Factors contributing to motorcycle accidents in Malaysia

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Abstract. Road accident in Malaysia is a major issue and the rate of accident is increasing yearly as per demonstrate by the indicator published by the relevant authority. A prompt action on this issue is vital because road accident and fatalities contribute to the loss in term of economic to the country. Statistic by Road Transport Department, Malaysia show the ratio of each Malaysian own a vehicle is mostly equal to one. Fatalities due to road accident has become a worldwide issue and more than 1.25 million people died due to road accident every years. Motorcycle is a popular mode of transport in Malaysia compare to other mode of transportation and the numbers of fatalities & road accident involve motorcyclist & pillion is an alarming and need to be address effectively by the relevant authority. This paper aim is to review the scenario of road accident happen in Malaysia especially event involving motorcyclist and pillion. It’s will discuss on the factor that cause the road accident happen based on the statistic produce by the relevant authority and research done on the matter. Road safety research is important to enable a reliable strategies can be develop to mitigate the cause of road accident and reduce the number of fatalities. Providing safer and forgiving road is required to reduce risk of fatalities / injuries to motorcyclist and pillion if involve in road accident.

1. Introduction
Road accident in Malaysia is a major issue and need to be addressed by the relevant authority and also the community to prevent the number of accidents and fatalities from increasing. Mark J.M. Sullman et.al, 2015 reported the rate of road accident recorded in Malaysia in 2008 is 23.5 per 100,000 people is higher compare to other develop country in Asia Pacific region such as Australia (6.8/100,000) and New Zealand (8.6/100,000). Nevertheless, it is much higher if compare to other country that already leading in road safety aspect such as Netherlands (4.1/100,000) and Sweden / UK which the rate is only 4.3/100,000. In Association of Southeast Asian Nations (ASEAN) country, analysis done by World Health Organization (WHO) based on data in 2013 and reported in Global Status Report On Road Safety 2015, Malaysia recorded index of 24 per 100,000 people and become the 3rd highest after Thailand (36.2/100,000) and Vietnam (24.4/100,000) compare to Singapore recorded 3.6 per 100,000 people and become the lowest amongst ASEAN country.

Motorcycle has become the second most popular mode of transport in Malaysia because of economic factor and ease of mobility especially through congested traffic conditions. The number of motorcyclist at non urbanised areas is much higher compared to urban areas (Muhammad Marizwan Abdul Manan and Andras Varhelyi, 2012). The number of accidents and fatalities involving motorcyclist is very high and most of the fatality cases are due to head injuries or combination of multiple injuries (Roszalina Ramli et. al. 2014). There are 3 major contributory factors to road accident involving motorcyclist. The human factor is the major cause of road accident. Age & gender of the motorcyclist is a factor that need
to be looked into due to high number of road accidents involving the young rider with less driving experience especially female motorcyclist. The other factor that contribute to road accident are the area, weather & fatigue (Muhammad Marizwan Abdul Manan and Andras Varhelyi, 2012).

The motorcyclist emotion while driving is important and survey by Mark J. M. Sullman et. al. (2014) found that unstable emotion due to anger will increase the risk of being involved in road accident. Speeding is a bad behaviour and contribute to road accident. Observations found more than half of motorcyclists ride above the posted speed limit. Speeding leads to serious injuries to motorcyclist if involved in road accident. Motorcyclist attitude of not wearing helmets properly or in correct way make the impact worsen and caused fatalities (Muhammad Marizwan Abdul Manan et. al., 2017). Roszalina Ramli & Jennie Oxley (2016) also found wearing the helmet properly and in correct way will provide better protection to motorcyclist compared to the type of helmet used.

Provision of dedicated motorcycle lane or extra lane may reduce the fatalities risk to motorcyclist but record showed that motorcycle road accident still occur on along this lane. A collaboration amongst the authority, researcher and the industry is vital to overcome the road safety issue towards safer road and reducing the number of fatalities (Nhan T. Tran et. al., 2009). M. I. N. Ma’arof et. al. (2015) has develop a simulator to conduct a study on the performance of motorcycle design and its relation to road accident.

Fatalities due to road accident is a major issue especially event involved motorcyclist & pillion and it is important to reduce the number of the fatalities. This paper discuss on the cause of road accident that has been identified as human behaviour/negligence, road infrasctucture, surrounding area and vehicle. It is important to identify the root cause of the issue and prompt mitigation action from those relevant agencies is required to reduce the number of fatalities.

