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CONTENTS

Thermoplastic Transverse Bar as Speed Reducer

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Abstract

This paper summarizes a research project that evaluates the performance of traffic marking material made from thermoplastic, which is used as transverse bar. Transverse bar is designed to alert drivers by inducing vibration and noise as the vehicle crosses the devices which eventually will 'self enforcement' the drivers to decrease their speed. The study was conducted in two main stages; first data collection from field survey followed by data analysis. Detailed speed measurements recorded before and after the markings were laid at the sites. A total of one hundred and fifty speed measurements were recorded at the site using a radar gun. The results showed a large initial reduction in traffic speed after one week of installation of the device. However one year later the traffic speeds recorded showed that the speed resume back to normal although not completely. The effect of driving over these markings is quite unique, "the faster a driver passes through the device, the less uncomfortable they become". This can be seen from the speed profile after one year of installation where drivers tend to increase speed while crossing the device. Probably, some drivers who are aware of the device can explain this phenomenon. Other factors such as traffic volume and composition may also affect the effectiveness of this device; through visual observation, impact on lorry and trucks is not effective. However, significant reduction in speed by approximately 12% is observed when the performance of the thermoplastic is in good condition.

Introduction

A measure for Traffic Calming arises from the need to find solutions to the growing problem of road casualties. Road traffic problems, such as congestion, pollution and safety either in urban or rural areas have caused concerned to our government and local authorities. At present our road safety record is not very encouraging (Radin Umar, 1997), thus a target of less than 30% accident rate for the year 2000 has been specified by the government. Accident record statistics showed that about 95% of road traffic accidents are due to human factors (Barton Edward, 1996). In Malaysia there are about 4500 fatalities and over 36500 injuries per year. This means that more than 1 person in every 450 people in the country suffers injury or death in a road accident each year (TRL and IKRAM, 1995).

Traffic markings are major traffic control devices for traffic movement and safety. Transverse bar constructed from thermoplastic is one kind of traffic markings which can be used as traffic calming device. The thermoplastic markings normally used on road wear. The markings are designed to alert drivers by noise and vibration as their vehicles crosses the tranverse marking and influencing them to slow down in a situation, which might not be obviously hazardous.

Thermoplastics Transverse Bar

Thermoplastics consist of a resin binder, colouring agents, inorganic filter and glass beads (Jian John Lu, 1998). An important factor contributing to the service life of these thermoplastics is environment temperature. An average service life of 10 years can be achieved in normal condition; however thermoplastics may not last one year if traffic is heavy. The most common problems due to the deterioration process are;

- Abrasion and shaving
- Abrasive materials and studded tires
- Bond failure resulting from improper installation due to inadequate heating and dirty or oily pavement surface.

Photo 1: Transverse Bar at Jalan Bangsar

Thermoplastics are more effective on asphalt then on concrete (Jian John Lu, 1998). Under the right circumstances, thermoplastics are relatively durable reflectorized traffic markings and its initial appearance is generally excellent. When the reflectivity of a traffic marking type reaches a level at which inadequate reflectivity cannot be provided to travelling public, it is said that the service life of the marking type is due. Research studies have reported the expected service life of traffic markings. Table 1 shows the expected service life of traffic markings, although the actual service life of specific traffic markings can't be accurately predicted due to many factors as mentioned above. These factors include installation techniques, pavement type, traffic volume, environment condition and etc.

Marking Materials	Expected Service Lives (Years)
Traffic paints	< 1
Thermoplastics	1 – 7
Methil methacrylate (MMA)	2 – 7
Preformed tapes	2 - 6

Table 1: Expected Service Lives

Installation of Transverse Bar

Thermoplastics road marking provides a well-textured durable matrix typically 5mm thick which meets the Highways Agency requirements for skid resistance and texture depth, (Prismo,2001). The system is readily applied to concrete or asphalt surfaces and available in a variety of colours including red, blue, green and yellow. The road surface to be treated shall be dried and cleaned using hot compressed air with velocity of 400 to 600 mps, (Prismo, 2001). All dust and foreign matter need to be removed. The material needs to be loaded into a preheating mixer with temperature control between 190Celcius. The material will then be poured into screed box of appropriate size 200mm to 600mm with a suitable design trailing edge and applied by combing transversely across the road surface, allowing the high PSV aggregates to be evenly distributed to provide a well textured, durable, skid resistance surface. A minimum skidding resistance value of 65 when measured by the Portable Skid Testing Apparatus should be achieved. Finally, the finished surface can be open to traffic as soon as it reaches the ambient temperature of the adjacent road surface normally between30 to 50 minutes.

