Potential study of motorcycle parking on State Polytechnic of Malang

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Abstract. Parking is a vehicle that stops or does not move for a while and is abandoned by the driver. Requires infrastructure for parking purposes while the available land is increasingly limited. The method of field research (Field Research Method) is direct observation at the location to see the physical condition of the movement of vehicles entering and leaving the location during rush hour. Meanwhile, research on the area of parking was carried out by means of digital map measurement (Digital Map Measurement Research Method), namely by measuring based on measurement results from digital maps. The number of motorbikes that entered was 5716 vehicles, while 1373 vehicles exiting with a volume of 4546 vehicles were parked. The parking area for motorbikes is 7,480.44 m² with a parking area of 5,217.67 m² and a circulation area of 2,262.77 m².

1. Introduction

Parking according to Tamin [1] can be interpreted as a place to stop a vehicle for a while, meanwhile according to the Law on Traffic and Road Transportation Parking is a vehicle that stops or does not move for a while and is abandoned by the driver [2]. Meanwhile, according to Nawawi, et al. [3] stated that parking is a temporary immovable condition of a vehicle because it is abandoned by the driver. According to Gusnadi [4], it is legally prohibited to park in the middle of the highway, but parking on the side of the road is generally allowed. Included in the definition of parking is any vehicle that stops at certain places, whether declared with traffic signs or not, and not solely for the purpose of raising and or unloading goods or people [5]. From the above understanding, it can be concluded that parking is a condition in which the vehicle does not move or stops for a certain duration of time.

Parking facilities are locations that are determined as non-temporary stopping places for carrying out activities at a certain time. Where is the parking lot on the street, (on street parking) and off street parking facilities [6]. The parking problem is a problem that is often encountered in the transportation system, in an effort to deal with this problem, it is necessary to provide sufficient parking space, where the need for parking space (Supply) and vehicles to be parked (Supply) must be balanced and adjusted to parking characteristics [7].

The parking space unit (SRP) is a unit of measure needed to park a vehicle according to various forms of provision. The amount of parking space is influenced by the dimensions of the vehicle, vehicle free space and the width of the vehicle door openings [8].
Table 1. Determination of parking space units.

| Transportation type          | SRP (m²) |
|-----------------------------|----------|
| a. Passenger cars for goals. I | 2.30 x 5.00 |
| b. Passenger cars for goals. II | 2.50 x 5.00 |
| c. Passenger cars for goals. III | 3.00 x 5.00 |
| 2. Bus / truck              | 3.40 x 12.50 |
| 3. Motorcycle               | 0.75 x 2.00 |

Source: Directorate General of Land Transportation [6].

Parking volume is the number of vehicles parked per time period in minutes or hours [9], is the number of vehicles parked in an area at a certain time.

\[ \text{Parking volume} = \text{Ei} - \text{Ex} + \text{X} \]

Information:
\( \text{Ei} = \text{Entry (vehicles that enter the parking location)} \)
\( \text{Ex} = \text{Extry (vehicles that leave the parking location)} \)
\( \text{X} = \text{Number of existing vehicles} \)

Volume This can be used as a measure of parking space requirements at the research location [10].

Parking duration is the length of parking time used by each vehicle to stop at a parking space. The average length of parking is expressed in hours / vehicle.

From the results of the calculation of the average length of parking time, it will be known the time taken by parkers to park the vehicle on the parking lot [11].

\[ \text{D} = \text{time out} - \text{time of entry} \]

Information:
\( \text{D} = \text{parking time / duration (hour / vehicle)} \)

2. Methodology

This research was conducted to determine the number of motorbikes parked during peak hours by counting the number of vehicles entering and exiting the research location during peak hours. To get the number of vehicles parked by mfield research method (Field Research Method), namely direct observation at the location to see the physical condition of the movement of vehicles entering and leaving the location during rush hour. Meanwhile, research on the area of parking was carried out by means of digital map measurement (Digital Map Measurement Research Method), namely by measuring based on measurement results from digital maps.

