Analysing Motorcyclist Characteristics and Parking Behaviours towards Different Parking Schemes

Gusri Yaldi1*, Imelda M. Nur2, Apwiddhal1, B. Army1, Syaiful Amri1, Syaifullah Ali1, Wisafri1

1 Civil Engineering Department, Politeknik Negeri Padang
2 Administration Businesses Department, Politeknik Negeri Padang

*Corresponding Email

Abstract. Unlike developed countries, traffic characteristics in developing countries are dominated by passenger cars and also motorcycles. For example is Indonesia where more than 70% of transport mode share is contributed by motorcycles and a number of the riders are below age indicating poor law enforcement. This figure is suspected to worsen the transport negative impacts like road accidents as well as congestion level due to poor behaviour of motorcycle riders. Therefore, any efforts to reduce the trip number by mode of motorcycles on the road as well as improving their rider behaviours are necessary. For example is by managing motorcycle parking facilities like in this research. The results of this study suggest motorcycles were used as the primary transport mode for low income people mainly for studying and working. Further, motorcyclists tend to park for long time period with parking areas located about 50 meters from the activity centres. Off-street parking facilities are preferred than on-street parking. These findings are expected could be a considerable contribution for policy makers in minimizing the negative impacts of transport, in particular related to motorcycle usage.

1. Introduction

One of the emerging issues from transport sector in developing countries especially in Asia is the high number of road accident involving motorcycles like in Malaysia [1], Cambodia [2], Thailand [3] as well as in Indonesia [4]. According to World Health Organization (WHO), more than 1.2 million road users die annually due to road accidents. It resulted in a massive impact towards nation economic building where the estimated financial losses contributed by road accident could reach six per cent of GDP as reported by Gwilliam [5] in Ma et al. [6]. It also negatively impacts the health sector where road accidents are suspected as the main cause of death to the community within age of 15-29 years [7]. Number of death on road was reported beyond 90% occurred in low and mid income level countries, including Indonesia were the fatality rate is as double as developed countries. Particularly in Indonesia, more than 70% of road traffic accidents involved motorcycles [8] and the highest victims were at age range (15-24) years [9].

Road accident number in Indonesia has been showing an increasing trend since 2001 as illustrated by Figure 1. Based on its casualty, number of road users die on road is showing a more obvious increasing trend. In average, about 18% was killed while seriously and slightly injured were about...
21% and 61% respectively. The highest recorded accident number occurred in 2012 where nearly 30000 people die on road or in average more than 80 people die on road on the daily basis [10]. The latest data in 2016 suggest the pattern remain the same (see Figure 1).

Based on transport modes, the highest percentage belongs to motorcycles [7, 8]. Figure 2 suggests number of road accidents involving motorcycles is in average about 73% followed by car and truck with 15% and 9% consecutively. This tendency may be related to the motorization trend in Indonesia where all transport modes such as Motorcycle, Car, Bus and Truck are experiencing a growing number. Motorcycles contribute to the transport market share about 81% and remain the highest one. It is followed by cars and trucks about 11% and 6% each while buses are the smallest one with 2% [10].

In case of urban area and road space usage, private cars are often blamed for the congestion occurrence, fossil fuel crisis of as well as air pollution and hence many researches have been undertaken in order to determine the solution for example is by increasing transport supply facilities as well as controlling its demand [11]. Including in this strategy is managing parking supply as well as increasing public transport usages. However, it becomes unique in case of negative impacts from transport sector due to motorcycle usages. It requires much less road, consumes insignificant petrol and produces less pollutant than private cars. In term of transport cost, it is much cheaper compared to private cars.

These situations tend to increase trip number conducted by using motorcycles and hence seem to be unstoppable. In contrast, motorcycles were found to involve in majority of road accidents and suspects as the main cause once accidents occurred [12]. Therefore, major efforts must be devoted in managing motorcycle usages so that less trip number conducted by this transport mode. Consequently, number of
motorcycles on road could be minimized and number of traffic accident involving motorcycles could be gradually reduced. This research is aimed at analysing the behaviour of motorcycle users towards different virtual parking schemes and expected could help the transport authority in developing effective motorcycle parking schemes in order to reduce trip number undertaken by motorcycles.

