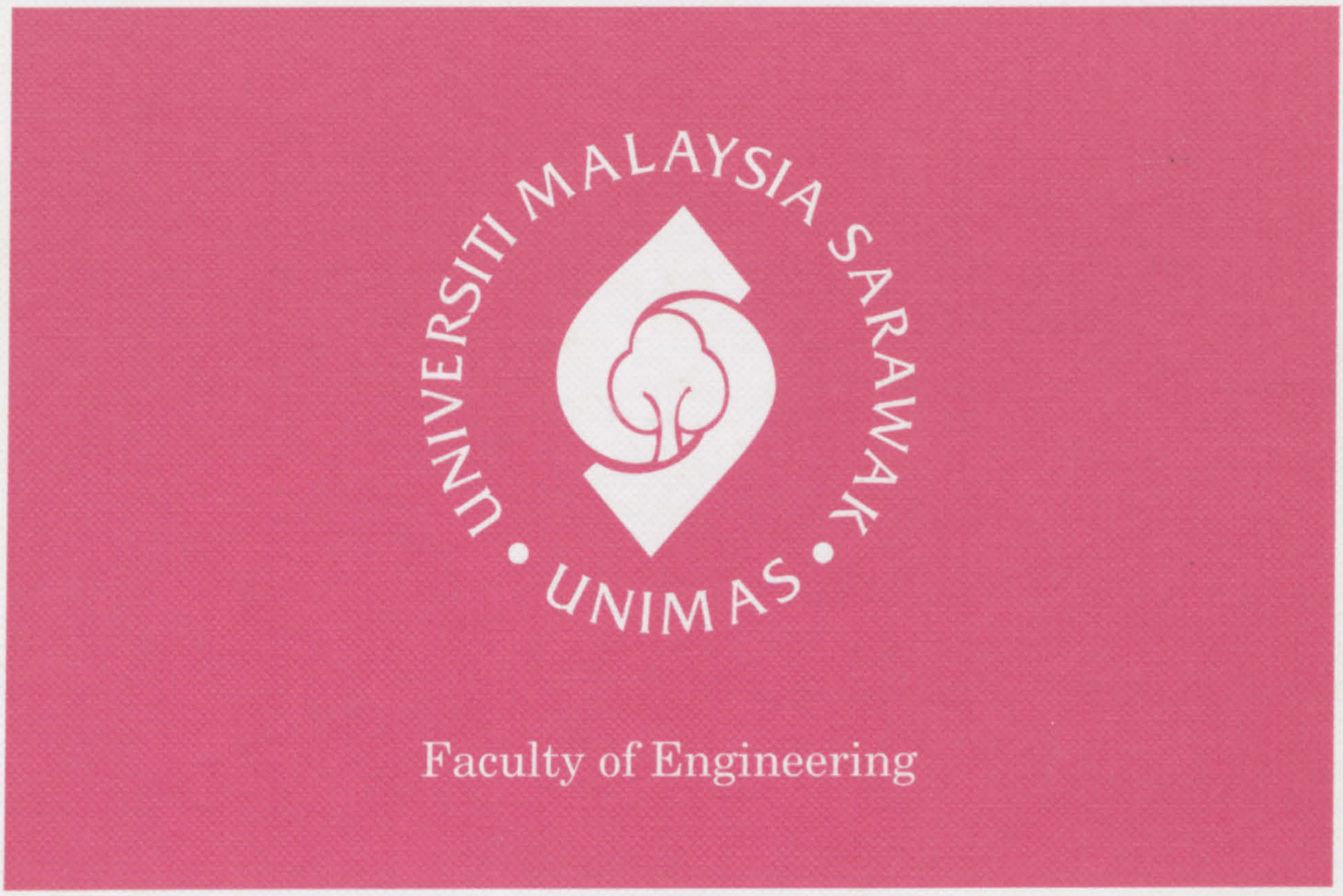

THE EFFECTIVENESS OF 3 TYPES OF PHYSICAL TRAFFIC CALMING DEVICE: WHICH IS MOST RELEVANT AT REDUCING TRAFFIC SPEEDS?

