



This document will explain road users' perspectives and concerns on current motorcycle usage and future electric two wheelers uptake

Road Map and Timetable of Two-Wheeler Electrification in Greater Jakarta

Road Users' Perspectives and Concerns

31/12/2021

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1. Introduction

In 2019, the number of registered motorcycles in the capital city region of Jakarta is well above 15 million with the latest annual growth rate between 2018 and 2019 being around 5.3% (BPS-Statistics of DKI Jakarta Province, 2020). Unfortunately, this high number and potential growth are accompanied by issues related to safety, environmental, economic, and traffic violation (Lubis, 2009). This argument is supported by the increasing number of traffic accidents, traffic violations, and the motorcycle contribution to the air pollution from exhaust emissions.

Nearly 73% of traffic accidents on the road involve motorcycles, where the majority of traffic accident perpetrators are people between 22-29 years old and the majority of victims are people between 25-39 years old (Korlantas Polri, 2019). Another study from Queenrides as cited in Setyowati (2018) shows that accidents involving women are more common than men, with a ratio of 5:2. Furthermore, the same study stated that this ratio could continue to rise due to an increase in the number of motorcycle traffic accidents involving women in 2018 by 49.5%. Other than that, motorcycles with a 39% mode share in Jakarta, have contributed to 55% CO, 75% HC, and 9% CO₂ emission that decreasing the air quality (Syafrizal et al., 2014). In the economic and energy aspect, it is predicted that the energy demand from gasoline will increase from 95 MBOE in 2020 to 140 MBOE in 2050 as the number of motorcycles grows from 131 million to 295 million (IESR, 2020). Moreover, Indonesia relied on its gasoline demand by importing from other countries (Ministry of Energy and Mineral Resources, 2020). Therefore, this condition will jeopardize the future of national energy security and the economy, which Jakarta itself contributed due to its number of registered motorcycles which is up to 14.8% in 2020, of the total registered motorcycles nationally (BPS-Statistics Indonesia, 2021).

Nowadays, Indonesia is focusing its research and development on vehicle electrification by listing it as the national research priority, especially for motorcycles (Nanda and Ferdian, 2021). This shifting can be a solution to address the environmental issues to achieve zero emissions. It also can reduce fuel consumption (Umah, 2021). In the economic aspect, electric motorcycles also have lower operating costs and better fuel efficiency (Huang et al., 2018). However, apart from these advantages, the characteristics of electric motorcycles which have almost the same size and speed as conventional motorcycles will also pose the same safety and driver behaviour challenges. Other than that, the electric motorcycle produces a very low sound, so that other road users will find it difficult to identify its presence. This would make electric motorcycles perceived to be riskier from certain road users' perspectives.

Although the electrification of two-wheelers would not address any existing safety-related issues of two-wheelers usage, it can be designed so that the same safety-related issues concerning conventional motorcycle usage would not be repeated by the uptake of electric 2W in the future as a result of the motorcycle electrification program. Therefore, this report is conducted in order to identify possible causes of road safety issues related to current motorcycle usage and to assess concerns on future electric 2W uptakes from the perspectives of current road users, which should

include inputs from vulnerable groups such as elderly, children, and persons with disability (PwD). This report would also identify their expected mitigation measures to avoid any safety issues surrounding electric 2W uptakes in the future.

2. Road Users' Perspectives and Concerns

As mentioned before, understanding the perspectives and concerns of the road users is very important to identify the root causes and mitigate the issues related to current 2W usage from happening towards electric 2W usage in the future. Road users' perception regarding safety, security, and comfortability of current modes, in particular conventional 2W, would be necessary to be captured. Factors influencing currently used modes to have a certain level of safety, security, and comfortability would also be needed to complement the report. Other information regarding perspectives and concerns about motorcycle electrification, as well as proposed solutions to overcome motorcycle issues and electrification barriers from road users' points of view would also need to be collected and analysed.

2.1. Methodology

The general framework of this study is to identify the data requirements, followed by collecting, compiling, and analysing those data, finished by incorporating findings into the report. Inputs from women, PwD, elderly, children, and other marginalized communities should be clearly identified, thus the data gathered will be disaggregated by sex, disability, age, and income level, among others. The process to obtain and analyse the perception data is as follows:

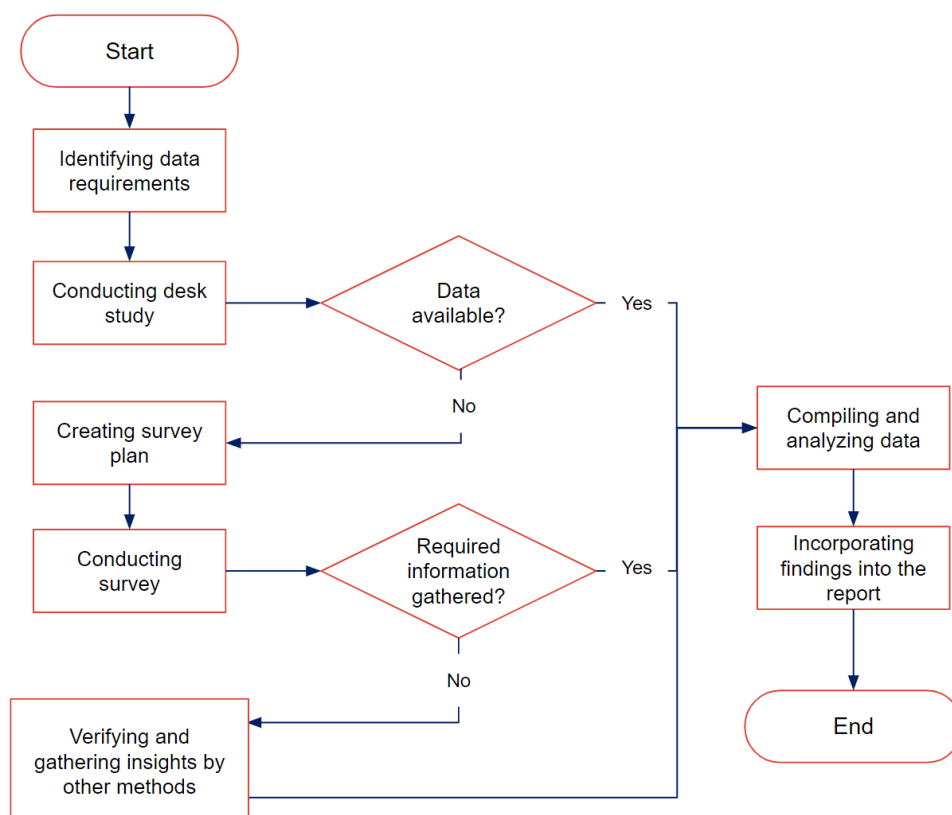


Figure 1 Methodology Diagram

1. **Identifying data requirements:** This stage aims to determine what data is needed for the process of analysing road user issues. The required data include demographic data, travel patterns data, assessment of road conditions, concerns on current motorcycle usage, concerns on future electric 2W usage, concerns on charging infrastructures, traffic accident experiences, and prevention efforts in the context of improving safety, security, and comfortability of Greater Jakarta traffic.
2. **Conducting desk study:** After identifying each data needed to compose this report, an initial desk study was conducted to see whether the aforementioned data are already available on public sources. Data that was already available would be directly compiled and analysed. On the other hand, data that were not available from public sources would be captured through field surveys.
3. **Creating a survey plan:** Survey plan was created to capture all data needed in this report that were not available yet on public sources. This activity includes determining survey objectives, number of samples, survey locations, survey questionnaire, etc.
4. **Conducting the survey:** A survey in accordance with the survey plan was conducted to capture all the information needed. The survey was done by interviewing various road users, such as pedestrians, cyclists, motorcyclists, car users, and road-based public transport users, to possibly capture all available perspectives.
5. **Verifying and gathering inputs by other methods:** This activity would be conducted towards any group of road users that were not sufficiently represented from the field survey. Initial findings from the field survey would then be presented to those groups of road users to verify if these findings were also happening to them. The next step is to also gather additional inputs, where available.
6. **Compiling and analysing data:** Data gathered from the desk study, field survey, and any other methods would then be compiled and analysed to produce several findings that would be presented in this report.
7. **Incorporating findings into the report:** All the findings would then be incorporated and presented through the next section of this report.

2.2. Findings

2.2.1. Demographics

- Respondents come from various age groups, with the majority of respondents being in their 20s
- Most of the respondents are students, employees, and freelance workers with an income range either below Jakarta's minimum wage or does not yet have income

- Perspectives from people with disabilities were captured both from the field survey and Focus Group Discussion
- The almost balanced proportion of respondents who lived in DKI Jakarta and outside DKI Jakarta (Bodetabek) could represent the entire Greater Jakarta

In this survey, of the total of 625 respondents obtained, the overall respondents are dominated by men (60.64%), followed by women (39.36%). The majority of the respondents are in the age range of 20-24 (26.24%) as shown in [Figure 2](#), with the youngest respondent being 8 years of age and the oldest being 76. Most of the respondents, namely 91.84% are in the productive age group (15-64 years of age), while the remaining 6.40% were children (<15 years of age) and 1.76% were elderly (>64 years of age). Ideally, the overall respondents obtained could represent the distribution of all age groups in Greater Jakarta, but due to the limitation in obtaining direct samples of children and elderly, it is necessary to at least meet the minimum samples of 10 children and 10 elderly.

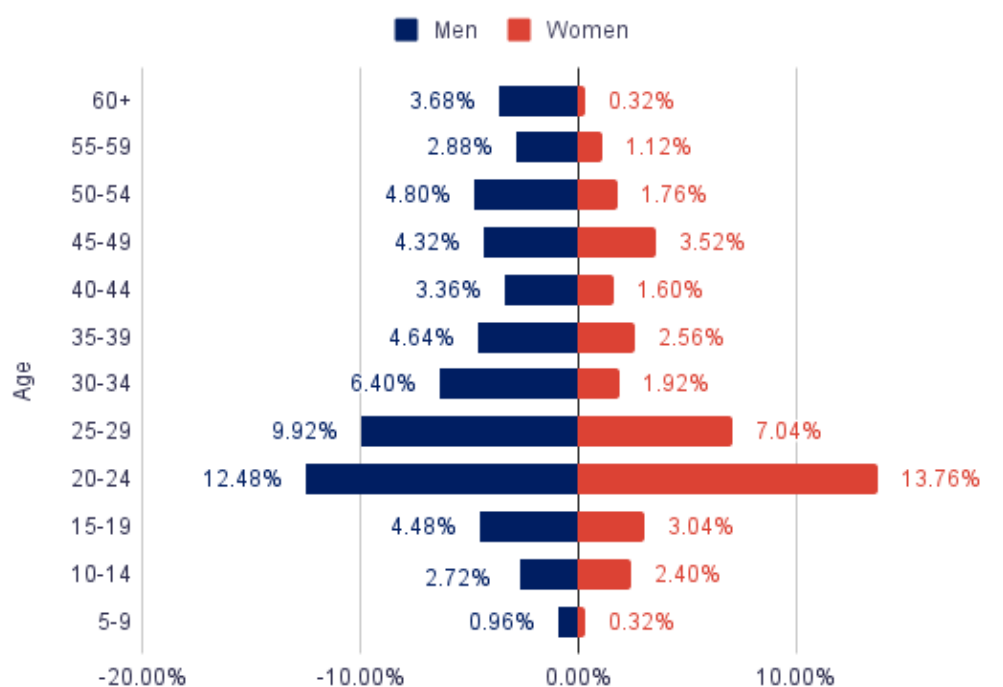


Figure 2 Age Distribution Based on Gender

As a result of the respondents mostly being in the productive age, their occupations are dominated by students (28.48%), employees (23.52%), and freelance workers (21.60%) which include ride-hailing drivers. As most of them are students, their average monthly income is also dominated with an income range of <4.5 million (38.24%) which is below Jakarta's minimum wage, and do not yet have income (31.52%). The rest are in the range of equal to or more than 2x the minimum wage (18.56%) and choose not to answer (11.68%).

People with disabilities' concerns as road users is also necessary to be taken into account, but only a small portion of people with disabilities (1.12%) was obtained during the field survey, namely a respondent who has a mental disability, a respondent who has a hearing disability, and two respondents who have visual disabilities. Therefore, apart from the field survey, a focus group discussion with the same set of objectives was also conducted to gather road safety experiences from PwD. Their perspectives are explained further in the GESI section.

The majority of respondents live in DKI Jakarta (57.28%), with the rest being from outside DKI Jakarta (Bodetabek) (42.72%). Most of the respondents came from South Jakarta (19.52%) and the least were from Tangerang Regency (0.16%). Overall, the almost balanced proportion of respondents who lived in DKI Jakarta and outside DKI Jakarta (Bodetabek) could be representative for the entire Greater Jakarta, although the expected area of residence ratio was initially seven to three.

2.2.2. Travel Patterns

- Cars tend to be used on longer trips, averaging around 16 km on each trip.
- Motorcycle users covered longer distances on a single trip (10.8 km) compared to public transport users (10.4 km).
- The difference in frequency of using certain modes generally do not result in major differences on travel pattern, except for motorcycles and bicycles.
- Motorcycles are mainly used to get to workplaces while bicycles are mainly used for sport purposes

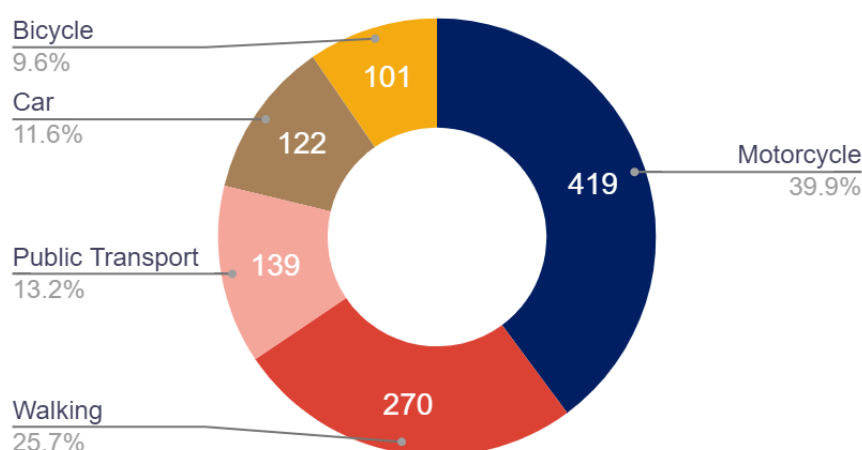


Figure 3 Distribution of Respondents Based on Mode Types

As mentioned above, this report would present perspectives from various road users on electric 2W uptakes and their perspectives on current safety, security, and comfortability aspects of travelling in Greater Jakarta. Those road users would be differentiated between 5 types of mode,

which are pedestrians, bicycles, motorcycles (including 2W ride hailing vehicles), cars (including taxis and 4W ride hailing vehicles), and road-based mass public transport vehicles (*microtrans* and buses).