2. Road Accident Statistic In Malaysia

In Malaysia, motorcycle has become a popular choice mode of transport due to its affordability in term of purchasing and economical in maintenance (Teik Hwa Law et. al, 2015). It is also due to traffic condition whereby riding a motorcycle is much easier and faster especially in highly populated and congested area. In Malaysia, the number of people using motorcycle is higher at less developed state such as Kelantan and Perlis compared to Selangor, Wilayah Persekutuan that more active in economic growth. (Muhammad Marizwan Abdul Manan & András Várhelyi, 2012). Teik Hwa Law et. al, (2015) presented that in advance economic country (AEC), people start to shift their mode of transport from motorcycle to passenger car when the level of income has increase.

Statistic shows the total numbers of registered vehicle recorded since 2009 until 2016 is 28,272,416 vehicle compared to 31,660,000 of total population in Malaysia in 2016. From the data available until July 2017, 45.89 % from the total vehicle registered in Malaysia is motorcycle which are the second highest after car with 1.29 % difference only. The number of road accident also increasing every year in parallel with the additional number of registered vehicle (Road Transport Department, Malaysia, 2017).

2.1. Fatalities Involving Motorcyclist & Pillion

Other than number of road accident occurrence, number of fatalities has been used widely as a parameter to compare and rank the country in term of road safety. According to World Health Organization (WHO) the total number of fatalities due to road accident in the world is more than 1.25 million people every year (Fred Wegman, 2017). Road accident also affect the country in term of economic due to loses of investment, damage of property etc. Table 2 show the loss due to road accident in Malaysia from 2011 until 2016. (Road Transport Department, Malaysia, 2017). This is a very serious matter and WHO expected the fatalities in road accident will become a major cause of death in 2030 if no precaution or preventing measures taken. In lieu of that, WHO has set a target to reduce the number of fatalities and injuries due to road accident by half in year 2020 and it has been set as an agenda in adopting sustainable development.
Due its smaller size and less safety features compare to other type of vehicle, motorcyclist faced high risk and vulnerable of injuries and the worst case is fatality if involve in road accident. The number of fatalities involving motorcyclist or pillion is very high compared to other mode of transport. The percentage of fatality cases involving motorcyclist and pillion from 2008 until September 2017 is the highest (61.2 %) compared to other category followed by car (20.3 %) and the lowest is fatality cases involving bus. (Road Transport Department, Malaysia, 2017).

The high number of fatalities is really alarming and need efforts from all parties with proper strategies to reduce the number of road accidents especially involving motorcycles which in turn brings down the overall road fatalities. Roszalina Ramli et. al, (2014) presented most prominent causes of fatal cases in road accident involved motorcyclist is due to head injuries. It is also due to multiple or single cause especially due to chest, neck and abdominal injuries. With knowledge of injuries or cause of fatalities amongst motorcyclist and pillion, the relevant authority should be able to plan proper prevention strategies to reduce the severity of injuries and total number of fatalities.
Figure 2. Percentage of Fatalities According to Types of Vehicle.
Source: Road Transport Department (RTD) Malaysia

Figure 3. Fatal, Serious and Slight Injuries Statistic
Source: Road Transport Department (RTD) Malaysia
Table 2. Loss Due to Accident

| Year | 2011 | 2012 | 2013 |
|------|------|------|------|
|      | Nos  | Nos  | Nos  |
|      | (RM) | (RM) | (RM) |
| Death| 6,887| 6,917| 6,915|
|      | 8.25 b| 8.3 b| 8.29 b|
| Severe Injury| 6,328| 5,868| 4,294|
|      | 759 m| 704 m| 515 m|
| Minor Injury| 12,365| 11,654| 8,028|
|      | 148 m| 139 m| 96 m|
| Total| 25,570| 24,439| 19,237|
|      | 9.16 b| 9.14 b| 8.9 b|

Source: Malaysia Institute of Road Safety Research (MIROS)

Table 3. Cause of Death in Fatal Subject

| Cause of Death | Fatal Subjects (n = 177) |
|---------------|-------------------------|
| (According to Site) | n | % |
| Head | 80 | 45.2 |
| Neck | 5 | 2.8 |
| Thorax | 19 | 10.7 |
| Abdomen | 10 | 5.6 |
| Multiple Sites | 53 | 29.9 |
| Underlying Co - Morbidity | 10 | 5.6 |

Source: Roszalina Ramli et. al, (2014)

Figure 4. Road Accident Involving Motorcycle
Source: Google Image
3. Cause of Accident Involving Motorcycles
Malaysia Institute of Road Safety Research (MIROS) studied the road accident data in year 2011 and found that the cause of accident is mainly due to human behaviour/negligence, road infrastructure and surrounding area and vehicle condition. The most critical issue contributing to road accident is human behaviour/negligence that recorded an 80.6% compared to road infrastructure and surrounding (13.2%) while vehicle factor is only 6.2%. (Buku Statistik Kemalangan Jalan Raya Malaysia, Ministry of Transport Malaysia, 2017).