Wong Leong Sing

Bachelor of Engineering with Honours
(Civil Engineering)
2004

Universiti Malaysia Sarawak
Kota Samarahan

fk

BORANG PENYERAHAN TESIS

Judul: THE EFFECTIVENESS OF 3 TYPES OF PHYSICAL TRAFFIC CALMING DEVICE: WHICH IS MOST RELEVANT AT REDUCING TRAFFIC SPEEDS?

SESI PENGAJIAN: 2001 - 2004

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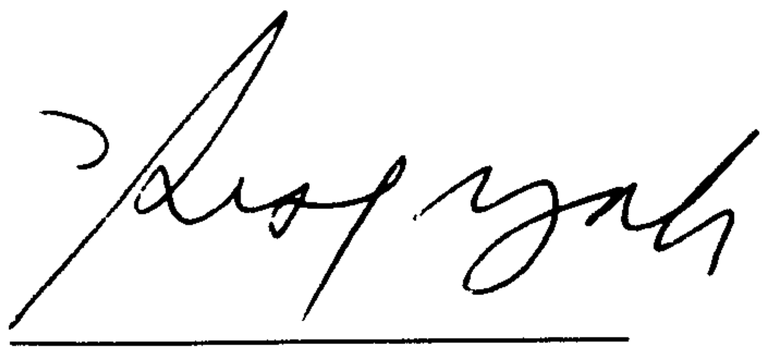

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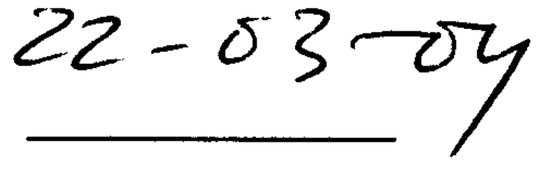

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THE EFFECTIVENESS OF 3 TYPES OF PHYSICAL TRAFFIC CALMING DEVICE: WHICH IS MOST RELEVANT AT REDUCING TRAFFIC SPEEDS?

WONG LEONG SING

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ABSTRACT

The demand by the public to reduce traffic volumes and speeds in their restricted areas has necessitated traffic engineers and the government authority to come out with effective traffic calming strategies. Physical traffic calming devices are often installed to overcome traffic flow problems in restricted areas but the effectiveness of such devices is largely dependent on the size and shape of such devices. As such, the project aims to determine the most effective physical traffic calming device at reducing vehicular speeds from 3 types of such devices, namely speed bump, round-top speed hump and speed table which were installed in 3 different locations as well as to evaluate the relevancy of installation of such devices. The methodology contained in the project illustrates method of sampling from populations of vehicles on the streets where the devices were installed and describes procedures of conducting spot-speed studies using speed radar gun to analyze the relationship between vehicular speeds and the devices. Engineering review and analysis of all data were done through traffic volume studies, spot-speed studies, regression studies, questionnaires and interviews. From the project, although speed table at Padungan Street proves to be most effective at reducing critical speeds (-6.82 kph) if compared to speed bump in the compound of Universiti Malaysia Sarawak (UNIMAS) campus (-2.40 kph) and round-top speed hump on Lane 8A, Bayor Bukit Road (-4.70 kph), the amount of vehicular speed reduction for all the devices are rather small (less than 10 kph). This creates an issue on the suitability of installing such devices in their respective areas. Regression analysis performed in the project indicates that as the height and width of the devices increase, the entry speeds decrease. This shows that drivers are reasonably influenced by the dimensions of the devices. However, there is a lack of association between the 15^{th} percentile entry speed with respect to the height ($R^2 = 0.3697$) and width ($R^2 = 0.4942$) of the devices. This may be due to differing drivers' attitudes and speed preferences in selecting the 15^{th} percentile entry speed at 15 m before the devices. Relevancy analysis through questionnaires distributed among 50 responders at locations where such devices were installed reviews that all the devices are reasonably accepted with speed bump mostly accepted (80 % rate of approval), followed by speed table and round-top speed hump with 76 % and 62 % rate of approval respectively.

