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Research Report

Exploring Moped Use in Malaysia



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MALAYSIAN INSTITUTE OF ROAD SAFETY RESEARCH

ASEAN ROAD SAFETY CENTRE

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Abstract

The use of low engine capacity or low-speed two-wheelers, known as mopeds (primarily in Europe) is relatively very quiet and does not catch much attention from other road users. Its undefined status in road transport regulations makes its presence somewhat unofficial, or a grey area. Correspondingly, records of crashes are not available for detail scrutiny. The design of moped as a single-track vehicle, like motorcycle, exposed them to comparable crash risks, except its speed range is lower. Mopeds fill the void between motorcycle and the electric bicycle categories, where it occupies the vehicle speed category of >25 km/h to 50 km/h. A recent survey at selected areas in Klang Valley, Ayer Keroh, Melaka and Serdang, Kedah provided some valuable information on existing moped specifications and its user's characteristics. Comparing to existing vehicle standards, the mopeds displayed strong resemblance to the electric bicycle (e-bike) such as having cycle pedals and cycle body frames. Almost all were equipped with throttle/accelerator device in the handle bar. Users of moped were primarily in the higher age group and for short-distance travel and none used safety helmets. Their travel and movement in traffic are very much like bicycles and they have been providing important mobility to a certain group of the population, as early as the 1990s. Findings from this study could be useful for future government policy direction considering that the safety record of two-wheeler users is not very encouraging, and has been unfavourable, for decades now. Nevertheless, the all-electric drives moped could be one of the good options for low carbon emission initiative.

1. Introduction

The demand for and supply of low engine capacity motorcycles, or known as moped has long been talked about in Malaysia. However, to date, there is yet a solid policy regarding its utilization on public roads. Recently in the early quarter of 2018, the Road Transport Department has had a request for moped type approval from manufacturers and importers. This warranted the urgent need for a feasibility study.

The moped subject was briefly discussed back in 2009 when the issue of electric bicycle was hotly debated; whether it needed to be regulated or otherwise. In the end, the electric bicycle was clearly defined in the rules and treated just like a conventional bicycle (e.g. no license and helmet requirements). The moped subject was, therefore, left unattended and undefined. However, a recent market intelligence estimated that roughly there are more than 60,000 units of moped in operation throughout the country (concentrated especially in industrial areas such as in Jawi, Pulau Pinang) and this was worth checking.

By specification and vehicle construction rules, a motorcycle (conventional, hybrid or electric) has a minimum speed requirement of >50 km/h while an electric bicycle falls under the ≤ 25 km/h category (motor assisted speed). Such a ruling leaves a void in the >25 km/h to 50 km/h speed class, which matched nicely with moped speed profile of a maximum 50 km/h. So, from that perspective, the inclusion of moped into the rules would complete the speed range classification. However, considering the scenario Malaysia has been experiencing with the 2-wheel vehicle, particularly motorcycle fatalities and injuries, great care has to be exercised prior to making any decision with respect to expanding the 2-wheeler category to include moped. This is primarily to prevent unnecessary road safety burden to the nation. One distinct advantage of moped is that almost all models are equipped with electric drives, which make them relatively a clean zero-emission vehicle. This potentially augurs well with the government green initiative.

1.1 Scope and Objectives of the Study

1.1.1 Scope of Studies

This study covers the moped vehicle and moped users only and attempts to establish fundamental understanding of its operation on the road. The study could provide some insights for future government policy regarding its use.

1.1.2 General Objectives

The general objective of the study is:

- i. To establish baseline information of moped use in Malaysia

1.1.3 Specific Objectives

The specific objectives of the study include:

- i. To review international practices of allowing moped on the road
- ii. To examine moped specifications and usage pattern in Malaysia
- iii. To examine moped user characteristics in Malaysia

1.2 Limitation of the Study

This study was primarily conducted in the Klang Valley area, especially in Kajang, Kepong and nearby localities, constrained by the budget and the market information on moped presence. Survey sites which were able to provide a good population of moped/e-bike and economically accessible by the team members (close to place of residence & work) were given preference. Nevertheless, responding to trustable information, the team was able to explore moped use in Serdang, Kedah and Nibong Tebal, Pulau Pinang.

2. Literature Review

A review of international practice especially on moped use requirements (e.g. age, license, safety device, etc.), road access, moped specifications and standards was briefly carried out using web-based information. Articles describing and elaborating moped crash risks and crash patterns were also gathered for insight.