![Figure 5. Cause of Accident](image_url)

Source: Malaysia Institute of Road Safety Research (MIROS)

Muhammad Marizwan Abdul Manan & András Várhelyi, (2012) found that there are 3 major type of road accident involving motorcyclist in Malaysia. The highest is collisions with passenger car at percentage of 28%. The other two type with same percentage i.e. 25% is single motorcycle accident and collisions with other motorcycle.

3.1. Human Behaviour
Prudent driving is very important in ensuring safety and avoidance of accidents happen while driving on the road and the issue is related to human behaviour. Nur Sabahiah Abdul Sukor et. al. (2017) found that human behaviour is one of the factor that contribute to road accident and it is important for the relevant authority to carry out effective enforcement action to create psychological impact to road user that will help discipline them to reduce the number of road accident.

3.1.1. Age & Gender
Motorcycle licence age limit in Malaysia is 16 years old and based on the data from Royal Malaysia Police (RMP), 22.5% of fatality cases in 2009 involved motorcyclist in age group 16 – 22 years old. (Muhammad Marizwan Abdul Manan & András Várhelyi, 2012). Tsu-Hurng Yeh & Hsin-Li Chang (2009) in a study in Taiwan also found that young driver are in high risk to be involved in road accident with high severity because of immature and less experienced. In term of gender, the percentage of female
motorcyclist fatality cases is higher than male and also higher in categories with riding experience below of 5 years.

Muhammad Marizwan Abdul Manan & András Várhelyi, (2012) also observed that 35% of the fatalities cases involved no licence holder and 34% cases involved motorcyclist that have riding experience below of 5 years. It is important to study how the age and gender factor contribute to the occurrence of road accident especially on the attitude issue and propose mitigation measure such as improvement in the licencing procedure. Mohamad Ghazali Masuri et. al. (2014) suggested an implementation of attitude test to evaluate driver attitude before given licence and renewal especially for young people to establish a better road community.

Figure 6. Percentage of Motorcycle Fatality by Gender & Licence Type
Source: Muhammad Marizwan Abdul Manan & András Várhelyi, (2012)

3.1.2. Anger & Aggression

Driver are at high risk and expose to danger of involving in accident if their emotion is not stable. Mark J.M. Sullman et. al, (2014) studied on the effect of anger to Malaysian driving behaviour using Driving Anger Expression Inventory (DAX) presented the correlation of accident rate involving driver which experience disruption in their emotion. The driver are exposed to higher risk involving in an accident or getting ticket due to less concentration while driving the vehicle.

3.1.3. Speeding

Speeding is a bad behaviour that increase the risk to be involve in road accident other than anger that contribute to aggressive driving. Muhammad Marizwan Abdul Manan et. al. (2017) observed that more than 50 % of motorcyclist riding above the speed limit stipulated at all road categories and sometime the speed is higher than other vehicle.

The small size of motorcycle allow the rider to manoeuvre easily and overtake other vehicle while speeding. Speeding is vulnerable to motorcyclist and pillion because higher speed will cause a high level degree of injuries or impact if involve in road accident. After certain speed, motorcyclist will have less control to their motorcycle due to human ability factor and will increase the risk involved in road accident (Nur Sabahiah Abdul Sukor et. al., 2017). To overcome the issue, Muhammad Marizwan Abdul Manan et. al. (2017) suggested a provision of road shoulder may give benefit and help to overcome the riding over the speed limit occurrence. Even though motorcycle lane is provided there are still stubborn rider that still maintain using the mainline and exposed them to more risk if involve in road accident.
3.1.4. Improper Ways Wearing Helmet

The fatal cases involving motorcyclist and pillion are due to major head injuries because improper way of wearing the helmet such as not been tightened. Roszalina Ramli & Jennie Oxley (2016) in the study conclude that wearing helmets in proper way is very important to provide better protection to the motorcyclist compare to the type of the helmets used such as full face, half head or open head type of helmets. Muhammad Marizwan Abdul Manan & András Várhelyi, (2012) presented that 20% of fatalities cases that involved motorcyclist because of not wearing helmet while another 4% due to improper way of wearing helmet. This is due to human behaviour by not taking into seriously on safety aspect while riding even though safety campaigns has been carry out to inform the importance of wearing a helmet in correct way. The usage of helmet that has been enforced in Malaysia proved that it helps in reducing the numbers of injuries and fatalities by 30%. (Nur Sabahiah Abdul Sukor et. al., 2017).

