TRAFFIC CALMING DEVICES: APPLICATIONS AND ITS EFFECTIVENESS

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ABSTRACT

Speeding problem in some area especially where there are high pedestrian flows mainly school children's and elderly people has becomes a major concern to the public. Many accidents reported which involves pedestrians at such area were caused by excessive speeding vehicles. To mitigate the situations, installation of traffic calming devices were implemented by the local government. Thus, the aims of this study were to find out the effectiveness of various type traffic calming devices installed at the roadway. Also, this research will gather all the relevant information on the standard design material used for the traffic calming devices. The sites were chosen for each type of traffic calming devices implementation is yellow rumble strips at Tabuan Jaya, speed hump at Jalan song and speed table at Jalan Padungan. Spot speed studies were carried out at the selected sites to obtain the required data. Then, the normal and cumulative distribution curves were plotted based on the traffic data obtained. Further analyses by employing SPSS were carried out to find the relationship and the effectiveness of the devices. From the studies, it has found that yellow rumble strip at Jalan Tabuan Jaya to Samarahan reduce the average speed by 7.5 kph or 10.7%, the speed bump at Lorong Song 3 to BDC reduce the average speed by 6.8 kph or 14.1% and speed tables at Jalan Padungan reduce the average speed by 4.8 kph or 14.6%. From correlation analysis conducted, the entry speeds decreases very significantly as the width of traffic calming devices increases (R^2 = 1.0). The effect of the height of the devices also highly significant at reducing the vehicle entry speed (R^2 = 0.9217). Potential recommendation for a better way or guidelines for traffic calming devices installation is also addressed or presented in this report.

ABSTRAK

Isu memandu dengan laju di sesetengah lokasi terutamanya di jalan yang mempunyai bilangan pejalan kaki yang tinggi iaitu pelajar sekolah dan orang tua telah menarik perhatian orang ramai. Banyak laporan kemalangan melibatkan pejalan kaki disebabkan oleh memandu dengan laju. Bagi mengatasi masalah ini, alat-alat fizikal kawalan lalulintas telah dibina oleh pihak kerajaan tempatan. Tujuan projek ini adalah untuk mengkaji keberkesanan pelaksanaan alat-alat fizikal kawalan lalulintas. Di samping itu, projek ini juge termasuk rekabentuk standard and bahan-bahan yang digunakan untuk membuat alat kawalan lalulintas fizikal. Lokasi yang dipilih untuk kajian keberkesanan alat-alat kawalan ini iaitu Jalan Tabuan Jaya (Yellow Rumble Strip), Jalan Song (Speed Hump) dan Jalan Padungan (Speed Table). Ujian kelajuan atau " Spot Speed Studies " telah dijalankan di ketiga-tiga lokasi berkenaan. Selepas itu, " Normal Distribution Curve" dan " Cummulative Distribution Curve" dibentuk. Analysis mengunakan Microsoft Excell dan SPSS telah dilakukan untuk mengkaji keberkesanan alat kawalan lalulintas fizikal tersebut. Kajian mendapati "yellow rumble strip" di Jalan Tabuan Jaya mengurangkan " 85^{th} percentile speed " kenderaan 7.5 kph atau 10.6%, "speed hump" di Jalan Song pula mengurangkan " 85^{th} percentile speed " kenderaan dengan 6.8 kph atau 14.1% dan "speed table" di Jalan Padungan mengurangkan " 85^{th} percentile speed " dengan 4.8 kph atau 14.6%. Melalui analysis korrelasi, kelajuan masuk berkurangan apabila lebar alat-alat kawalan fizikal bertambah ($R^2 = 1.0$). Ketinggian alat-alat kawalan fizikal ini juga memberi kesan ke atas kelajuan masuk kenderaan ($R^2 = 0.9217$). Projek ini turut merangkumi cadangan yang lebih baik sebagai panduan untuk pembinaan alat kawalan tersebut.

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B	Width of physical traffic calming devices
d	Hump separation in meter
E	Permitted error
H	Height of physical traffic calming devices
K	Constant corresponding to percentile speed
N	Sample size
S	Estimated sample standard deviation
U	Constant corresponding
V	Speed vehicles
a	Angle of incident
C	Constant
α	Coefficient

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND AND OVERVIEWS

Speeding issues have become the major concern in certain area such as neighbourhood area, school zones and commercial area. The high speeding can cause the negative impact such as increasing of accident rate, noise pollution and air pollution. Traffic studies found that as residential street traffic speeds increase, neighborhood livability ratings decline (DKS Associates, 2002). This speeding also creates a danger environment to the pedestrians and the residents especially the children. Besides that, the loud noise from the speeding especially in the middle of night has interrupted the people life. The qualities of people life have been eroded by the high speeding and this lead to their angrier.

The implementation of traffic calming devices is one of the solutions of speeding issue. The traffic calming devices such as speed bump, speed table and yellow rumble strip and it effective in reducing the vehicles speed. By slowing traffic, eliminating conflicting movements, and sharpening drivers' attention, traffic calming

may result in fewer collisions (City of Portland, OR, February 1996). The reductions of speed are hopefully can reduce the accident rate. Fatality risk increases with vehicle speed to the fourth power; a 1% reduction in the speed of a vehicle involved in a collision provides a 2% reduction in the risk of injuries and a 4% reduction in the risk of fatalities (Stuster and Coffman, 1998). The severity of pedestrian injuries from vehicle crashes increase with the square of speed (ITE, 1997, p. 18). The probability of a pedestrian being killed in a crash is 3.5% if the vehicle is traveling at 15 mph, 37% at 31 mph and 83% at 44 mph (Limpert, 1994, p. 663).