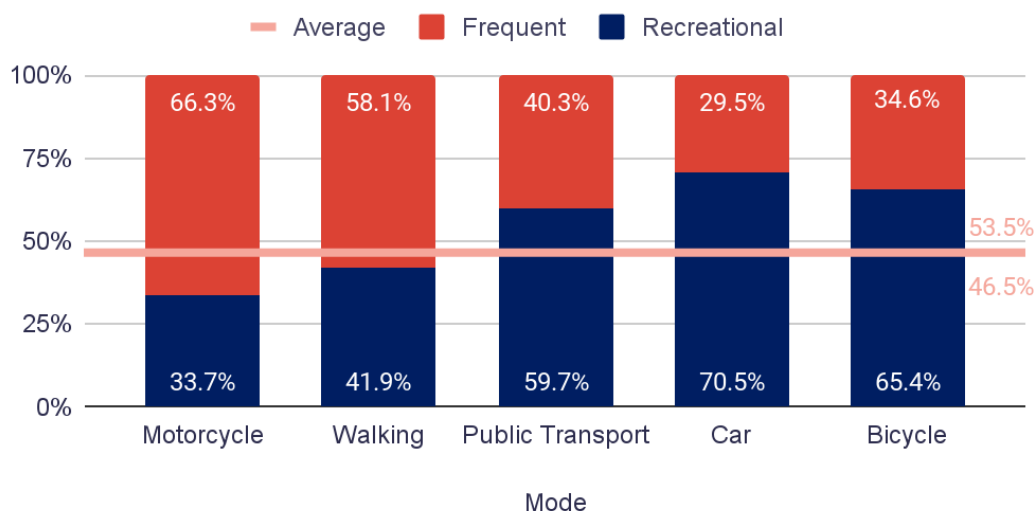


Figure 4 Distribution of Users Type Based on Mode Types and Frequency

One of the first things to look at is how many users are actually using each mode on a daily basis and how many are using it occasionally. To differentiate between those types of users, those who use each mode 5 or more days a week were grouped as “Frequent Users” and those who only use each mode less than 5 days a week were grouped as “Recreational Users”. As shown by [Figure 4](#) above, it turned out that those modes do not have any apparent similarities on type of users as the distribution of users type on each mode varies. Therefore, it should be investigated further whether there are any major differences on travel patterns between recreational and frequent users on each mode.

Table 1 Comparison of Average Distance per Trip (in Metres) Based on Mode and User Types

Mode	Average Distance per Trip (Km)			Differences towards Overall	
	Overall	Recreational Users	Frequent Users	Recreational Users	Frequent Users
Walking	1.03	1.10	0.98	6.75%	-4.86%
Bicycles	3.95	4.51	2.89	14.24%	-26.86%
Motorcycles	10.76	7.62	12.36	-29.17%	14.79%
Cars	15.96	15.76	16.46	-1.30%	3.10%

Mode	Average Distance per Trip (Km)			Differences towards Overall	
	Overall	Recreational Users	Frequent Users	Recreational Users	Frequent Users
Mass Public Transports	10.45	10.27	10.71	-1.71%	2.53%
Weighted Average	8.09	7.79	8.46	-3.71%	4.52%

By looking at the average distance covered on a single trip, it was found that bicycles and motorcycles are the two modes that have quite significant differences in utilisation between frequent and recreational users. Therefore, it should be investigated further whether there are significant differences in perspectives between user types on bicycle and motorcycle users.

Looking at bicycle users' data on [Table 1](#) above, it was found that frequent users cover lower distance per trip compared to recreational users. However, it should be noted that frequent users use bicycles more often than their recreational counterparts. Therefore, it might lead to comparable distances covered on a weekly basis between those two user types which might suggest that they have similar levels of exposure towards traffic. Unlike motorcycle users, this should allow the analysis of bicycle users to be aggregated regardless of user type on the following parts of this report.

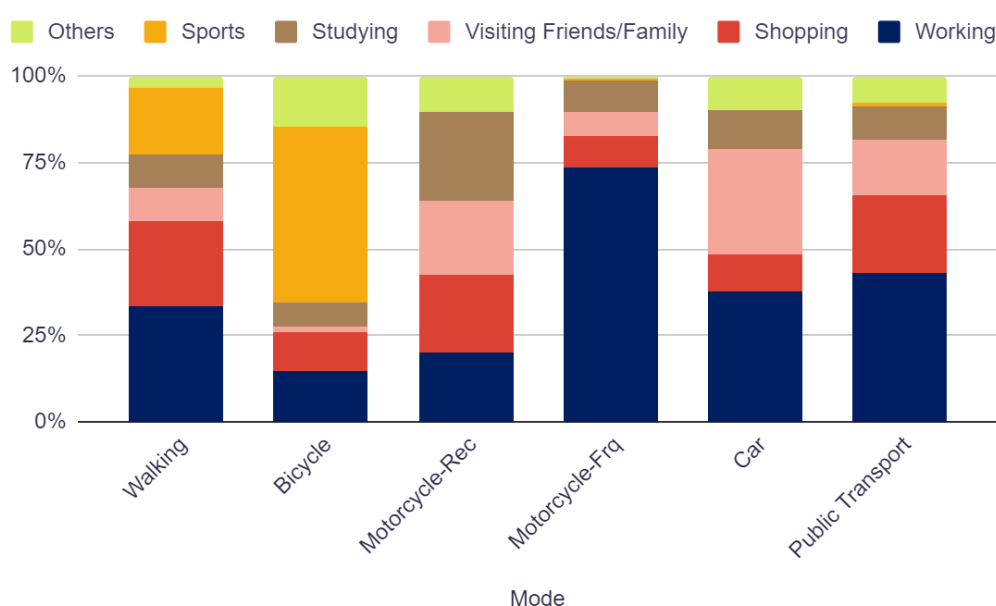


Figure 5 Distribution of Trip Purposes Based on Mode Types

Further analysis at the utilisation purposes, all types of mode in general are being used for various purposes. However, there are two significant findings on trip purposes involving motorcycles and bicycles, which are the two types of 2W used in Greater Jakarta. It was found that motorcycles are used by more than 70% of their users to get to their respective workplaces, while bicycles are currently being used mainly for sport purposes (50.5%). This might suggest how electric 2W will be used in the future as bicycles and motorcycles are the two most similar modes of transportation with electric 2W.

2.2.3. Issues

Issues discussed in this section would be separated into three main categories: issues related to road safety, road security, and road comfortability.

2.2.3.1 Road Safety

- Bicycle users perceived their safety level to be the lowest among other modes on arterial and collector roads.
- The most cited reason affecting perceived road safety is driver behaviour, although infrastructure provision has a more positive correlation towards perceived road safety compared to other reasons.
- Running a red light is perceived to be the most dangerous traffic violation that is commonly done by motorcycle users.
- Around 20% of the respondents had or almost had been involved or witnessed a traffic accident.
- Traffic accidents occur the most in the afternoon, during busy but not congested traffic, and at the middle of the road.
- Obeying traffic rules and driving carefully are the most cited measures on how road users ensure their own safety on the road.

On the safety aspect, respondents that have been classified by modes were told to review their safety level perception on using different types of roads by giving a score from 1 to 4. A higher score means a higher safety level perception, with the highest score being 4 and the lowest being 1. It turns out that bicycle users perceive their safety level to be the lowest among other modes when using arterial roads and collector roads, as shown by [Figure 6](#).

This might be due to the unavailability of dedicated bicycle lanes, to protect the bicycle users. It was previously known that bicycles are one of the vulnerable modes, due to the high risk of the potential severity of injury at traffic accidents that also involved other modes (Herrero et al., 2019). Speed differences could also be one of the reasons why they felt unsafe sharing road spaces with other bigger and faster vehicles. On the other hand, road users who tend to perceive

their safety level to be relatively high on every type of road are pedestrians. This might be due to the availability of dedicated sidewalks and low traffic on the local roads. A study showed that adequate walking facilities quality is important to improve safety perception (Alemgena et al., 2018).

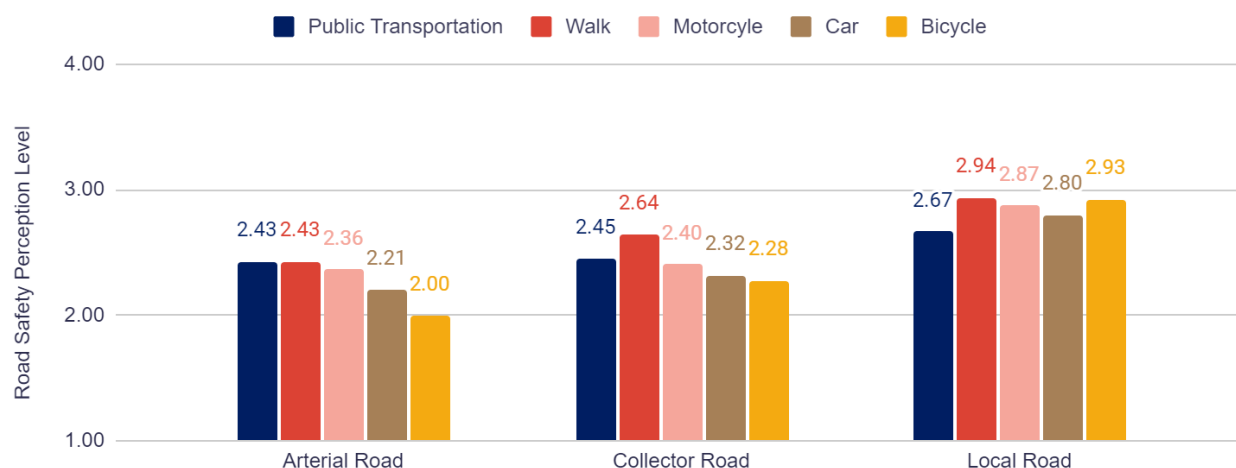


Figure 6 Road Safety Level Perception Based on Used Modes and Road Types

Comparing the average score from every mode on each type of road, road users of Greater Jakarta in general rate local roads to be safer than the collector and arterial roads. One of the reasons for this is due to the traffic volume which was shown in [Figure 7](#) below. Traffic volume on local roads tends to be smaller compared to other types of roads, thus leading to lower risks related to safety. An analysis using the R square value showed that despite driver behaviour being the most cited reason for a perceived level of safety, the provision of suitable infrastructures and traffic volume level has a more significant correlation with the perceived level of safety. It means that higher provision of suitable infrastructures would lead to a higher perceived level of safety and the lower the traffic on a certain road would lead to a higher perceived level of safety. Whereas on the other hand, driver behaviour was not rated uniformly by road users, thus no apparent solutions could be drawn except that it is being the most influential factor as it was cited the most by all respondents.

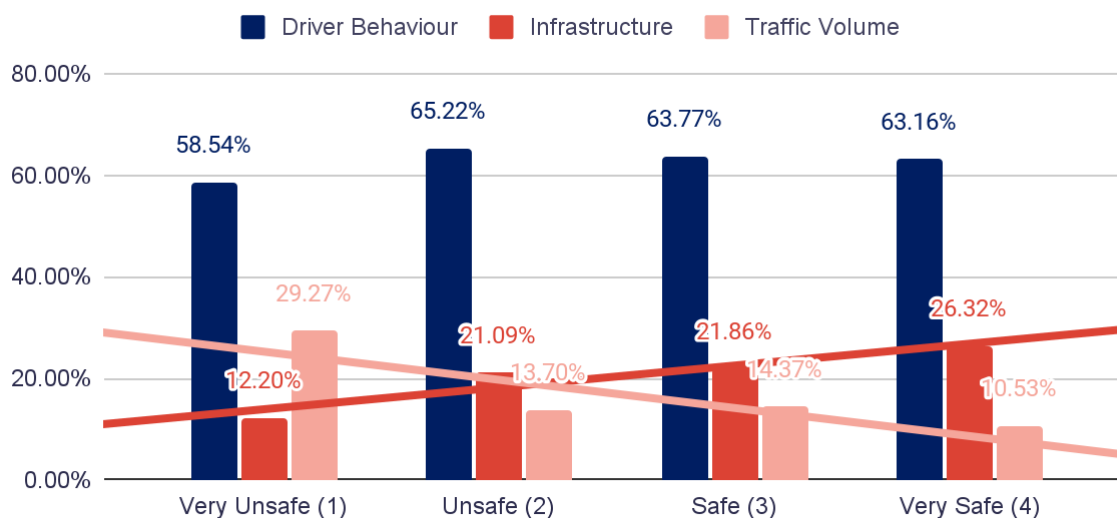


Figure 7 Factors Affecting Road Safety Level

Further analysis was also conducted towards motorcycles safety level, rated by all road users. In general, motorcycle safety performance in Greater Jakarta was rated moderately between safe and unsafe by all road users, regardless of road types. One interesting finding was that car users tend to perceive motorcycles to be less safe than what is currently perceived by other road users (Figure 8).

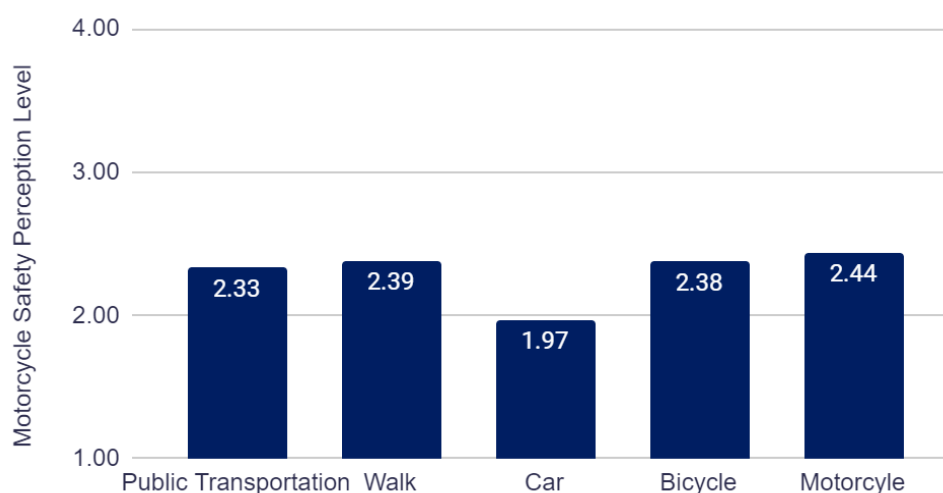


Figure 8 Perception of Motorcycle Safety Performance Based on Used Mode

Being cited the most as the influencing factor of perceived road safety level, further analysis was also conducted to know which driver behaviours among motorcycle users are deemed the most dangerous. It turned out that running a red light, driving against traffic direction, and using mobile phone while driving are the top three behaviours that are perceived to be the most dangerous actions commonly done by motorcycle users (Table 2).

