



THE EFFECTIVENESS OF VARIOUS TYPES OF SPEED HUMPS

MUHAMMAD FARHAN BIN ABD. KARIM

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University Malaysia Pahang**

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ABSTRACT

Traffic calming is defined as a device that will reduce the speed of the vehicle at a certain places. There are many types of traffic calming devices such as speed humps, roundabouts, semi dividers, street closures, and chicane deviation. Generally in residential area in Malaysia, the most widely traffic calming devices that been used in order to reduce vehicles' speed is speed humps. There are many types of speed humps has been design and vary according to its shapes, dimensions, and condition of application. This study is carried out to determine the effectiveness of various type of speed humps to reduce vehicles' speed. The types of speed humps that been analyze are speed humps, transverse bar, and the combination of speed humps and transverse bar. The research and data collection will be conducted at a residential area in Kuantan. To determine the spot speed of the vehicles that going through those speed hump, Radar Gun will be used. The vehicles' spot speed will be read before, on, and after the they gone through those speed humps. The delay of time taken for the vehicles passing the speed humps also will be recorded. After sufficient data and amount of samples has been taken, the data will be analyze using one way ANOVA and Microsoft Excel. The analysis that been conducted will come to the conclusion on which types of traffic calming devices is the most effective one in order to reduce speed and to increase delay and the results obtained is the combination of the speed hump and transverse bar for the most effective in reducing the vehicle speed and cause the longest duration of delay.

ABSTRAK

Pereda lalulintas adalah dikenali sebagai suatu alat yang digunakan untuk mengurangkan halaju kenderaan di suatu lokasi. Terdapat pelbagai jenis pereda lalulintas yang biasa digunakan seperti bonggol, bulatan, semi dividers, street closures, dan chicane. Biasanya di Malaysia, bonggol ada jenis pereda lalulintas yang biasa digunakan. Bonggol juga terdapat banyak jenis dan direka dalam pelbagai bentuk dan ukuran. Kajian ini dijalankan adalah untuk mengenalpasti jenis bonggol yang paling efektif dalam mengurangkan halaju kenderaan. Jenis bonggol yang diuji adalah bonggol, garisan lintang, dan kombinasi antara bonggol dan juga garisan lintang. Kajian dan cerapan data dijalankan di kawasan penduduk sekitar Kuantan. Untuk mengenalpasti halaju setempat bagi kenderaan, radar tembak akan digunakan. Halaju setempat kenderaan yang melalui pereda lalulintas akan di ambil sebelum, diatas dan selepas kenderaan melalui bonggol. Masa lengahan kenderaan juga akan di ambil. Setelah data yang mencukupi di ambil, data akan di analisis menggunakan ANOVA satu hala dan juga perisian Microsoft Excel. Analisis yang dijalankan memberi kesimpulan bahawa kombinasi bonggol dan garisan lintang adalah paling efektif dalam mengurangkan halaju setempat kenderaan dan memberikan masa lengahan yang paling panjang.

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CHAPTER 1

PREFACE

1.1 Introduction

Malaysia has grown rapidly in the field of transportation since 25 years ago. Our country has achieved high reputation and rating in automotive industry and many of local's vehicles have been produced. Due to this circumstance, the number of the vehicle on our road also is rising and indirectly increased the number of road accidents.

Due to the Jabatan Keselamatan Jalan Raya Malaysia (JKJR 2011), the number of the vehicle involved in accidents are increasing every year. In the year 2002, the total accidents occur are 279,711 cases recorded from January until May which includes 5,378 cases fatal accidents, 6,696 cases severe injury, and 30,259 cases minor injury meanwhile in the year 2010, the total accidents occur are 414,421 cases recorded from January until May which includes 6,260 cases fatal accidents, 6,002 cases severe injury, and 10,408 cases minor injury. The data tell us that since 2002, the cases of accident recorded from January to May has increased 48.16% in the year 2010.

From the **Table 1.1**, it is obvious that the rate of accidents in Malaysia is high and increasing every year. This issue should be deeply studied and has to come out with a way to overcome the problem. One of the step that could be taken in order to reduce the rate of accidents is reducing the vehicles' speed on road. The method is by using traffic calming devices.

Traffic calming is used to control the vehicles' speed and avoiding hazard to other road users such as pedestrian and cyclist. Traffic calming devices is only suitable for the low-density road only. If traffic calming devices is placed at high-density road such as federal highway, this will cause serious traffic congestion.

According to Kent County Council, traffic calming is about reducing speed. Speed humps in particular, are not suitable for main roads that are used by large numbers of vehicles, as it would cause delays. For example, this would cause particular problems if the roads were used by emergency services, buses and lorries. (Kent County Council, 2011).

