Brief Report: Study the effectiveness of the traffic calming measures (humps)

Introduction

Humps or raised pedestrian crossings are constructed at places where accidents are reported, to reduce the speed of vehicles and there by reducing the risk accidents. However, there are no proper standards for constructing these traffic-calming measures in Sri Lanka. Hence, road users have been experiencing several difficulties at humps. Effect of humps on vehicle speed varies with the type of vehicle. Often, a queue of vehicles can be observed near a hump when certain vehicles pass over a hump when the traffic flow is heavy. Some vehicles can pass over humps without reducing the speed.

A number of accidents have been recorded near humps, since vehicle operators try to avoid humps by manoeuvring vehicles to shoulders. Furthermore, vehicle maintenance and operating cost increases due to abrupt changes in road elevation at humps tends to excess acceleration, deceleration and vibration for vehicles. In addition, frequent acceleration and deceleration actions of vehicles induce considerable surface distresses to road pavements.

Research needs to identify the factors to be considered in designing of traffic calming measures such as raised pedestrian crossings and humps. This study will attempt to examine the effectiveness of the available humps and raised pedestrian crossings available and propose suitable design depend on the functional classes of the road taking into account the other factors affected.

Objectives

The main objectives of this study are as follows

- Identify effectiveness of humps or raised pedestrian crossings
- Develop geometric standards for traffic calming measures

Methodology and Data Collection

Humps are installed in several locations. Round Top and Flat top with straight ramp humps are widely available in Sri Lanka. However, most of the humps are not installed with Road signs or road markings. Numerous 15 hump locations were selected including various geometries in different road categories within Colombo metropolitan. Speeds of vehicles before the hump and at the hump were observed for different vehicle categories. Hump dimensions such as height, ramp length and plateau length were observed including other road features such as road signs and road markings. Manually classified traffic counts were conducted to observe traffic condition of each road.

Speeds of vehicles were observed where vehicle flow was under uninterrupted situation. In addition, special features those would affect to the traffic flow in the vicinity were observed.

Summary and Conclusion

Round top humps are recommended to install only for minor/residential roads where bus, emergency and heavy traffic flow is not available. Flat top humps can be recommended to set up on major roads.

Each and every hump should be marked and warning signs should be installed. Recommended hump dimensions are mentioned below.

TABLE 1: RECOMMENDED HUMP DIMENSIONS

Speed over Hump	Major Roads	Minor/Residential Roads
20Km/h	Flat Top Hump Height - 50mm Gradient – 1:13 Plateau Length – 0.1m	Round Top Hump Height – 50mm Length – 0.5m
15Km/h	Flat Top Hump Height - 50mm Gradient – 1:13 Plateau Length – 0.1m	Round Top Hump Height – 75mm Length – 0.5m-1.5m
10Km/h	Flat Top Hump Height - 75mm Gradient – 1:13 Plateau Length – 0.1m	Round Top Hump Height – 100mm Length – 1.0m-1.5m

Raised pedestrian crossings do not reduce vehicle speeds same flat top humps. To maintain speeds less than 20Km/h over raised pedestrian crossings with height of 100mm, plateau length of 6.1m and ramp gradient of 1:8. Hence, it can be recommended to set up raised pedestrian crossings where higher pedestrian demand is available.

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STUDY THE EFFECTIVENESS OF TRAFFIC CALMING MEASURES (HUMPS)

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Abstract

In Sri Lanka humps or raised pedestrian crossings are constructed at places where accidents are reported in order to reduce speeds of vehicles. However, there are no appropriate standards used for constructing those traffic-calming measures. Hence, road users have been experiencing several difficulties at those places. Effect of humps on vehicle speed varies with the type of vehicle. Sometimes a line of vehicles can be observed near a hump depending on the traffic flow and the vehicle mix. Some vehicles can pass over certain humps without reducing the speed. Therefore, Researches need to identify the factors to be considered in designing of these traffic-calming measures. This study will attempt to examine the effectiveness of the available humps and raised pedestrian crossings, and propose suitable design depend on the functional classes of the road taking into account the other factors such as vehicle type, road signs and markings.

It was discovered that round top humps are recommended to install only for minor/residential roads where bus, emergency and heavy traffic flow is not available. Flat top humps can be recommended to set up on major roads. All the humps should be marked and warning signs should be installed.

