UNIVERSITI PUTRA MALAYSIA

RANKING OF TRAFFIC AND ROADWAY FACTORS PERCEIVED RISKY BY MOTORCYCLISTS ALONG LOCAL ROADS

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Abstract

Motorcycle fatalities in Malaysia are the highest to be compared to other vehicle fatalities. The numbers keep rising year by year even though various measures were employed by the Malaysia government to address the nation's number one road accident fatalities. From the engineering aspect, it is very important to understand the behavior of motorcyclists and their interaction with the traffic and roadway conditions. Therefore the objective of this study are to identify traffic and roadway factors perceived risky by motorcyclists and to rank the most risky traffic and roadway factor as perceived by motorcyclists along the local roads. A video footage is produced to be evaluated by motorcyclists in Universiti Putra Malaysia.

There are eight risk factor identified in this study and the risk factor are ranked from most risky to less risky as follows: 1) the presence of manhole, 2) bad pavement conditions, 3) the presence of on-street parking beside the road, 4) unsignalised junction, 5) the presence of mix traffic on the road, 6) the presence of pedestrian in the traffic system, 7) vehicle at junction, 8) narrow road.

SUSUNAN KEDUDUKAN TRAFIK DAN FAKTOR JALAN YANG DIRASAKAN BERISIKO BAGI PENUNGGANG MOTOSIKAL SEPANJANG JALAN TEMPATAN.

Abstract

Kematian dalam kemalangan membabitkan penunggang motosikal dalam Malaysia adalah paling tinggi berbanding kenderaan lain. Bilangan kematian itu semakin bertambah tahun demi tahun walaupun kerajaan Malaysia sudah mengambil berbagai tindakan untuk mengurangkan kadar kemalangan penunggang motosikal yang dinobat sebagai nombor satu kematian melibatkan kemalangan jalan raya. Dari sudut kejuruteraan, ia adalah penting untuk memahami kelakuan penunggang motosikal dan cara mereka berinteraksi dengan trafik dan keadaan jalan. Oleh itu, objektif kajian ini adalah untuk mengenalpasti trafik dan faktor jalan yang dianggap berisiko oleh penunggang motosikal serta untuk menyusun kedudukan faktor risiko yang paling berisko hingga kepada yang paling kurang berisiko sepanjang jalan tempatan. Satu klip video singkat telah dihasilkan bagi dinilai oleh penunggang motosikal dalam University Putra Malaysia.

Terdapat lapan faktor risiko dikenalpasti dalam kajian ini dan faktor risiko itu telah disusun mengikut kedudukan dari yang paling berisiko kepada yang paling kurang berisiko seperti berikut: 1) kehadiran lubang kumbahan, 2) kehadiran trafik bercampur, 3) kehadiran kenderaan parkir di sisi jalan, 4)simpang yang tidak berisyarat, 5) kepelbagaian trafik di atas jalan, 6) kehadiran pejalan kaki dalm system trafik, 7) kenderaan di simpang jalan, 8) jalan yang sempit.

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CHAPTER 1

Introduction

1.1 Background

According to the World Health Organization (WHO) (2016), about 1.25 million people die every year because of the traffic accidents. Among these victims, the average ages of the people involved was between 15-29 years old. WHO stated that 90% of the world's fatalities on the roads happen in low- and middle-income countries, although these countries have about half of the world's vehicle compared to others countries. Half of the victims involve in these fatalities are pedestrians, cyclists and motorcyclists.

Based on the research conducted by Malaysian Institute of Road Safety Research (MIROS, 2011), the results from Figure 1 shows that from early 80's until 1992 the rate of accidents involved motorcycles are lower compared other roads user. However, the rate of accidents involved motorcycle increased much higher compared to other vehicles started from 1994 until 2010. The result from the research shows that the rate of accidents among motorcyclist has an average of 2% increment back on ten years ago.

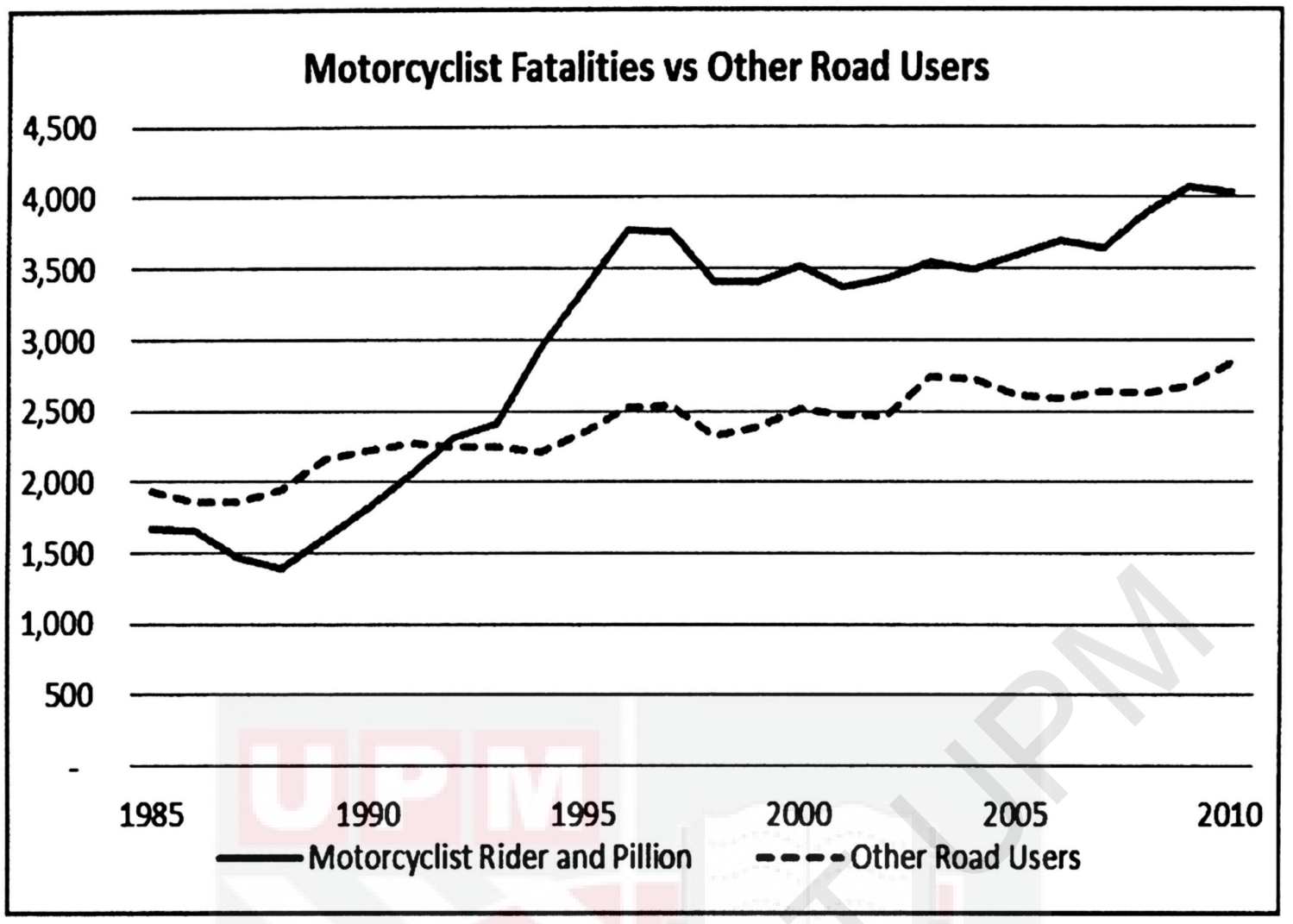

Figure 1.1: Line graph of motorcyclist fatalities vs other road users by MIROS (2011).

As shown in table1.1, MIROS stated that the rate of registered motorcycles increase year by year and at least 1% of those registered motorcycle involved in road fatalities. The outcome from the research shows that from 1% of those registered motorcycle involved in road fatalities, more than 10,000 motorcyclists and pillions are injured and died each year. From 2000 until 2004, the rates of victims in the roads fatalities among motorcyclist whose are involved in serious injury are smaller compared to the number motorcyclists killed in the roads fatalities in those years. However, the rate of motorcyclists killed in the roads fatalities increased from 2005 until 2010.

Table 1.1: Motorcycle accidents fact by MIROS (2011).

Years	New Registered Motorcycle (accumulative) (A)	No. of Motorcycle Accidents (B)	% (B/A)	No. of Rider Fatalities (C)	No. of Rider Casualties* (D)	% (C/D)	No. of Pillion Fatalities (E)	No. of Pillion Casualties* (F)	% (E/F)
2000	5, 356, 604	79,816	1.490	3,118	30,109	10.356	401	3,542	11.321
2001	5, 609, 351	85,761	1.529	2,971	30,348	9.790	398	3,279	12.138
2002	5, 842, 617	86,834	1.486	3,034	29,201	10.390	395	3,450	11.449
2003	6, 164, 958	95,545	1.550	3,166	30,832	10.269	382	3,416	11.183
2004	6, 572, 366	99,227	1.510	3,101	32,023	9.684	399	3,704	10.772
2005	7, 008, 051	97,072	1.385	3,181	27,445	11.590	410	3,777	10.855
2006	7, 458, 128	104,382	1.400	3,243	19,394	16.722	450	3,017	14.915
2007	7, 943, 364	111,958	1.409	3,197	18,151	17.613	449	3,124	14.373
2008	8, 487, 451	111,819	1.317	3,459	14,074	24.577	439	2,527	17.372
2009	8, 940, 230	113,962	1.275	3,640	13,561	26.842	430	2,250	19.111
2010	9, 441, 907	120,156	1.273	3,614	12,112	29.838	422	1,936	21.798

Roads accidents among motorcyclists mostly occur on municipal roads. The research conducted by MIROS showed that the most of those accidents happens on the rural roadways followed by built-up, urban, and city areas roadways. The accidents among motorcyclists on the rural roadways recorded averagely about 6000 cases each year from 2005 until 2010.

