Prevalence Study of Motorcycle Lightings and Conspicuity

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Abstract – Road accidents involving motorcycle is an alarming matter in Malaysia as well as ASEAN countries. National statistics showed that motorcycle fatality cases were at average 60% in the year 2007 to 2009. Due to this reason, a prevalence study was performed to tackle one of contributing factors: conspicuity. A survey was conducted to gather information on functionality of daytime running light (DRL) and brake light, availability of third brake light, motorcyclist attire and existence of helmet reflector in selected area. A total of 950 samples were analysed. The study shows that 80% motorcyclist used DRL, with almost 96% motorcycles were not equipped with third brake light, while approximately 44% motorcyclists wore dark attire. A few recommendations are highlighted in this review paper to increase awareness to motorcyclist regards to conspicuity issue.

Keywords – Motorcycle, Day Running Light (DRL), Conspicuity, Lighting, Malaysia

I. INTRODUCTION

Road traffic accidents and injuries are well-known problem in developing countries. In Malaysia, the statistics made by the Royal Malaysia Police (RMP) show that average number of fatalities due to road traffic accidents is around 6,316 for each year between 2000 and 2010. The major contributor for road traffic fatalities in Malaysia is motorcycle user (about two-third), and the number keeps increasing consistently with the number of registered motorcycles [1]. Table 1 shows the magnitude of motorcyclist casualties with regard to other road users for 2007-2009 period.

As highlighted in Table 2, the most risky time of day for motorcycle is between 6pm and 8pm, when most fatalities and serious injuries occurred. Furthermore, the statistic shows that 53% of fatalities occurred during daytime.

<table>
<thead>
<tr>
<th>Time of day</th>
<th>Fatal</th>
<th>Serious</th>
<th>Minor</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>0001 – 0200</td>
<td>563</td>
<td>422</td>
<td>622</td>
<td>1,607</td>
</tr>
<tr>
<td>0201 – 0400</td>
<td>322</td>
<td>425</td>
<td>598</td>
<td>1,345</td>
</tr>
<tr>
<td>0401 – 0600</td>
<td>445</td>
<td>429</td>
<td>556</td>
<td>1,430</td>
</tr>
<tr>
<td>0601 – 0800</td>
<td>246</td>
<td>418</td>
<td>455</td>
<td>1,119</td>
</tr>
<tr>
<td>0801 – 1000</td>
<td>274</td>
<td>496</td>
<td>480</td>
<td>1,250</td>
</tr>
<tr>
<td>1001 – 1200</td>
<td>167</td>
<td>397</td>
<td>466</td>
<td>1,030</td>
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<tr>
<td>1201 – 1400</td>
<td>263</td>
<td>391</td>
<td>879</td>
<td>1,533</td>
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<tr>
<td>1401 – 1600</td>
<td>169</td>
<td>399</td>
<td>869</td>
<td>1,437</td>
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<tr>
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<td>344</td>
<td>496</td>
<td>643</td>
<td>1,483</td>
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<tr>
<td>1801 – 2000</td>
<td>773</td>
<td>826</td>
<td>2,348</td>
<td>3,947</td>
</tr>
<tr>
<td>2001 – 2200</td>
<td>356</td>
<td>425</td>
<td>826</td>
<td>1,607</td>
</tr>
<tr>
<td>2201 – 2400</td>
<td>269</td>
<td>434</td>
<td>925</td>
<td>1,628</td>
</tr>
<tr>
<td>Total</td>
<td>4,191</td>
<td>5,558</td>
<td>9,667</td>
<td>19,416</td>
</tr>
</tbody>
</table>
Conspicuity is one of the factors contributing to motorcycle accidents, whether during daytime and nighttime. Conspicuity is the inability of motorcyclist to be seen by other motorists [2]. This issue may come from a few factors, such as dimension of motorcycle, low luminance which assimilates with background environment and others. Motorcyclist attire, Daytime Running Light (DRL) and existence of lighting also play important roles towards motorcyclist conspicuity.

Daytime Running Light (DRL) initiative was introduced as law in Malaysia since 1992. Based on a study performed by Radin Umar et al. (1996), there was a significant increment on DRL installation and usage among motorcyclist, approximately 80%, which complied with the DRL new law during that time. It was revealed that there was 22% reduction in conspicuity-related crashes involving motorcycle after the campaign [3]. Henderson et al. (1983) showed that motorcycle crashes were reduced by about 5% after the introduction of DRL legislation for motorcycles in North Carolina in 1973 [4]. In another study, Williams (1996) reported an estimated 13% of reduction in motorcycle crashes through the use of motorcycle DRLs (mostly headlights) in the USA [5].

Currently in Malaysia, a lot of motorcycle manufacturers use headlight as DRL (no need for extra fitment & is easy to implement), but the effectiveness of the headlights declines with increasing cars with DRL. Dedicated DRL for motorcycle is very low in Malaysia. Hence, an issue is raised in Malaysia of whether there are the motorcycles on road which still have ON/OFF switch. There is no directive or regulation to ensure that manufacturers must provide headlights which must be constantly “ON” when the engine starts (automatic headlight). In addition, the application of third brake light for motorcycle is not a regulation in Malaysia. However, some manufacturers add the third light brake in their new design and additional accessory, such as compartment box which comes with additional lighting (as third brake light).

Motorcyclist’s attire is one of the factors contributing to motorcyclist’s conspicuity to other motorists. A study conducted in New Zealand showed that the risk was 37% lower for a motorcyclist getting into an accident if the rider was wearing any reflective or fluorescent clothing, and the risk was 24% lower if the rider was wearing a white helmet, instead of a black one [6]. Nevertheless, a study conducted by Hole et al. (1996) revealed that the brightness and contrast of surrounding and the rider are more important factors as compared to attire and headlight themselves [7]. In Malaysia, reflective or fluorescent clothing is not a mandatory law to motorcyclist.