For a brief overview of moped-related crashes and injury risks, a look at other countries which allow moped operation reveals unwelcoming findings, as shown below;

Table 1 Moped crash risks

Country	Findings	Authors, Year
Florida, US	Moped speed >32 km/h doubled the injury severity.	Miggins et al., 2011
Queensland, AU	Crash rates for moped were 4 times higher than motorcycle for a similar travel distance.	Blackman and Haworth, 2013
Denmark	Moped user injury risks were 10 to 20 more likely than car occupants, riding behavior is a key accident factor.	Møller and Haustein, 2016
France	Moped passengers have higher risks of severe injuries.	Moskal, Martin, and Laumon, 2012
Denmark	Moped 30 km/h has higher risks of serious injury when compared to 45 km/h.	Moller, Hyldekær, and Furlanetto, 2018

For moped user requirements (vehicle specifications (speed), license, safety device), the list below in Table 2 briefly describes the general rules of each country. Most western countries provide clear rules with regard to riding age, license and helmet requirement, but very limited information is available for the listed ASEAN countries, although they are among the countries with high motorcycle registration.

Table 2 Moped speed regulation and riding requirements [Wikipedia]

Country	Max. speed (km/h)	Minimum rider age (Years)	License requirements	Helmet requirement
Australia	50	N/A	Yes	Yes
Japan	30	16	Yes	Yes
Germany	25	15	No, no passenger	No
	45, no highways	16	Yes	Yes
Denmark	30	15	Yes	N/A
	45	18	Yes	N/A
Spain	45 km/h	15	Yes, no passenger	Yes
United Kingdom	45 km/h, no motorway	16	Yes	Yes
Indonesia	N/A	17	N/A	N/A
Thailand	N/A	N/A	N/A	N/A
Vietnam	N/A	N/A	N/A	N/A

In short, there are variances in requirements in these countries with respect to implementing moped rules, and they may implicate the road safety outcomes. Therefore, for Malaysia to consider regulating moped use, a baseline study is rightfully necessary before any decision could be reached. Information such as moped specifications, user characteristics, usage pattern are among the factors to be explored. Issues of license, safety devices, lane use and benefits of allowing moped may be worth noting as well. The minimum riding age shall be addressed too.

3. Methodology

The term “moped” is presumably uncommon in Malaysia and is not available in any transport documents such as the Road Transport Act and Rules. It is undefined and unregistered in Malaysia, thus to seek out for them operating on the road was very challenging, if not impossible. A moped physical characteristics bear a close resemblance to an electric bicycle (e-bike), such as having two-wheels and a lean body configuration. Therefore, to increase the likelihood of capturing moped data, the study includes electric bicycle users as part of the potential respondents.

In general, the study employed two approaches for moped data collection. First, face to face interview and the other was through the use of internet-based form. The observation sites were constrained to those areas able to provide sizeable population of moped/e-bike, accessible to the research team at low cost (close to researchers place of residence).

3.1 Market Surveillance

The moped is normally available in bicycle shops and less likely in motorcycle shops. The team was able to locate a few bicycle shops that sell moped and electric bicycles (Figure 1). For site observation and surveys for moped, the team considered the following strategies in order to get favourable return:

- Common time for survey: early morning/afternoon (peak commuting time)
- Location: School vicinity, market, industrial area, residential area
- Home visits for interviews after users were spotted on roads
- Some information was received through referrals of moped users

A brief check on the internet also revealed numerous websites offering moped and electric bicycle. The price ranged from RM1200 to RM3500 per unit and the vehicle

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models being offered were very diverse. All models were manufactured in China and all were equipped with electric drives.

The figure displays six distinct models of electric bicycles and mopeds, each with its own advertisement. Each ad includes a main image, a smaller side view, a price tag, and a list of technical specifications. The models are: BIKE-SUPER/MN, BIKE-GOLD, BIKE-SUPER5, BIKE-2448, BIKE-WHE/TU01, and BIKE-3WHEEL.