1.2 Problem statement

The problem of accident among motorcyclist and other vehicles is higher of magnitude in middle-income countries. High frequency of motorcyclist fatalities on the road are the result of the behavior of motorcyclist, exposure to other vehicular traffic and also poor roadway condition. Mixed traffic flow with high composition of motorcycles and other vehicles such as car, lorry, and also busses is a common situation in most Asian countries including Taiwan, Vietnam, Thailand and also Malaysia. The number of motorcycle registered in Malaysia shows nearly to half of all the other registered vehicle population as shown in Table 1.2.

Table 1.2: Number of registered vehicle in Malaysia during 2011.

Vehicle type	Motorcycles	Motorcar	Bus	Taxi	Rental car	Lorry	Others	Total
Number	9,771,671	9,468,37	70,989	88,421	19,187	984,142	505,199	20,910,001

The rate of accidents among motorcyclist still increasing year by year although there are a lot of program carried out by government in Malaysia in order to reduce the rate of accidents involved motorcyclists. The program that had been held are not reducing the rate of accidents among motorcyclist due to the behavior of the motorcyclist while using the roadway provided in Malaysia. So, the study of motorcyclist behavior is important in order to understand the main factor perceived by motorcyclist while using the roadway in rural and urban areas.

1.3 Studies objective

The general objective of this study is to determine the risk factor perceived by motorcyclist interact with roadway and traffic conditions through naturalistic motorcycle riding study. The specific objectives are:

1. To identify traffic and roadway factors perceived risky by motorcyclist.
2. To rank the most risky traffic and roadway factors as perceived by motorcyclists along the local roads.

1.4 Significance of study

The important from this study of identification of traffic and roadway risk factor perceived by motorcyclists in local areas is it will allows better understanding of motorcyclist riding behavior and interactions with the traffic, roadways and also the environmental factors. It is important to determine the behavior of motorcyclist while interact with the traffic, roadways and environmental factor because of the rate of accident involved motorcyclist keep increasing year by year although there are a lot of program carried out by government to decrease the rate of those fatalities and still had no effect. So, the output from this research will be useful for engineers to tackle traffic, roadways and also environmental factors that posed risk to motorcyclist riding along the road in Malaysia.

1.5 Scope of study

The module of the video that will be recorded during this study will involve a motorcyclist riding along traffic and roadways in Malaysia. Research by Peden et al., (2004) in the USA in 2002 revealed that majority of the riders were the younger ones (between ages 14-25 years old). Therefore, the researcher applied in this study to the respondents within the age range. The participants are the students of University Putra Malaysia (UPM). The male participants who are motorcyclist are to be choose randomly about 15 person in UPM same as female motorcyclists. This study also involved with short video clip and questionnaires. Likert scale and scores are used in order to carry out this study.

CHAPTER 2

Literature Review

2.1 Introduction

This Literature review is the selection of available documents which include publishes and unpublished documents on the topic which contain information, ideas, data and evidence that are written from a particular standpoint to fulfill certain views on the nature of the topic (Hart,1998).

Most of the countries around the world nowadays, facing problem with road fatalities including motorcycles. The rate of the accidents involve motorcyclist are increasing every year. These fatalities have negative impact on society. There is an estimation about 1.2 million people are killed and also 20-50 million people are injured on the roads annually (Peden et al, 2004).

WHO in 2009, revealed that 90% of these fatalities occur in low-income and middle-income countries.

As a measure to curtail this problem, there are many researches on this phenomenon around the globe back on 1970's.

A motor vehicle fatality happen when a vehicle or motorcycle collides with another vehicle, pedestrian, animal, road debris, or other stationary obstruction including tree and pole (Wikipedia, retrieved on 20/12/2016).

The Hurt committee had documented the first research about motorcycles accidents in United States of America (USA) which was began in 1976 and was completed in

1981. The report was published in 1981 and the result from the report showed that 75% of road fatalities involved a motorcycle and a passenger vehicle, and other 25% were single motorcycles accidents (Wikipedia, retrieved on 20/12/2016).

This chapter is grouped under the following thematic areas below.

- Motorcyclists' attitude and driving patterns
- Age, gender, and experience of motorcyclists
- Motorcyclists' traffic rule violations
- Types of roadway areas
- Road geometry and infrastructure
- Pavement surface condition
- Chapter summary

2.2 Motorcyclists' attitude and driving patterns

The attitude of motorcyclists towards the safety while on the road varies significantly as stated in some of related studies. In the research conducted by Mannering and Grodsky (1995), the result showed that motorcyclists have a reasonable grasp of factors that incline the possibility of the accident involvement. These factor that stated in the studies involve exposure, engagement in risk taking behavior like always riding exceeded the speed limit, and passing other vehicles on the shoulder or passing between the lanes of traffic.

There is a different of hazard perception to be compared among motorcyclists to automobile drivers. Based on comparative study between a group of motorcyclists and a matched group of automobile driver carried out by Horswill and Helman (2003), the outcome of the study showed that motorcyclists chose faster speed than automobile

drivers, overtook more frequently, and pulled into smaller gaps in traffic, which may give a better hazard perception such as responding and detecting to hazard faster compared to car drivers. Another study carried out by Rosenbloom et al. (2011), also came out with the same result which stated that motorcyclists having higher hazard perception ability compared to car drivers.

According to Harrison and Christie (2005), the less experience of motorcyclists riding activity might result to a decline in safety related to motorcycle skills, whereas more experienced motorcyclists appears to moderate crash risk. Their study showed that there is a relationship between annual exposure and crash risk, such that motorcyclists who ride relatively little have higher crash risks (per 100,000 km travelled) than those motorcyclists who ride more often.

2.3 Age, gender and experience of motorcyclists

There are three factors that may affect both motorcyclists' attitude and behavior which are age, experience and also gender. The outcome from the study carried out by Yeh and Chang (2009), revealed that younger and inexperienced motorcyclists which having risk taking behaviors have higher possibilities of being involved in a crash. Furthermore, the highest motorcycle injuries are typically found in the age groups close to the lowest legal age limit for riding a motorcycle. They describe specific patterns of youth behavior, which are having willingness to break the law and violate the rules of safety riding which contribute to higher risk in accident involvement than inexperience (Rutter and Quine, 1996). Moreover, the older motorcyclist are have more tendency to be involved in severe injury crashes because of decrease physical resilience to crash, slow reaction time and also perceptual ability (Pai and Saleh, 2007; Savolainen and Mannering, 2007).

Harrisson and Christie (2005) reported that the behavior of the motorcyclists are related to their age and riding exposure, which may influence their safety on the road. The amount of riding experience reported for different purpose change with age, with older riders are more likely than the younger motorcyclists to ride for recreational reasons and on weekend. They proposed that a period of absence from riding may lead to a decline in safety-related motorcycle skills, whereas high exposure appears to moderate crash risk. The experienced motorcyclists were faster to respond to hazards than inexperienced rider, and such faster response times may be due to experienced motorcyclists having a visual search pattern that is more flexible than that of inexperience motorcyclists (Hosking et al., 2010).

The motorcyclists experience in accidents involvement are related to their hazard perception skill due to accident-involved motorcyclist has a poor skill in order to identify hazards while interact with traffic and roadway (Cheng, et al., 2011). This means that accident-free motorcyclist tend to identify the hazard faster compared to the accident-involved motorcyclist.

2.4 Conspicuity and perception of motorcyclists by other road users

Because of their related size (conspicuity), motorcycles may be difficult for other road users to detect. Car drivers have difficulties in perceiving motorcycles, especially at far distance (Crundall et al., 2008). Conspicuity is linked to the expectation factor of car driver which mean if the driver does not expect to encounter a motorcycle, he or she will usually fail to see it (Clarke et al., 2007; Simons, 2000). The new car drivers who are beginner in driving might fixate on an oncoming motorcycle sooner than their more experienced counterparts (Labbett and Langham, 2006). The most right-of-way accidents involving motorcycles were attributable to conspicuity issues.

2.5 Type of roadway areas

Malaysian Institute of Road Safety Research (MIROS) in 2011 stated that the number of motorcyclists accidents between 2005 until 2010 showed 66.62% of motorcycle crash event occur in the rural area, city 4.60%, urban 11.49%, and built-up area 17.29%. According to Jaafar et al., (2003), 50% of motorcycle fatalities occur in rural areas and most of the motorcycle accidents happen on straight roads section.

2.6 Road geometry and infrastructure

A serious attention in motorcycle safety is the influence of road geometry, road markings and roadside installations which include barriers, post and so on. Parallel longitudinal grooves in the road surface that act as aquaplaning prevention are ineffective marking and can cause instability for motorcyclists. Based on statement by National Park and Recreational Association (NPRA) in 2004, in wet condition, road markings, manholes and cattle grids might be more slippery to be compared with the rest of the road surface.

There are several studies that mentioned about the risk of fatalities correlated with road geometry such as curve or straight road section. The high rate of right of way violations and single vehicle accidents occur on bends (Hurt et al., 1981). Preusser et al., (1995) and Clarke et al., (2007) stated that a high portion of motorcycle crash that involve going out control mostly occur on a curve. The radius and length of the horizontal curve, along with the shoulder width, annual average daily traffic, and the location of the road segment, in relation to the curve, greatly influence the rate of single motorcycle fatalities. Jaafar et al., (2003) and Radin Umar (2005) mention that majority motorcycle fatal crashes in Malaysia occur on the straight road section.