Table 1.1 : Data of Road Accidents 2002-2011 (Jan-May)

| PERANGKAAAN KEMALANGAN JALAN RAYA BAGI TAHUN 2002-2011 (JAN-MEI) | | | | | | | | | | | |
|------------------------------------------------------------------|------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| TAHUN | | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
| JENIS KEMALANGAN INJURI | Kemalangan Maut | 5,378 | 5,634 | 5,674 | 5,604 | 5,711 | 5,672 | 5,952 | 6,218 | 6,260 | 2,500 |
| | Kemalangan Parah | 6,696 | 7,163 | 7,444 | 7,600 | 7,375 | 7,384 | 7,020 | 6,978 | 6,002 | 2,029 |
| | Kemalangan Ringan | 30,259 | 31,357 | 33,413 | 5,928 | 15,596 | 3,979 | 12,893 | 12,072 | 10,408 | 4,121 |
| JUMLAH KEMALANGAN INJURI | | 42,333 | 44,154 | 46,531 | 39,132 | 28,682 | 27,035 | 25,865 | 25,268 | 22,670 | 8,650 |
| JUMLAH KEMALANGAN TANPA INJURI (ROSAK SAHAJA) | | 237,378 | 254,499 | 280,283 | 289,136 | 312,550 | 336,284 | 347,182 | 372,062 | 391,751 | 170,048 |
| JUMLAH KEMALANGAN | | 279,711 | 298,653 | 326,814 | 328,268 | 341,232 | 363,319 | 373,047 | 397,330 | 414,421 | 178,698 |
| JENIS INJURI | Mati | 5,891 | 6,286 | 6,228 | 6,188 | 6,287 | 6,282 | 6,527 | 6,745 | 6,872 | 2,671 |
| | Cedera Parah | 8,425 | 9,040 | 9,229 | 9,397 | 9,254 | 9,273 | 8,866 | 8,849 | 7,781 | 2,581 |
| | Cedera Ringan | 35,236 | 37,415 | 38,631 | 31,429 | 19,884 | 18,444 | 16,901 | 15,823 | 13,616 | 5,314 |
| JUMLAH INJURI | | 49,552 | 52,741 | 54,088 | 47,014 | 35,425 | 33,999 | 32,294 | 31,417 | 28,269 | 10,566 |
| INDEKS KEMATIAN JALAN RAYA | Setiap 100 ribu penduduk | 24.10 | 25.10 | 24.30 | 23.70 | 23.60 | 23.10 | 23.60 | 23.80 | 24.20 | NA |
| | Setiap 10 ribu kenderaan berdaftar | 4.88 | 4.88 | 4.51 | 4.18 | 3.98 | 3.73 | 3.63 | 3.55 | 3.40 | NA |
| | Setiap 1 Bilion VKT | 22.71 | 22.77 | 21.1 | 19.58 | 18.69 | 17.6 | 17.2 | 17.28 | 17.28 | NA |
| Sumber : Polis Diraja Malaysia (PDRM) | | | | | | | | | | | |
| Cawangan Trafik Bukit Aman | | | | | | | | | | | |

1.2 Problem Statements

A speeding vehicle will cause many bad effects to the road users and the surrounding people. It will produce noise pollutions and endanger the other road users especially the pedestrian. So, in the residential area especially, the traffic calming devices will be construct to void the vehicles' speed. The most common device that been used is speed hump. Though, there are several types of speed humps had been design and each of it gives different results on the speed reduction of the vehicle that pass by. The most common type of speed humps in Malaysia's residential area are speed bump, transverse bar, and combination of speed bump and transverse bar.

This research is conducted to investigate and analyze several types of speed humps and its effectiveness towards the vehicles speed reduction. From this research we can determine the changes of vehicles' speed while passing by the speed hump and later we will know the delay of the vehicle.

1.3 Research's Objectives

The main goal of the research is to determine the various type of speed hump and its effect on speed reduction of the vehicles that pass by. To achieve that, the research objective are as below :

- i. To identify and illustrates the various type of speed hump designs.
- ii. To determine vehicle speed before, on and after the speed humps.

- iii. To determine the most effective speed hump design at reducing vehicles' speed.

1.4 Important of Study

The research on traffic calming is seldom be done in Malaysia. So, this research is to improve on what has been discovered before. The selection of the most suitable speed humps type to be construct on a certain place can be well manage and considered due to how much speed reduction it will perform on vehicles. If the most effectiveness type of speed hump is already discovered, it can save a lot of cost because it no need to reselect the other type of speed hump to be built at a certain area.