Table 2 Perceived Level of Danger between Traffic Violation Examples Based on Type of Mode

Violations	Walking	Bicycles	Motorcycles	Car	Public Transports
Running a red light	3.647	3.625	3.669	3.762	3.731
Exceeding speed limit	3.601	3.516	3.547	3.623	3.452
Driving on sidewalk	3.500	3.531	3.238	3.298	3.312
Driving on cycle lane	3.138	3.406	3.031	3.126	3.075
Using mobile phone while driving	3.583	3.578	3.577	3.709	3.753
Overtaking carelessly	3.555	3.531	3.540	3.728	3.602
Turning without signals	3.335	3.344	3.556	3.583	3.538
Driving against traffic	3.624	3.516	3.587	3.841	3.613
Not using the headlight	3.156	3.313	3.223	3.411	3.129

To understand road safety more comprehensively, traffic accidents occurrence is an important factor that also needs to be included in the safety analysis. Based on the survey result, about a fifth (20.00%) of the respondents have witnessed or experienced traffic accidents in Greater Jakarta as shown by [Figure 9](#) below.

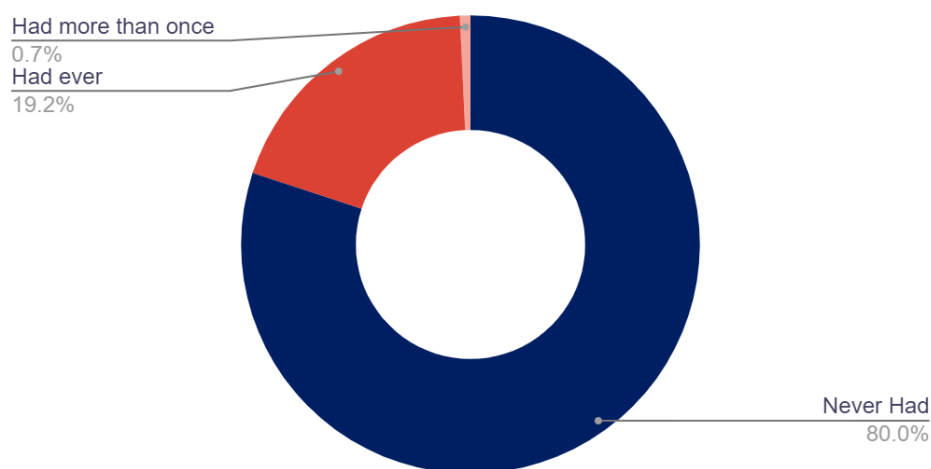


Figure 9 Witnessing or Experiencing Traffic Accidents

An analysis towards the time of accidents happening showed that accidents often occur during the afternoon as shown by [Figure 10](#) below. One of the reasons for this might be due to the higher level of traffic caused by people getting off from work, as it was shown that most of the accidents happen when the traffic is quite dense but not congested yet.

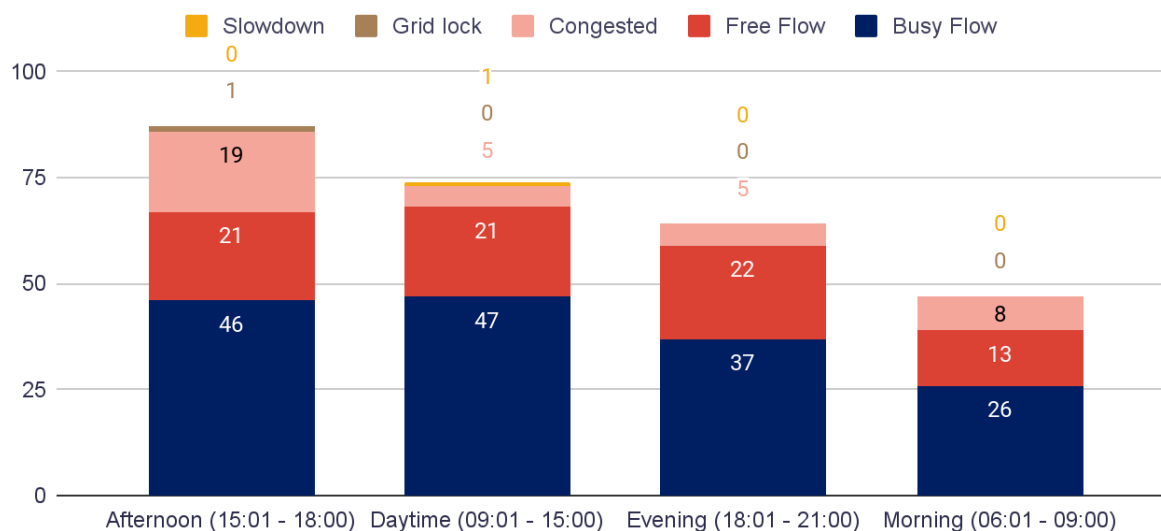


Figure 10 Traffic Condition and Time of Traffic Accident Occurrence

Looking at the exact location of the accident, it was found that traffic accidents mostly occur in the middle of a road, followed by on the side of the road, and at intersections ([Figure 11](#)). Traffic accidents happen very rarely at the pelican crossing and zebra cross, although they are the places where conflict between pedestrians and other road-based modes happens. Therefore, it could be concluded that this part of the road is relatively safe based on this finding.

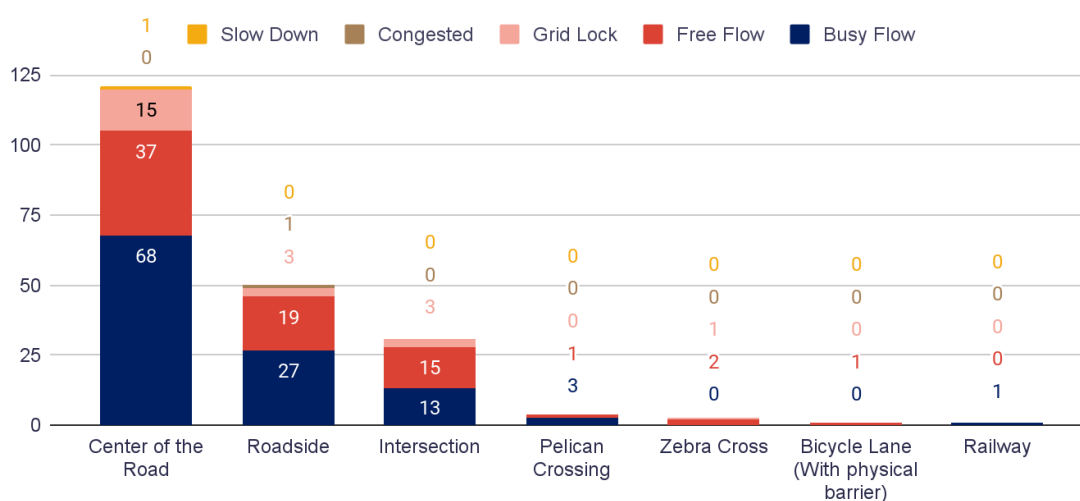


Figure 11 Traffic Condition and Location of Traffic Accident Occurrences

Looking at the reasons why those traffic accidents are happening, it was found that driver's negligence is the most dominant reason, regardless of the location of accidents or the traffic condition during which the accident happens.

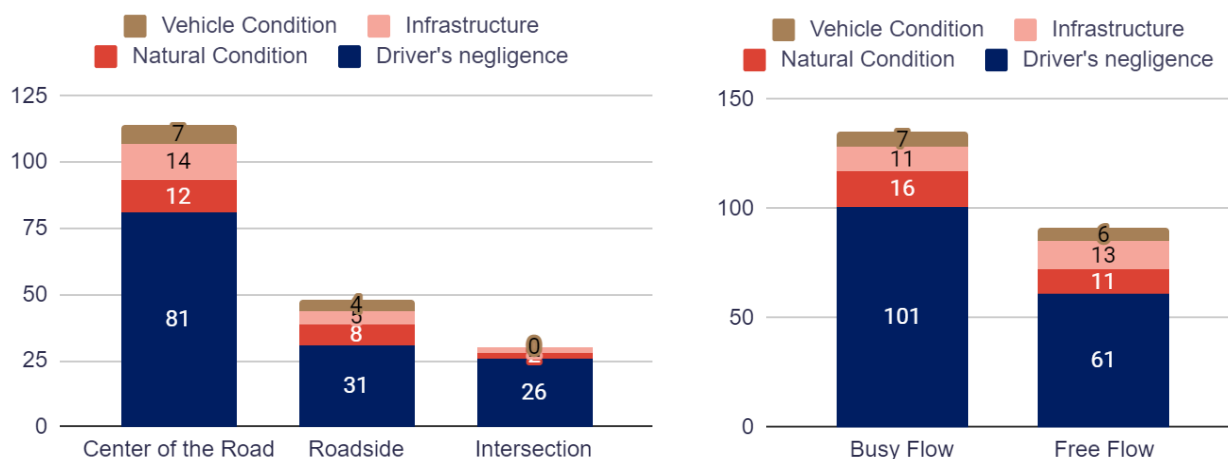


Figure 12 Frequent Traffic Accidents Occurrence Reasons Based on Locations (left) and Traffic Density (right)

Further information on this study is also gathered to get road users' perspectives on how they improve road safety. As they are most concerned about other drivers' behaviours shown by [Figure 7](#) above, the most cited measures are related to drivers' behaviours, such as obeying traffic rules (20.70%), and driving carefully (20.66%) shown by [Figure 13](#) below.

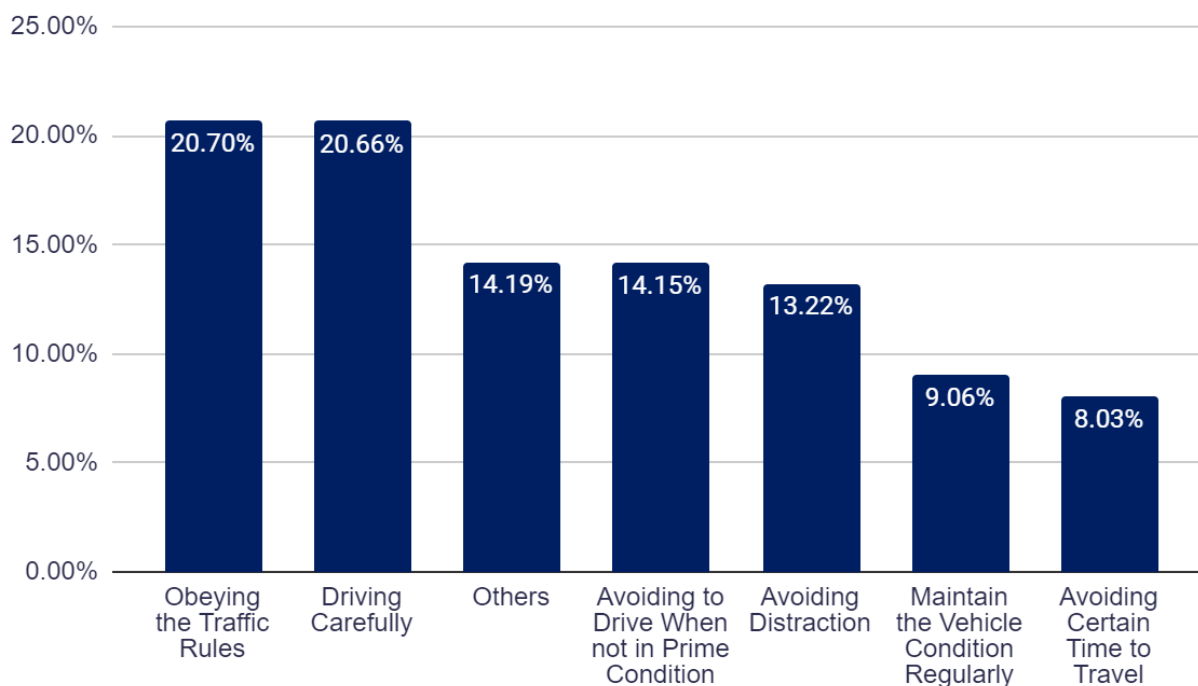


Figure 13 Frequent Traffic Accidents Occurrence Reasons

2.2.3.2 Road Security

- Bicycle users tend to rate their security level to be relatively lower than other mode users on arterial and collector roads.
- The crime rate of the area and the availability of surveillance systems are highly influential towards people's perceived security level on the road.
- Avoiding certain times and routes to travel, as well as avoiding using valuable items are the most cited measures road users did to ensure their security on the road.

Similar to the previous section, road users were also asked to give scores to measure the security level perception based on their commonly used modes on each road type.

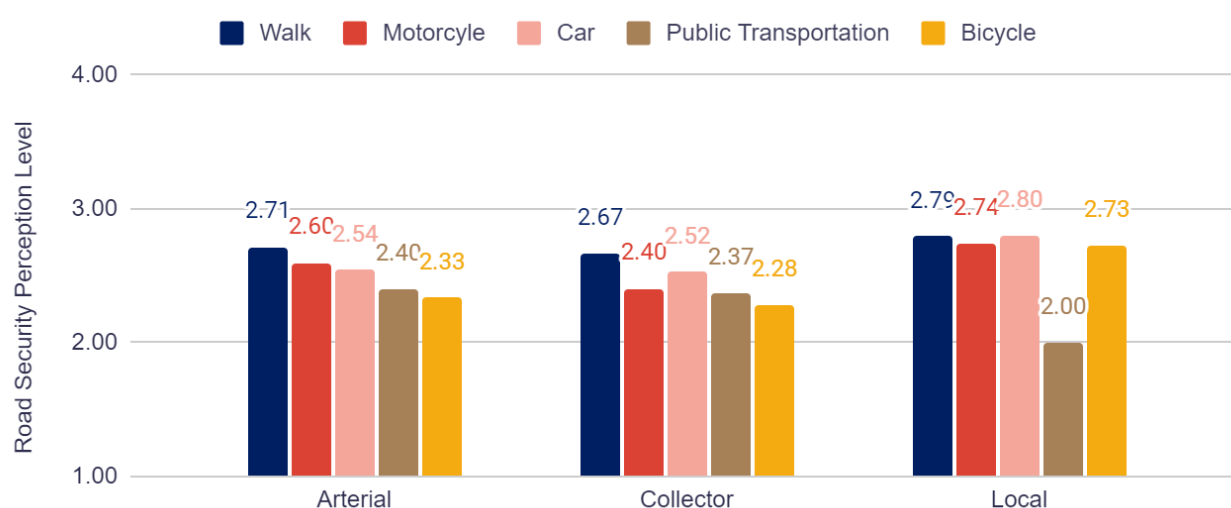


Figure 14 Road Security Perception Level

As shown by [Figure 14](#), bicycle users tend to rate their security level to be relatively lower than other mode users on arterial and collector roads. Meanwhile, public transport users felt the least secure among other modes when taking a trip on local roads. Further analysis into the reasons behind these findings showed that the crime rate of an area is the predominant factor on low road security level for bicycle users on arterial and collector roads, as well as public transport users on local roads ([Figure 15](#)). Based on the same figure, the second most cited reason with insignificant difference was the low number of activities on those roads, which could be caused by either remote locations or taking trips at night time.