2.7 Pavement surface condition

According to Elliot et al., (2013) the road surface conditions that may produce hazard to motorcycle rider are slippery surfaces, repaired patches on the road, unevenness, road markings, longitudinal parallel grooves, cobbles, drain covers and gratings. Their study revealed that sudden changes in road surface friction may raise instability in one-track vehicles which can be caused by patches of diesel and oil on the road and in some areas by spillage of grease from stationary buses. In addition, motorcycle rider are especially vulnerable when it comes to bitumen which is a material mostly used in modern road repair mainly to fill and patch road cracks.

Haworth et al., (1997) mentioned that the road surface actively contributed to 15% of fatalities examined by the Victorian motorcycle case control study which suggested that the significant factors in these crashes were the surface grip, surface irregularities and potholes, loose materials, patch repairs and road markings. A wet pavement surface is also a cause at-fault motorcycle crashes at non-intersections (Haque et al., 2009). However, despite poor road surface conditions being often mentioned by motorcyclists in United Kingdom, the road surface was revealed only give 5% of errors made by the motorcyclists on built-up and no-built-up roads (Hurst, 2001).

2.8 Chapter summary

The literature review brought to the forward motorcycle accidents around the globe and also explores the views of various scholars on the cause of these accidents. Malaysia is the middle-income countries that have high frequency of motorcyclist crashes. The outcomes from other researcher studies will be taken as variable in this study such as gender, riding experience and accident involvement of respondents.

CHAPTER 3

Methodology

3.1 Introduction

This chapter explains about the methodology that used to fulfill the objectives of the study. The methodology used id consisted of making stimuli, data collection procedures, analysis of data and make recommendations to improve motorcyclists safety related to the risk factor perceived by motorcyclists in relation to roadway and traffic condition. Initially, the focus is on determination of variables followed by related topic to make a video clips, scenarios, data collection and making recommendation.

3.2 Determination of variable

As mentioned in objective section, the main objective of this study is to determine the risk factor perceived by motorcyclist interact with roadway and traffic conditions through naturalistic motorcycle riding study. Therefore, the dependent variable in this study is the evaluation given by respondents for each risk factor identified by five volunteer from the video recorded. The evaluation from the respondents will determine which risk factors give most impact to the motorcyclists while interact with roadway and traffic conditions after watched a video from the perspective of motorcyclists while riding on the road were taken. From these result, the recommendations to improve motorcyclist safety related to the risk factor perceived

by motorcyclist in relation to roadway and traffic condition is made based on the data analysis from the video.

3.3 Materials

One high definition video camera was positioned on a motorcyclist helmet to record the point of view of the motorcyclist while riding along local roads. This study was conducted in Malaysia where the vehicles travel on the left lane. The motorcycle speed was constant about 50-60 km/hr.

3.4 Motorcycle riding sceneries (stimuli)

There were several video that had been recorded and will be analyzed by five volunteers that have motorcycle license. These volunteers were watching the video recorded and tell to the researcher the risk factors that perceived by them as motorcyclist. The researcher wrote down the risk factor that had been mentioned by the volunteers. These interviews were conducted separately one volunteer at once. The result from the interviews were compared each other and a video clip had been produced combining the risk factors that had been choose by these five volunteers. The video clip represents the view point of the motorcyclist while riding along local roads and separated into eight sections whereby each section represent one risk factor perceived by motorcyclist while riding along the local road. The videos were edited to 2.42 minutes length.

Figure 3.1: Respondent evaluating risk factor perceived by motorcyclist from the video clip.

The eight part of the video clip consist of:

- Clip 1: On-street parking
- Clip 2: Pedestrian
- Clip 3: Vehicle at junction
- Clip 4: Mix traffic
- Clip 5: Manhole
- Clip 6: Pavement
- Clip 7: Narrow road
- Clip 8: Unsignalised junction

The video clip was manual reviewed by the participants to evaluate each risk factors in the video perceived by motorcyclist while interact with roadway and traffic system on local area. It is important to understand how crashed are avoided, as well as how they actually occur, to ensure that the safe practices to prevent crashes are known and encouraged, but also to identify the elements of the road network that need to be improved to assist with motorcyclists safety.

3.5 Participants

A total of 30 volunteer subjects took part in this study. Of these, 50% participants were female and another 50% were male. The range of ages among the participants was 19 to25 years old. The participants that take part in this study were held a motorcycle license. Students from University Putra Malaysia (UPM) were volunteered to take part in this study.

3.6 Design of the study

A repeated measures design was employed with all stimuli presented to all the participants. Participants were approximately sat 50 cm from the screen and first were instructed with the stimuli video clip for 2.42 minute. The stimuli video clip was included eight part. Each part of the video clip represent the point of view of a motorcyclists riding along local roadway. They supposed they are the motorcyclist. They were instructed to evaluate each risk factors perceived by themselves as they are riding along the local roadway into five categories which are very safe, safe, neutral, risky, and very risky. From the respondent answer, they will be evaluated by researcher to give score to each respondent.

3.7 Method of analysis

Analysis of variance and repeated measure analysis is conducted to understand the effect of gender, motorcycle licensing, riding experience, and road traffic accident experience on the score obtained by respondents after evaluate the risk factor perceived by motorcyclists while riding along the local areas from the video footage.

3.8 Data analysis

Participants were answered the questionnaire provided to them while watched the stimuli videos. From the participants answer, the data were collected and analyzed to identify the risk factor perceived by motorcyclists while riding on urban and rural areas.

In order to rank the most risky factor as perceived by motorcyclists along the local road, relative index method was used. The relative index in this study represent as perceived risk. The higher the value of perceived risk, the more risk the risky factor. The perceived risk calculated by using these formula below:

$$\text{Perceived risk} = \frac{N(risky)+N(very\ risky)}{N(neutral)+N(safe)+N(very\ safe)}, \quad \text{Eq. (1)}$$

N: number of respondents who evaluated the risk factor as (risky, very risky, neutral, safe, very safe).

Besides that, all the respondents was evaluated based on their evaluation for each risk factor. The score was evaluated based on the rate of the respondents given to each risk factor as shown in Table 3.1.

Table 3.1: Score based on rating for each risk factor.

Respondents evaluation	Very safe	Safe	Neutral	Risky	Very risky
Score	-2	-1	0	1	2

The highest possible score in this study are 16 because there are 8 risk factor involved while the lowest score are -16. The higher the score shows that the more the respondents cautious towards the hazard perceived while interact with traffic and roadway while riding motorcycle.

Based on the collected data and analysis, recommendations to improve motorcyclists safety related to the risk factor perceived by motorcyclists in relation to roadway and traffic condition were made.

CHAPTER 4

Result and Discussion

This chapter in this research work did an analysis of the data collected from the respondents for the purpose of obtaining the objectives of the study.

The main objective of this study is to determine the risk factor perceived by motorcyclist interact with roadway and traffic conditions through naturalistic motorcycle riding study. The sample size of this research was 30 respondents. Data collected from the respondents was presented with the aid of frequency distribution tables, bar chart and line chart for easy visualization and comprehension.

Based on the video clip produced, there are eight risk factors identified by the five volunteers from the raw video as shows in Table 4.1. The risky factors are selected when there are more than three respondents choose the same factors which are:

1. On-street parking
2. Presence of pedestrian
3. Presence of vehicle at the road junction
4. Mix traffic
5. Manhole
6. Bad pavement condition
7. Narrow road
8. Unsignalised junction

Table 4.1: Risk factors identified by five repondents.

NO.	RISK FACTOR IDENTIFIED				
	VOLUNTEER 1	VOLUNTEER 2	VOLUNTEER 3	VOLUNTEER 4	VOLUNTEER 5
1	On-street parking	On-street parking	On-street parking	On-street parking	On-street parking
2	Pedestrian	Pedestrian	-	Pedestrian	Pedestrian
3	Vehicle at junction	Vehicle at junction	Vehicle at junction	-	Vehicle at junction
4	Mix-traffic	Mix-traffic	-	Mix-traffic	Mix-traffic
5	Manhole	Manhole	Manhole	Manhole	-
6	Pavement	Pavement	Pavement	Pavement	Pavement
7	Narrow road	Narrow road	Narrow road	Narrow road	Narrow road
8	Unsignalised junction	Unsignalised junction	Unsignalised junction	Unsignalised junction	Unsignalised junction
9	Bump	-	-	-	-
10	-	Damaged traffic light	-	-	Damaged traffic light
11	-	-	Straight road no bump	-	-
12	-	unwanted material beside road	-	-	-

These risk factor will be analyzed under respondent's background which included their gender, riding experience and accident involvement.

4.1 Perceived risk

According to the bar chart presented in Figure 4.1 based on Table 4.2, the highest perceived risk among the risk factor is the presence of manhole with the value of 29.0 followed by the bad pavement condition (6.50), the presence of on-street parking along the road (5.00), the unsignalised junction in the road system (3.29), the mix traffic in traffic system (2.00), the presence of pedestrian along the road (1.73), the presence of vehicle at road junction (1.14) and lastly the narrow road condition (1.00).

Table 4.2: Perceived risk for each risky factor.