1.5 Scope of Study

To achieve the aims and the objectives, the research is done on several types of speed humps at residential area in Kuantan that is speed humps, transverse bar, and combination of speed humps and transverse bar.

The research begin with spot speed data collection of the vehicles that passing by the area. After obtained the data, the data will be analyzed and the percentage of vehicle delay while passing by the speed hump will be determined.

1.6 Expected Outcome

By running this study, the expected outcome are :

- i. Knowing the commonly various type of speed humps design at residential area.
- ii. Acquire the vehicles spot speed data.
- iii. Analyze the obtained data and be able to choose the most effective speed hump design at reducing vehicle's speed.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

In this chapter, literature review covers the definition, history of traffic calming, types of traffic calming devices, study of traffic calming, statistic in traffic engineering and effects of using traffic calming devices.

2.2 Definition of Traffic Calming

According to Institute of Transportation Engineers in 1996, traffic calming are the combination of mainly physical measures that reduce negative effects of motor vehicle use, alter driver behavior and improve condition for non-motorists streets users.

Another definition describe by Chow Kim Hoong (2008), Victioria Transport Policy Institute define traffic calming as a certain design and strategy to aim for reducing speed and density of a vehicle on road.

Bunte (2000) claims that Build America in the year 1997 define traffic calming as a process where public is finding another alternative transport, driving in slow speed, driving using alternative roads and driving in considering the residential that they passing by.

According to Nor Sarwani binti Ahmad Rodzuan (2009), Public Technology define that traffic calming is a way to calming the road from the vehicle chaos. It also a way to improve the comfort and safety for the residential area that always polluted by the noise of the accelerates vehicles.

2.3 Traffic Calming History

The traffic calming measures have been introduced in many other countries in the world since many years ago despite it is still in the infancy stage in Malaysia. According to Leslie W. Bunte, (2000) some 30 to 40 years ago the beginnings of traffic calming programs came into popularity in Europe. The earliest roots of traffic calming have been traced backed to the Netherlands, where in the late 1960's, the desire were "to turn the street into an obstacle course for motor vehicles, and an extension of home for residents.

The Dutch utilized diversion schemes, such as street closings, one way streets, and other traffic calming devices using physical measures such as speed humps. These concepts quickly spread to many other countries such as Germany, Sweden, Denmark, England, France, Japan, Israel, Austria, and Switzerland. They then embarked upon a plan to extend the devices to the main roads (Leslie W. Bunte, 2000).

Although traffic calming has been around for a number of years, Great Britain has elected, within the last decade, to aggressively implement traffic calming programs. This was developed in the shadow of a 1963 government document, *Traffic in Towns*, which is credited with initiating the shift towards traffic calming as a viable transportation program. Colin Buchanan, the author of the document, is considered to be the father of traffic calming (Leslie W. Bunte, 2000).

Some European communities have long since concluded that traffic calming must encompass higher order roads if traffic safety, liability, and walk ability are to be achieved outside isolated pockets." Given the unpopularity and rising opposition to traffic calming, the move to higher-class roadways in the United States may never be reached. This may be evidenced by the growing sentiment that "everyone seems to want traffic calming in their neighborhood, but not on their route into the city which might be someone else's neighborhood." (Leslie W. Bunte, 2000)

Another program of traffic calming was early of 1980's when Norway and Denmark discuss the problem on traffic that they confront. They has invented the Chicane, roundabouts, and many others technique of traffic calming. The existence of traffic calming devices is able in reducing the vehicles' speed, reducing accidents, and producing a better air that less polluted.

2.4 Types of Traffic Calming Devices.

The types of traffic calming devices that will be discussed here are chicane, zigzag road control, roundabouts, semi-diverter, street closure, speed bump, and transverse bar.

2.4.1 Chicane

Chicanes are a type of "horizontal deflection" used in traffic calming scheme to reduce the speed of traffic. Drivers are expected to reduce their speed to negotiate the lateral displacement in the vehicle path. **Figure 2.1** show the examples of chicane.

There are many variations of traffic calming chicanes, but they generally fall into one of two broad categories:

- i. Single-lane of working chicanes, which consist of staggered build outs, narrowing the road so that traffic in one direction has to give way to opposing traffic.
- ii. Two-way of working chicanes, which use build outs to provide some deflection, but with lanes that separated by road markings or a central island.