Model	Price (RM)	Battery	Charge Time	Max Distance	Brakes	Weight	Rims	Frame
BIKE-SUPER/MN	2,280	48V 10AH Lithium	4-6hrs	30km	Front & Rear Hub Brake	33KG	14 Inches	Steel
BIKE-GOLD	2,380	48V 10AH Lithium	4-6hrs	30 km	Front & Rear Hub Brake	32KG	14 Inches	Steel
BIKE-SUPER5	2,380	48V 10AH Lithium	4 - 6 hrs	30 km	Front & Rear Hub Brake	33KG	14 Inches	Steel
BIKE-2448	2,380	48V 10AH Hidden Lithium Battery	4-6hrs	30 km	Front & Rear Hub Brake	30KG	24 Inches	Steel
BIKE-WHE/TU01	3,500	24V 12AH Lead Acid	4-6hrs	10-12 km	-	34KG (Battery Excluded)	22"	Steel
BIKE-3WHEEL	2,580	30V 10AH Lithium	4-6hrs	30 km	Front & Rear Hub Brake	26KG	20 Inches	Steel

Figure 1 Sales advertisement of moped/electric bicycle

The sites for moped observation and interviews were decided based on the information gathered from market intelligence. For instance, clues from communication with the authorities and work and personal networks. Among the identified areas with reported presence of moped included: 1. Serdang, Kedah; 2. Jawi, Penang 3. Kajang and Kuala Lumpur suburbs.

In addition, a brief market study was performed to examine moped specifications, standards and product quality being offered to would-be-buyers. A comparison to the established Malaysia Standards, MS 2688:2018 – Electric moped specification, would be done to gauge any gap. Roadside observation would be implemented to examine moped users conduct on the road (traffic behaviors, lane use, use of safety device, etc.). A questionnaire survey would be deployed to identify moped users to obtain information on user characteristics and their usage pattern (time and reason of use, route selection, etc.).



Figure 2 Interview session

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For analysis, descriptive statistics were employed to analyse moped technicalities and the users conduct on the road and to explain users demographic and usage patterns.

4. Results

4.1 Demography of Respondents

A total of 104 respondents were interviewed and another 20 responded to an online survey using Google Forms. 11 online respondent data were discarded due to incompleteness. The breakdown by survey sites is shown in Table 3. Most of the respondents (52%) were located within Klang Valley such as Kajang, Selangor and Kepong, Kuala Lumpur. 15 respondents claimed they were foreigners. Gender wise, male users were slightly higher than female by 10%.

Table 3 Survey locations and respondents (N=126)

Survey site	No. of respondents	Nationality		Gender	
		Malaysia	Foreign	Male	Female
Gombak	5	5	0	2	3
Kajang	26 (2)	25	3	18	10
Sg. Long	22	18	4	20	2
Petaling Jaya	(4)	4	0	3	1
Ayer Keroh	2	2	0	1	1
Jinjang	11 (7)	15	3	6	12
Kepong	24 (7)	27	4	16	15
Serdang, Kedah	14	13	1	2	12
Shah Alam	1	1	0	0	1
Kelang	1	1	0	1	0
Total	126	111 (89%)	15 (12%)	69 (55%)	57 (45%)

Note: () indicates online respondent

4.2 Users Characteristics

The user characteristics are reflected in Table 4. The mean age for moped users was 38.8 years, possibly indicating higher age group users and may be less attractive to younger age class. As moped riding did not require a driving license, or rather it was unprescribed, a substantial number of users (44%) did not possess any kind of driving license. Yet, the respondents on average had around 10 years of motorcycle riding experience. Moped riding experience registered an average of 3.7 years with the most seasoned user had ridden moped for 15 years.

Table 4 Moped users' characteristics

Variables	Details
Age	Mean 38.8 years-old [Range 12 – 72]
License owned	27% Motorcycle; 17.5% Motorcycle & car; 11.1% Car; 44.4% No License
Motorcycle riding experience	Mean 10.3 years, [Range 0 – 40]

About two-thirds of the respondents belonged to an income group of <RM3000, as illustrated in Figure 2 below. The next group (RM3000 – RM6000) occupied the second spot with 14% and was followed by the >RM6000 income group at 11%. The no income group, primarily related to retirees accounted for 8%.