ABSTRAK

Permintaan daripada orang ramai untuk mengurangkan kesesakan dan kelajuan lalulintas di kawasan-kawasan terhad telah mendorong jurutera-jurutera trafik dan pihak kerajaan untuk merancang strategi-strategi kawalan lalulintas yang efektif. Alat-alat fizikal kawalan lalulintas sering dibina untuk mengatasi masalah-masalah aliran lalulintas di kawasan-kawasan terhad tetapi keberkesanan alat-alat tersebut adalah amat bergantung kepada saiz dan bentuk alat-alat tersebut. Oleh itu, projek ini bertujuan untuk menentukan alat fizikal kawalan lalulintas yang paling efektif dalam mengurangkan kelajuan kenderaan daripada 3 jenis alat fizikal kawalan lalulintas, iaitu 'speed bump', 'round-top speed hump' dan 'speed table' yang dibina di 3 lokasi yang berlainan serta mengkaji keperluan pembinaan alat-alat tersebut. Metodologi dalam projek ini menghuraikan cara-cara untuk mendapat sampel daripada populasi kenderaan di jalan-jalan raya dimana alat-alat tersebut dibina dan menerangkan prosedur-prosedur untuk membuat kajian pengukuran laju jurusan lalulintas jalan raya dengan menggunakan pistol laju radar bagi menjalankan analisis tentang hubungan antara kelajuan kenderaan dengan alat-alat tersebut. Pemerhatian dan analisis untuk semua data telah dilakukan melalui kajian isipadu lalulintas, kajian pengukuran laju jurusan lalulintas, kajian regresi, borang-borang soal selidik dan temuramah-temuramah. Melalui kajian projek tersebut, walaupun 'speed table' di Jalan Padungan terbukti adalah paling efektif dalam mengurangkan kelajuan kritikal (-6.82 km/jam) jika dibandingkan dengan 'speed bump' di kampus Universiti Malaysia Sarawak (UNIMAS) (-2.40 km/jam) dan 'round-top speed hump' di Lorong 8A, Jalan Bayor Bukit (-4.70 km/jam), jumlah pengurangan kelajuan kenderaan akibat pembinaan alat-alat tersebut adalah kecil (kurang daripada 10 km/jam). Ini membangkitkan isu keperluan pembinaan alat-alat tersebut di kawasan masing-masing. Analisis regresi yang dibuat dalam projek ini menunjukkan bahawa apabila tinggi dan lebar alat-alat tersebut semakin bertambah, kelajuan masuk semakin berkurangan. Ini menunjukkan bahawa pemandu-pemandu dipengaruhi oleh dimensi alat-alat tersebut dalam memilih kelajuan masuk. Walau bagaimanapun, terdapat kekurangan perkaitan antara 15 peratus kekerapan kelajuan masuk dengan tinggi (R^2 = 0.3697) dan lebar (R^2 = 0.4942) alat-alat tersebut. Ini mungkin disebabkan sikap dan pilihan kelajuan di kalangan pemandu-pemandu yang berbeza dalam menentukan 15 peratus kekerapan kelajuan masuk pada jarak 15 m dari alat-alat tersebut. Kajian keperluan alat-alat tersebut melalui borang-borang soal selidik yang diedarkan kepada 50 individu di setiap lokasi dimana terdapat alat fizikal kawalan lalulintas tersebut menunjukkan bahawa majoriti individu menerima kewujudan alat-alat tersebut dengan 'speed bump' mendapat kadar persetujuan yang paling tinggi (80 % kadar persetujuan) diikuti oleh 'speed table' dan 'round-top speed hump', masing-masing dengan 76 % dan 62 % kadar persetujuan.