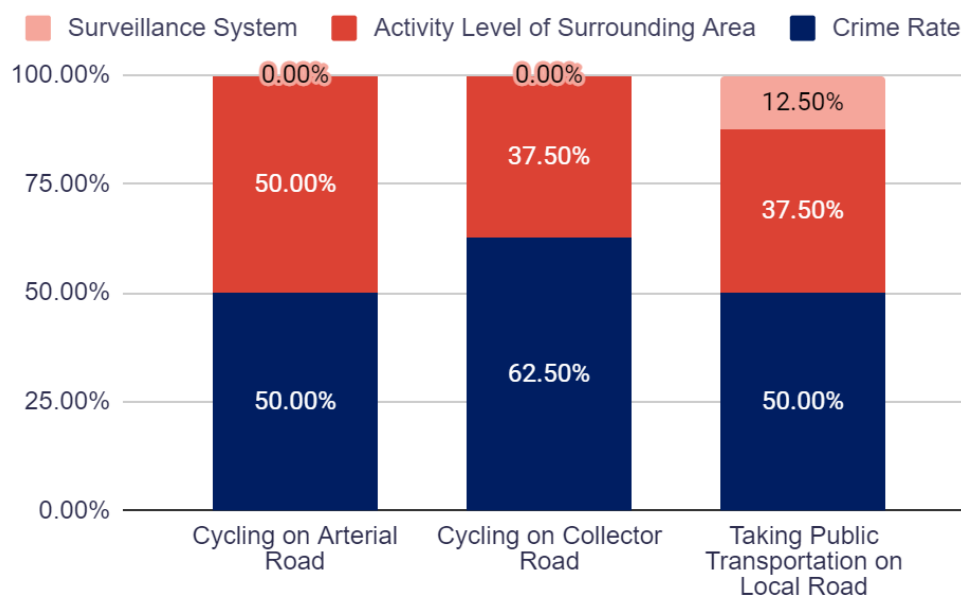


Figure 15 Low Road Security Perception Level Reasons

Despite being cited less compared to the previous two reasons, the availability of surveillance systems is proved to be one of the most influential factors determining security perception from road users based on the high R square value shown by Figure 16. The others being the crime rate of the area. Those two variables are highly relatable towards security improvement, which are applicable on every type of road and every road-based transportation mode.

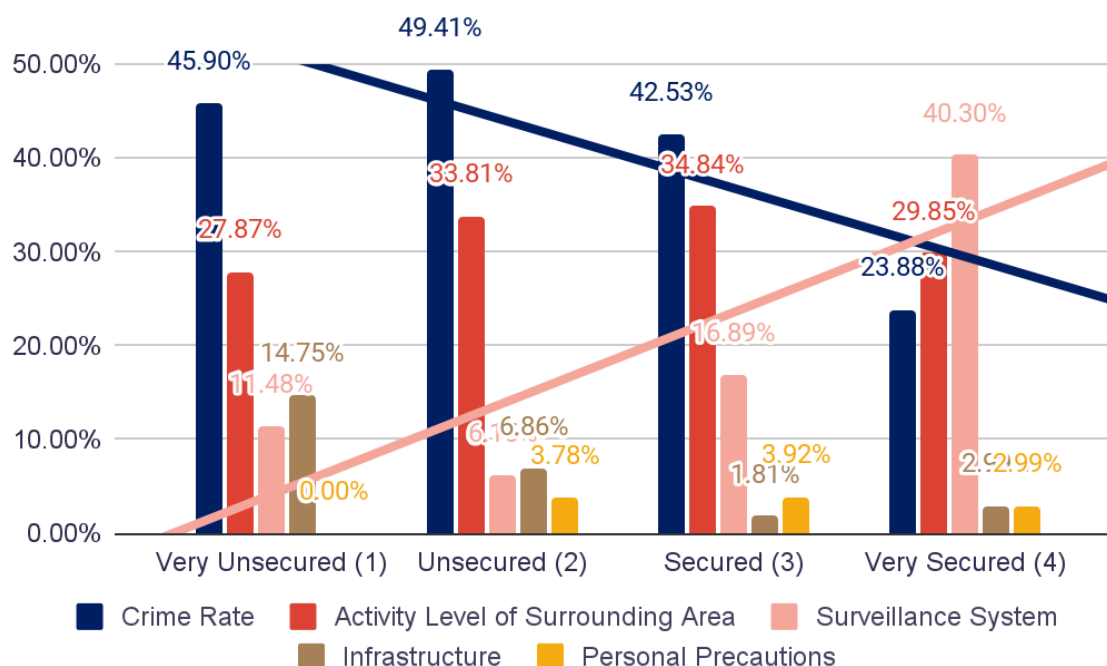


Figure 16 Road Security Perception Level Factors

Further analysis was conducted to capture measures done by road users to improve their own security level on the road. The results on [Figure 17](#) showed that avoiding certain time to travel, avoiding using valuable stuff, and avoiding certain travel routes are three of the most cited measures. However, one less cited but not the least interesting measure found was some people opted to avoid using certain modes to increase their security level on the road.

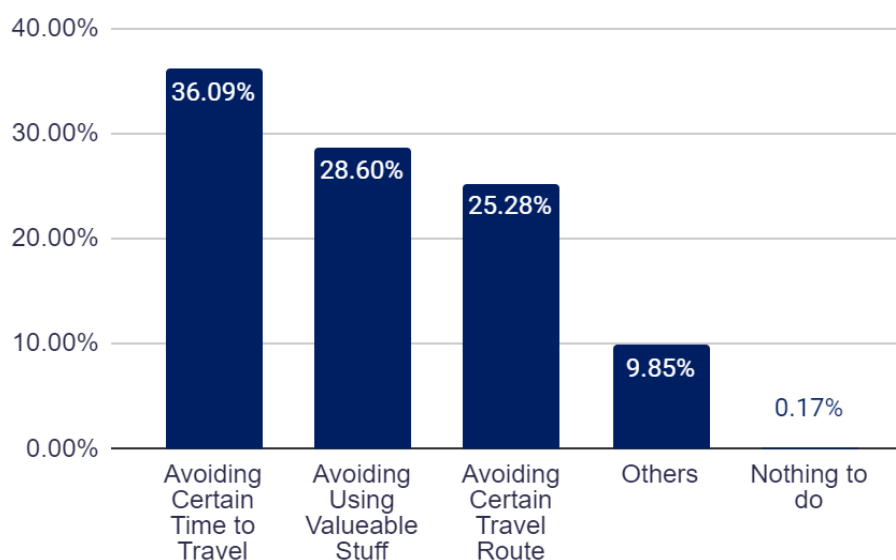


Figure 17 How to Improve Security Perception from Road Users' Perspectives

Further analysis was conducted to figure out which modes are actually being avoided, which might suggest that they have relatively low security record among other modes. Based on [Figure 18](#), the three most avoided modes are motorcycles, shared taxi, and bus. This might also suggest that, if not handled correctly, electric 2W could also be perceived as one of the less secure modes in the future as they are quite similar in characteristics with motorcycles.

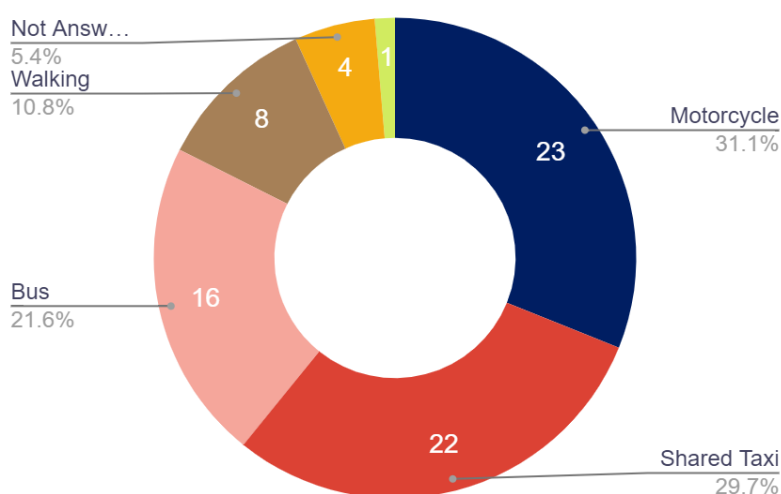


Figure 18 Mode to Be Avoided to Be Used to Improve Security Level

2.2.3.3 Road Comfortability

- Pedestrians tend to rate their comfortability level to be relatively lower than other mode users on arterial roads. Meanwhile, car users perceive their experience when using collector roads to be the least comfortable among users of other modes.
- The quality of infrastructures, followed by pollution level, turned out to be two of the most influential factors towards the comfortability of a road, regardless of mode types.
- Using suitable equipment, such as jackets for motorcycle users, was the most occurring measure done by road users to increase their comfortability level on the road

To measure the road comfortability level, the same procedures as the road safety and the road security perception level were conducted. Respondents were asked to rate each road type with their respective comfortability level when using respondents' preferred mode of choice on each road type. It turned out that pedestrians perceived their experience on using arterial roads to be the least comfortable compared to answers gathered from users of other modes. This might be due to the exposure towards pollution among pedestrians on arterial roads that makes them feel that their experience on using arterial roads was not comfortable enough. On the other hand, cars, as one of the modes that generally thought to be the most comfortable modes, were rated the lowest by their users when using collector roads. This might be due to the high volume of motorcycles and other smaller vehicles on those roads that makes them uneasy every time they use collector roads.

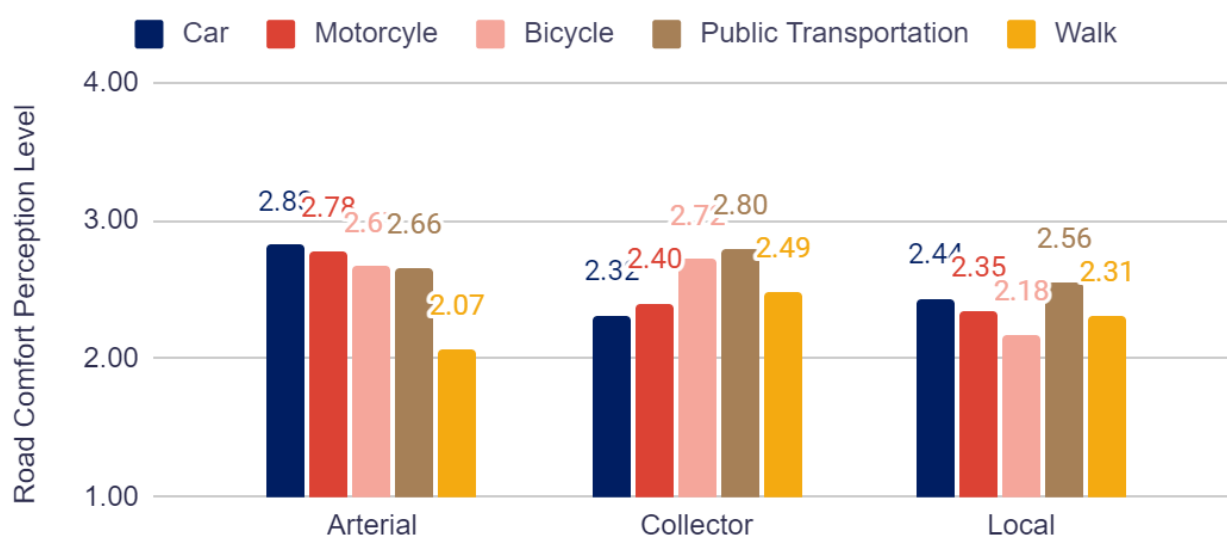


Figure 19 Road Comfortability Perception Level

The respondents were also asked why they give those scores towards each road type. The purpose of this question is to understand what factors are related to the road comfort level from road users' perspectives. Infrastructure condition turned out to be the most influential factor towards

comfortability level improvement, followed by pollution level of the area. Therefore, improving the quality of the infrastructure and reducing pollutants in the area might effectively improve the road comfortability level in Greater Jakarta.

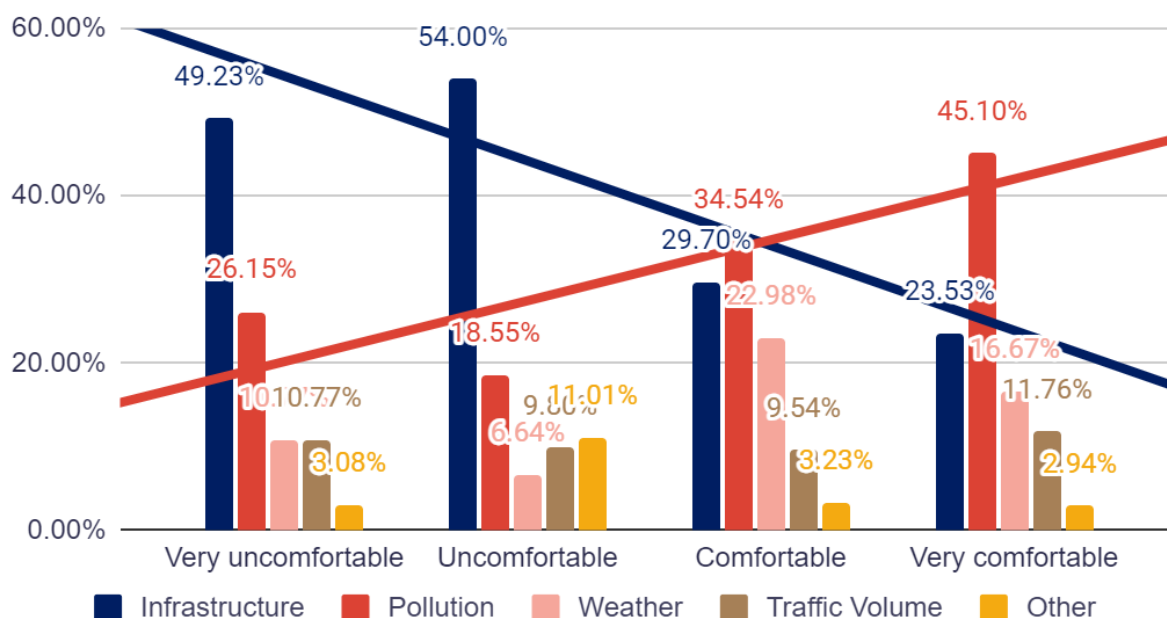


Figure 20 Road Comfortability Perception Level Affecting Factors

Further analysis was conducted to capture road users' perspectives on how to improve the road comfortability level. Using suitable equipment, such as jackets for motorcycle users, was the most occurring measure done by road users to increase their comfortability level on the road. Although not particularly significant, the results also showed that some respondents choose to avoid using and interacting with certain modes.