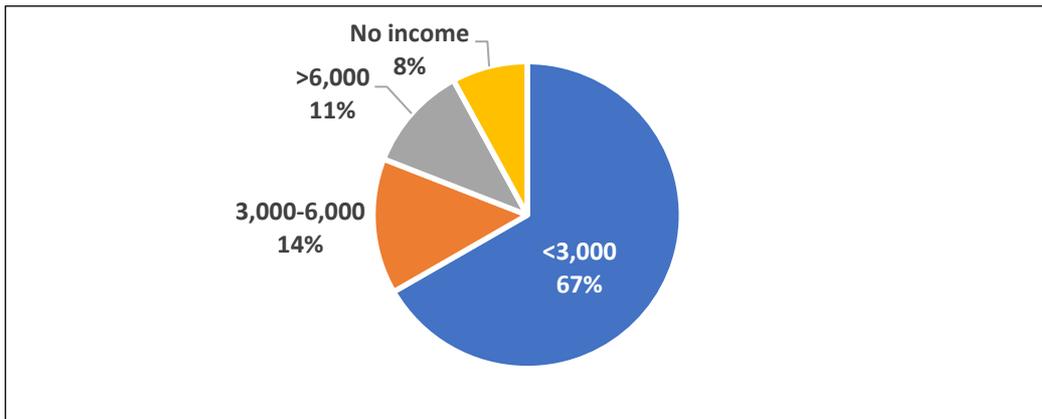


Figure 3 Income distribution of moped users

For education background, college graduates and secondary school leavers made up two-thirds of the respondents. Those with only primary education accounted for 14% and other background was 18%.

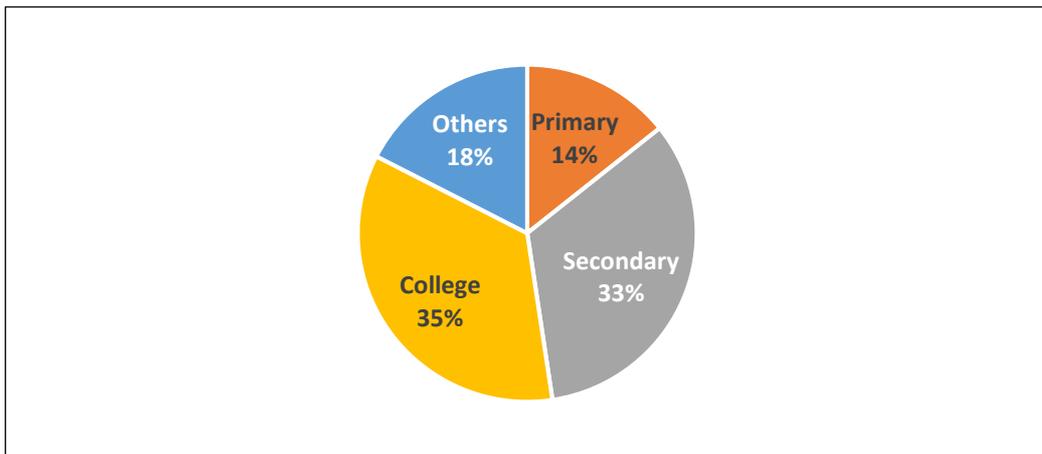


Figure 4 Education background

With respect to employment sectors, those who were attached to private companies made up the biggest group with 67% (Figure 4) with civil servants at 16%. It was surprising that unemployed group was only 14%, which was lower than expected. The

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survey also managed to attract respondents who were school going children or their parents (3%) who used moped to commute to school.

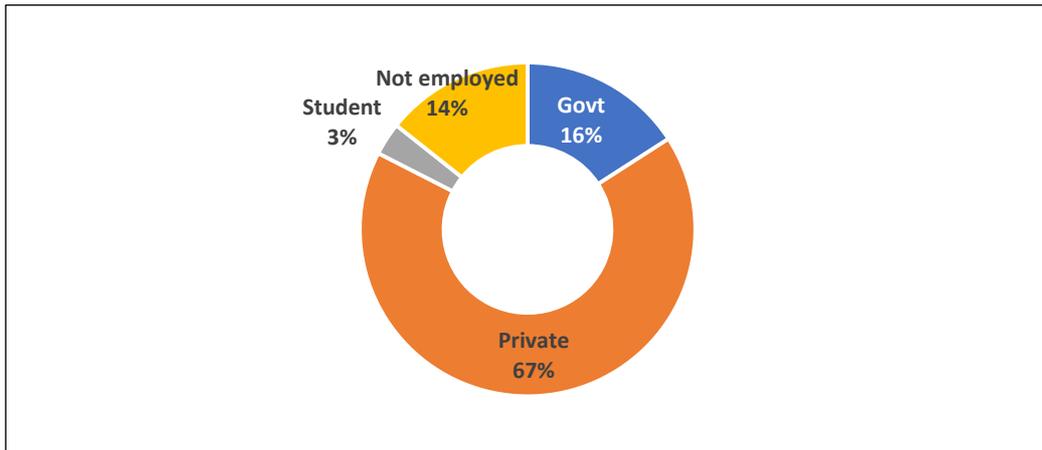


Figure 5 Employment sector

Looking at transport type use, half of the respondents utilized cars as their main transport vehicle (49%), followed by motorcycle (33%) and bicycle/electric bicycle (11%). This was significant as the high car ownership implied that many of these moped trips were displacing travel by car; therefore, greatly reducing environmental impact.