1. Introduction

Humps or raised pedestrian crossings are constructed at places where accidents are reported, to reduce the speed of vehicles and there by reducing the risk accidents. However, there are no proper standards for constructing these traffic-calming measures in Sri Lanka. Hence, road users have been experiencing several difficulties at humps. Effect of humps on vehicle speed varies with the type of vehicle. Often, a line of vehicles can be observed near a hump when certain vehicles pass over a hump when the traffic flow is high. Some vehicles can pass over humps without reducing the speed.

A number of accidents have been recorded near humps, since vehicle operators try to avoid humps by manoeuvring vehicles to shoulders. Furthermore, vehicle maintenance and operating cost increases due to abrupt changes in road elevation at humps tends to excess acceleration, deceleration and vibration for vehicles. In addition, frequent acceleration and deceleration actions of vehicles induce considerable surface distresses to road pavements.

2. Literature Review

Among several types of hump profiles such as Sinusoidal, Round-Top, Flat-Top with Sinusoidal ramps and Flat-top with straight ramp, many research have been carried out to identify the profile which provides a superlative performance based on numerous factors.

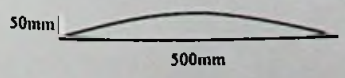

FIGURE 1: A ROUND TOP HUMP

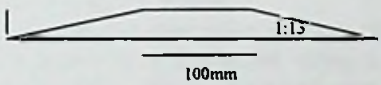

FIGURE 2: FLAT TOP HUMP WITH STRAIGHT RAMP

According to the highways (Road humps) regulations 1996 [Highways(Road Humps) Regulations 1996] minimum hump recommended height is 25mm and maximum hump height is 100mm. minimum length is 900mm and no vertical face to exceed 6mm in height.

Considerable flexibility has been allowed for the design of road hump profiles, permitting a variety of shapes to be used. However, whilst considerable research has been undertaken into the performance of road humps, research has concentrated on few well recognized shapes, and has not investigated some of the profiles used in other counties [US DOT, Report 2000]

Humps are more effective if the ramp is shorter. However, as the hump takes the whole width of the street also affects buses, and so these should be avoided on bus routes [Traffic Calming Measures and Bus Traffic August 2002]. Transport for London organization has published a report on traffic calming measures for bus routes.

When discomfort criteria is concerned sinusoidal hump profile gives less discomfort to cyclists than the standard round top hump, though the difference is not large. There is also a slight benefit in reduced discomfort to car passengers, but little, if any, to motor cyclists, bus passengers, and commercial vehicle and emergency service vehicle occupants. The track trials shown that when buses are

50mm

crossing road humps, the discomfort experienced by bus passengers can increase substantially as speeds increase from 24 km/h towards 32 km/h. To minimise discomfort, bus operators should consider adopting an operational speed of 24 km/h or less when crossing road humps [Road Humps 1999]. Hence, by concerning above factors it has verified that special care should be taken for busses and emergency vehicles.

Warwickshire country council has been developing a hump profile that is acceptable to bus operators and emergency services but will also reduce traffic speeds effectively. According to their observations, 1:15 gradients were noticeably more comfortable than 1:10 [Warwicks 1992]. In Sri Lanka flat top humps ramp gradient has been maintaining as 1:8. Collected data were summarized and a parametric study was conducted.

3. Methodology

Humps are installed in several locations. Round Top and Flat top with straight ramp humps are widely available in Sri Lanka. However, most of the humps are not installed with road signs or road markings. Fifteen (15) hump locations were selected including various geometries in different road categories within Colombo metropolitan area. Speeds of vehicles before the hump and at the hump were observed for different vehicle categories. Hump dimensions such as height, ramp length and plateau length were observed including other road features such as road signs and road markings. Manually classified traffic counts were conducted to observe traffic condition of each road.

Speeds of vehicles were observed where vehicle flow was under uninterrupted situation. In addition, special features those would affect to the traffic flow in the vicinity were observed.

Heavy vehicles and large busses operate at low speeds at the hump. For a given speed, the passenger discomfort in busses and other large vehicles when travelling over humps is likely to be higher than that in cars. Also Busses and heavy vehicles are less manoeuvrable than other light vehicles.