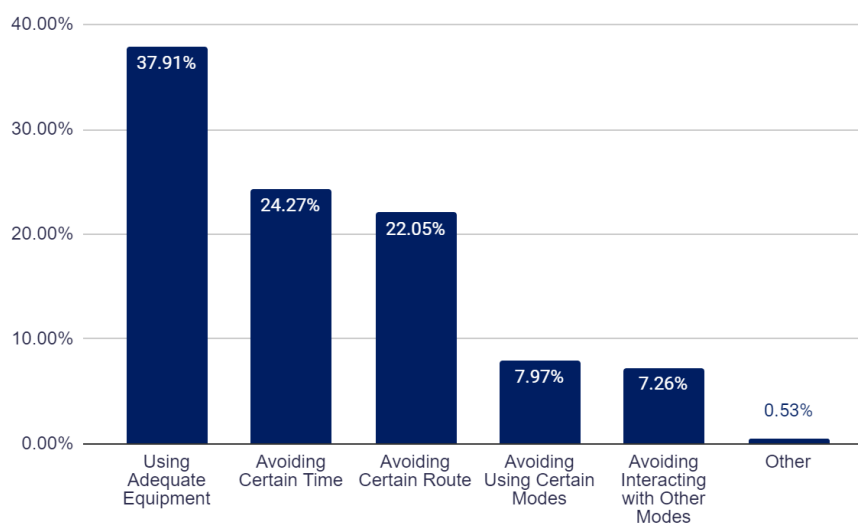


Figure 21 How to Improve Comfort Perception from Road Users' Perspectives

Being analysed further, respondents who had said to avoid using certain modes were mostly avoiding using motorcycles, followed by bus and shared taxi in second and third place respectively (Figure 22). It can be concluded that these modes are perceived to be less comfortable to be used on Greater Jakarta roads.

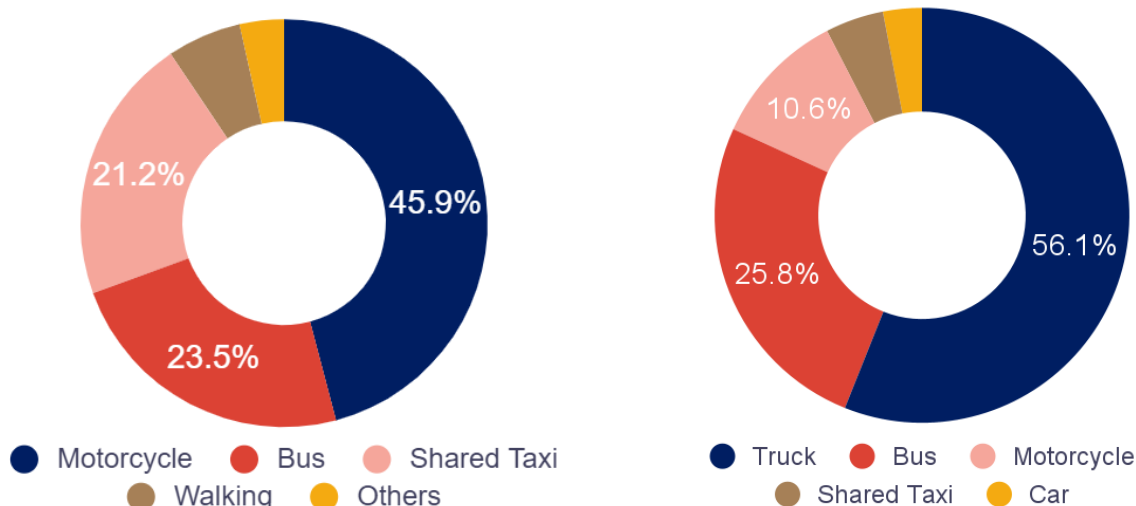


Figure 22 Modes to be Avoided to be Used to Improve Comfort Level (Left); Modes to be Avoided to be Interacted with to Improve the Comfort Level (Right)

Furthermore, respondents who had said to avoid interacting with other modes mostly choose trucks followed by buses as the modes to be avoided on the road (Figure 22). This might be due to those two modes having a higher level of tailpipe emission which resulted in them being the most avoided modes on the road.

2.2.4. Electrification

2.2.4.1 Concerns on Electric 2W

- Over 50% of the respondents have interacted directly or at least know about electric vehicles. Meanwhile, only less than 33% of the respondents have interacted directly or at least know about the availability of charging infrastructures.
- Over 70% of the respondents are unworried about the use of electric 2W although the reason behind was quite similarly divided. Meanwhile, over 50% of those who are worried said so due to its specification disadvantage.

Although the usage of electric 2W in Indonesia is still on a small scale, it can be seen in Figure 23 that more than half of the respondents (53.76%) have direct interactions with electric 2W, either have seen or used, while the rest have never (46.24%). Despite that, 45.33% of the respondents who have never seen or used an electric 2W at least know or have heard of electric vehicles in general.

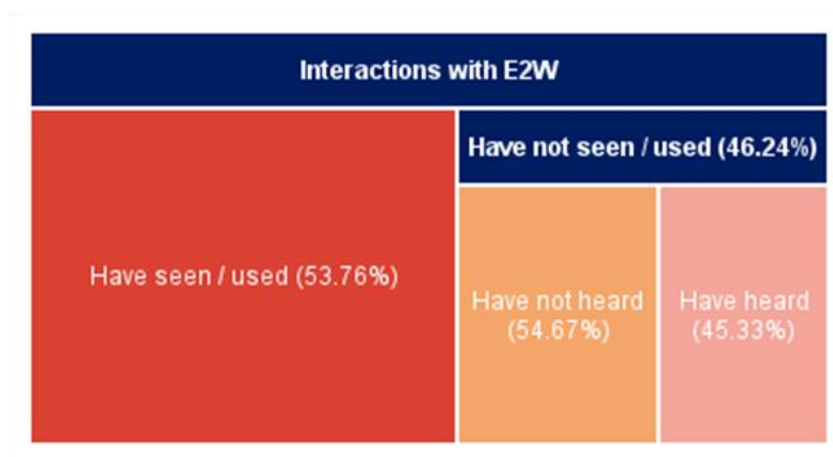


Figure 23 Respondents' Interactions with Electric 2W

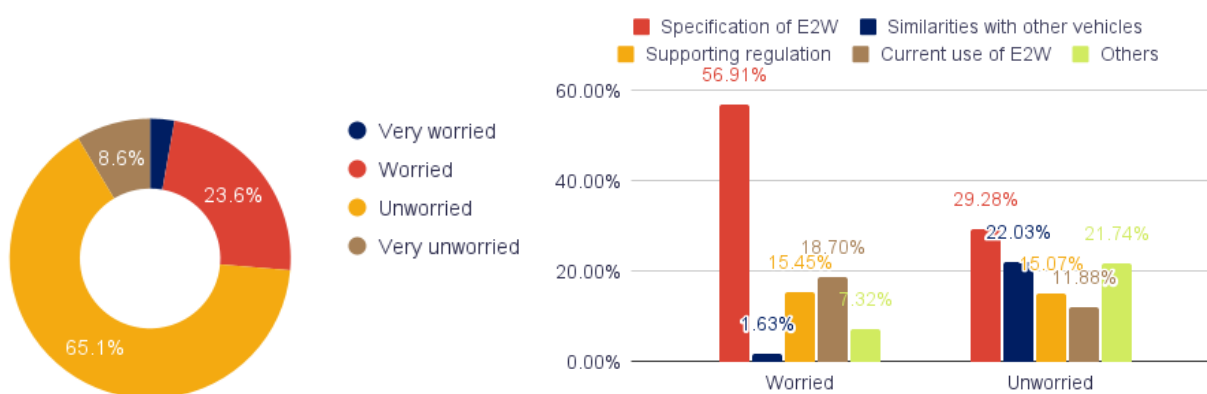


Figure 24 Respondents' Concerns on Electric 2W Use (left); Causes for Concerns (right)

As shown in [Figure 24](#), excluding the respondents who neither have seen nor used electric 2W, most of the respondents who have direct interaction or at least have knowledge about electric vehicles were unworried (65.10%) about the use of electric 2W by other road users when driving in Greater Jakarta. There are various reasons regarding concerns and lack of concerns about the use of electric 2W. To make identification easier, the “worried - very worried” and “unworried - very unworried” categories were merged into two new base categories. It turned out that the majority of respondents are worried due to the specification of electric 2W. Meanwhile, those who are unworried were quite similarly divided on their reasoning behind it.

Further analysis was made to uncover why the specification of electric 2W was cited by 56.91% of respondents who are worried about the use of electric 2W. The absence of sound in electric 2W makes it difficult for other road users to notice the passing electric 2W, thus endangering not only other road users but also the electric 2W drivers themselves. They are also worried about the low speed because it can block other vehicles passing at medium or high speed so that they are prone to accidents. Some respondents also felt that electric 2W low speed might slow down their own trips. However, those conditions are in contrast to respondents who are unworried because of the exact same reason. They said that the reason for their lack of worries is because electric 2W does

not use gasoline to run, therefore it does not emit emissions and has a positive impact on reducing air pollution. Also, they felt that electric 2W is less harmful because it typically has lower speed than conventional motorcycles and the absence of sound is actually beneficial in reducing noise pollution.

From [Figure 24](#) above as well, it turned out that a quite significant number of road users who are unworried of electric 2W (22.03%) said that electric 2W is quite similar to commonly found motorcycles. Despite having different fuel requirements, there are no major differences in the use and characteristics of electric 2W with conventional motorcycles, bicycles, cars, or other vehicles. Similar to other conventional vehicles, electric 2W is not dangerous as long as the drivers comply with all traffic rules. On the other hand, a small portion of respondents thought otherwise. A small portion of those who have worries about electric 2W usage (1.63%) said that every vehicle will always pose a danger to other road users.

In terms of supporting regulation, 15.45% of respondents who are worried about the use of electric 2W said so because there are no official regulations yet regarding the use of electric 2W on roads such as passable lanes, lanes that need to be avoided, and other rules. Thus, it was perceived that there are still many risks related to its safety. However, 15.07% of respondents who are unworried believe that there are regulations to test the feasibility of electric 2W and there is nothing to be worried about if the drivers comply with existing traffic regulations. This survey also captures respondents' suggestions regarding regulations needed to support electric 2W on the road which are discussed further in [section 2.2.4.3](#).

In terms of the current use of electric 2W, 18.70% of respondents who are worried said that they had seen electric 2W drivers who did not comply with traffic regulations before. For instance, they often use it at high speed and did not use helmets because they thought electric 2W are non-motorized vehicles. Meanwhile, 11.80% of respondents who are unworried said so because currently only a small number of people use electric 2W and most of them are used in residential areas or medium roads.

Apart from the findings discussed above, low public awareness regarding electric vehicles is also one of the reasons for people's concerns and lack of concerns about the use of electric 2W. A quite significant number of respondents who are unworried (21.74%) said so because they had never interacted directly with electric 2W and felt like there is nothing dangerous from using electric 2W. Meanwhile, a proportion of those who are worried (7.32%) believes that there is still little information available related to electric 2W so they might think that it is potentially dangerous to use.

2.2.4.2 Concerns on Charging Infrastructure

- Less than 10% of the respondents are worried about the availability of charging infrastructure with the majority worried for safety reasons while about 60% are unworried because it is beneficial to support electric vehicles. Meanwhile, the rest know nothing about charging infrastructures.

- The majority of the respondents preferred charging infrastructure, either charging stations or battery swap stations, to be built just like gas stations on the main roads because it would encourage electric vehicle usage, it would be easily accessed, and it would be convenient for most people.

Due to the limited access and knowledge of public charging infrastructure in Indonesia, it can be seen in [Figure 25](#) that almost all of the respondents (91.84%) have never seen or used charging infrastructure, while a small portion has (8.16%). In contrast to respondents' concerns about electric 2W, the respondents who have never seen or used charging infrastructure mostly did not have heard about it either. Thus, all respondents will have their concerns considered in this section.

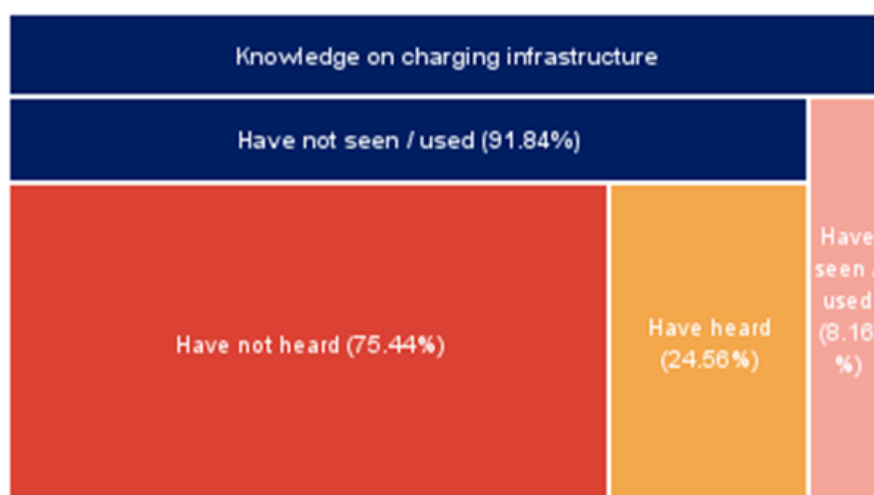


Figure 25 Respondents' Knowledge on Charging Infrastructure

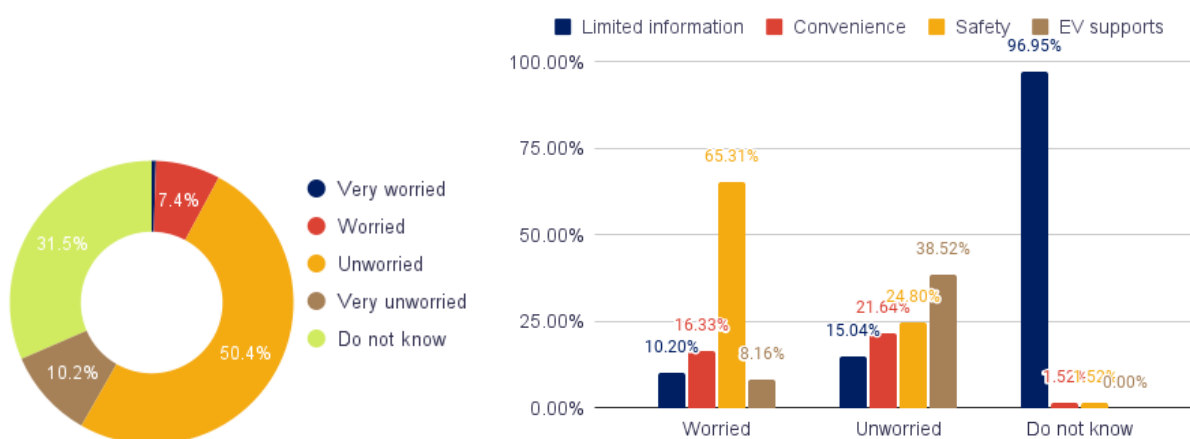


Figure 26 Respondents' Concerns on Charging Infrastructure Use (left); Causes for Concerns (right)

As shown in [Figure 26](#), they are mostly unworried (50.40%) and very unworried (10.24%) about the existence of charging infrastructure. The rest (31.52%) do not lean into any sides as they knew

nothing about charging infrastructures. Similar to the previous identification about concerns on electric 2W, the “worried - very worried” and “unworried - very unworried” categories were merged into two new base categories to make identification easier. The majority of respondents are worried about charging infrastructure due to safety reasons while there are no major reasons why some of them are unworried. On the other hand, almost all respondents do not know because of the limited information related to charging infrastructures.

