Impact of heavy rainfall on traffic operation

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SUMMARY

Extreme weather is one of the contributing factors to road accidents in Malaysia. Extreme rainfall does not only cause poor visibility to drivers, but it also increase the risk of flooding. Certain part in southern region of Malaysia is prone to flood during monsoon season (November to January). In relation to these situations, it is crucial to understand how the abrupt weather situation affect response of drivers. This paper attempts to examine the impact of heavy rainfall at night on the operating speed of vehicles. The study was conducted on a cross section of a road at southern region of Peninsular Malaysia for three months during monsoon season. Traffic data were obtained using automatic traffic counter and rainfall data were obtained from Department of Drainage and Irrigation, Pontian within the three months monsoon season. The data then were then extracted and analysed. From this study, it was found that there was 18.3% speed reduction during heavy rainfall at night. It can be understood that the adverse weather condition cannot be avoided, but necessary action can be taken to manage the traffic. Findings from this study can be used to help local authorities and transport planners in planning an efficient traffic management system for a safer travel experience to road users in Malaysia before the flooding occurs.

Keywords: rainfall intensity, travel behaviour, operating speed, highway, safety, flooding

INTRODUCTION

In the past few years, Malaysia has experienced several extreme weather and climatic events, ranging from thunderstorms to monsoonal urban flash floods, which have caused havoc in the country. Without any doubt, weather is one of the important parameters affecting transportation performance on road. The intensity of light and rainfall are among other factors that contribute to the changes of speed and travel time during driving (Nookala, 2006; Theofilatos and Yannis, 2014; Tsapakis, et al., 2012). These factors have significant impact on visibility of drivers during driving that affect drivers psychologically and physiologically. Even though the effect of rainfall has on transportation is not extreme as snow, fog, hurricanes, etc., but it has an implication on road safety (Yau, 2004; Angel, 2014). Hence, this study was conducted to determine the impact of heavy rainfall at night on vehicles’ operating speed. The findings of this study, derived from traffic and weather data collected in the Pengkalan Raja of Pontian, Johor, Malaysia can provide an understanding of the impact of heavy rainfall on operating speed of vehicles. It is believed that the integration of weather data and traffic operation can improve transport system efficiency.

DATA COLLECTION

The study site is located at one section of the Skudai-Pontian Highway as shown in Figure 1.

Figure 1. Site Location at Pengkalan Raja, Pontian

The road under investigation, site FT001 is single carriageway road with two-lane road. To collect the traffic data during rain at night, the Automatic Traffic Counter (ATC) was set up in the middle of a straight road and two pneumatic tubes were laid parallel across the road section at Pontian with a gap of 1 metre apart as shown in Figure 2.
Vehicle volumes, vehicle classification and speeds were captured continuously for three months period during monsoon season (November 2010 to January 2011). The rainfall data was collected from the information on the rain gauge station number 1534002.

RESULTS

Figure 3 shows vehicles’ operating speed for dry and heavy rainfall condition at night.

![Figure 3. Average Vehicles’ Speed for Different Vehicle Classes](image)

Figure 3 shows an obvious reduction of speed under heavy rainfall condition at night particularly for motorcycles and heavy vehicles and buses. Figure 4 and 5 show the vehicles’ speed distribution at night for both dry and heavy rainfall conditions.

DISCUSSIONS AND CONCLUSIONS

It was found in this study that sudden changes in weather would initiate vehicle users to reduce speed in order to minimise risks especially in a poor visibility condition. It was perceived that the mitigation action should be considered seriously before the risk of flooding occurred to prevent safety consequences to people and assets.

Weather responsive traffic management is suggested to be developed to reduce the negative impact of adverse weather on traffic operations. This strategy is not yet developed and applied in Malaysia hence the need of further research on the management strategies. This could help the local authorities in planning an efficient mitigation action especially during monsoon season. This study represents a starting point for research into low cost and highly accessible methods of evaluating the climate vulnerability on transportation infrastructure and operation.

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