Followings are the effects considered under this study, (1) Effect of hump geometry, (2) Effect of road markings to vehicle speed and (3) Effect of road signs to vehicle speed

4. Results and Discussions

4.1 Effects of Hump Geometry to Vehicles

Round top hump geometry is widely used in Sri Lanka. Somehow, benefits and consequences of round top humps are not yet considered. Results showed that speed over a round top hump decreases as the length or height increases for all vehicle categories. To maintain a speed over hump less than 20 km/h, 75mm hump height would be recommended. With 100mm high humps, speed over the hump can be maintained less than 15 km/h.

Round top hump length should be restricted 0.5m-1.0m and 1.0m-1.5m to maintain the speed over the hump less than 20 km/h and 15km/h respectively. But survey data has shown that Motor cycles do not reduce their driving speed to acceptable extents and most of them maintain their usual speed by manoeuvring the vehicle to shoulder or damaged portion of the hump (at a lower elevation)

The similar trend has been observed flat top. To maintain a speed over hump less than 15 km/h (except motor cycles) 75mm height hump is suitable. Ramp length and the Platu length were insignificant for the speed reduction. This may be due to less variation of those parameters in the available humps. Plateau length of the selected humps were varied between 100mm-200mm Most of the vehicle speeds decreases as the length of hump increases for the flat top humps. Speed at the hump decreases as the height of the hump increases.

Motor cycles have maintained highest speed at the hump for all hump types. Heavy vehicles and busses have maintained lowest speeds at humps.

Bus passenger discomfort was not observed in this study, but results of a discomfort rating scale used in a study [Strathclyde 1993] suggested that a discomfort level between reasonably comfortable and some discomfort might be acceptable to bus drivers and passengers and that could be achieved when traversing round top humps 100mm high and flat top humps 75mm high with ramp gradient of 1:13 at the speeds of 15 to 25 km/h.

Speed reduction of large busses and heavy vehicles induce traffic incidents and it causes delay to other vehicles and generates long queues. Therefore, it would be a great disadvantage for transport network. There is a severe speed reductions over round top humps than other geometries. Speed reduction over round top hump is higher. So it cannot be recommended to install round top humps as a traffic-calming device for bus and heavy vehicle routes. However, it is acceptable to put up round top humps for residential or minor roads with a height restriction of 100mm.

4.2 Effect of Road Markings to vehicle speed

Effect of marking on Speed reduction over the hump is shown in figure 10

Road marking has become a major governing factor for speed reduction and for road safety. It can be verified in the study. Even with smaller hump dimensions higher speed reduction can be observed. That is a marvelous advantage to reduce speed with minimal hump dimensions and less damaging effects to vehicles. With same dimensions marked hump can reduce speed 25% more than unmarked hump. Hence, to maintain a speed over marked round top hump less than 15 km/h, 75mm hump height would be recommended. Speed over the hump can be maintained at

less than 10km/h with 100mm high marked round top humps.

Speed over a marked round top hump can be maintained at 10 km/h and 15 km/h by restricting the hump length between0.5m and 1.0m and between 1.0m and 1.5m respectively. To maintain a speed over marked flat top hump less than 10 km/h (except motor cycles) a 75mm height hump is suitable. There is insignificant speed reduction was observed with the increase of ramp length.
Road markings play a vital role in road safety. Visibility of hump to vehicle drivers is extremely important. Otherwise, it would create an unexpected shock to people inside vehicles. In addition, sudden jolting at the hump would create jerk to people inside vehicles including injuries. Therefore, it has become a major requirement to place road markings at humps. However, frequent vehicle passes would rub off road markings. Hence, frequent maintenance is very important.

4.3 Effect of Road Signs to vehicle speed

Warning signs should be installed at desired locations at hump. Distance from Hump to the Warning sign should be decided based on design speed of the road and speed reduction required at the hump. To avoid sudden jolting of vehicles and to improve safety precautions, installation of road sings is extremely important. This is vital to reduce surface distresses due to hasty stopping, starting and accelerating actions.

4.4 Summary and Conclusions

Round top humps are recommended to install only for minor/residential roads where bus, emergency and heavy traffic flow is not available. Flat top humps can be recommended to set up on major roads. Each and every hump should be marked and warning signs should be installed. Recommended hump dimensions are given below.

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