3. Discussion

The parking problem is very important to be studied more deeply, because almost all outdoor activities require a parking space. The required parking space must be available adequately. Because with the greater the volume of activity that either leaves or goes to the center of activity, the greater the need for parking space.

Observations for all gates (6 locations) were carried out simultaneously on 27 August 2019 and 28 August 2019 in the morning hours (06: 00-09: 00) and during the day (11: 00-14: 00), by recording the number of motorbikes and cars, both entering and exiting, with an observation time interval of 10 minutes.

The recapitulation of the number of incoming and outgoing vehicles is visible on 27 August 2019 all gates are:
- Motorbikes enter 5566 vehicles, exit 1020 vehicles
- Motorbikes parked 4546 vehicles

While the Recapitulation of the Number of Motorcycles Entering and Exiting on August 28, 2019 for all the gates are:
- Motorbikes enter 5716 vehicles, exit 1373 vehicles
- Motorbikes parked 4373 vehicles

From the results of these calculations it can be obtained data that the number of parking vehicles can be used as a basis in calculating current predictions to prepare motorcycle parking facilities with the largest value of 4546 vehicles.

### Table 2. Recapitulation of the number of vehicles in-out the morning session on Tuesday, 27 August 2019.

| City      | Malang       |
|-----------|--------------|
| Location  | Politeknik Negeri Malang |
| Surveyor  |               |
| Day / Date| Tuesday, 27 August 2019 |
| Session   | Morning      |

| Time       | In |  | Amount |  |  | Out |  |  | Amount |
|------------|----|---|--------|---|---|-----|---|---|--------|
|            | Motorbikes | Car | Exectra |   | Motorbikes | Car | Exectra |   |
| 06.00 - 06.10 | 85 | 3 | 0 | 88 | 1 | 0 | 1 |
| 06.10 - 06.20 | 140 | 6 | 1 | 147 | 16 | 2 | 0 | 18 |
| 06.20 - 06.30 | 225 | 5 | 1 | 231 | 6 | 1 | 0 | 7 |
| 06.30 - 06.40 | 441 | 16 | 0 | 457 | 21 | 6 | 0 | 27 |
| 06.40 - 06.50 | 864 | 23 | 2 | 889 | 45 | 2 | 0 | 47 |
| 06.50 - 07.00 | 1222 | 29 | 0 | 1251 | 57 | 4 | 0 | 61 |
| 07.00 - 07.10 | 775 | 32 | 1 | 808 | 47 | 11 | 0 | 55 |
| 07.10 - 07.20 | 392 | 28 | 1 | 421 | 40 | 6 | 1 | 47 |
| 07.20 - 07.30 | 233 | 21 | 0 | 254 | 76 | 6 | 0 | 82 |
| 07.30 - 07.40 | 203 | 19 | 0 | 222 | 72 | 14 | 0 | 86 |
| 07.40 - 07.50 | 165 | 15 | 1 | 181 | 62 | 9 | 0 | 71 |
| 07.50 - 08.00 | 138 | 18 | 0 | 156 | 42 | 17 | 0 | 59 |
| 08.00 - 08.10 | 82 | 18 | 0 | 100 | 71 | 10 | 0 | 81 |
| 08.10 - 08.20 | 114 | 17 | 0 | 131 | 82 | 8 | 0 | 90 |
| 08.20 - 08.30 | 104 | 12 | 0 | 116 | 84 | 4 | 0 | 88 |
| 08.30 - 08.40 | 130 | 13 | 2 | 145 | 91 | 9 | 0 | 100 |
| 08.40 - 08.50 | 117 | 16 | 1 | 134 | 113 | 13 | 0 | 126 |
| 08.50 - 09.00 | 136 | 11 | 0 | 147 | 94 | 8 | 0 | 102 |
| Total        | 5566 | 302 | 10 | 5878 | 1020 | 130 | 1 | 1151 |
Figure 1. Recapitulation of motorbikes in-out the park area in the morning session on Tuesday, 27 August 2019.

Figure 2. Recapitulation of cars in-out the park area in the morning session on Tuesday, 27 August 2019.