	Number of respondents						
Risky factor	Very safe`	Safe	Neutral	Risky	Very risky	TOTAL	PERCEIVED RISK
On-street parking	0	2	3	18	7	30	5.00
Pedestrian	0	2	9	13	6	30	1.73
Vehicle at junction	0	4	10	13	3	30	1.14
Mix traffic	0	4	6	12	8	30	2.00
Manhole	0	1	0	19	10	30	29.00
Pavement	0	0	4	21	5	30	6.50
Narrow road	0	3	12	9	6	30	1.00
Unsignalised junction	0	1	6	9	14	30	3.29

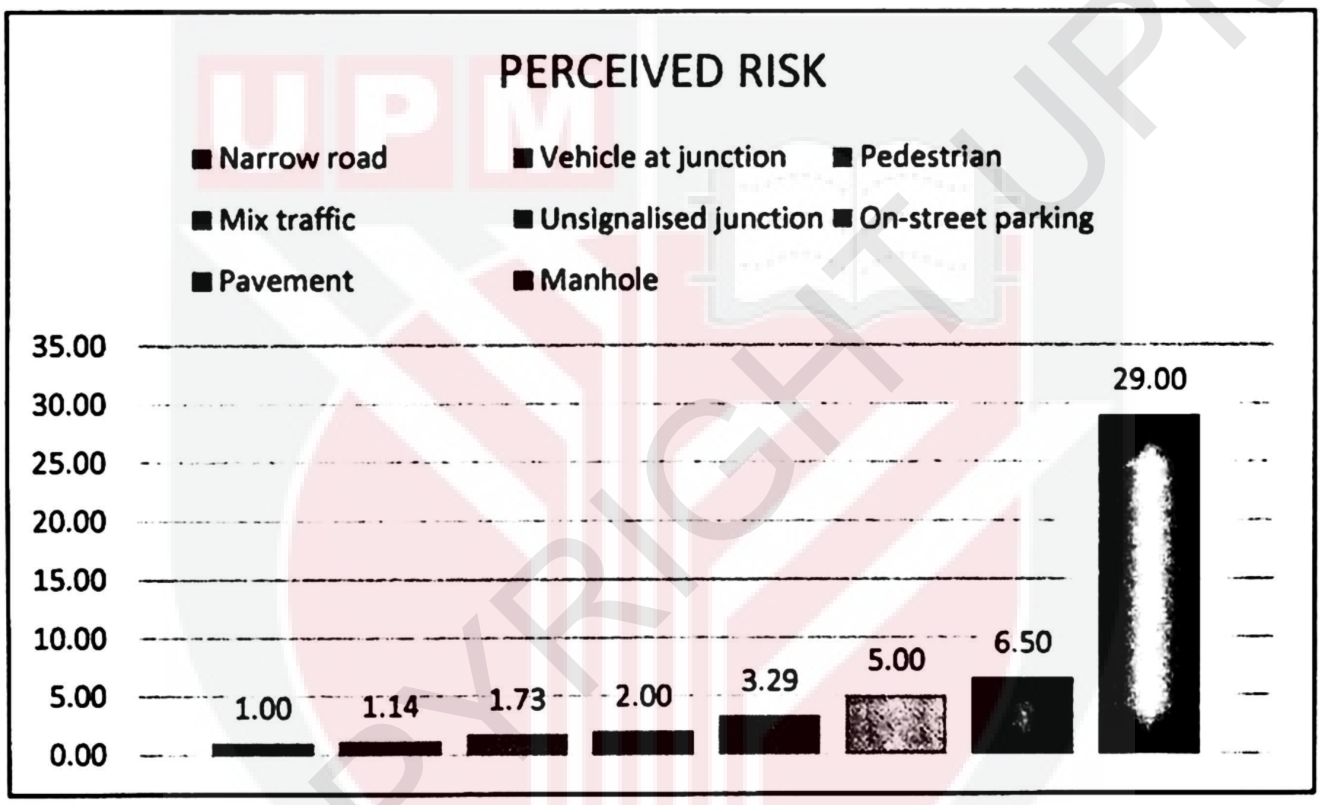

Figure 4.1: Perceived risk value in bar chart form.

The risky factors are ranked from the most risky traffic and roadway factors as below:

1. Presence of manhole.

   Manhole is considered as the most risky among the risk factors perceived by motorcyclist while riding on local road in this study. This may be due to the level of the manhole are not same with the level of the roads. In case of raining, manhole may be slippery when in wet condition and will cause hazard to motorcyclists when interacted with it. National Park and Recreational Association (NPRA) in

2004 had mentioned that manholes might be slippery to be compared with the other road surface. The example of the presence of the manhole is shows in Figure 4.2.

Figure 4.2: Presence manhole along a local road.

2. Bad pavement condition.

   Pavement surface plays important roles on the road because it is provide comfort condition for motorcyclists while riding along the road. Pavement should be in good condition to avoid hazard to motorcyclists. Bad pavement conditions give hazard to the motorcyclist because it will cause motorcyclist to lost control toward handling motorcycle while it is encountered. Study conducted by Elliot et al., (2003) stated that repaired patches on the road and unevenness of the pavement may cause hazard to the motorcyclists. The example of bad pavement condition is shows in Figure 4.3.

Figure 4.3: Bad pavement condition along a local road.

3. Presence of on-street parking along the road.

On street parking are considered as risky for motorcyclist while interact with traffic and roadways because it make the space of the road reduced and could lead to accident. Edguist J. et al., (2012) revealed that on street parking is associated with elevated crash risk. Figure 4.4 shows the example of on-street parking on the local road.

Figure 4.4: On-street parking alongside a local road.

4. Unsignalised junction in the road system.

The next risk factor is the unsignalised junction in the road system. The junction is considered as risky to motorcyclist due to road users tend to cross the junction at same time. Thus, this will increase the risk of crash to motorcyclist while at the unsignalised junction. According to Kentucky State Police (2012), more than half motorcycle crashes occurred are caused by drivers entering a motorcyclist's right-of-way at the unsignalised junction. Figure 4.5 shows the example of unsignalised junction on a local road.

Figure 4.5: Unsignalized junction on a local road.

5. Mix traffic in traffic system

The presence of mix traffic in traffic system is also considered as risk factor to motorcyclists. This is maybe because of the other road user have difficulties to see motorcyclists from far distance (Crundell et al., 2008). Clarke et al., (2007) and Simon et al., (2000) stated that conspicuity is linked to the expectation factor of car driver which mean if the driver does not expect to encounter a motorcycle, he or she will usually fail to see it. Dinesh Mohan (2006) stated that one of the main

factors of risk for traffic injuries is the mixture of high-speed motorized traffic with motorcyclists.

Figure 4.6: Mix traffic in traffic system.

6. Presence of pedestrian along the road.

   The presence of pedestrian in the traffic system is risky to motorcyclist maybe cause of the pedestrian are not using pedestrian walk provided and using the main road instead. This are causing risk for motorcyclist while using the road because the pedestrian are using the space provided for motorcyclists on the road and will increase the risk of crash. Because of pedestrian related size (conspicuity), pedestrian may be difficult for the motorcyclists on the road to detect (Crundall et al., 2008). The example of the presence of pedestrian on the local road is shows in Figure 4.7.

Figure 4.7: Presence of pedestrians on the local road.

7. Presence of vehicle at road junction.

The presence of vehicle at the road junction is considered as risky to motorcyclists in this studies maybe because the vehicle such as car are make suddenly turn to cross the road and cause motorcyclists unable to avoid the vehicle when encountered. According to Bikelawyer Motorcycle Accident Solicitors (2015) stated that 55% of road crashes occur at junction. The examples of the presence of vehicle at junction on local road are shows in Figure 4.8.

Figure 4.8: Presence of vehicle at a road junction.

8. Narrow road condition.

The last risk factor considered risky in this study is the narrow road condition. This condition may give risk to motorcyclists when encountered with bigger vehicle such as car and caused the space on the road reduce for motorcyclists and increase the risk of crash. Dave and Meg Stefanac (2015) mentioned that when motorcyclists ride on the narrow space, it will leave little room to maneuver around any obstacle and it will increase the risk of crash. The example of narrow road condition is shows in Figure 4.9.

Figure 4.9: Narrow road condition.

4.2 The gender of the respondents

This section looked at the personal characteristics of the respondents involved theirs gender. Study conducted by Cordellier et al., (2016) showed that both men and women were able to understand and to detect risk, but only women showed concern about the risk. Thus, the number of respondents between male and female in this research were

balanced (15 males and 15 females). The score points between male and female motorcyclists involved in this study were compared using line graph in Figure 4.10.

Figure 4.10 indicated that the male respondent score points are higher to be compared to the female respondent although the lowest scored point (-1) among the respondent is among the male respondent. The highest score in this research is 13 points which was scored by a male respondent while the highest score by female respondent is 9 points and the lowest score is 0 point. The average score by male respondents is 7.87 points higher compared to the female respondent average score which is 6.40 point.