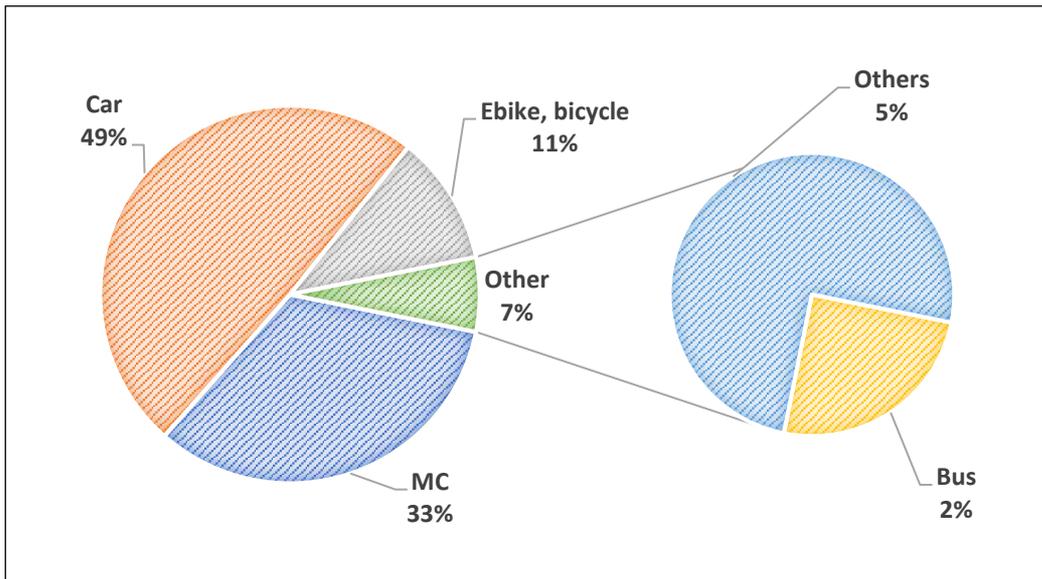


Figure 6 Main transport used by respondents

4.3 Moped Ownerships and Specifications

Figure 6 shows the moped year of ownership in which 1 – 3 years class had the highest frequency and was followed by >6 years class. Surprisingly, few mopeds had been in operation for more than 10 years, with the longest ownership recorded at 23 years. That indicates that moped use in the country has been around for decades, although, at relatively low volume. Around 48 users could not recall their purchase date.

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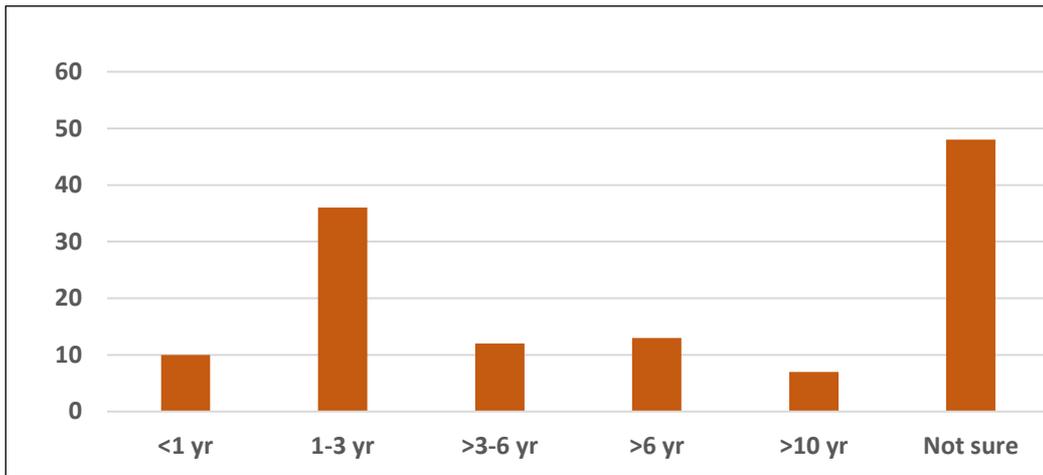


Figure 7 Moped ownerships (N=78)

All mopeds surveyed had electric drives and a large majority of them were purchased from bicycle or motorcycle dealers (97%) and only 3% were purchased either through online order or rental basis (Figure 7). The average purchased price was RM1659, from a range between RM700 and RM3200.

