

Motorcycle Positioning in Queues at Signalized Intersections in City of Klang Valley

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ABSTRACT

For the past years, motorcycle fatalities have risen in Klang Valley with the overall constitution had passed 60% of total road traffic accident (RTA). Many motorcycle fatalities occurred within intersections after a driver failed to see a motorcyclist. However, little is known about the behavior of motorcyclists when they negotiate an intersection. This study was undertaken to analyze the behavior of motorcyclist in queues at signalized 3-leg and 4-leg intersections along state road of Klang Valley. An observational data was gathered based on microscopic data collected from video images that were taken from a research vehicle instrumented with on-board video camera. The research vehicle made routine trip through out Klang Valley for 10 weeks during peak and off-peak hour period. Twenty-seven (27) intersections with traffic light captured by the research vehicle were selected and observed. The preliminary findings shown three-ways of motorcycle approached the signalized intersection (SI), i.e. (1) approaching the SI with Weaving/Lane Splitting, (2) approaching the SI from center of the lane, and (3) approaching the SI from the left side/the shoulder. 87% of the motorcycle tend to maneuver in a queue during a red-light period, to avoid obstruction and tend to move forward for a wide and clear field of vision closest to the stop line. It is recommended that an exclusive motorcycle stopping space is provided for motorcyclist to enhance motorcycling safety and road safety in the country.

Keywords: Motorcycle safety; signalized intersection; traffic operation

INTRODUCTION

Transport related death recorded almost half of all deaths on the world's roads among those with the least protection: motorcyclists (23%), pedestrians (22%) and cyclists (4%) (WHO 2015). Motorcycle crashes are one of the leading causes of transport related death worldwide as motorcycle riders and their pillions are susceptible to being fatally injured if involved in a collision (Haworth 2012). Motorcyclists accounted for 9% of road fatalities in Europe, 20% in America, and 34% in both western Pacific and Southeast Asia countries (WHO 2015). In particular, Malaysia ranked number 5 in the world among other countries recorded with high percentage of motorcyclist fatalities in 2013, more than 50% of the total road traffic fatalities associated with motorcycle (WHO 2013).

In heterogeneous traffic, motorized two-wheelers such as motorcycle often create traffic conflicts against other transportation modes. Unlike cars, motorcycle is capable of maneuvering in non-lane-based movement such as swerving between vehicles and can move slowly to the front of other vehicles queue in traffic. These movements can become more problematic at signalized intersections (SI).

At a normal SI, motorcycle do not follow the "First in First out" rule (Minh et al. 2012), instead, rider always attempt to move their motorcycle slowly forward to the front of the vehicle in queue formation. Due to their small in size, the rider does not require much space for maneuvering ahead of vehicle stopping at the intersection (Hussain et al. 2005; Minh et al. 2012).

As reported by Minh et al. (2012), there are four reasons for a motorcyclist maneuver forward at SI as the following:

1. An attempt to stop at a favorable position during queue formation: While traveling in a queue during a red-light period, motorcyclists tend to move forward and stop at a position that is closest to the stop line.
2. A desire to avoid traveling behind a heavy vehicle: Due to their preference for a wide and clear field of vision, motorcyclists are more likely to avoid traveling behind a heavy vehicle by maneuvering into another position.
3. Preparation for making a turn: Motorcyclists in an improper position tend to maneuver so that they are in a position that is conducive for making a turn.
4. An attempt to avoid an obstruction: Motorcyclists maneuver to avoid pedestrians crossing the intersection.

Therefore, this study is aimed at focusing on motorcyclist maneuvering behavior pattern and stopping position on red light at signalized intersection in Klang Valley. Some studies have investigated the maneuvering behavior for motorcyclist especially in Vietnam where the area is called motorcycle dependent city (Minh et al. 2012). Also, many studies have reported on red light running behavior among motorcyclist at signalized intersection (Abdul Manan et al. 2019). For this study, the data was collected by means of observations. This cross-sectional study was conducted in the Klang Valley, which has a high density of motorcycle (47% of registered vehicles) and recorded among the highest motorcyclist fatality (PDRM 2018; Abdul Manan et al. 2013).

