motorcycles as their primary mode of transportation to campus due to ease of access. Motorcycles dominate because they are considered the most efficient mode of transportation for short trips (0-15 minutes or 1-7 km). The relatively short distance and brief travel time make motorcycles the logical choice. Other transportation modes, such as buses, struggle to compete because motorcycles offer easier access. Private vehicle ownership is highly influenced by possessing a driving license, particularly a motorcycle license (Driving License C). The parking space for two-wheeled vehicles at the Faculty of Engineering, UMY, has exceeded its capacity (121.7%) with a saturation rate 1.21 during peak hours. Meanwhile, the parking capacity for four-wheeled vehicles has reached 100%, with a saturation rate of 1, meaning it is complete but has not exceeded capacity during peak hours. The conclusion of this study emphasizes that the transportation mode choice of students at the Faculty of Engineering, UMY, is dominated by private vehicles, particularly motorcycles, due to ease of access. This condition results in high parking congestion, which requires transportation management strategies such as improving public transportation accessibility, regulating private vehicle use policies, and optimizing parking space to reduce pressure on on-campus facilities.

SUGGESTION

The following recommendations can be provided for future research:

1. Focus can be placed on strategies to increase the use of public transportation, such as Trans Jogja buses, by addressing the main barriers found. For example, studies could be conducted on how to shorten bus waiting times, expand bus stop access, or add services until nighttime.
2. Future researchers should conduct further studies related to transportation modes by analyzing other criteria not mentioned in this study.
3. The results of this research on transportation mode choice characteristics can serve as a basis for planning transportation infrastructure within the Universitas Muhammadiyah Yogyakarta campus and the surrounding campus area.

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