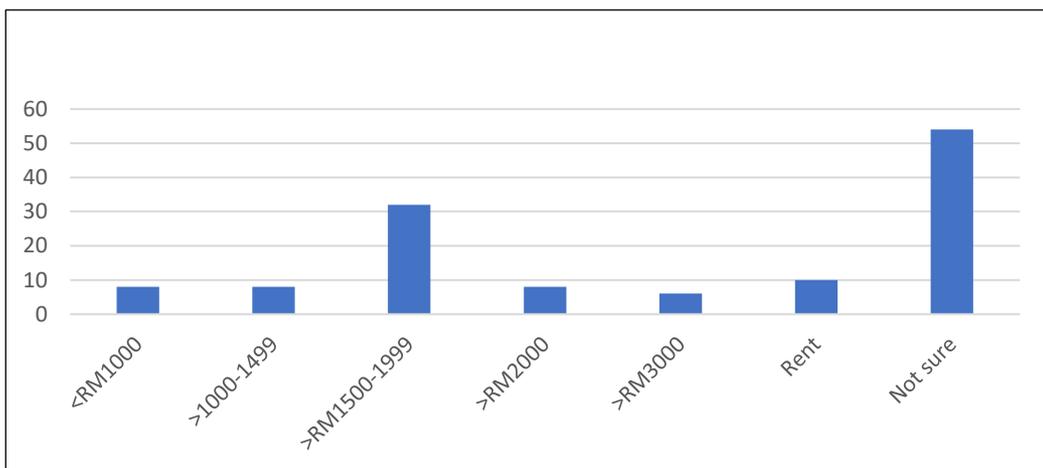


Figure 8 Moped purchase price (N=78)

Since all mopeds were equipped with electric drives, travel range was an important aspect (Table 5). At full charge, the average maximum travel distance was 33.6 km with a range of 12 to 60 km and a reported average travel speed of 27 km/h. The reported average maximum travel speed was 40 km/h with a range of 20 to 70 km/h. Both speed ranges were relatively low to allow them to mix with other transport modes such as motorcycles and cars.

Next, two interesting features of the surveyed mopeds were the presence of cycle pedal (61.9%) and an overwhelming majority (95.2%) of accelerator/throttle device to allow hand/finger operation for acceleration. The former was a standard feature for electric bicycle while the latter was a basic feature of a moped and motorcycle.

Table 5 Moped specifications (N=126)

Variable	Mean, [Range]
Max. distance at full charge (km)	33.6, [12 – 60]
Average travel speed (km/h)	27, [12 – 60]
Average max. moped speed	40, [20 – 70]
Cycle pedal availability	YES 61.9%, NO 38.1%
Throttle/Accelerator availability	YES 95.2%, NO 4.8%

4.4 Moped Usage Pattern

The moped use pattern is displayed in Table 6 below. On average, moped users had been riding moped for 3.7 years with a range between 0 to 15 years. They rode moped for 5.3 times per week with an average weekly travel distance of 29.1 km. With regard to the type of roads, more than half of the respondents rode their moped just around their place of residence and about 17.5% rode to towns. Shockingly, 3.2% claimed they used moped on highways, which was dangerous, given their low-speed relative to the speeds of other motor vehicles. With regard to safety helmet use, more than two-thirds were willing to wear helmet should it become mandatory.