2. Methodology

This research was conducted in Padang city, West Sumatra where the population of motorcycles contributed about 70% of total motor vehicles [13] and road accident number was dominated by motorcycles. The current practice of on-street parking for motorcycle is still poorly managed, and to certain extends it is illegally operated and causes disadvantages to both society and local government. Figure 3 illustrates the current practices of motorcycle parking in Padang city.

Figure 3. Existing motorcycle parking portraits in Padang city

Meanwhile, the behaviour of motorcyclists towards different virtual parking schemes was obtained by using SP survey. There were three virtual parking schemes were proposed to the motorcyclists as depicted by Figure 4. This scheme is the same one as used by Yaldi et al. [14] in studying the behaviour of private car users related to different parking facility options. The first scheme offers on-street parking with unlimited time parking duration and the parking cost is fixed. Parking area is equipped with clear parking signs as well as automatic parking meter machine.

The second scheme is also on-street parking with similar facilities; however it uses progressive parking cost with additional parking fee after the first hour. This scheme is also used parking inspectors. The last one is off-street parking scheme and the cost is progressive with better security facilities. More details can be seen in Figure 4.

The data was collected from the motorcyclist by means of home interview survey using Revealed Preference (RP) and Stated Preference (SP) survey forms. The respondents are limited to the motorcycle users only. RP was used in order to gather information regarding the road user socio-economic and socio-demographic data as well as daily trip characteristics such as age, occupation, education, monthly income, household size, motorcycle ownership, trip purpose, trip mode, parking location, parking duration, and parking cost.

Regular parking cost in Padang city varies based on parking locations, motor vehicles types, and peak & off-peak periods. For motorcycles, the minimum parking fee is Rp.2000 or about 0.13USD. However, the minimum motorcycle parking fee used in this research is Rp.3500 (0.23USD) since the existing parking fee for motorcycles is considered very cheap especially for on-street parking where the parking duration is unlimited.
3. Result and Discussion

Based on the RP data, the percentage of male and female respondent is about 54% and 46% respectively and hence it can be assumed that the data represent the relatively equal numbers of respondent based on gender. This is important since the motorcycle is not only used by men but also by women for different purposes. In addition, a number of motorcycles accidents involved female riders [15] and there are different behaviours in using motorcycles between male and female riders [16]. Figure 5 suggests that more than 90% of respondent ages are above 18 years old where the minimum age allowed to ride a motorcycle in Indonesia is 16 years [17]. Therefore, almost all of motorcyclists involved in this researched were assumed to have fulfilled the requirement to ride a motorcycle.
Furthermore, motorcycle usages were mainly for study and work trip purposes. The average monthly income was found nearly Rp.2 million or about 133USD (see Figure 6). This number suggests the motorcycles were used by mostly low income people [18]. Yet, about 13% of motorcycles were used by medium and high income respondents. It can be seen, although majority of motorcycles were used by poor people, it is still used by medium and rich people with likely different reasons. Based on these characteristics, it could be assumed that motorcycle users were mainly poor people with the main usage is for working and studying purposes. Hence, the related stakeholder needs to seriously address this information in minimizing trip number by mode of motorcycle. For example is by providing school or worker buses.

The average household size is 4 people and the motorcycle ownership is less than two for each household. It was found that there were two trips conducted by the respondent every day, and the frequency for parking also twice a day. More than 80% motorcyclists parked their motorcycles in off-street parking facilities with an average parking duration of nearly 100 minutes (see Figures 7 & 8, and Table 1). Nearly 70% of motorcyclists parked the vehicles longer than one hour and only about 11% motorcyclists parked for a maximum duration of 30 minutes. These data suggest that majority of motorcyclists parked for a long duration and one third of them parked longer than three hours.