The limited information was cited by 15.04% of respondents who are unworried about charging infrastructures because the unclear information makes it difficult to assess their concerns so they felt indifferent with it. Over 95% of the respondents who do not know anything about charging infrastructure also felt the same. The information is very limited so they cannot share their concerns. However, those limitations are in contrast to respondents who are worried (10.20%) because the impacts and risks posed by the development of charging infrastructure are not known yet and might be dangerous. In terms of convenience, respondents who are unworried (21.64%) about charging infrastructure, in particular charging stations, said so because of the functional similarities with the more commonly encountered gas stations. In addition, charging stations seem to not disturb and harm the surrounding community. Meanwhile, respondents who are worried (16.33%) believe that it will be inconvenient for other road users due to the potential congestion increase near the charging infrastructure area.

In terms of safety, respondents who are worried (65.31%) about charging infrastructure believe that there are still many unpredictable risks of accidents that endanger many people such as risks of explosion, electric shock, radiation, and electric short circuit. However, some respondents who are unworried (24.80%) believe that the planning and development of charging infrastructure are in accordance with safety standards and have gone through the testing phase before operating to the public. Meanwhile, as for electric vehicle support, respondents who are unworried (38.52%) about charging infrastructure said so because it is very helpful and easier for the users to recharge their vehicles. Besides, it could also promote the use of electric vehicles. A small number of respondents who are still worried (8.16%) thought that the presence of electric vehicles, in general, will negate the oil industry or gas stations industry and slowly replace conventional motorcycles.

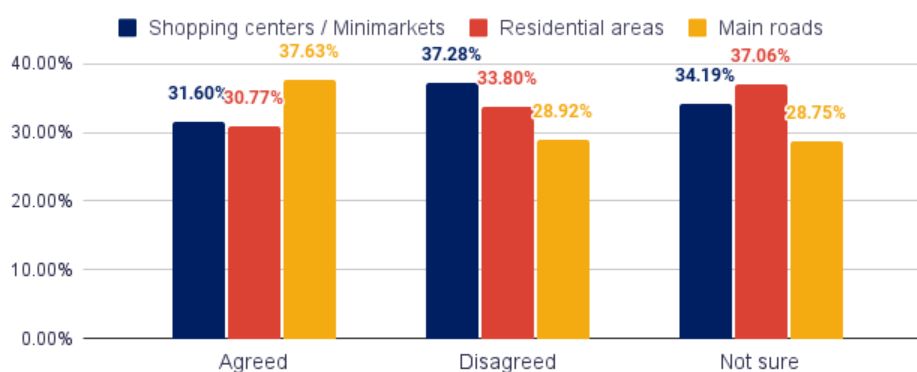


Figure 27 Respondents' Perception on Charging Infrastructure Development

This survey also captures respondents' opinions regarding charging infrastructure development in several locations such as shopping centres or minimarkets, residential areas, and main roads. As shown in [Figure 27](#), the majority of the respondents who agreed (37.63%) believe that charging infrastructure, either charging station or battery swap station, should be built on the main roads just like gas stations. The main reason is due to its function to support electric vehicles. Lots of vehicles pass by on main roads so it is easy to find charging/battery swap stations if needed to recharge. Respondents also felt that charging/battery swap stations on main roads are strategic and accessible. It is also easier for all road users to use main roads which do not disturb certain groups of people, compared to shopping centres or residential areas which seem to be more private. Similar to gas stations in general, the development permit seems to be easier to obtain and safety standards are guaranteed. However, respondents who disagreed (28.92%) felt that charging/battery swap stations on main roads would cause congestion, endanger other road users, prone to theft, and the development was not too urgent because only a few people use electric vehicles. The lack of information related to charging infrastructure also made respondents unsure (28.75%), but most of them thought that it is possible to build charging infrastructure on main roads because its function is similar to gas stations, as long as it does not interfere with the surrounding land use.

Respondents mostly who disagreed (37.28%) with charging infrastructure development in shopping centres or minimarkets believe that it is due to the places is often crowded, so the availability of charging/battery swap stations most likely will add traffic congestion and interfere with visitors who do not use electric vehicles. Those places are also inaccessible because not everyone often goes there. Not to mention the potential damage or accidents such as explosions or short circuits will not only harm the station itself, but also the shopping centres or minimarkets and endanger visitors. Some of the respondents who are unsure (34.19%) about the development said so because they do not really understand the ideal location for charging infrastructure. Respondents felt that as long as it does not harm the surrounding communities and there are safety systems guaranteed, then it is possible to build charging infrastructure at shopping centres or minimarkets. Meanwhile, respondents who agreed (31.60%) thought that recharging electric vehicles takes a long time so while waiting for the battery to be fully charged, drivers could visit the places or shop. Besides, in terms of accessibility, those places are usually strategically located. Respondents also felt that having a charging/battery swap station does not disturb the visitors. In fact, it could increase visitors to the shopping centres or minimarkets hence benefiting those places as well.

Most of the respondents who are unsure (37.06%) about charging infrastructure development in residential areas believe that it is due to the lack of information obtained regarding charging infrastructure in general. But they felt that it is possible to consider building charging/battery swap stations in residential areas if there are indeed many users of electric vehicles and all the residents agreed with it. Some respondents also felt that charging infrastructure development is a lot more feasible in apartment complexes rather than landed houses. Some of them who agreed (30.77%) to the idea, thought that it is convenient and it could support the residents who have electric

vehicles to recharge their vehicles in a close and accessible location. The problem is related to the safety risks. Lots of respondents who disagreed (33.80%) about the development believe that it is due to the potential damage and accidents such as explosions and short circuits would be very dangerous for the residents. Besides, the targeted use of charging/battery swap stations in residential areas most probably will not be limited to the nearby residents but also the general public. Thus, it will mostly cause congestion and through-traffic. Respondents who disagreed prefer private home charging because currently there are still few residents who use electric vehicles.

2.2.4.3 Recommendation on Regulation Related to Electric 2W

- The three most recommended regulations regarding electric 2W by respondents who used multiple modes on a regular basis are special lanes, no special rules needed, and speed limit.
- Meanwhile, respondents who used single-mode on a regular basis preferred regulations on special lanes, speed limits, and other regulations such as tax incentives, user's age limit, ownership restrictions, and charging infrastructure usage.
- Special lanes are the most needed regulation due to several reasons, which are to increase road comfortability level, road safety level, and to differentiate electric 2W from other vehicles

One of the challenges in the large-scale uptake of electric 2W in Indonesia is the unavailability of regulations that clearly regulate electric 2W usage in the road user ecosystem. Therefore, this survey also tried to capture suggestions and recommendations from various road users regarding regulations needed to support the use of electric 2W on the road. [Figure 28](#) shows several regulations recommended by respondents who used multiple modes on a regular basis. The three most recommended regulations are special lanes (28.42%), no rules needed (15.76%), and speed limit (12.67%). All selected regulations, except for special lanes, are mostly recommended by motorcycle users. As for special lanes, it is mostly recommended by respondents who use public transport. In contrast to [Figure 28](#), [Figure 29](#) shows different perspectives by respondents who exclusively used a single mode on a regular basis. Hence the total samples are much smaller than in the previous part. The three most recommended regulations are special lanes (23.97%), speed limit (14.88%), and other regulations (14.33%). All recommendations are dominated by respondents who exclusively used motorcycles since the number of samples is larger than other vehicles.

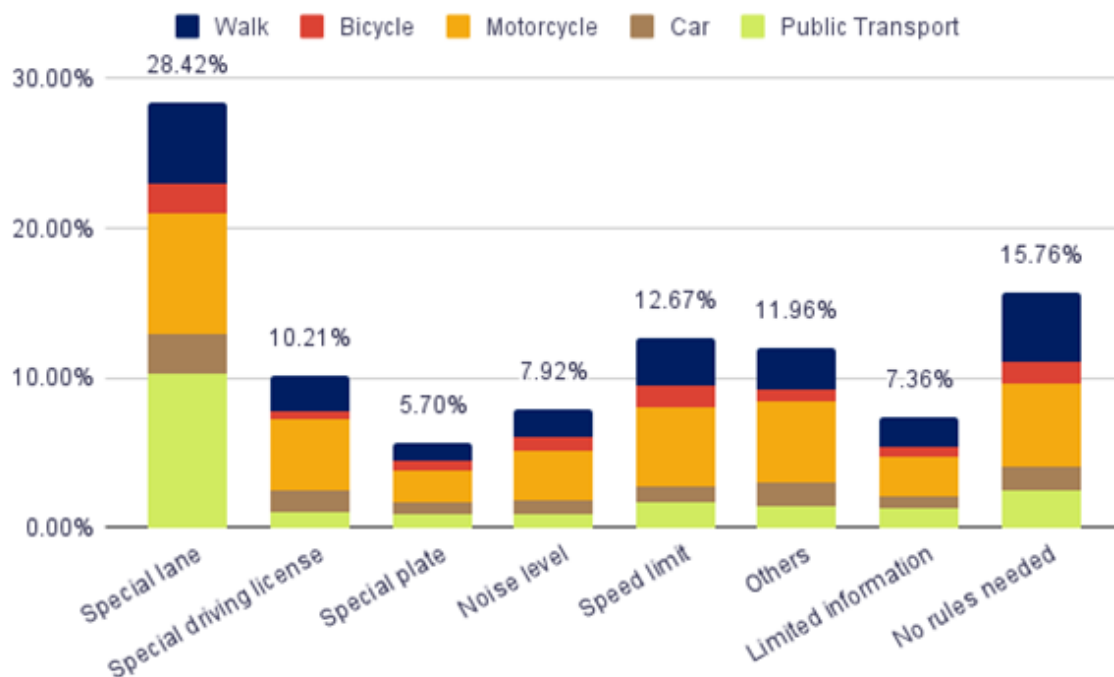


Figure 28 Regulations Recommended by Multiple Mode Users

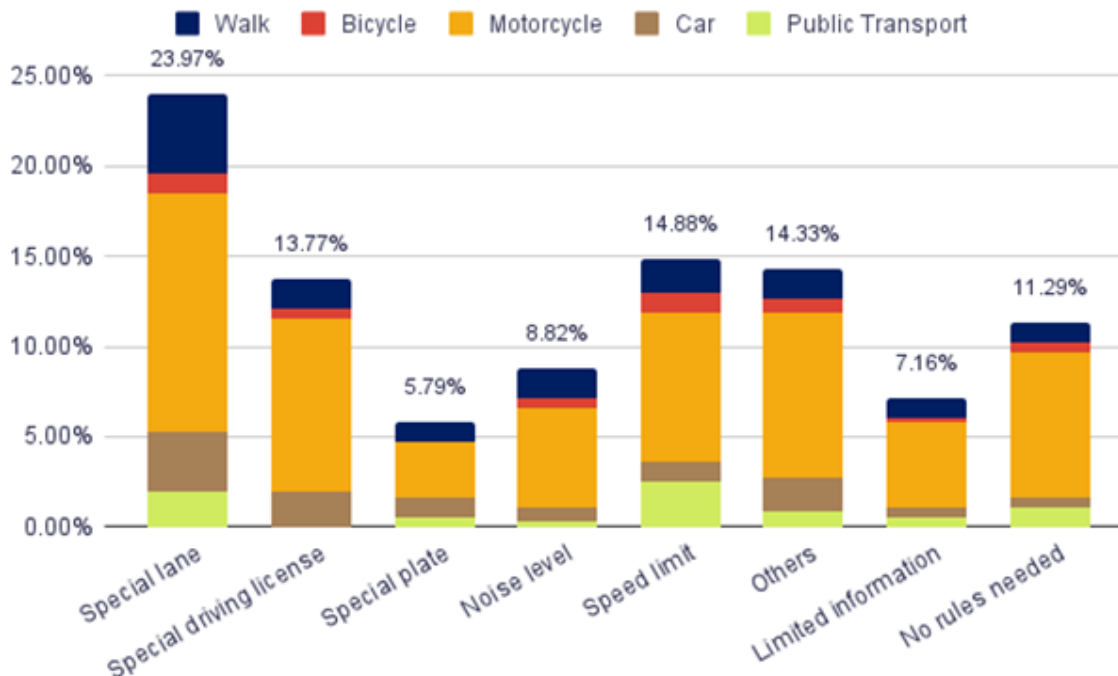


Figure 29 Regulations Recommended by Single Mode Users

Based on the four most recommended regulations from both multiple mode users and single-mode users, as shown in [Figure 30](#), the majority of respondents felt the need for regulation regarding special lanes that accommodate electric 2W on the road. The most dominating reasons

are related to road comfortability (35.9%), road safety (32%), and as a differentiator from other vehicles (13.3%). Due to the characteristics of electric 2W that may fall into a gray area between bicycles and conventional motorcycles, the existence of special lanes could increase comfortability and safety for all road users. It is feared that electric 2W that blends in with other vehicles on the main road will not be able to match the speed of other vehicles, thereby endangering all road users. A small number of respondents even felt that electric 2W are the same as bicycles, so the special lanes for electric 2W need to be integrated with bike lanes.

One of the characteristics of electric 2W is their generally lower speed compared to motorcycles. This generates concern by respondents because the low speed could potentially block other vehicles passing at medium or high speed so that they are prone to accidents. Therefore, there is a need for regulation regarding the minimum speed limit for electric 2W and to be equalized with conventional motorcycles. This is necessary to improve road safety (49%) and road security (8.7%), as well as to not disturb other road users on the road (32.7%). On the other hand, quite a few respondents felt that there was no need for special regulation related to electric 2W. This is mainly due to the reason that current information about electric 2W is still limited (65.4%) so that respondents cannot provide recommendations or advice. In general, respondents think that electric 2W is actually similar to other vehicles (24%) so it might be better if all regulations related to road vehicles would also be imposed on electric 2W and not be differentiated.

Other recommended regulations are related to the implementations of electric 2W tax incentives – which already have been implemented, electric bike user age limit to reduce usage by the underages, electric vehicle ownership restrictions to avoid high dependency on motorized vehicles, and the last recommendation is regulation regarding charging infrastructure usage. Overall, these regulations are needed to ensure road safety (29.7%) and comfortability (12.1%), as well as to encourage electric 2W usage (25.3%).