Table 6 Moped use frequency

Variable	Mean, Range
Moped riding experience	3.7 years, [0 – 15]
Use frequency (Week)	5.3 times, [1 – 7]
Travel distance (Weekly, km)	29.1 km, [1 – 100]
Road commonly used by moped	61.9% Residential roads 17.5% Town roads 3.2% Highways 17.5% Not sure
Willingness to use safety helmet if enforced	YES 79.4%, NO 3.6% Not sure 14.3%

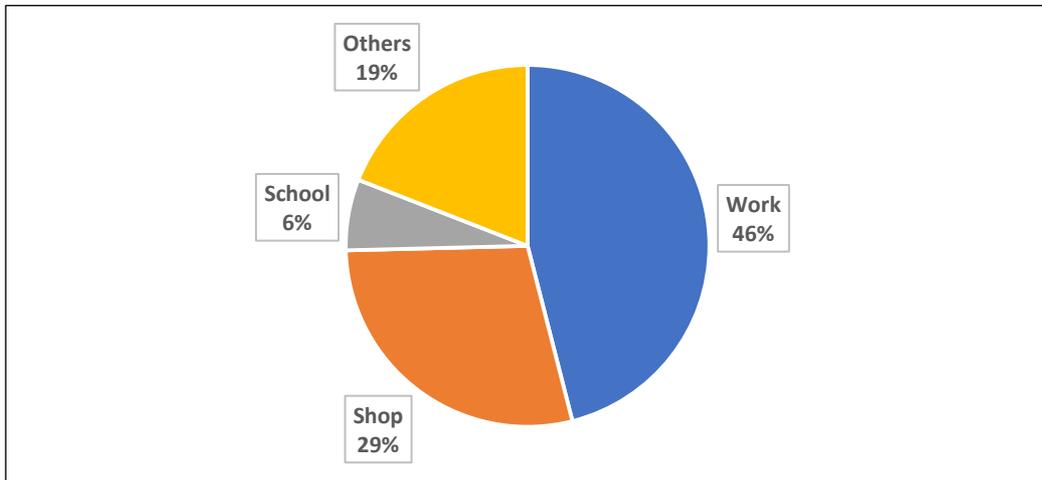


Figure 9 Moped use purpose

Almost half of the respondents rode moped to their workplace (46%) and 29% used them to run errands. The remaining respondents utilized moped to go to school and for other purposes.

4.5 Moped Accidents

Traffic crashes involving either moped or electric bicycles were not available in the police statistics, possibly they were integrated with either bicycle or motorcycle classification (Hamzah et al., 2016). In this study, there were 6 accident cases reported by the respondents with the main configuration being single vehicle accidents in 5 cases. A total of 2 cases occurred on a straight road section while 3 were at junctions. A more serious accident involved a moped rear-ending a car at a junction. In all cases, no injury was reported. Perhaps this was related to the fact that all the collisions more likely occurred at low speed. A simple calculation yielded a moped crash rate of 4.8% (simply 6/126). The police records showed that motorcycle rate of accident was 0.8% (108,221 accident cases reported over 12,897,496 registered motorcycle) (PDRM,2017).

Table 7 Accident involvement (N=6)

Configuration	Road section	Injury
Single vehicle accident, n=5	Straight 2	Nil
	Junction 3	Nil
Rear ended car, n=1	Junction 1	Nil

Given the relatively low mileage of the moped, this indicated an even higher rate of accident per kilometre travelled. However, the comparison between reported motorcycle accidents and moped survey accident number was not strictly comparable, as many motorcycle accidents go unreported.

5. Discussion

Moped use is yet to be authorized in Malaysia. Thus, the information on them is rather challenging to acquire. The details on sales volume and availability in the market are very limited. Correspondingly, to locate and spot them, and to get the users to take part in the interview was not an easy task and was resource-intensive and time-consuming.

The study was able to gather 126 respondents after many months of intelligence and identifying the potentially promising spots. The online or web-based response was not very encouraging, possibly due to the points iterated in the earlier paragraph on legality. Nevertheless, 20 people (17%) who responded were able to provide a useful insight into the study and further enrich the live interview data.

The distribution of moped users was widespread, for they were present in many places including a few locations in the Klang Valley zones such as Jinjang and Kepong in northern Kuala Lumpur and Kajang, located to the southeastern part of Kuala Lumpur. These locations including Sg. Long, Selangor and Serdang, Kedah reflected a higher volume of moped. Gender-wise, male and female users did not show any significant difference (10%). Interestingly, there were 12% of foreigners noted to use moped in their daily commute. Among the reasons given were lack of requirements for driving license and helmet.

On average, moped users belonged to a higher age group (38.8 years) and had a very wide age range from 12 – 72 years old. In a way, such a diverse group may indicate the versatility of moped to facilitate travel of the population. The undefined or unestablished legal aspect with regard to its operation could be a determining factor for its use. The unlicensed ridership of 44.4% further supported this statement. Other countries such as Japan, the United Kingdom and others have introduced specified minimum age to operating moped.