According to Institute of Transportation Engineers, the speed bump is the most effective in reducing the speed with average 23 % decreased in the 85th percentile travel speed, while speed table are with average 18% decreased. The 12-foot speed humps decrease the accident with average 11% or from an average of 2.7 to 2.4 accidents per year .The 14-foot speed humps decrease the accident in average 41% or from an average of 4.4 to 2.6 accidents per year. The speed table and raised crosswalk are with average 45% decrease in accident or from an average of 6.7 to 3.7 accidents per year. The study from Seattle of traffic circle shows an average of 73% decrease in accident from a sample of 130 sites. The effectiveness of roundabout is with an average 29% reduction in accidents, reduction from 9.3 to 5.9 accidents per year (from a sample of 11 sites; source: Roundabouts: An Informational Guide).

1.2 PROBLEM STATEMENT

Speeding at neighborhood area has become a driver attitude especially the motorcycle. The motorcycles always speeding and produce and air noise pollution on this area. These trends have drawn the residential attention on their safety and they feel it have disturbing their life. The speeding also create a danger to the pedestrian and children safety. Beside that, the speeding problems also occur at others area such as school zone and commercial zones.

Table 1.1: Accident Rate at Jalan Song to BDC

	2004	Until Aug 2005
Normal	28	22
Killed	0	0
Total	28	22

(Sources: Police report, Kuching Traffic Police Headquarte, 2005, Kuching.)

Table 1 shows information on traffic accidents at Jalan Song and BDC in 2005. The accident statistics are base on measured the number and severity of accidents case reported. From the statistics it can be seen that Jalan Song to BDC has a considerable number of accidents reported. The total accidents at Jalan Song in 2004 were 28 cases and 22 cases from January until August 2005. There are some factors leads to accidents such as excessive speeding, poor road or vehicles condition

and poor geometric road design. Often, the human mistakes are the typical causes of accident especially when they are driving at exceeding the posted speed limit.

Table 1.2: Accident Rate

	2001	2002	2003	2004
Normal	97	111	171	138
Light	27	32	31	99
Fatal	29	16	27	17
Killed	12	12	4	10
total	165	171	233	264

(Sources: Police Report, Samarahan Police Headquarters, 2005, Samarahan)

From the statistics above, the accident rate at Samarahan area increase year by year. There are 165 cases reported in 2001, 171 cases in 2002, 233 cases in 2003 and 264 in 2004. The increasing numbers of accident are most probably caused by speeding. To reduce the number of accident rate, the high speeding problem need to be addressed.

The location of high accident rate at Samarahan is;

1. Batu 9, Jln Kuching Serian
2. Jalan Datuk Mohd Musa, Kota Samarahan
3. Jalan Kota Samarahan/Tabuan Jaya.

When the location of accident problem has been identified, the remedial action must be taken to reduce it. Accident problems due to high speeding had caused the government especially the city council to implement or install traffic calming devices on the roadway. The speed humps, speed table and yellow rumble strip are the most popular traffic calming devices applied in Sarawak road. According to Institute of Transportation Engineers (1999), the speed bumps and speed table work effectively in reducing the speed. The installations of these devices are suitable for local street and arterial road only not for major road.

1.3 OBJECTIVES

The objectives of the project are as follow;

a) To determine various applications and construction materials of traffic calming devices

b) To analyze and evaluate the effectiveness of traffic calming devices.

1.4 SCOPE OF STUDIES

With the aims mentioned, the followings are the scope of the project;

a) The scope of this project includes the identification of the application and its construction material of traffic calming devices.

The study will cover the most widely traffic calming devices applied in Sarawak road (yellow rumble strip, speed hump and speed table). The descriptions of traffic calming devices and their geometric design consideration / standard will be discussed.

b) The scope of the project also covers the determination of effectiveness of traffic calming devices.

From the spot speed studies data, analysis shall then be conducted to find out the influences of traffic calming devices in reducing speed.

1.5 LIMITATION

The studies have some limitations. Due to time constraint, only one site has chosen for the most each traffic calming devices used. The equipment used in spot speed study also has it limited ability. It can only measure speed above 20 km/hr.

CHAPTER 2

LITERATURE REVIEW

2.1 History of traffic calming devices

The applications of traffic calming devices begin in late 1960's. Traffic calming devices started in Netherlands when their life disturbed by motorist speeding in residential area at night. They took up the paving stones in a road to make sure the motorist cannot speed up. Then, the Officials allowed the redesigned of paving stones and it led to the first traffic calming project. In 1970's, German planner adopted this concept and apply it in their country. Then, the traffic calming devices were widely used and accepted by many countries. Traffic calming then spread quickly at Europe and to others country such as Denmark, New Zealand, Great Britain, United Stated and Japan.

2.2 Traffic Calming

Traffic calming is fundamentally aims to reduce the adverse impact of motor vehicles on built up areas. It involves in reducing vehicle speeds, providing more space for pedestrians and improving the local environment. Although much information is now available on techniques for calming residential roads, there is less documentation available on measures suitable for main roads (T. Harvey, HETS, 2000).

Traffic calming is a set of traffic engineering measures and devices that used to solve traffic problem. Traffic calming consist of operational measures such as enhanced police enforcement, speed displays and a community speed watch program, as well as such physical measures as edge lines, chokers, chicanes, traffic circles, speed humps and raised crosswalks (Montgomery County Maryland) .According to Roess (2204), the specific goals of traffic calming are to;

- Reduces traffic volumes on local streets through the used of volumes control measures such as Full Closure, Half Closure, Diagonal Diverter and Median Barrier.
- Reduces traffic speed on local streets by speed control measures such as Speed Bumps, Speed Table, Traffic Circles and Yellow Rumble Strip.
- Reduces accidents on local streets by implementation the speed reduction devices.