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B	–	Width of a physical traffic calming device
d	–	Hump separation in meter
E	–	Permitted error in the 85^{th} percentile speed estimate, mph
H	–	Height of a physical traffic calming device
K	–	Constant corresponding to percentile speed
N	–	Minimum number of measured speeds
R^2	–	Coefficient of determination
R_{15}^2	–	Coefficient of determination of 15^{th} percentile speed
R_{50}^2	–	Coefficient of determination of median speed
R_{85}^2	–	Coefficient of determination of 85^{th} percentile speed
$R_{Average}^2$	–	Coefficient of determination of average speed
S	–	Estimated sample standard deviation, mph
U	–	Constant corresponding to the desired confidence level
V	–	Speed of vehicle at mid hump in kilometer/hour

CHAPTER 1

INTRODUCTION

1.1 Background and Overview

Residents want to reduce traffic volumes and speeds in their neighbourhood areas. Commercial centre owners want moderate traffic speeds within their building compound areas to avoid collision of vehicles and to ensure safe parking of vehicles. Hospital authorities try to get motorists driving on the freeway instead of speeding through hospital compound areas as a short-cut route to their destinations. Traffic engineers need a smooth flow of traffic to avoid localized traffic congestion. Those are a few very common scenarios that prompt the government authority to strike a balance between mobility and safety by implementing strategies to reduce traffic speeds in restricted areas. This is often done by introducing speed bumps, round-top speed humps and speed tables in the areas instead of stop signs simply because those physical traffic calming devices are very effective at speed reduction of vehicles. According to Wroe (2003), stop signs are for controlling right-of-way instead of controlling speed. The assumption is that everyone will stop, but compliance goes on low-volume residential streets. According to Wroe (2003) again, facts from studies, which show that 11 percent to 25 percent of drivers do not even apply the brakes when approaching a stop

sign, are really worrisome. The statement is further supported by the information obtained from Table 1 as follows:

Accident	**Year 2001**	**Year 2002**	**Year 2003**	Total number of accidents
Killed	-	-	-	-
Fatal	-	1	-	1
Light	2	-	-	2
Normal	5	5	4	14
Total number of accidents	7	6	4	17

Table 1: Accident Rate at Urat Mata Road of Tabuan Jaya, Kuching Obtained from Kuching Traffic Police Headquarter

Urat Mata road is in fact, one of the residential area roads in South Kuching where round-top speed humps are located. Table 1 shows a consistent decrease of accident cases at Urat Mata road from 7 cases in 2001 to 6 cases in 2002 and finally, to 4 cases in 2003. This points to the fact that physical traffic calming devices like round-top speed humps are effective at reducing traffic speeds, which led to the reduction of accident cases on the road from Year 2001 to Year 2003.

All in the same family, each of round-top speed hump and speed table raises the pavement from 7.5 cm to 10 cm (3 to 4 inches) with speed bump raises the pavement from 7.5 cm to 15 cm (3 to 6 inches) (Institute of Transportation Engineers, 2003). Despite the fact that

they all share the same primary objective that is to reduce traffic speed through a vertical deflection of pavement, it is their shape that produces different impacts in reducing traffic speeds. Speed bump and round-top speed hump have curvature shape whereas speed table usually has flat top shape. Engineers often refer to speed bumps as narrow and abrupt best confining to parking lots. Round-top speed hump and speed table are more gradual often with broader width if compared to speed bumps. They are relatively inexpensive, effective in reducing traffic speeds and self-enforcing. Since they are self-enforcing, they are often referred to as 'sleeping policemen'. According to the 1997 survey conducted by the Institute of Transportation Engineers, they appear to produce the greatest speed reduction and have high public satisfaction. This points to the fact that speed bump, round-top speed hump and speed table are very effective in reducing traffic speeds.

But what is more interesting is which of those physical traffic calming devices is most effective at speed reduction of vehicles. Definitely, this involves an in-depth understanding and studies of the physical traffic calming devices namely, speed bump, round-top speed hump and speed table so as to enable comparison among the 3 types of physical traffic calming device to be made. As the matter of fact, that is the main goal of the project.

Two important criteria in evaluating the functions of speed bump, round-top speed hump and speed table are the appropriateness of the 3 physical traffic calming devices in reducing traffic flows and the level of approval of the physical traffic calming devices by the community in the areas where those devices are placed. In this aspect, it is of great interest to know the necessity and reasonability of the design and construction of speed bump, round-top speed hump and speed table in their respective areas. This forms the secondary goal of the project. According to Marti (2002), little effective information is available to help planners to