METHODOLOGY

This study is focusing on the rider waiting on red light at signalized intersection and more concentrates on the rider who tries to manoeuvre to their favourable position to gain a better forward view, gain a speed advantage and to avoid travelling behind other vehicle.

This study employed an observational video recording method. Video data were extracted from the bigger road traffic study using an instrumented research vehicle equipped with high definition calibrated cameras as shown in Figure 1.

Main system(BVR-04FHD@NewSpaceDesign):
 -Recording traffic situation and BST working status
 -Four cameras (Front, Rear Left/Right Side mirrors)
 -FullHD (1920×1080, 15fps, 4GB/h)

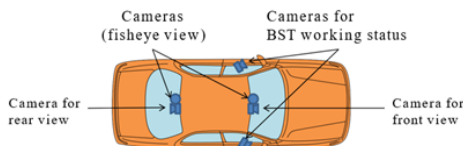


FIGURE 1. Location of cameras installed on-board of test vehicle

The research vehicle was plying the main roadways, with a combination of expressway, urban and interurban roads, as well as rural road in Klang Valley according to the selected route. The route passed through urban (city), suburban and residential areas with abundant volume of motorcycles available for video records. From Kajang, the instrumented research vehicle travelled (through Cheras and Kuala Lumpur) approximately 110km per day (including return trip) to Sungai Buloh. For this particular study, 27 signalised intersections travelled and captured by the research vehicle were selected. The trip includes peak hour (7.00am – 8.00am, 5.00pm – 6.00pm) and off peak hour (10.00am – 11.00am, 4.00pm – 5.00pm). This method differs with other observation studies (i.e Manan et al. 2019) in which observer was usually stationed on fixed or stationary location at any particular intersection during data collection.

Recorded video was collected and analysed to determine the pattern of motorcycle behavior approaching and stopping while waiting at the red light at signalised intersection. Figure 2 illustrates the motorcycle travel behaviour at signalised intersection. All related information captured by the video camera during the research vehicle stopping on red light of signalised intersection is recorded in the observation form including motorcycle manoeuvre forward, stopping position according to road lane, stopping position relative to other vehicle, carrying pillion, intersection and road type, carriageway category, number of lanes, location and time of day. All data recorded in the forms were then transferred into computer for further analysis.

Observed motorcycles were segregated into three categories as referred to Vien et al. (2008):

1. Motorcycle stopping before stop line
2. Motorcycle stopping after stop line
3. Motorcycle stop on Advance Stop Line

To better understand the behaviour of the motorcycle riders who stop after the stop line, closer observation were recorded and segregated into two different groups:

1. Stop after the stop line and wait the red light on pedestrian crossing
2. Stop after the stop line and wait the red light on yellow box

RESULTS AND DISCUSSION

The total of 328 recorded videos were selected for study analysis. The videos captured 2,760 motorcyclists stopping at the selected 31 signalized intersections. The selection was based on stopping distance of the research vehicle relative to stop line, clear view and visibility of motorcyclists. Table 1 summarized the proportion of stopping location of motorcyclist at signalized intersection.

2,064 (74.8%) motorcyclists were showing a risky behavior as they were stopping after the stop line marking as shown in Figure 3. Of the 2,064 observed stopping after stop line, most of the motorcyclist were stopping on the pedestrian crossing, 856 (41.5%). This behavior will further disturb pedestrian crossing the road. It was reported that motorcycle blocking the pedestrian crossing lane causing delay to the pedestrian to cross the road (Syazwan et al. 2017). Delay to pedestrians, in both aspect of their own right as well as in the aspect of safety, may lead to pedestrians taking greater risk (Cantillo et al. 2015).

The remaining, 416 (20.2%), demonstrated a riskier behavior by stopping further ahead on the yellow box. This may potentially increase the risk of motorcycle being struck by another vehicle crossing the junction. This particular group of motorcyclists were observed more prone to conduct an illegal riding behavior such as running a red light, moving in a contra-flow and make an illegal U-turn similar as reported by Manan et al. (2019).