Records indicated that mopeds have been around more than 10 years in the country, a very conservative statement to begin with. The longest showed a record of 23 years of use, reflecting that it had already been in service since the late 1990s.

Specification of the mopeds showed that by speed class, all of them were capable of exceeding 25 km/h (electric bicycle assisted speed). Therefore, to categorize them as e-bike may not be acceptable. Furthermore, all were equipped with the throttle or accelerator device, making them much more motorcycle-like. The presence of cycle pedal (61.9%) was the only visual clue to differentiate between the moped and the motorcycle. Compliance to Malaysian Standards MS2688:2018 would be a practical means to verify their class.

The moped is being ridden regularly by the respondents, with 5.3 times use per week, covering an average distance of around 29km per week. More than half of the users (61.9%) claimed to travel in residential areas. These figures showed that their use was mainly for local and short distance travels through 46% use the moped to get to their workplace. This seems a practical effort. Unpredictably, there were users who admitted to travelling on highways (3.2%) which was considered significantly dangerous. Having a maximum speed of only 50 km/h would create a big speed difference with other motor vehicles and make the moped susceptible to collisions and severe injuries. Significantly, almost half (49%) of the moped users also travelled by car, indicating that moped use was reducing their dependency on cars, and subsequently reducing fuel consumption and emissions.

International literatures have disclosed adverse effect facing moped users. Their crash and injury risks are high even though moped are typically known for low speed. Karepov et al. (2019) highlighted the injury severity experienced by young teens who rode e-bike and were involved in accident (average age 11.3 ± 4.85 years-old, range of 1.5 to 17), with 17 of 20 of them suffering skull fractures and none wore safety helmet. Similar to the motorcycle, riding behaviour on the road and skills play a crucial role in ensuring a safe ride. With respect to road accident in this study, the 6 reported crashes did not produce any injuries to the users, thus, potentially pointing to a low-speed collision. The overwhelming cases of single vehicle involvement point to vehicle control issue, which was less likely a speed matter.

6. Conclusion

This study was able to provide useful insight into moped and its operation. Though the moped is neither defined nor registered officially, the data collected was able to provide good information on its availability and the users' characteristics. mopeds have been around for more than 20 years but their existence may not have caught attention. Nevertheless, they have provided good mobility for a certain group of users. Therefore, efforts to ensure a good ecosystem for moped should be considered.

7. Recommendations

Reflecting on the information gathered in this study with regard to moped and its use, the following suggestions are put forward;

- i. mopeds have been in service for a group of users, as early as the 1990s, though they were unregistered and undocumented by the authorities. Given that they are continually being utilized for mobility, consideration should be given to define mopeds in relevant road transport documents and to regulate their use. By regulating them, the whole supply chain including sales, operation, quality and safety can be appropriately monitored and controlled. Additionally, vehicle and user licensing and safety helmet use should be addressed as well.
- ii. Since Malaysian Standard MS2688:2018 for moped has been established, it would be timely for the authorities to begin considering adopting the standard for regulation. This is to ensure good quality and safe moped are manufactured and sold, and that consumers will get quality assurance. Furthermore, it could also be utilized as a reference for authorities at point of entry into the country (for imported products).
- iii. By design, moped travels less than 50 km/h. This study indicated an average moped travelling speed of 27 km/h, just slightly higher than the electric bicycle classification travel speed of 25 km/h (motor-assisted speed). So, speed-wise, both are comparable. However, since mopeds are motor-driven (unlike bicycle which requires pedalling effort), their road access should be restricted to ensure their safety. For instance, mopeds should not be allowed on highways and expressways. Furthermore, electric mopeds have limited range on a fully charged battery (maximum 60 km in this study). Notably, law enforcement strategies should be developed as well.
- iv. All mopeds associated with this study were fully electric, which means they can be categorized as a zero-emission vehicle. Their use explicitly supports the government's effort in reducing carbon footprint in the country, more so as they

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replace the fossil fuel engine vehicles. Therefore, electric moped use should be encouraged.

- v. When dealing with electric vehicles, the power supply device (battery) is an important matter to be dealt with. Battery recycle and disposal policies and regulations may be worth looking into, as early as possible in the supply chain.
- vi. The police effort in collecting in-depth road crashes data is highly applauded and appreciated. For enhancement, the moped and electric bicycle crash records could be clearly separated and uniquely identified.

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Research Report

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