Table 3. Recapitulation of the number of vehicles entering and exiting the morning session on Wednesday, 28 August 2019.

| Waktu       | Motorbikes | Car | Exectra | Amount | Motorbikes | Car | Exectra | Amount |
|-------------|------------|-----|---------|--------|------------|-----|---------|--------|
| 06.00 - 06.10 | 49         | 6   | 28      | 83     | 12         | 5   | 0       | 17     |
| 06.10 - 06.20 | 75         | 4   | 54      | 133    | 21         | 5   | 0       | 26     |
| 06.20 - 06.30 | 143        | 6   | 131     | 280    | 36         | 3   | 0       | 39     |
| 06.30 - 06.40 | 226        | 5   | 273     | 504    | 127        | 9   | 1       | 137    |
| 06.40 - 06.50 | 516        | 14  | 468     | 998    | 82         | 9   | 0       | 91     |
| 06.50 - 07.00 | 619        | 16  | 448     | 1083   | 91         | 15  | 0       | 106    |
| 07.00 - 07.10 | 514        | 20  | 412     | 946    | 110        | 16  | 0       | 126    |
Table 3. Cont.

| Time   | In  | Out | In  | Out | In  | Out | In  | Out | In  | Out |
|--------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 07.10  | 225 | 17  | 236 | 478 | 70  | 16  | 1   | 87  |
| 07.20  | 141 | 18  | 115 | 274 | 48  | 13  | 0   | 61  |
| 07.30  | 100 | 10  | 91  | 201 | 41  | 13  | 0   | 54  |
| 07.40  | 72  | 9   | 95  | 176 | 55  | 9   | 0   | 64  |
| 07.50  | 54  | 4   | 66  | 124 | 41  | 21  | 0   | 62  |
| 08.00  | 57  | 5   | 57  | 119 | 92  | 9   | 2   | 103 |
| 08.10  | 55  | 9   | 56  | 120 | 84  | 13  | 0   | 97  |
| 08.20  | 60  | 7   | 65  | 132 | 77  | 7   | 0   | 84  |
| 08.30  | 104 | 13  | 67  | 184 | 133 | 13  | 0   | 146 |
| 08.40  | 161 | 11  | 52  | 224 | 142 | 10  | 0   | 152 |
| 08.50  | 62  | 7   | 62  | 131 | 111 | 5   | 1   | 117 |
| Total  | 3233| 181 | 2776| 6190| 1373| 191 | 5   | 1569|

Figure 3. Recapitulation of motorbikes in-out the park area in the morning session on Tuesday, 28 August 2019.

Figure 4. Recapitulation of cars in-out the park area in the morning session on Tuesday, 28 August 2019.
From the Study of the Situation Map Open land and part of the closed land (parking building), the area of land used for motorcycle parking is 7,480.44 m², while for cars it is 3,659.35 m² or all of 11,139.79 m², while the total area of Polinema Campus is 13.8 Ha or 130,800 m² means that almost 10% of the available land is used for parking needs.

4. Conclusion
The pattern of vehicle movement both in and out gives an overview of activity activities in Polinema which are more dominant in the morning with specific patterns giving a certain value. Meanwhile, during the day, it provides an overview of the activity transition, which value is lower than that in the morning when viewed by the number of vehicles entering or leaving. Collecting data using the field research method (Field Research Method) obtained by motorbikes the number of vehicles that entered was 5716 vehicles while those that left were 1373 vehicles. Accumulated parking is the difference between incoming and outgoing vehicles, the largest accumulated parking for motorbikes when viewed from the difference between incoming and outgoing vehicles during the observation that occurred in the morning of 4546 vehicles. Research on the area of parking was carried out by measuring the digital map (Digital Map Measurement Research Method), namely by measuring based on the measurement results from the digital map, while the measurement of the parking area was carried out directly in the field. The parking area for motorbikes is 7,480.44 m² with a parking area of 5,217.67 m² and a circulation area of 2,262.77 m² or 34% of the motorbike parking area. The total parking area is 11,140 m², if calculated with the land area of Malang State Polytechnic Campus 13.8 Ha (138,000 m²) then 8.07% is used for Parking area.

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