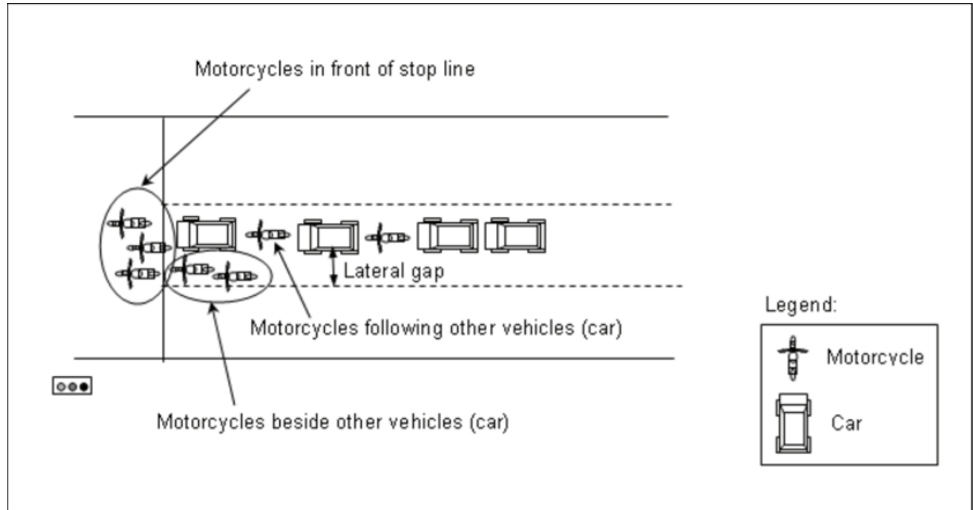


FIGURE 2. Motorcycles stopping pattern at signalized intersection (Vien et al. 2008)



FIGURE 3. Example of motorcycle stopping location at signalized intersection

Furthermore, this study captured one particular case whereby the observed intersection has an advanced stop line (ASL) exclusive for motorcycle, a box paint in red. This ASL is designed as a special area for motorcycles in front of the signalized intersection stop line to accommodate the high number of motorcycles on the roads. 32 (1.2%) of the observed motorcyclist did occupied the ASL. Dill et al. (2010) reported that, the availability of ASL had significantly reduced the number of vehicle encroachment on the pedestrian crossing. However, there are also issue of misuse of ASL that need further study in the future as the ASL is also occupied by another vehicle.

Pie of pie chart in Figure 4 shows the proportion of motorcycle rider stopping behavior at signalized intersection.

Majority, 2,291 (83%), of the observed motorcyclist maneuver forward at signalized intersection towards the best spot that they prefer in three-ways i.e. (1) approaching the SI from center of the lane, 1,024 (37.1%), (2) approaching the SI from the left side or the shoulder, 696 (25.2%),

and (3) approaching the SI from right side, 571 (20.7%). The remaining, 469 (17%), stay in queue as there were not enough gap between vehicles to maneuver forward as shown in Figure 5.

TABLE 1. Stopping location of motorcyclist at signalized intersection.

Stopping Location	No of Motorcyclist	%
Before stop line	696	25.2
On ASL	32	1.7
After stop line	2064	74.8
On pedestrian crossing	856	41.5
On yellow box	416	20.2

From this observation, motorcyclist who tends to maneuver forward for speed or space advantage will tend to run the red light. Red light running is one of the risky behaviors that can lead into catastrophic road traffic