Majority of motorcyclists paid more than Rp.2000 for each parking, and nearly 30% of motorcyclists parked their vehicle along unpaid parking areas. In average, each motorist spent nearly 11% of their monthly income just for parking or equals to Rp.213.000 (14.2USD) (see Tables 2 & 3). For rich people, this amount of spending may be insignificant. Yet, that amount is likely a considerable expense for those who live below poverty line. Thus, increasing parking cost could
prevent motorcycle usages; however it must be compensated by providing reliable and affordable public transports.

![Figure 8. Respondent number based on parking duration](image)

**Table 1.** Percentage of motorcyclist based on parking duration

| Parking duration (minutes) | % motorcyclist |
|---------------------------|----------------|
| 0-30                      | 11             |
| 30-60                     | 14             |
| 60-120                    | 33             |
| 120-180                   | 7              |
| >180                      | 35             |
| Total                     | 100            |

**Table 2.** Percentage of motorcyclist based on parking cost

| Parking cost (Rp.) | % motorcyclist |
|--------------------|----------------|
| 0                  | 29             |
| 1000               | 1              |
| 2000               | 59             |
| 3000               | 10             |
| >3000              | 1              |
| Total              | 100            |

**Table 3.** Percentage of motorcyclist based on parking cost-monthly income ratio

| Parking cost-monthly income ratio (%) | % motorcyclist |
|--------------------------------------|----------------|
| <10                                  | 88             |
| 10-20                                | 9              |
| 20-30                                | 3              |
| Total                                | 100            |

The motorcyclists usually parked within a distance of less than 50m from their final destinations as indicated by about 72% of respondent (see Figure 9). Further, off-street parking is preferred by the motorcyclist as confirmed by Figure 10. It can be assumed that motorcyclists prefer an off-street parking location very close to their destination. Based on this statistics, different parking fees could be promoted based on the distance of parking area to the activity centres.
Figure 9. Respondent number based on distance of parking location

Figure 10. Respondent percentages based on parking location preferences

Figure 11 depicts the behaviour of motorcyclist towards three virtual parking schemes based on parking location, cost, duration and security facilities as illustrated by Figure 1. It can be seen that scheme 1 is preferred by the motorists when the parking cost is not more than RP.3500. Once it is increased, the preference is shifted to scheme 3. It can be drawn that the motorist considers parking cost more important than the parking safety and convenience facilities provided in off-street parking scheme. However, it becomes more important than parking cost when the fee is increased.

Figure 11. Respondent choice for each parking schemes

Meanwhile, the Willingness to Pay (WTP) for each parking schemes is showed by Figure 12. The motorcyclist still tends to choose on-street parking with an average parking fee about Rp.4000 fixed for unlimited time. If the parking fee is increased, they tend to select off-street parking. Figure 12 also
depicts the Ability to Pay (ATP) of the motorcyclist for parking their vehicles. The ATP constantly decreases once the parking fee higher than Rp.2000. It is sharply decreased once it reaches more than Rp.3000. However, more than 72% of motorists has the same WTP and ATP value which is Rp.4000. About 50% of motorists have ATP up to Rp.5000, yet the WTP remains Rp.4000. It can be assumed that the motorist would be able to pay more for parking once the parking service is increased based on their preferences.

![Figure 12. WTP and ATP](image)

### 4. Conclusion

Findings from this research suggest that there is motorcycle dependency for people who live under poverty line. Motorcycles were mainly used for studying and working. Majority of motorcyclist parked for long time period closed to the activity centres. Since majority of motorcycle users are considered poor people, parking fee is considered more important than the parking service. However, the motorists tend to willingly select a better parking facility like off-street parking-in this case scheme 3 once the parking fee is increased up to double of existing parking cost. Based on the promoted parking schemes, the motorcyclists seem to have a higher ability in paying the parking fee than the parking tariff for each scheme. This could imply that the motorcyclist expects better parking facilities close to their final destinations. Yet, providing more parking facilities might trigger a higher trip number undertaken by motorcycles. Therefore, the relevant stakeholder is suggested to rigorously manage existing and future motorcycle parking facilities; for an example is by providing parking area where its distance is above the motorist preference. For parking fee, it should beyond their affordability. In the meantime, school and working bus policies could be promoted as well as strong law enforcement.