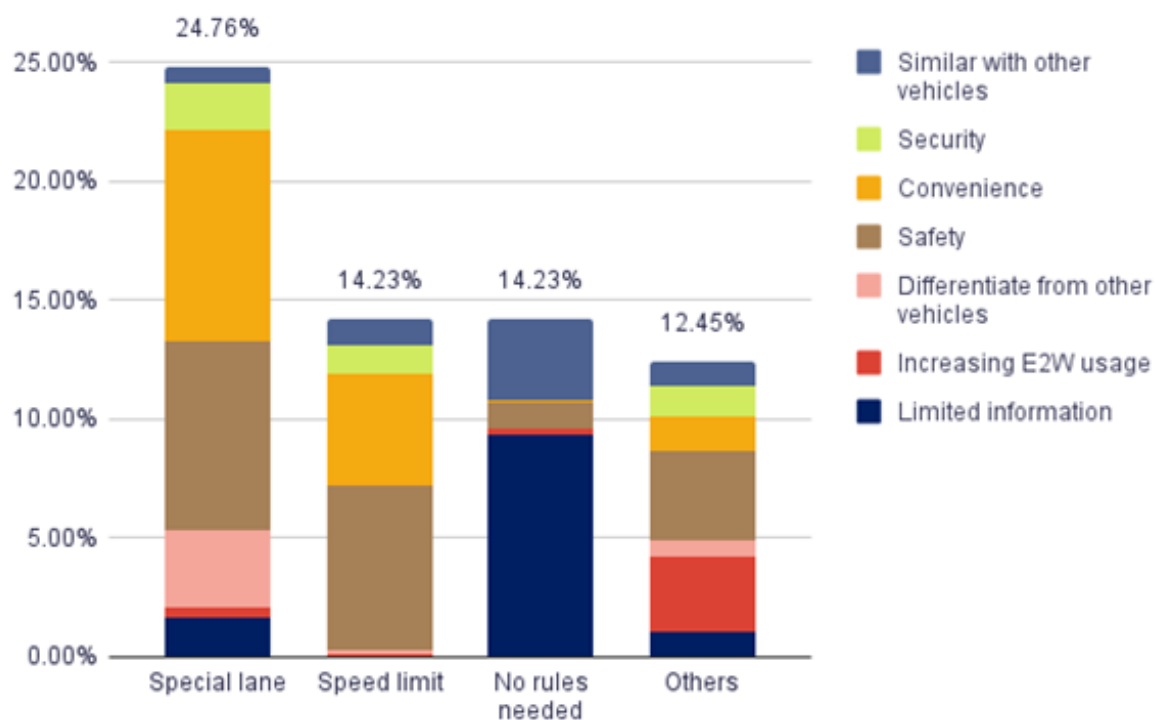


Figure 30 Reasons for Most Recommended Regulations

In addition to the four regulations mentioned above, several other regulations are also important to consider which are the provision of special driving licenses, special license plates, and minimum noise levels for electric 2W.

Regulations regarding special driving licenses for electric 2W are needed to support road safety (36.8%), to differentiate from other vehicles (27.6%), and road security (16.1%). Driving licenses in general is the main requirement for driving, so those who can get electric 2W's driving licenses are people who are proficient enough at using electric 2W and understand the recharging system. This is also to prevent underage electric 2W users. Special driving licenses are also required to distinguish information related to electric 2W from conventional motorcycles. Currently, there is already a regulation regarding special driving licenses (SIM CI and SIM CII), which are intended for electric 2W. However, they are not widely applicable yet. In terms of road security, a special driving license for electric 2W could be useful to avoid misuse or crime.

Meanwhile, regulations regarding special license plates for electric 2W have been implemented at this time with a distinguishing feature from conventional vehicles, namely the blue colour in the Motorized Vehicle Number (TNKB) area. Respondents find that special license plates are useful to differentiate electric 2W from other vehicles on the road (61.4%) so that other road users could be aware of electric 2W passing by and be more careful with each other. This could minimize road accidents and increase road safety (13.6%), as well as provide comfort (11.4%) for all road users.

Another characteristic of electric 2W is the absence of sound. Respondents felt that this specific feature is quite dangerous because it makes it difficult for other road users to notice an electric

2W's passing. Therefore, there is a need for regulation regarding the minimum noise level or additional noise that must be issued by electric 2W. This regulation would be useful as a reference for electric vehicle OEMs to design electric 2W that at least make a sound or provide a special alarm for alerting purposes. This is to prevent potential accidents and to support road users' safety (59.4%), to differentiate electric 2W from conventional motorcycles (26.6%), as well as provide comfort when driving (9.4%).

Several respondents also felt that specific information about electric vehicles, especially electric 2W is still limited (57.1%), so there is a need for more socialization by the government to increase public awareness. More intensive socialization regarding charging infrastructure, incentives, and purchase schemes could certainly increase the use of electric 2W (26.8%).

2.2.5. Gender Equality and Social Inclusion (GESI)

- Motorcycles are less preferable for women rather than men with a 7.10% mode share difference. It is also less preferable for elderly and children, with 23.2% and 12.24% mode share difference respectively compared to the average from all respondents.
- Women motorcycle users felt that they have low security levels while travelling on the road in Greater Jakarta among the others which might be one of the reasons why motorcycles are less preferable for women. For elderly, comfortability and safety might be the reason why motorcycles are less preferable, while for children, it is more related to comfortability.
- PwD concerns on current motorcycle usage involves driver behaviour that tends to drive through the walkway, parking on the walkway, and conducting other traffic violations.
- 74.72% of the respondents have some sort of knowledge on electric 2W. Meanwhile, the majority of elderly do not have knowledge about electric 2W, with only 24% of them having some sort of knowledge on electric 2W. On the other hand, charging infrastructure knowledge was still very low for all genders and age groups.
- Most of the respondents are unworried about future electric 2W and charging infrastructure uptakes. However, additional education might be needed, as this might be the result of lack of knowledge on those things.
- Out of the 625 respondents, 83.4% suggested special regulations need to be imposed on electric 2W, while only 16.6% of the respondents said no special regulation was needed.
- The most suggested regulation is to give a special lane for electric 2W. Special regulations on the minimum noise produced, standard brightness for the headlight, and differentiating with the e-bike is also needed based on PwD's perspectives.

2.2.5.1 Road Users' Profile

To identify GESI related issues, analysis was carried out by grouping the respondents based on their age, gender, and disability types. As mentioned before, out of the 625 respondents, 379 (60.6%) are male and 246 (39.4%) are female. Most of the respondents, namely 91.84%, are in the productive age group (15-64 years of age), 6.4% of the respondents were children (<15 years of age) and 1.76% were elderly (>64 years of age).

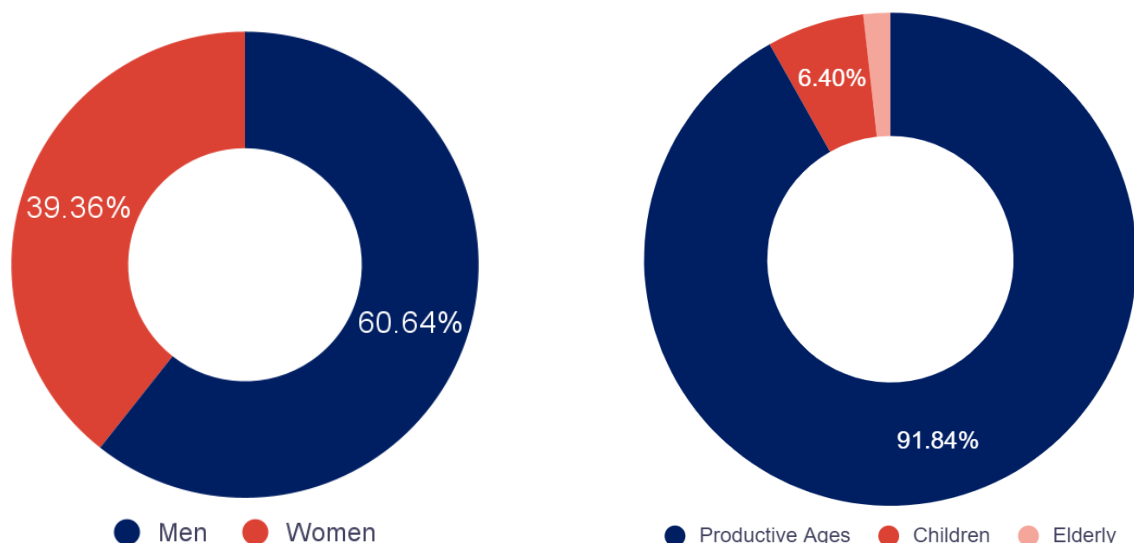


Figure 31 Distribution Gender (Right) and Age Group (Left)

An analysis towards the preferred mode of choice shows that women are less likely to use motorcycles compared to men ([Table 3](#)). While women themselves prefer to use public transportation than men, it shows an indication that there is an issue about motorcycle usage from women's perspectives that will be furtherly discussed. Moving on to the analysis made based on age group, the elderly and children are also less likely to use motorcycles, compared to the productive age. It might be because they have their limitations in driving motorcycles. For children, it is due to the restriction to access driving licences which are defined in current regulations. However, further analysis can be conducted based on its safety, security, and comfortability at using motorcycles. Moreover, it is found the use of bicycles is more preferable for elderly and children among the others.

Table 3 Mode Share Based on Gender and Age Group

Road Users' Profile		Walking		Bicycles		Motorcycles		Cars		Public Transports	
		Mode Share	Differences	Mode Share	Differences	Mode Share	Differences	Mode Share	Differences	Mode Share	Differences
All respondents		25.7%	-	9.6%	-	39.9%	-	11.6%	-	13.2%	-
Genders	Men	25.2%	-0.5%	11.3%	+1.6%	42.8%	+2.9%	11.1%	-0.5%	9.7%	-3.6%
	Women	26.3%	+0.7%	7.2%	-2.4%	35.7%	-4.2%	12.4%	+0.8%	18.4%	+5.2%
Age Groups	Children	34.2%	+8.5%	27.6%	+18%	27.6%	-12%	5.3%	-6.3%	5.3%	-8.0%
	Productive Age	24.9%	-0.8%	7.9%	-1.7%	41.3%	+1.4%	12.2%	+0.6%	13.7%	+0.5%
	Elderly	33.3%	+7.7%	22.2%	+13%	16.7%	-23%	5.6%	-6.1%	22.2%	+9.0%

It is found that only 1.12% of the total respondents were PwD. Therefore, it can be said that the survey results do not meet the representation criteria for PwD. Another data collection method was carried out, which is through FGD with the representatives of PwD's communities. The FGD was held online on Thursday, November 18, 2021, and was attended by various communities of representatives of people with disabilities, such as:

1. Jakarta Barrier-Free Tourism (JBFT)
2. *Himpunan Wanita Disabilitas Indonesia* (HWDI) - Indonesian Association of Women with Disabilities
3. *Persatuan Tunanetra Indonesia* (Pertuni) - Indonesian Blind Union
4. *Gerakan untuk Kesejahteraan Tunarungu Indonesia* (Gerkatin) - Indonesian Association for the Welfare of the Deaf
5. *Perhimpunan Jiwa Sehat Indonesia* (PJS) - Indonesian Mental Health Association
6. *Gerakan Aksesibilitas Umum Nasional* (GAUN) - National Public Accessibility Movement

2.2.5.2 Road Users' Travel Pattern

It was found that the average travel distance for women is the smallest compared to men for all transportation modes ([Table 4](#)). Among age groups, children have the smallest average travel

distance, except when using cars. As for the elderly, the average distance travelled is also generally lower than those in the productive age group, except when they are walking where they averagely cover the longest distance among other age groups.

Table 4 Average Travel Distance by Modes – Groups

Road Users' Profile		Walking	Bicycles	Motorcycles	Cars	Public Transports
Genders	Men	1.00	3.64	12.04	16.12	10.75
	Women	0.86	2.45	8.19	12.50	10.16
Age Groups	Children	0.53	2.02	6.32	11.50	7.73
	Productive Age	0.99	3.80	11.06	14.74	10.74
	Elderly	1.23	2.80	11.00	7.50	8.93

2.2.5.3 Motorcycle Usage Concern

Based on the perceived value of safety, security, and comfortability given by respondents who use motorcycles shown by [Table 5](#), it turned out that women motorcyclists perceived to have a lower level of security compared to male. This is because the security perception for them still depends on the activity level, hours of activity, and the crime rate in an area ([Figure 32](#)). This means that there are concerns for women regarding security in using motorcycles in remote areas, outside of activity hours, and in areas with high crime rates. They currently do not feel secure while facing those conditions.

An analysis towards different age groups showed that elderly perceive using motorcycles to be relatively more unsafe and uncomfortable than the general respondents ([Table 5](#)). This was also happening towards children. The reason for them feeling unsafe is due to the bad driver behaviour of the motorcyclist, while the reason for them feeling uncomfortable is due to the bad quality of the infrastructure, such as the pavement, followed by heavy traffic volume ([Figure 32](#)). This might also explain why the mode share of motorcycle use for the elderly shown by [Table 3](#) above was low.

Table 5 Motorcycle's Comfortability, Security, and Safety Level Perception Based on Gender And Age Group

Road Users' Profile		Safety		Security		Comfortability	
		Score	Differences	Score	Differences	Score	Differences
All respondents		2.57	-	2.63	-	2.58	-
Genders	Men	2.57	+0.20%	2.67	+1.28%	2.58	-0.11%
	Women	2.55	-0.43%	2.56	-2.73%	2.59	+0.23%
Age Groups	Children	2.71	+5.63%	2.68	+1.64%	2.23	-13.88%
	Productive Age	2.56	-0.17%	3.00	-0.14%	2.60	+0.70%
	Elderly	2.25	-12.29%	2.63	+13.88%	2.00	-22.61%

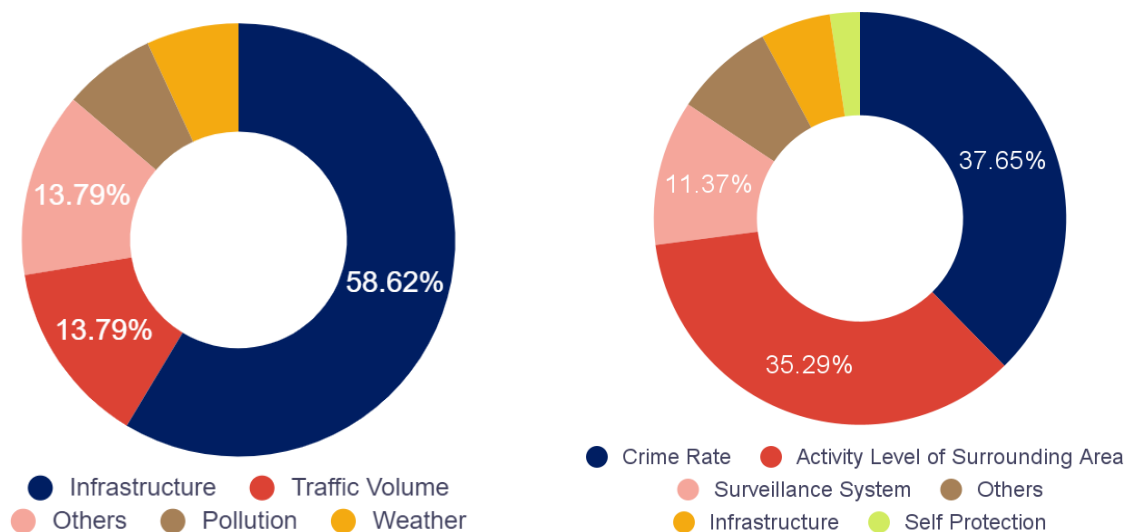


Figure 32 Uncomfortability Level of The Motorcycle Reason from The Elderly and Children (Left); Insecurity Level of The Motorcycle's Reason from The Women (Right)

Inputs from PwD captured through the FGD on their perceptions regarding motorcycle usage are as follows:

- Pedestrians are concerned about the occurrence of motorcyclists driving on the sidewalks which continue to be followed by other motorcyclists. However, from motorcycle users' point of view, one of the reasons for riding on the sidewalk is due to the peer pressure from other motorcyclists behind.