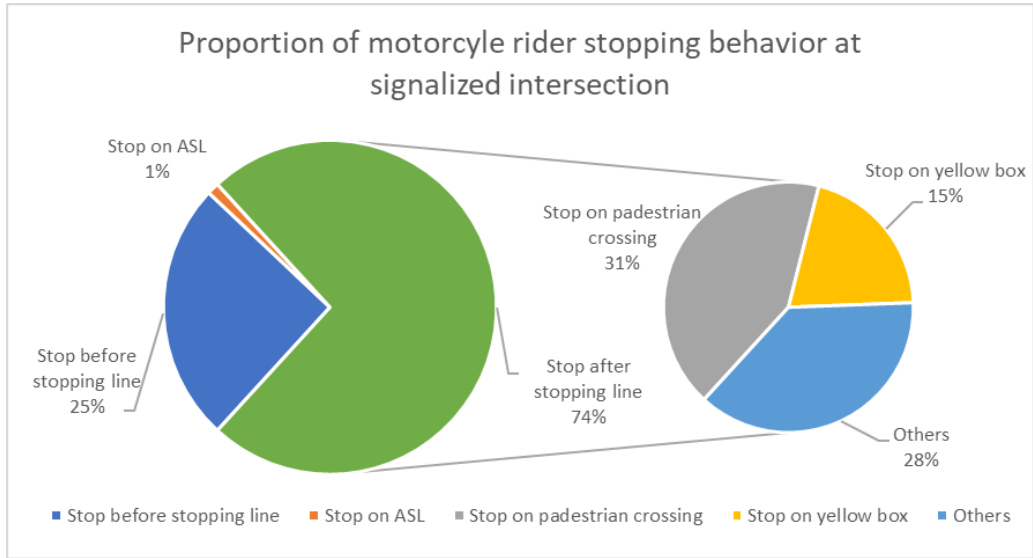


FIGURE 4. Proportion of motorcycle rider stopping behavior at signalized intersection

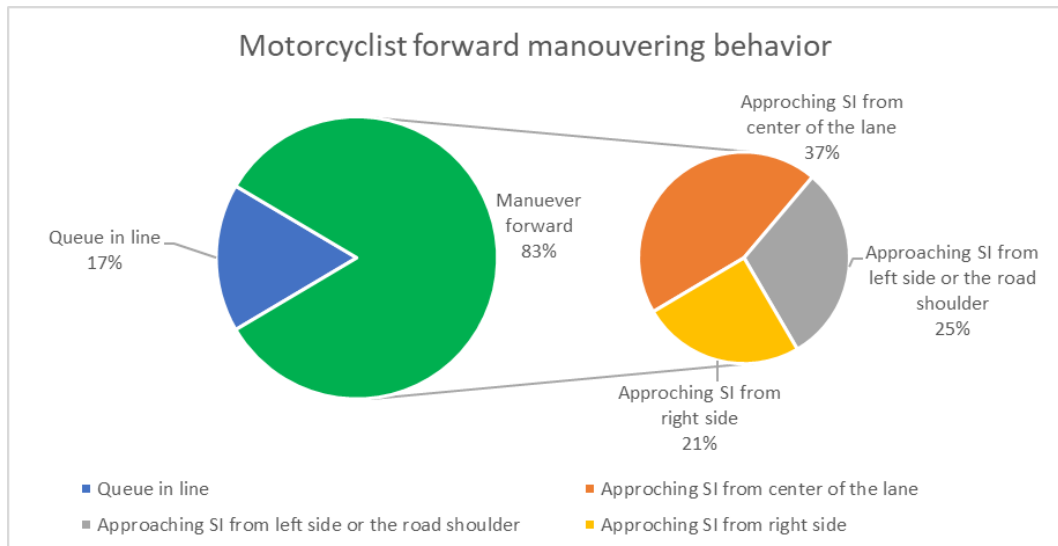


FIGURE 5. Proportion of motorcycle forward maneuvering behavior

accidents (Kulanthayan et al. 2007; Jensupakarn and Kanitpong 2018).

CONCLUSION

This study investigated motorcycle behavior during approaching and stopping at the signalized 3-leg and 4-leg intersections and develop measures to potentially curb the risky behavior. The study revealed the overall prevalence of motorcycle stopping after stop line marking at signalized intersection is significantly high with 74.8% of the time.

The current pilot phase of redbox, or in civil term is called advanced stop line (ASL) for motorcycle is a good initiative to give space that needed by most motorcyclist. A standardized ASL on all signalized intersection is good. To make it better and effective, make known to the all road user via education.

The finding shows that motorcyclists are commonly maneuver forward to a clearer field of vision. It is recommended that an exclusive motorcycle stopping space is provided for motorcyclist i.e Redbox in Kuala Lumpur, to enhance motorcycling safety and road safety in the country.

DECLARATION OF COMPETING INTEREST

None.

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