### 5. Acknowledgment

The authors would like to say thank to Ministry of Research, Technology and Higher Education as well as Politeknik Negeri Padang for supporting this research financially. A great appreciation is devoted for the reviewer whose comments and suggestions are valuable in improving the quality of this paper.

### References

[1] M. G. Masuria, et al., "Children, Youth and Road Environment: Road Traffic Accident," in Asia Pacific International Conference on Environment-Behaviour Studies, Sarawak, Malaysia, 2010.

[2] S. A. Sarm and K. Kanitpong, "Analysis of Factors Affecting the Severity of Motorcycles Casualties in Phnom Penh Using a Bayesian Approach " Asian Transport Studies, vol. 4, pp. 430-443, 2016.

[3] S. Baral and K. Kanitpong, "Factors Affecting the Severity of Motorcycles Accidents and Casualties in Thailand by Using Probit and Logit Model," Journal of the Eastern Asia Society for Transportation Studies, vol. 11, pp. 2175-2188, 2015.
[4] G. Sugiyanto, "The Effect of Congestion Pricing Scheme on the Generalized Cost and Speed of a Motorcycle," Walailak Journal, vol. 15, pp. 95-106, 2017.

[5] K. Gwilliam, "Cities on the Move: A World Bank Urban Transport Strategy Review," World Bank, Washington, DC2002.

[6] H. Ma, et al., "Motorization Process and Management in Big Cities in China," IATSS Research, vol. 31, pp. 42-47, 2007.

[7] WHO, "Global Status Report on Road Safety 2015," 2015.

[8] Kemenhub. (2012, 6 Juli). 72 Per cent road accident involving motorcycle (in Bahasa). Available: http://www.dephub.go.id/read/berita/direktorat-jenderal-perhubungan-darat/13119

[9] K. Polri. (2013, September 6). Road traffic accident data. Available: http://www.korlantas-irsms.info/graph/ageInjuryData

[10] BPS, "Road transport Statistics," Indonesia Statistics2017.

[11] W. Yan-ling, et al., "Current Situation and Analysis of Parking Problem in Beijing," Procedia Engineering pp. 777 – 785, 29 September – 1 October 2004 2016.

[12] M. G. Masuri, et al., "Public Participation in Shaping Better Road Users in Malaysia," in Asia Pacific International Conference on Environment-Behaviour Studies Berlin, 2014.

[13] BPS, "Padang city census report 2016," ed. Padang: Statistics Padang, 2018.

[14] G. Yalidi, et al., "Defining Suitable Parking Controls to Minimize Negative Impacts of Road Traffic: A Case Study in Padang City," International Journal on Advanced Science, Engineering and Information Technology, vol. 6, pp. 600-606, 2016.

[15] M. M. A. Manan and A. Várheley, "Motorcycle fatalities in Malaysia," International Association of Traffic and Safety Sciences, vol. 36, pp. 30-39, 2012.

[16] Fitroh, et al., "Analysis of Motorcyclists Driving Behavior in Bandung City," Journal of Eastern Asia Society for Transportation Studies, vol. 11, 2015.

[17] Menhumkam, "UU Lalulintas dan Angkutan Jalan," vol. 22 Th 2009, S. RI, Ed., ed. Jakarta: Setneg RI, 2009.

[18] BPS. (2018). National poverty line. Available: https://www.bps.go.id/pencarian.html?keywordforsearching=garis+kemiskinan&yt1=Cari