Figure 8. Motorcycle Fatalities by Type of Helmet Worn
Source: Muhammad Marizwan Abdul Manan & András Várhelyi, (2012)
3.2. Road Infrastructure & Surrounding
The percentage of road network in Malaysia that has provision of special lane for motorcycle is very low compared to the total road network. In early 2000, Government has launched the National Motorcycle Safety Program as an initiative to reduce the number of road accident involving motorcycle. Part of the program is to improve the facilities provided to motorcyclist such as providing dedicated lane or extra lane at road shoulder to reduce the conflict and possibility of major injuries if road accident occur. The first dedicated lane for motorcycle has been built at Federal Highway in Selangor and recorded reduction in numbers of accident by 39% every year (Hussain H. et. al. 2005). Although with implementation of the initiative, road accident still occur at the dedicated motorcycle lane or extra lane area (Muhammad Marizwan Abdul Manan & András Várhelyi, 2012).

Figure 9. Motorcycle Lane Source: Google Image

Muhammad Marizwan Abdul Manan & András Várhelyi, (2012) presented that the highest fatality cases involved motorcyclist happened in rural area (61%) and only 8% in city area. Further analysis also found that 62% of fatalities occurred on primary road/motorway and 20% in residential area.

The other factor that may contribute to road accident is the weather, daytime or night time and traffic condition. Based on road accident data from year 2000 until 2009, fatality cases involved motorcyclist is higher in the evening (after working hour) from 4.00 pm until 10.00 pm and maybe due to fatigue (Muhammad Marizwan Abdul Manan & András Várhelyi, 2012).

3.3. Vehicle
It is important to study the impact of the motorcycle design to the motorcyclist and its relation with accident (M. I. N. Ma’arof et. al., 2015). The current technology has now given the advantages to motorcycle manufacturers to diversify the motorcycles offered to consumers in term of the design and engine capacity. The higher capacity of the engine will increase the capability of the motorcycle to speed and increase the risk to motorcyclist if road accident occur (Muhammad Marizwan Abdul Manan et. al., 2017).

4. Road Safety Research
In Malaysia, various agency are involved in legislation/enforcement of road and transport law to public and road maintenance such as RMP, RTD, Land Public Transport Commission (SPAD), Ministry of Works (MOW), Public Works Department (PWD), Malaysian Highway Authority (MHA), local authority etc. Other than the agencies, Ministry of Education (MOE), Ministry of Transport (MOT),
MIROS, Road Safety Department (JKJR) also played their role in road safety to educate people on the importance of road safety.

Research and knowledge in road accident is very important to enable the understanding of what is the cause of road accident occurrence and the potential action need to be taken to address the issue in order to reduce the number of road accident. Data and finding from the road safety research is very important during engagement with the policy maker or relevant agency to demonstrate the actual evidence for them to decide the correct policy and plan the most effective initiative to overcome the road safety issue (Nhan T. Tran et. al., 2009).

As encouraged by the United Nation (UN) under their establishment Decade of Action policy, Malaysia has taken an action and developed Road Safety Plan for 2014 – 2020 with target to reduce the number of fatalities in road accident by 50% in 2020. MOT under its agency MIROS also develop a model to predict the fatalities due to road accident in year 2020 according to autoregressive integrated moving model (ARIMA) (Zarulazam Eusofe & H. Evdorides, 2017).

It is very important for policy maker to have good communication with the academician/researcher and all the stakeholder involved to ensure the correct policy is established, and the mitigation plan proposed implemented smoothly according to the milestone agreed. Implementation and monitoring the outcome of the action is very important part to be looked into especially the funding aspect to ensure the mitigation measures is done accordingly. The effectiveness of the action is crucial to be monitored to avoid loss of funds without achieving the objectives that has been targeted.

5. Conclusion
The number of road accident cases and fatality cases in Malaysia are amongst the highest compared to neighbouring countries in ASEAN region and the indicator become more significant if compared to a developed country. Motorcycle is an important mode of transport which recorded total percentage of 45.89% from vehicles registered in Malaysia. The statistic between year 2008 to 2017 showed 61.2% of fatalities in road accident involved motorcyclists and become the crucial issue that needs to be addressed by the government with collaboration of all stake holders.

The cause of accident can be summarised by three main categories which are the human behaviour/negligence, road infrastructure and surrounding area, and vehicle condition. The human behaviour factor recorded percentage of 80.6% compared to other categories and need to be given due attention as it become the highest percentage of causes of road accident compared to other cause identified. It is important for the relevant authorities to plan mitigation actions in all categories to overcome this issue to avoid the number of accidents increasing.

A proper mitigation plan is required especially involving motorcyclist and pillion to achieve the target to reduce the number of fatalities in road accident by 50% in 2020. A comprehensive study required to determine the root cause and plan the mitigation measures to overcome the issue and reduce the number of road accident and the fatalities especially involving motorcyclist and pillion. Collaboration between policy maker and academician/researcher together with assistance from all stake holders will enable workable mitigation measures and executed with proper monitoring to ensure objective that has been targeted is accomplished.

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