Figure 2.1 Chicane

2.4.2 Zigzag Road Control

Zigzag road control is construct to make a curving road as replacement of a straight road. zigzag is a line which a series of angles in it like a continuous series of 'W's. zigzag road control will require the drivers to slow down their vehicle to follow the road curve left and right. This type of traffic calming device is hard to apply otherwise there is enough space to construct the road. It also not suitable to apply in high-density traffic. **Figure 2.2** below show the examples of zigzag road control.

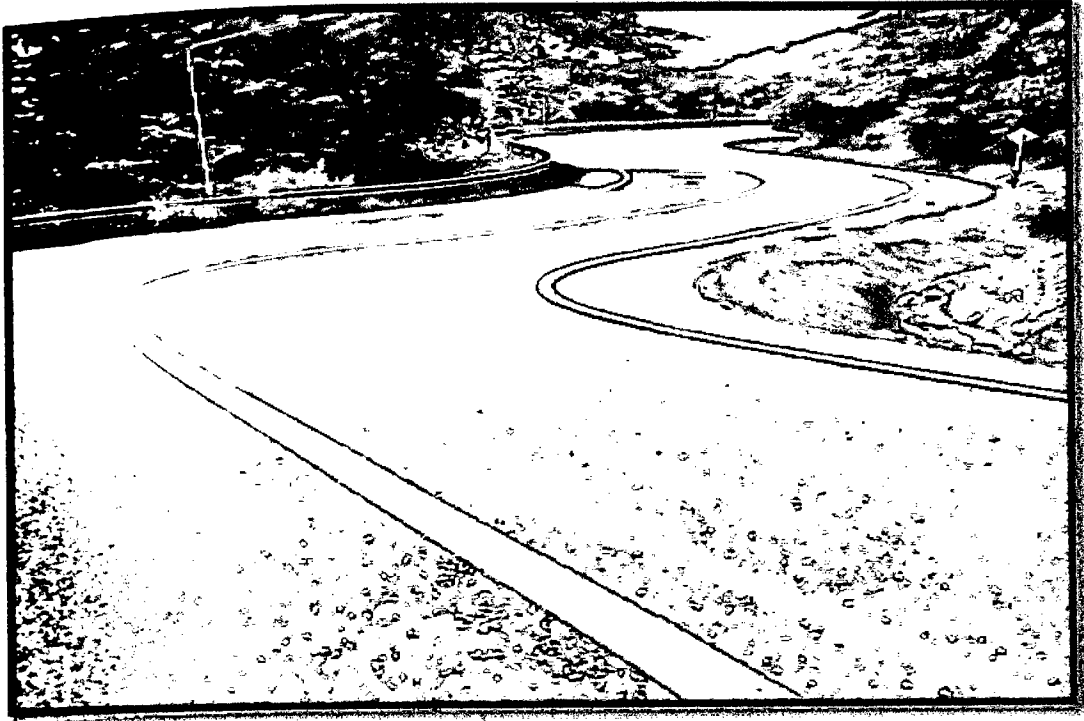


Figure 2.2 Zigzag road control

2.4.3 Roundabouts

Roundabouts as **Figure 2.3** is like an island or rounded plane that placed in the middle of a junction. Besides, vehicle should enter the roundabouts in clockwise flow along the circle. If the specification of the roundabouts is perfect, vehicle can exit the roundabouts in a straight line. According to Bunte (2000), roundabouts will cause confusion and endanger the pedestrian and cyclist to crossing the roads.