- Another issue related to motorcycles raised was the misutilisation of sidewalks as illegal motorcycles' parking lots in certain areas.
- Ride-hailing users with vision impairment often do not know the traffic violations committed by the ride-hailing drivers that carry them, although they do not want the drivers to conduct such things.

2.2.5.4 Motorcycle Electrification Concern

On average, 74.72% of the respondents have already used/seen/heard about the electric motorcycle. From [Figure 33](#) below, it was found that, among genders, men tend to be more familiar with electric 2W compared to women, while among age groups, people in the productive age tend to be more familiar than other age groups. It was also found that only 24% of elderly have knowledge on electric 2W, which is far lower than the average of all respondents. In order to make an equal understanding across all groups, the elderly need more special attention on the education of the motorcycle.

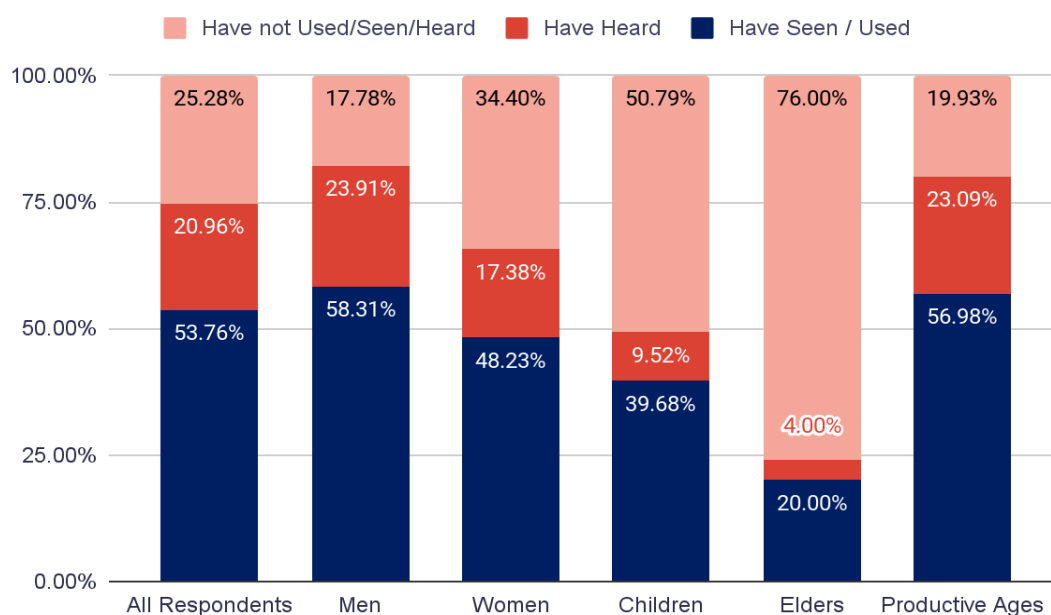


Figure 33 Electric Motorcycle's Knowledge Level Based on Gender and Age Group

Regarding concerns, all groups are relatively unworried about the e-motorcycles shown by the low level of concern found in [Figure 34](#). However, some concerns arise mostly on the vehicle specification ([Figure 35](#)), which are mainly related to low-speed performance, low level of sound produced, and typically lower vehicle power capacity.

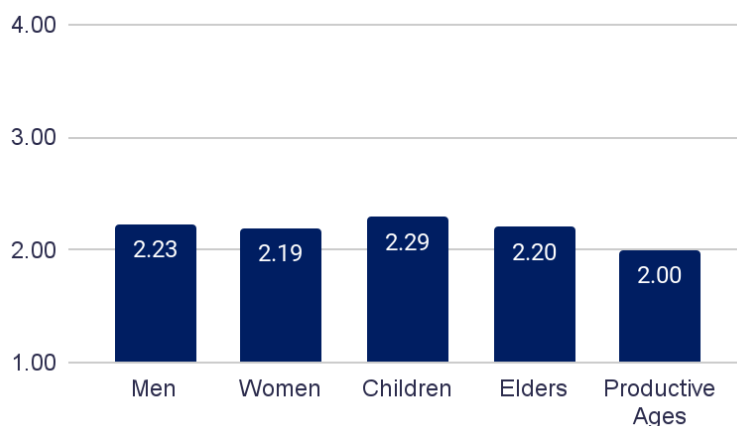


Figure 34 Level of Electric Motorcycle's Concern Based on Gender and Age Group

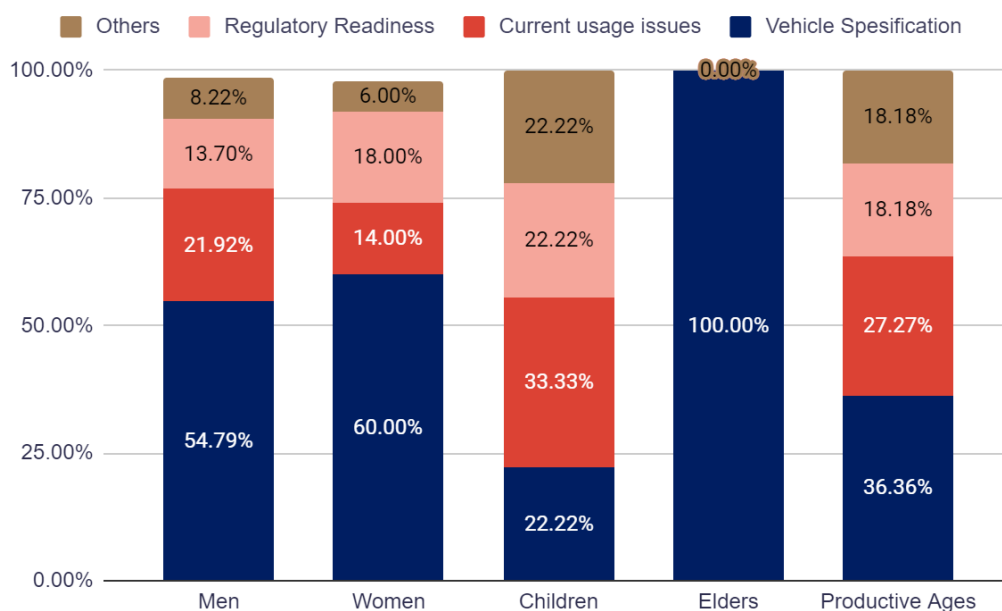


Figure 35 Electric Motorcycle Concern's Reason Based on Gender and Age Group

From the point of view of PwD, concerns regarding electric 2W that arise includes:

- Low level of sound emitted by electric 2W makes them hard to be identified, in particular for people with visual disability.
- Although electric 2W typically have lower performance than conventional motorcycles, the brightness of their headlight should be as bright as conventional motorcycles so that no additional risks are presented.
- Knowledge gaps on electric 2W and electrification programs also persist among PwD.

2.2.5.5 Charging Infrastructure Concern

In general, the level of knowledge regarding the charging infrastructure is very low for all groups, ranging from as high as 32.78% to as low as 8.00% (Figure 36). Similar to electric motorcycles, only a considerably lower number of elderlies have the knowledge of charging infrastructure. It shows the existence and the information about the charging infrastructure are very rarely found. Therefore, further education about charging infrastructures might be needed for all groups, in particular the elderly.

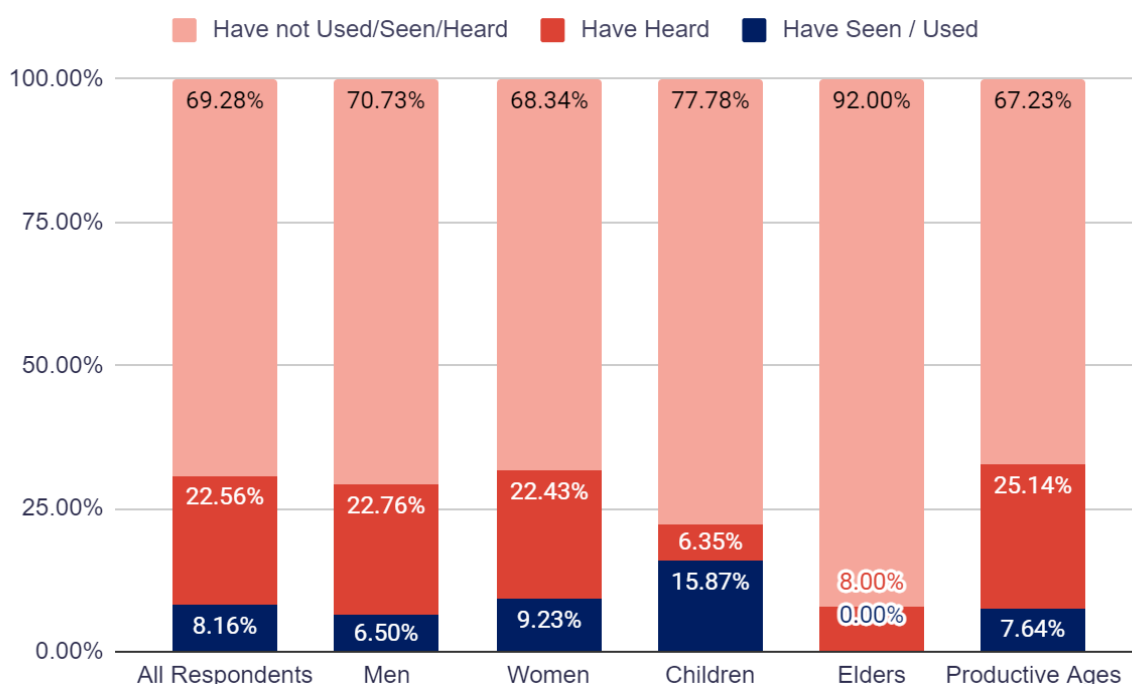


Figure 36 Charging Infrastructure's Knowledge Level Based on Gender and Age Group

On average, all groups tend to be not worried regarding the presence of charging infrastructures as shown by low numbers on Figure 37. However, their low level of knowledge might as well affect their perception. Therefore, further education on the charging infrastructures might reflect a different perception in the future.

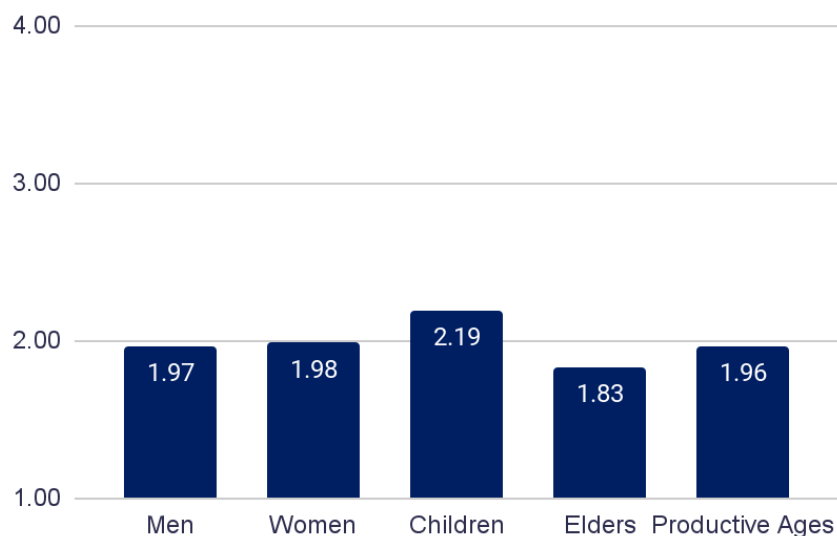


Figure 37 Level of Electric Motorcycle's Concern Based on Gender and Age Group

However, there is no further insights captured from the PwD group based on the FGD about charging infrastructures.

2.2.5.6 Regulation Inputs

Summarising findings on [section 2.2.5.3](#), improving the safety of the use of motorcycles by preventing the dangerous and violating rules behaviour of motorcyclists, such as driving through the sidewalk, is needed, in particular to improve the safety perception of motorcycles for elderly and PwD. On the other hand, to address the security concern from women on motorcycle usage, providing more surveillance systems in an area with high crime rate, low level of activity, and outside activity hours might be needed. Lastly, to address comfortability concerns, in particular for elderly and children, providing suitable infrastructures and maintaining its quality might be needed.

Summarising findings on [section 2.2.5.4](#) on issues regarding electric 2W, generally road users' knowledge is quite good already and they have relatively low concerns. However, some people are worried about the vehicle specifications such as speed, sound, and vehicle power of the electric 2W. Meanwhile from the next section on the charging infrastructures, although the level of concern is quite low, more efforts might be needed to familiarise road users with charging infrastructures, in particular the elderly.

Moreover, analysis was carried out on every gender and age group. It turns out that every group has the same perception about the regulatory input recommendation. Therefore, the input used is from the total respondents. As mentioned before on [section 2.2.4](#), out of the 625 respondents, only 14.23% of the respondents said no special regulations are needed ([Figure 30](#)). The most commonly encountered recommendation is to give a special lane for electric 2W to ensure road safety level, followed by applying minimum speed limit measures ([Figure 30](#)).

Table 6 Safety Improvement Advice for Electric Motorcycles

Road Users' Profile	1 st Recommended Policy	2 nd Recommended Policy	3 rd Recommended Policy
All Respondents	Special lane	Special vehicle's plate	Minimum noise produced
Elderly	Special lane	Speed restriction	Minimum noise produced
People with Disabilities	Minimum noise produced	Minimum brightness of headlight	Differentiation with electric bike

From the PwD perspectives, there is a need to set the minimum sound standard for the electric motorcycles. This regulation would avoid any additional risks for people with visual disabilities through the uptake of electric 2W in the future. There is also a need to set the brightness standard for electric 2W's headlight. Last but not least, electric 2W should be further defined as electric motorcycles and electric bikes, mainly due to differences in speed between some models. This way, those grouped as electric motorcycles should follow all existing regulations imposed on motorcycles, while electric bikes should also follow all existing regulations related to bicycles. Other advice from people with disabilities for the safety improvement and electric 2W are as follow:

1. Regulations should provide for standard safety features such as mirrors and other equipment for the electric motorcycles
2. More education for persons with disabilities regarding the electrification of motorcycles

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