II. OBJECTIVES

The objectives of this paper are as follows: -

- To determine motorcycle lights functionality, which includes daytime running light (DRL), rear position light (PL) and brake light (BL),
- To investigate on motorcycle’s and motorcyclists clothing’s dominant colour with respect to conspicuity, and
- To identify the availability of retro-reflective strip on motorcycle helmets.

The results obtained from this study can be used for counter measure for stakeholders involved such as Royal Malaysia Police (RMP), Road Transport department (RTD), Public Work Department (PWD) and other related agencies. In addition, it will help and support government to strengthen the current policy or regulation.

III. METHODOLOGY

A. Sample and Site Selection

This short, cross-sectional study, was conducted for a month, which covered four areas in Selangor state. Four areas (Kajang, Bangi, Semenyih and Dengkil) were selected to cover urban and suburban area settings. Data collection in every area was carried out by an assigned team member at pre-determined fixed observation points with high traffic volume. Criteria for the observation point included slow moving traffic near to junction, traffic light or roundabout, which could allow sufficient time for the team member to observe motorcycles. Safety was mandatorily practiced by the team members while performing their field observation task.

In this study, stratified random sampling technique was used for field observation data.
collection. Targeted sample included all two-wheeled motorcycles with at least a motorcyclist (helmeted) who passed through the observation points. All variables from the observed samples were recorded in field observation formed by the team members. The observations were conducted during daytime (8:00a.m.–6:00p.m.) on weekdays. In total, 950 motorcycles were analyzed during the period of data collection.

B. Defined Variables

The following variables were observed on both the motorcycle and the motorcyclist(s) during field observation.

(i) Motorcycle:
   a. Daytime running light (DRL) – functioning
   b. Rear position light (PL) – functioning
   c. Brake light (BL) – functioning
   d. Secondary brake light – availability
   e. Colour of motorcycle – dominance (bright, medium or dark)

(ii) Motorcyclist:
   a. Retro-reflector on helmet – availability
   b. Colour of motorcyclists clothing – dominance (bright, medium or dark)

IV. RESULTS

Fig. 1 shows the percentage of motorcycle parts based on lighting functionality. The results from the observation revealed that 83% of DRLs were working in good condition and only 17% did not function (turn off). In addition, compliance of PL among motorcyclist showed a significant percentage of 26%, in which the PL did not function well. As for the third brake light, the proportion was the highest with 95%.

In terms of helmet wearing and attire wearing (Fig. 2), majority of the helmets observed did not have reflectors (96.2%). Dark was the most dominant colour observed for motorcyclist’s clothing, having more than 40% of the total samples.

VI. DISCUSSION

A. Daytime Running Light

Since DRL has been implemented as mandatory law in Malaysia, most of the motorcyclists observed were using DRL during daytime. Observation from this study revealed that only 17% DRL did not function. It might be due to some reasons. The investigation showed that some motorcycle model is provided with ON/OFF switch for headlamp. Note that, most motorcycles in Malaysia used headlamp as DRL, and only a few manufacturers equip their motorcycle with dedicated DRL, especially scooter type. In addition, malfunctioned bulb is another factor motorcyclist do not switch on headlamps (as DRL). In Malaysia, there is no regulation/law for motorcycle DRL yet. It is recommended that dedicated DRL should be compulsory to overcome headlight bulb failure. A study conducted by Paine et al. (2008) also recommended that to reduce risk of headlight bulb failure, dedicated DRLs should be considered [8].

B. Rear Position Light (PL)

This study shows that 26% observed motorcycle had malfunctioned/off PL, and the percentage is high as compared to malfunctioned brake light with 16.3%. Further investigation
discovered that the malfunctions were due to bulb failure, electronic circuit error and lamp switch in off position. For brake light malfunction, it is commonly due to bulb failure, electronic circuit error, but there are a few cases that due to handbrake or/and footbrake not transmitting signal to brake light. Additional brake light or second brake light is possible but it requires space to locate based on regulation/law. Enhancing current PL and brake light by using LED type is more significant in terms of conspicuity and durability of the system.

C. Helmet Reflector and Motorcyclist’s Attire

In order to increase the visibility among motorcyclists, helmet reflector, bright and reflective clothing are cheap interventions that could considerably reduce motorcycle crash related injury and death. In the late 90’s, campaign of the use of reflective material was comprehensively done throughout Malaysia, however this item was not gazetted as law. This study revealed the result that less that 4% reflective materials were available on the observed helmets. Furthermore, dominant clothing was dark in color with proportion more than 40%. The finding from this study had proven that wearing reflective clothing can increase the visibility of riders, especially during night and daytime. The motorcycle riders who wore any reflective or fluorescent clothing had a 37% lower risk than other drivers, and for helmet, it was revealed that wearing a white helmet was associated with 24% lower risk as compared to dark helmet [9].

V. CONCLUSION

Motorcycle accident is most prominent in term of causality in Malaysia. Many interventions have been created and implemented to reduce the number of fatality. It has been proven that implementing DRL law can reduce 22% motorcycle conspicuity related. In addition, cheap solutions such as wearing bright attire and adding a helmet reflector could improve the risk on motorcyclist while riding. It is recommended that motorcycle retail shops should provide a reflector vest and reflective helmet during motorcycle purchasing, and also for the government to advocate motorcycle conspicuity through media campaign. Nevertheless, it is hoped that motorcycle manufacturers can help develop motorcycle parts to promote riders’ safety through the introduction of dedicated DRL and using LED types for all lightings to minimize the risk of bulb failure.

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REFERENCES