THE EFFECT OF SPEED HUMPS ON PAVEMENT CONDITIONS IN LOCAL STREETS

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STUDENT'S DECLARATION

I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.

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I dedicate this research to my parents, my lecturers and my fellow friends for unending supports and love.

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ABSTRACT

Speed humps is one of the traffic calming devices beside speed bumps, speed tables, roundabouts, transverse rumble strips, optical speed bars, textured pavement, and cat-eye reflectors. Main function of these devices is to control and calm the speed of vehicles such as cars, lorries and motorcycles so that they were driven at suitable speed, through critical areas or local streets. It also can be acknowledged as a raised pavement which is spanning across roadway to force drivers to reduce the speed of their vehicles. By slowing down their vehicles, more time could be given to the pedestrians to safely cross the road. The objective of this research is to identify surface pavements conditions within speed humps area and to determine the most suitable type of road hump to be build based on the traffic volumes at the study area. In order to achieve the objectives, traffic counting were carried out during peak hours at 5 speed humps along Sri Damai Road (C181). The traffic volume for this study area is in range of 2,000-5,000 vehicles per day. From this study, it was found out that the size and characteristics of hump located at the study area are totally different than Public Work Department's standard specification in terms of height and length of hump. The best speed hump that is suitable to be used at this local road is sinusoidal with 4 meter in length and 100 mm of height. The defect that usually occur before and after the hump is crocodile crack, transverse crack, block cracking, pothole and depression by divided it into three main conditions which is less severe, medium severe and badly severe. It is hope that there outcomes from this thesis could help the Public Work Department to plan appropriate measure for surface improvement at humps located at local roads.

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ABSTRAK

Humps merupakan salah satu alat penenang trafik selain dari bump, jadual kelajuan, bulatan, jalur melintang, bar kelajuan optik, turapan bertekstur dan mata kucing reflektor. Fungsi utama alat ini adalah untuk mengawal dan menenangkan kelajuan kenderaan seperti kereta, lori dan motosikal supaya mereka memandu kenderaan pada kelajuan yang sesuai, melalui kawasan yang kritikal atau jalan-jalan tempatan. Ia juga boleh diakui sebagai turapan yang dinaikkan merentasi jalan raya untuk memaksa pemandu mengurangkan kelajuan kenderaan mereka. Dengan memperlahankan kenderaan mereka, masa lebih banyak boleh diberikan kepada pejalan kaki untuk menyeberang jalan dengan selamat. Objektif kajian ini adalah untuk mengenalpasti keadaan permukaan jalan berdekatan dengan kawasan bonggol dan untuk menentukan bonggol jalan yang paling sesuai digunakan berdasarkan jumlah lalu lintas di kawasan kajian. Untuk mencapai matlamat tersebut, pengiraan lalu lintas telah dijalankan pada waktu puncak di 5 humps sepanjang Jalan Sri Damai (C181). Jumlah trafik bagi kajian ini berada dalam julat antara 2,000-5,000 kenderaan setiap hari. Dari kajian ini, ia mendapati bahawa saiz dan ciri-ciri bonggol yang terletak di kawasan kajian adalah benar-benar berbeza daripada spesifikasi standard Jabatan Kerja Raya dari segi ketinggian dan panjang bonggol. Bonggol kelajuan terbaik yang sesuai untuk digunakan di jalan raya tempatan ini adalah sinusoidal dengan 4 meter panjang dan 100 mm tinggi. Kecacatan yang biasanya berlaku disekitar bonggol adalah buaya retak, retak yang melintang, blok retak, pothole dan kemurungan yang boleh dibahagikan kepada tiga keadaan seperti kurang teruk, sederhana teruk dan teruk sekali. Adalah menjadi harapan bahawa hasil dari tesis ini dapat membantu Jabatan Kerja Raya dalam merancang langkah-langkah yang sesuai untuk penambahbaikan permukaan pada humps yang terletak di jalan-jalan tempatan.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Speed humps is one of the traffic calming devices besides speed bumps, speed tables, roundabouts, transverse rumble strips, optical speed bars, textured pavement, and cat-eye reflectors used to controlled and calming the speed of vehicle such as car, lorries and motorcycles at a suitable speed, usually below than 30 km/hr when travelling through a critical area or local streets. It also can be derives as a raised pavement which is spanning across a roadway to forcing the drivers reduces the speed of vehicle and improve a condition of pedestrian street users because it can give some time to the pedestrian to safely cross the road (Bekheet, 2014).