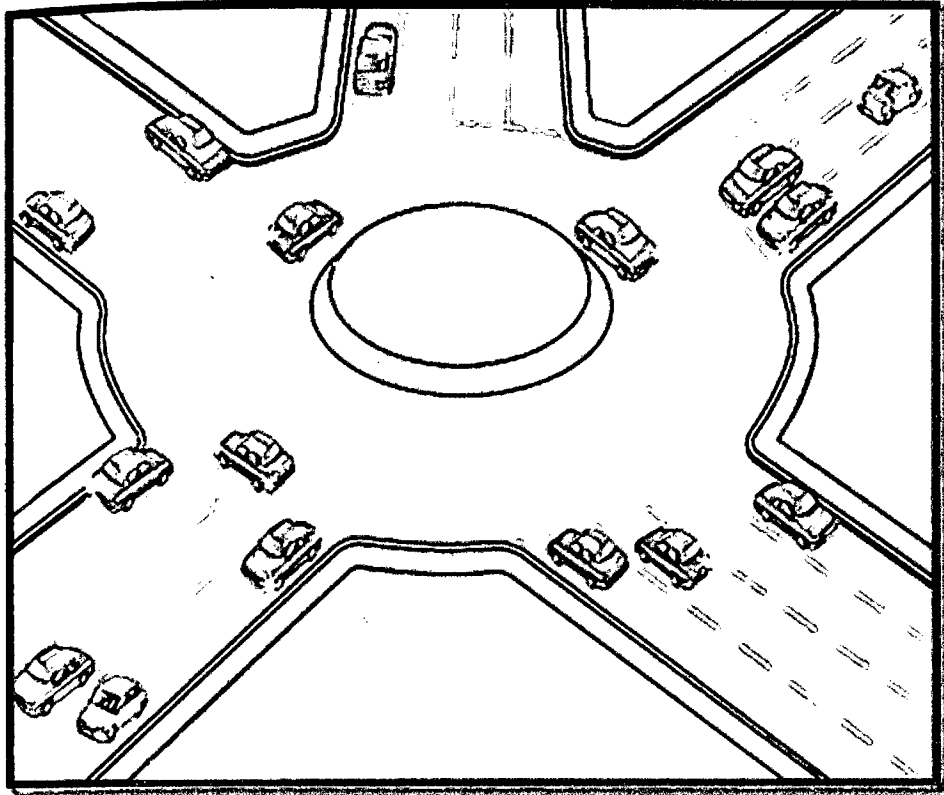


Figure 2.3 Roundabout

2.4.4 Semi-Diverter

Whenever there is a desire to physically block one direction of traffic at a certain point on a two-way street, a semi-diverter traffic-calming device is selected similar to the one in **Figure 2.4**. In effect; this prevents vehicles from turning, or forcing a turn, depending upon the desire. Cut through traffic is reduced, but there is not a 100% compliance with all drivers, particularly when no on-coming traffic is encountered. Again, trip lengths could increase for some residents depending on the location of the semi-diverters (Leslie W. Bunte, 2000).

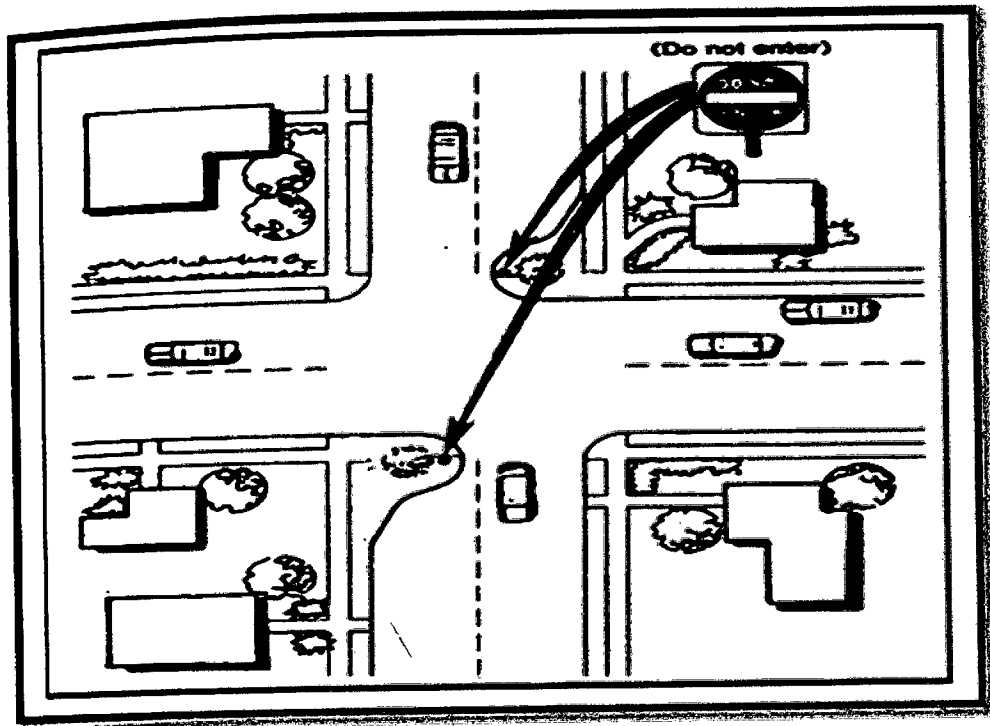


Figure 2.4 Semi-Diverter

2.4.5 Street Closure

This is the most drastic of all traffic calming devices as it severely limits the use of the street to the residents. Although it does eliminate cut through traffic, this device can often be perceived as an inconvenience by the residents and as an unwarranted restriction by the general public. Using planters, raised barriers, bollards or landscaping to completely block the street for traffic, accomplishes the desired effect as illustrated in the **Figure 2.5** (Leslie W. Bunte, 2000).