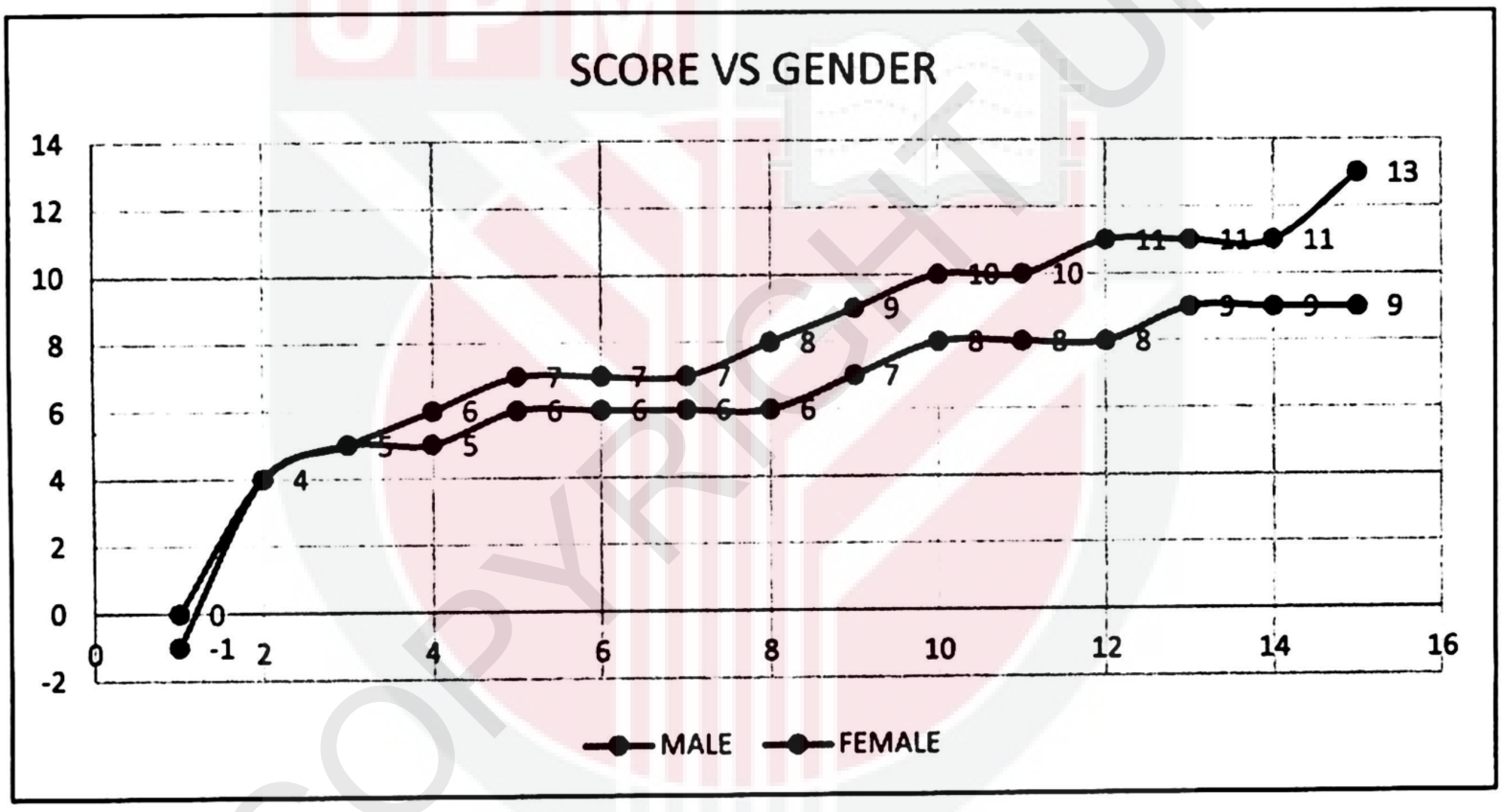

Figure 4.10: Score VS gender line graph.

Figure 4.11 indicate that there are only 1 female respondent choose the presence of manhole on the road as safe. 10 of the female respondents evaluated that the presence of manhole on the road while riding motorcycle as risky and other 4 evaluated manhole as very risky.

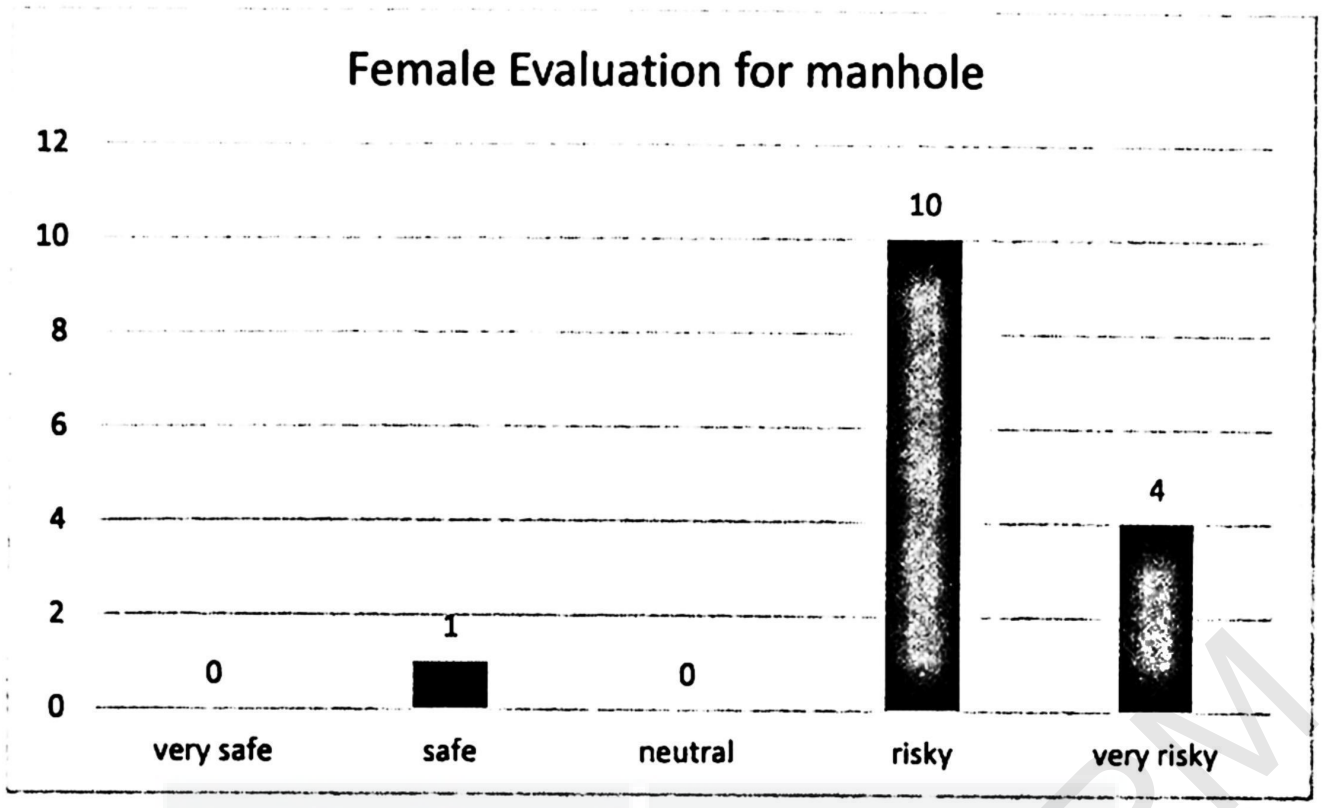

Figure 4.11: Female respondent evaluation for the presence of manhole along the road.

Figure 4.12 indicate that 8 male respondents evaluated the presence of manhole while riding motorcycle along the road as risky while the other 7 stated that manhole are very risky.

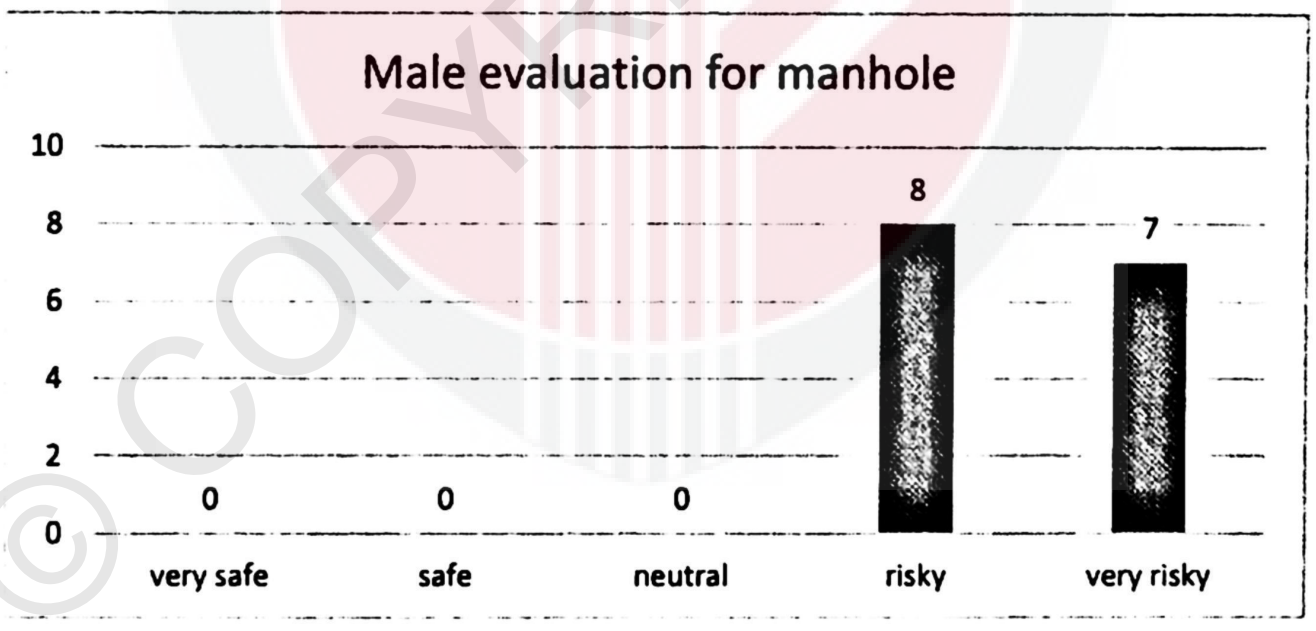

Figure 4.12: Male respondent evaluation for presence of manhole along the road.