Moreover, installation of the speed humps not only for safety of pedestrian but also to other vehicle's user to cross without any chances of involving in crashes. Speed hump is the most common type of speed calming devices used worldwide as it is more comfortable to the user because it was designed with wide length and lower height compare to speed bumps. Besides that, it can also reduce the impact of collision between the bottom of the vehicle and a surface of hump that can make the vehicle damaged easily (Berthod, 2011).

Although speed hump and speed bump have a similar objective which is to reduce the speed of vehicle and the impact of user but both devices are definitely different based on their application and its characteristic. The height of speed hump generally between

75mm to 150mm with the length of 3.7m to 4m meanwhile the height for speed bump is 75mm with the length of 300mm to 500mm which can causes a shock to the vehicles due to high impact from this bump.

Besides, the cost to build or doing maintenance for the speed hump is much cheaper as is doesn't involves any electrical and electronic system. The device also is quite easy to install without using any complicated method by referring to the standard specification at every country provided. However in Malaysia, they need to refer for Public Work Department's standard that was decided for all state.

In 1988, road humps or known as road hump undulation and speed rump was first provided at City of Wakefield MDC on Chidswell Lane, Gawthorpe. Function of this hump is to improve the condition of safety and to reduce the number of accident by building a rounded section of pavement as a traffic calming devices (Cottrell.et.al., 2006). The type of vertical speed control is deemed suitable and the design fitted the vehicle crossing speed which is between 20 until 30 km/hr to slow a vehicle on local streets but not at private road and parking lots (Hallmark et.al., 2012)

According to the data obtained from French Safety Department, cost of injury caused by speed hump had increased to 9.7 billion at local streets for every year (Haddak, 2016) .That means, a lot of crash occurred even when speed hump is provided. The speed humps usually built at a local streets since this type of road is near to the residential area and lot of vehicle especially the cars and motorcycles were drove through that road (Rychlewski, 2016).

Local streets or local road can be derived as a street that is primarily used to gain an access to the property bordering having lowest speed limit and carry low volumes of traffic or intra town movement (Iman.et.al., 2018). It can be provided by access and circulatory roads in land development including residential areas under Public Work Department or City Council's responsibilities. Local streets can be categorized as basic road network in neighborhoods. Local streets can provide links through the collector road and primarily to serve short trip lengths (Roads, 2012).

Local street was categorized as U2 that stands for urban design standard that have low geometric and low commercial traffic volumes which is rarely exceeding 2,000 Annual Average Daily Traffic (AADT) with less than 30 vehicle through the route in a day. Usually the range of speeds applied at local streets is limited to 60 until 70 km/h with no limitation of access, and the width of roads usually 5.5 until 6.0 m with very narrow unpaved shoulders about less than 1.0m (Johnson & Nedzesky, 2004)

Hump is normally suggested for a road having around 1,000 to 5,000 vehicle per day. The suitable size of hump for this type of road is normally 4m in length with 100 mm in height for 25 km/hr crossing speed. Although the local or residential streets only have the lowest traffic volume which is less than 2,000 vehicle per day including car, motorcycle, van, medium and heavy lorry, the requirement of constructing a hump is merely based on the number of crash cases occurred within the area (Ahmed, 2010).

The local streets is listed as a lowest level in the road hierarchy but it was an important road to link between the communities. This road is known as formal road network having community service facilities along the route such as clinic, factories and school. Consequently, installation of the speed hump on local streets can help reducing speed of vehicles that directly protecting pedestrian, bicyclist. Nevertheless, it can also produce a negative impact to the pavement condition as it might reduce a pavement service life due to improper design specification and characteristics of speed hump in term of height and width.

In Malaysia most of the road is flexible pavement type due to the lower cost of construction and easily to do maintenance (Ahmed & Erlingsson, 2016). Flexible pavement was constructed by several layers of natural granular material that started with natural subgrade layer then compacted subgrade layer, sub-base coarse layer, base coarse layer, binder coarse layer and surface coarse layer that have a tack coat and seal coat as a glue to bind the other layer together (Adlinge & Gupta, 2013). A flexible pavement will bend under the load of a tires so if the base layer is weak, the pavement will be easily damaged if additional load from the speed hump is also been put to the sub base layer.

Moreover, the friction between tires and pavement when the vehicle started to slow down near the hump, crossing the hump and increase the speed after passing the hump is

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