There are more male respondents choose manhole as very risky hazard toward motorcyclist compared to female motorcycle rider. This result shows that male motorcycle riders are more cautious to hazard perceived by motorcyclist while interact

with traffic and roadway compared to female. Perhaps males normally ride motorcycle faster than females which may lead them to consider manhole as very risky and difficult to avoid when it is encountered along the road while riding motorcycle.

To support the finding above, Figure 4.10 are analyzed and the graph clearly shows that male respondents are more cautious toward hazards perceived while interact with traffic and roadway while riding motorcycle compared to female rider. This finding are not same with the study conducted by Cordellier et al., (2016) which stated that female rider showed more concern toward the surrounding. Perhaps because this study was conducted in different place which lead to different outcome.

4.3 The riding experience of the respondents

The study conducted by Hosking et al., (2010) showed that the experienced motorcyclists were faster to respond to hazard compared to inexperienced rider. Thus, the experience of the respondents were taken and compared with the score to see the level of cautious toward hazard while riding along the road. The experience of the respondents were divided into two groups which are the respondents with less than 7 years riding experience and the respondents with 7 years and above riding experience.

From Figure 4.13, total respondents with less than 7 years riding experience are 14 people while the respondents with riding experience less than 7 years riding experience are 16 people. The respondents with riding experience less than 7 years riding experience came out with the highest score among all of the respondents which is 13 points and also came out with the lowest score among the respondents which is -1 point. The highest score in group of respondents that had riding experience more

than 7 years is 11 points while the lowest score in this group is 0 point. The different of score between these two groups are not too far from each other.

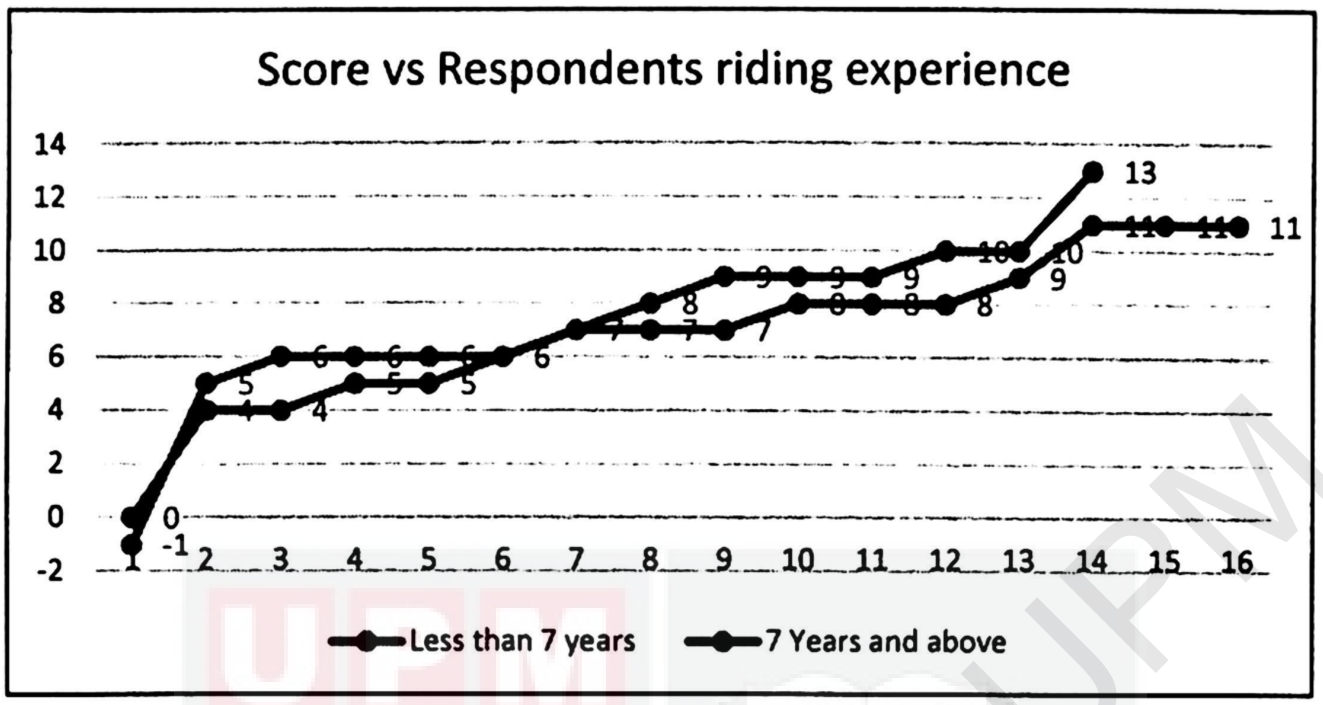

Figure 4.13: Score vs respondents riding experience line graph.

Figure 4.14 indicate that only 1 of the respondents from the group of respondents with 7 years and above riding experience evaluated the presence of manhole on the road as safe, 10 of them evaluated it as risky while the other 5 evaluated it as very risky.

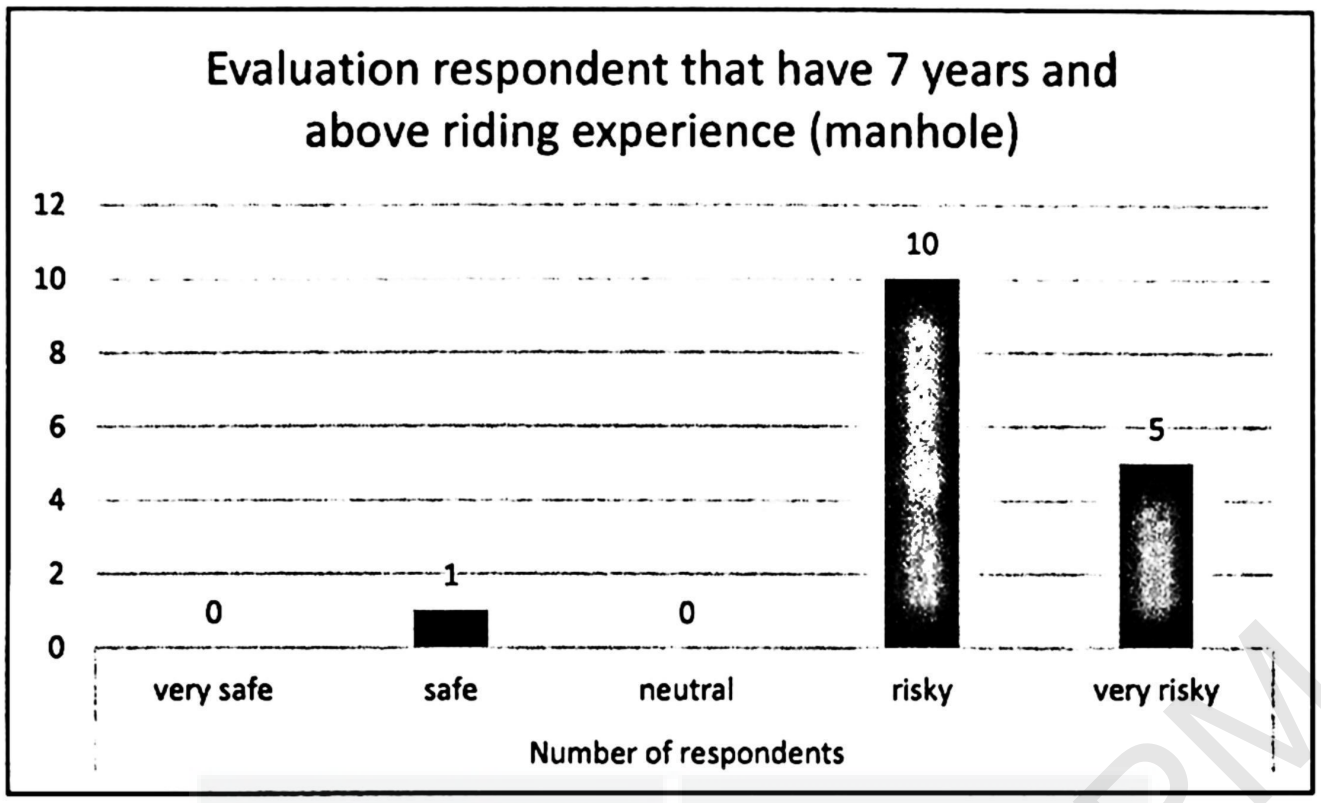

Figure 4.14: Evaluation of respondents that have 7 years and above riding experience toward the presence of manhole on roadway.

Figure 4.15 indicate that 8 respondents from the group of respondents with less than 7 years riding experience evaluated the presence of manhole on the road as risky while 6 of them evaluated it as very risky.

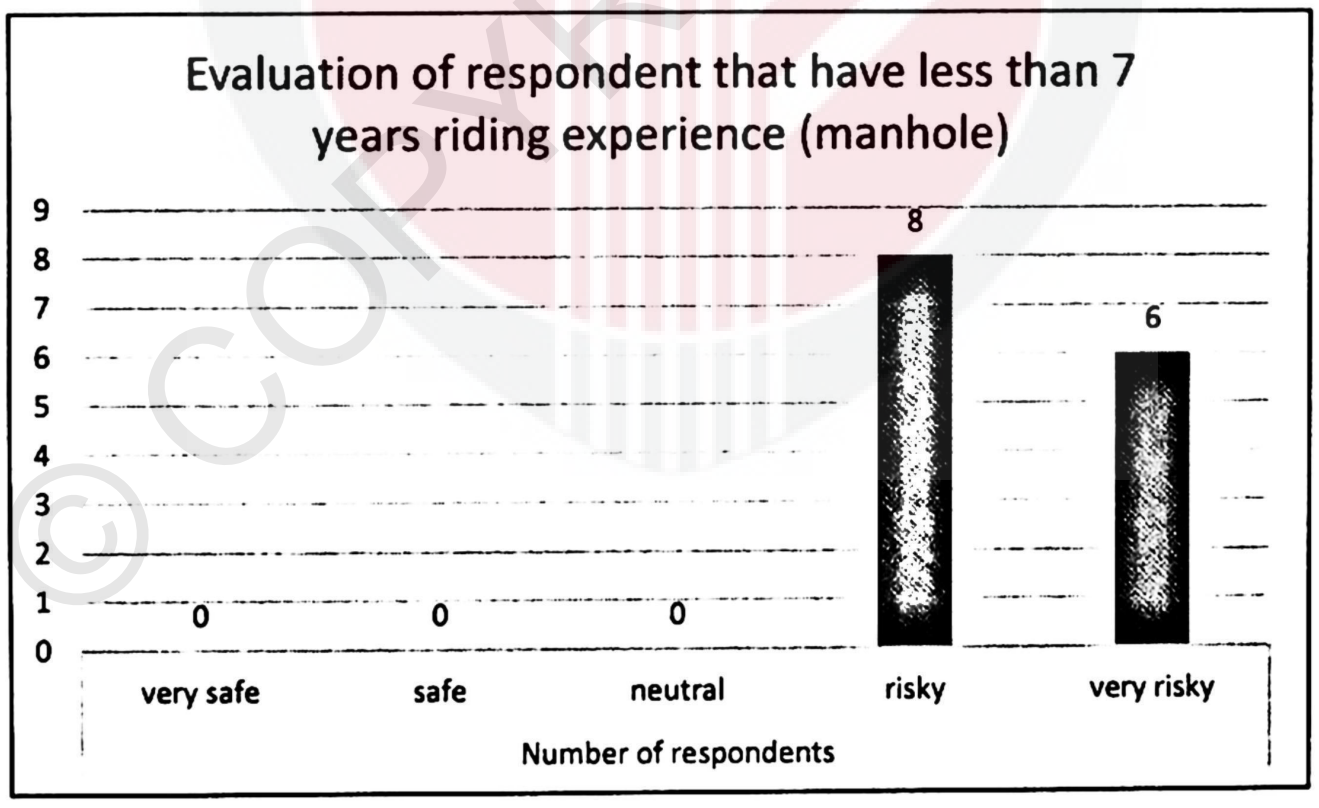

Figure 4.15: Evaluation of respondents that have less than 7 years riding experience toward the presence of manhole on roadway.

Although the total respondents with less than 7 years riding experience are less than the other group, the numbers of the respondents with less than 7 years riding experience who consider the presence of manhole as very risky toward them are 5 person which is higher compared with the other group. This outcome indicates that motorcyclists with less experience are more cautious toward hazard while riding along the road.

The finding from study carried by Hosking et al., (2010) had stated that experienced motorcyclists had faster response time toward hazard compared to the inexperienced rider. However, the inexperienced rider may have more concern toward hazard along the road compared to experienced rider as they are more caution while riding due to their lack of riding experience.

To support the statement above, Figure 4.13 shows that the scored points by the group of respondents who had less than 7 years riding experience are higher compared to the other group. This results shows that inexperienced rider are more alert toward hazard while riding along the road.

4.4 The respondents riding experience

The research carried out by Cheng et al., (2011), stated that the accident-free motorcyclist tend to detect hazard faster compared to accident-involved motorcyclist. Therefore, the respondent data about their involvement with accident were collected to be compared to their score.

Figure 4.16 shows that there are 12 respondents in this study that never encounter with road accidents while riding motorcycle while the other 18 respondents had encounter with road accidents while riding motorcycle. The highest score for the respondents

that never involve in road accident is 11 points while the lowest score among them is 4 points. For the group of respondents that had involved with accidents, the highest score among them is 13 points while the lowest score between them is -1.

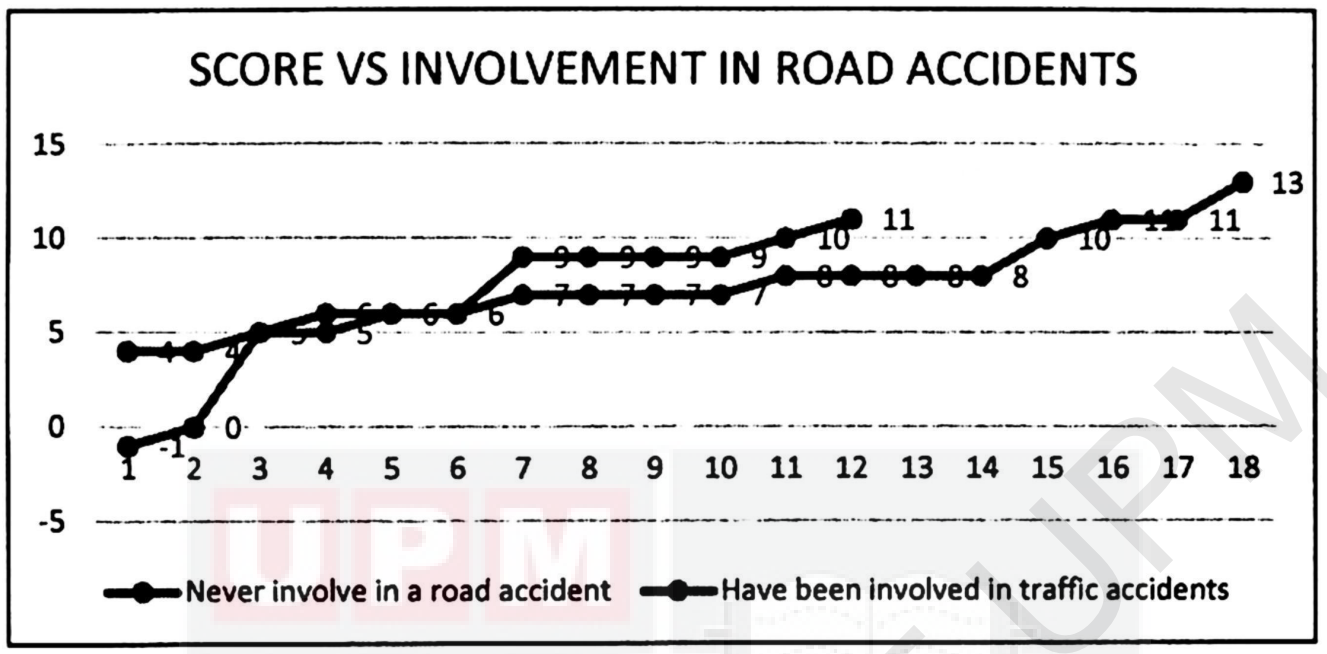

Figure 4.16: Score vs involvement in road accident line graph.

Figure 4.17 indicate that there are only 1 respondent from the group of respondents that never involved in road accident choose the presence of manhole on the road as safe while 10 of the respondents from this group evaluated that the presence of manhole on the road while riding motorcycle as risky and other 4 evaluated manhole as very risky.

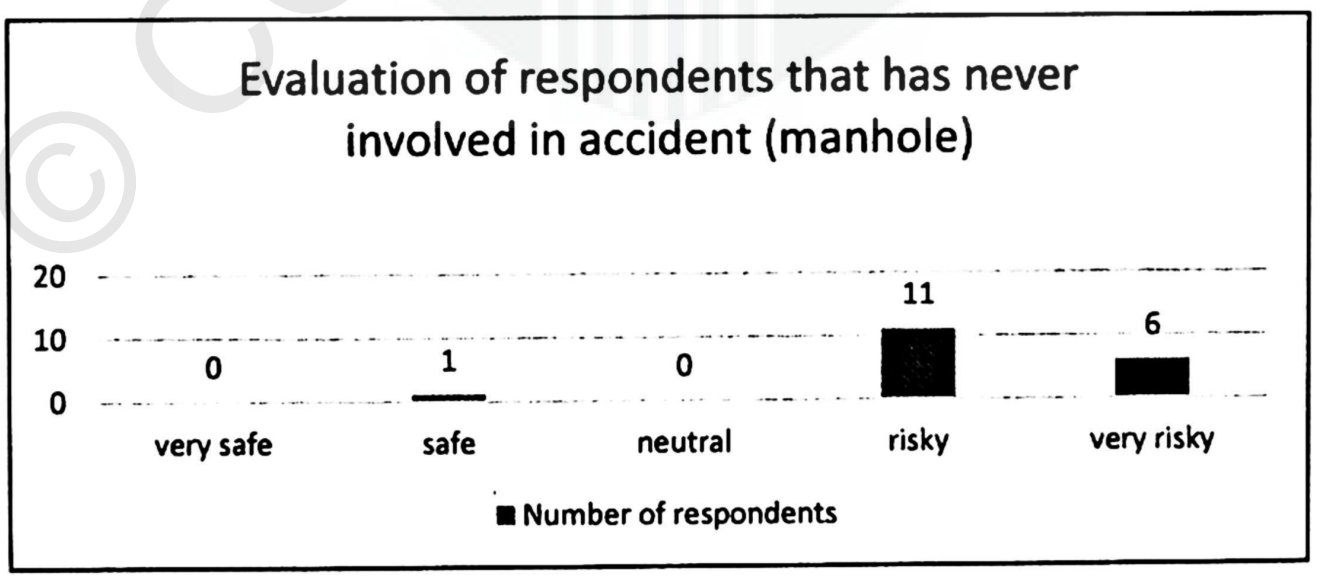

Figure 4.17: Evaluation of respondents that never been involved in road accident toward the presence of manhole on road.

Figure 4.18 indicate that 7 respondents from the group of respondents that had encounter with road accident evaluated the presence of manhole while riding motorcycle along the road as risky while the other 5 stated that manhole are very risky.

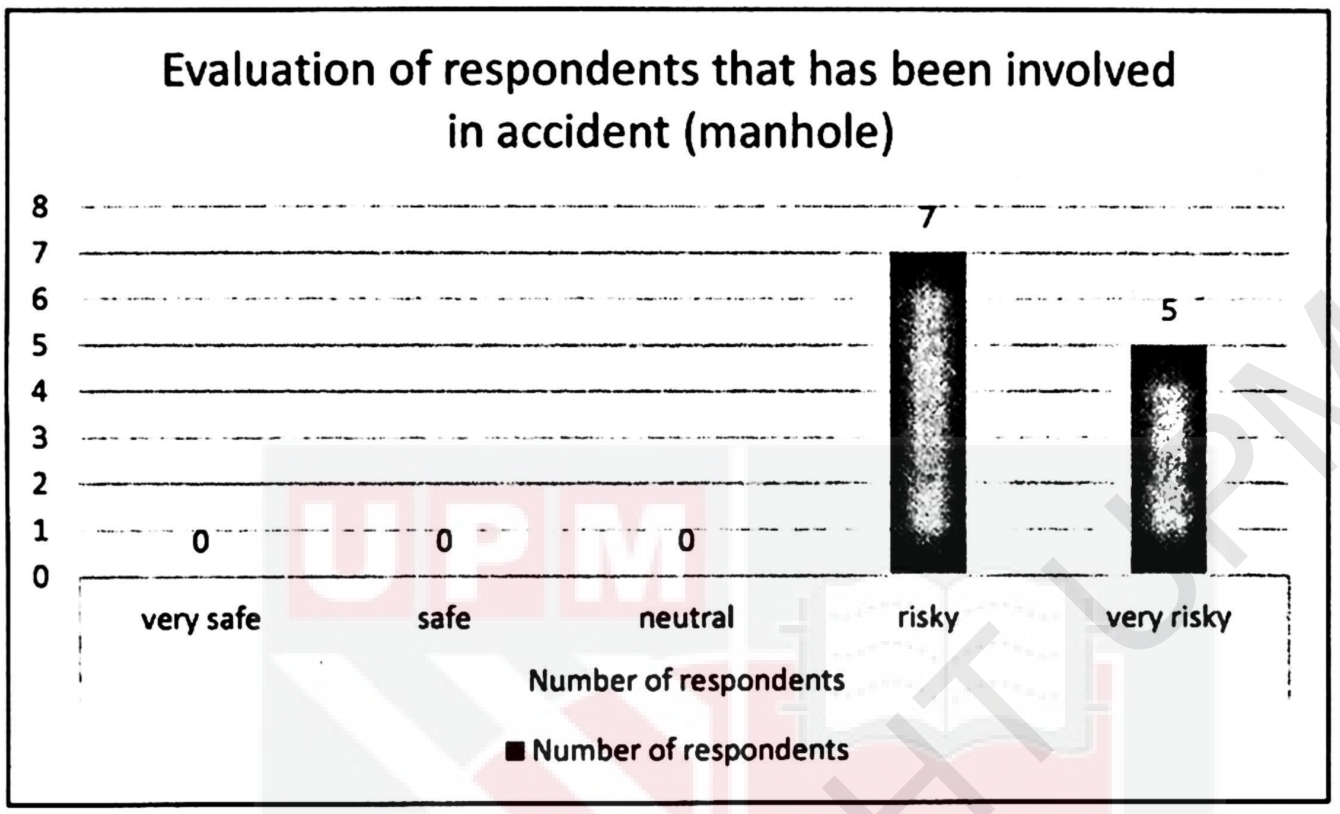

Figure 4.18: Evaluation of respondents that had been involved in road accident toward the presence of manhole on road.

The result indicates that most of the respondents from both group consider the presence of manhole while riding along the road as hazard. By referring to their score from Figure 4.16, both group only have slight difference from each other. That's mean those who had or never involved with accidents are alert toward hazard while riding motorcycle along the road.

The study carried out by Cheng et al., (2011) showed that the accident-involved motorcycle rider has poor skill in identify hazard in traffic environment. From the finding in this study, the motorcyclist who had been involved with road accidents are also alert to hazard during riding motorcycle may be due to their experience from the accidents cause them to be more caution while riding along the road. Besides, the

outcome from this study may be different from the other study carried out by other researcher may be because of the different place the study had been conducted.

CHAPTER 5

Conclusion & Recommendation

5.1 Conclusion

This study was conducted to find out the risky factor and also to rank the most risky factor perceived by motorcyclists while interact with traffic and roadway condition on local road.

The traffic and roadway conditions perceived risky by motorcyclists while riding along local roads are obtained and ranked from the most risky to the less risky are as follows:

1. Presence of manhole
2. Bad pavement condition
3. Presence of on-street parking along the road
4. Unsignalised junction in the road system
5. Mix traffic in traffic system
6. Presence of pedestrian along the road
7. Presence of vehicle at road junction
8. Narrow road condition

5.2 Recommendation

This study reveals that the presences of manhole on the road are the most risky hazard perceived by motorcyclist while interact with roadway and traffic along the local road. This may be due to the level of the manhole from the surface of the road are too different. This situation is same as pothole but with manhole. Thus, the surface of the road should be same level with the road surface to avoid manhole to cause hazard to the motorcyclists while riding along the road.

The bad pavement condition also perceived risky by motorcyclists while riding along the local road. Therefore every time when the pavement or road surface are damaged, the road surface need to be resurface immediately to prevent motorcyclist and the other road user from perceived this hazard while using the local roads.

The presence of on-street parking alongside the local road also perceived risky by motorcyclists while riding along the local road. The parking space should be provided to avoid the vehicle's owner from park beside the road. If there still illegal park beside the road, then the authorities should give summon to the involved vehicle so they park their vehicle on the right place and reduce the risk perceived by motorcyclists and other road users while using the road.

Besides that, the unsignalised junction on the road and the presence of vehicle at junction are perceived risky by motorcyclist while riding along the road from this study. The implement of traffic light on the risky junction must be considered to prevent the junction involved give hazard to motorcyclists while riding along the road

or the implement of signboard should be done to give warning so motorcyclists are more alert toward hazard at road junction.

Mix traffic in the traffic system on the road also considered as risk factor from this study. To reduce the risk, motorcyclists must be provide with their special lane to avoid contact with other road user that are bigger in size compared to motorcycle which can give hazard to motorcyclists.

The presence of pedestrian on the road also considered as risky factor from this study. The pedestrian should follow the right way to cross the road such as using the zebra cross. They should not be on the road because they give danger to other road user. Thus, pedestrian should be provided with walk lane beside road to reduce the risk factor perceived by motorcyclists while riding along the local road.

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APPENDIX

Questionnaire Survey for risk perceived by motorcyclist during riding

Date of Interview :

_____

Time of Interview :

_____

(A) Demographic Data

1. Age

☐ Years old

2. Gender

1 ☐ Male

2 ☐ Female

(B) Motorcycle Licensing and Riding Behaviour

3. Do you own a motorcycle licence?

1 ☐ Yes

2 ☐ No

4. How many years you have own this license?

☐ Years

5. Do you own a motorcycle?

1 ☐ Yes

2 ☐ No

6. How many years you have been riding a motorcycle?

☐ Years

7. How frequent do you ride a motorcycle?

1 ☐ 7 days a week

2 ☐ 5-6 days a week

3 ☐ 3-4 days a week

4 ☐ 1-2 days a week

8. Generally, when you ride a motorcycle for 10 times, how frequent do you wear helmet?

1 ☐ Always (10 times)

2 ☐ Often (7-9 times)

3 ☐ Sometimes (5-6)

4 ☐ Seldom (3-4)

5 ☐ Rarely (1-2)

6 ☐ Never (0)

(C) Traffic Violation, Time Lag and Summons

9. Have you ever been caught for any serious traffic violation? (i.e. red light running, speeding, drink driving and etc.)

1 ☐ Yes
2 ☐ No

10. How many times you have been caught for serious traffic violation?

1 ☐ 1-2 times
2 ☐ 3-5 times
3 ☐ > 5 times

11. When was the last offence that you received?

1 ☐ < 1 years ago
2 ☐ 1-3 years ago
3 ☐ 3-5 years ago
4 ☐ > 5 years ago

12. Do you owe any summon?

1 ☐ Yes
2 ☐ No

(D) Road Traffic Accident Experience, Injury and Time Lag

13. Have you ever involve in a road accident?

1 ☐ Yes
2 ☐ No

14. How many times do you involve in road accidents?

1 ☐ 1 time
2 ☐ 2-3 times
3 ☐ 4-5 times
4 ☐ > 5 times

15. How bad is it/ involvement injury?

1 ☐ Damage only
2 ☐ Slight injury
3 ☐ Serious injury
4 ☐ Fatal

16. When was it/ the most recent accident?

1 ☐ < 1 years ago
2 ☐ 1-3 years ago
3 ☐ 3-5 years ago
4 ☐ > 5 years ago

(E) Risk perceived by motorcyclist during riding

Rate the situation in video clips

	Very safe	Safe	Neutral	Risky	Very risky
CLIP 1: Off-street parking					
CLIP 2: Pedestrian					
CLIP 3: Vehicle at junction					
CLIP 4: Mix traffic					
CLIP 5: Manhole					
CLIP 6: Pavement					
CLIP 7: Narrow road					
CLIP 8: Unsignalised junction					