- At 20Mph, only 5% are killed, most injuries are slight and 30%suffer no injury.
- At 30Mph, 45% are killed and many are seriously injured.
- At 40Mph, 85% are killed.

Site Investigation Details

In establishing the extent of achievement of speed reduction, ideally the mean, 85^{th} percentile and maximum speed should be measured. Detailed speed measurements are made before and after the markings at Shapadu highway. One hundred and fifty speed measurements were recorded at three points. The first point is at 30m before the device, this is due to safe stopping sight distance for an average travelling speed of 50km/h), second point B is located at the transverse bar and point C less than 5m after the last transverse bar before the vehicles start to speed. Speeds were measured with a radar gun from inside a parked car. The motives for installing the transverse bar such as;

- To discourage drivers from rat running through a residential road.
- To reduce the number of accidents.
- To increase safety of the pedestrian crossing the highway.

Photo 2: Before Installation of Transverse Bar

Photo 3: After Installation of Transverse Bar

Traffic surveys were also conducted before and after the implementation of the device, refer to Appendix 1 for traffic volume vs. time and Graph 2 for traffic composition.

Traffic Speed Reduction Due to Transverse Bar

Higher speed in an inappropriate situation such as along Shahpadu Highway which passes through residential area not only increases the risks of accidents but there are also strong links between pedestrian injury severity and speed (Andre Tailleur, 1997). Investigation into road accidents showed that when pedestrians are hit by a car;

- At 20Mph, only 5% are killed, most injuries are slight and 30% suffer no injury,
- At 30Mph, 45% are killed and many are seriously injured.
- At 40Mph, 85% are killed.

Observation at Shahpadu Highway indicated changes in the mean and 85th percentile speed, relative to the 'before' data and these data were then calculated and analysed for statistically. At all the three points monitored between markings, (point A, B and C) initial speed reduction of between 5 to 7 km/h is obvious after one week the device installed. The reduction in 85th percentile speed is greater than in mean speed at point C after one week of installed. However, observation made after six months and one year seems that the reduction of mean speed is greater than 85th percentile speed. The traffic speed resumed to their original level, (reduction just between 1 to 3km/h in mean and 85th percentile speed) after one-year of the observation.

	Before		One Week		Six Months		One Year	
Speed(km/h)	85th %	Mean	85th %	Mean	85th %	Mean	85th %	Mean
Point A			-2.1	-3.3	-1.9	-2.5	-1.8	-2.3
Point B	58.5	53	-5.5	-5.7	-4.5	-4.8	-2.7	-3.1
Point C			-6.6	-5.9	-4.5	-5.0	-2.2	-2.4

Notes: Point A - 30m before the device. This is due to safe stopping sight distance.
Point B - 1m after the first Transverse Bar
Point C - 5 meters after the last Transverse Bar, before vehicle start to accelerate

Table 2: Speed Measurement at Shapadu Highway
(Direction from Klang to Port Klang)

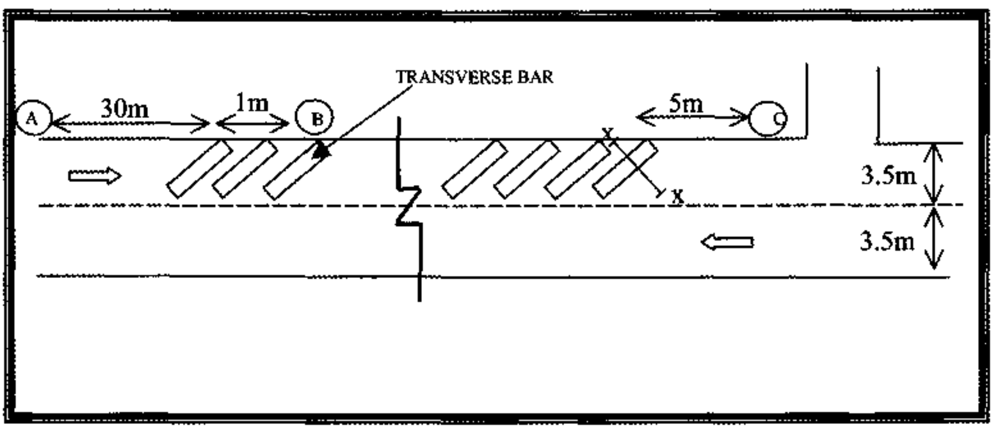
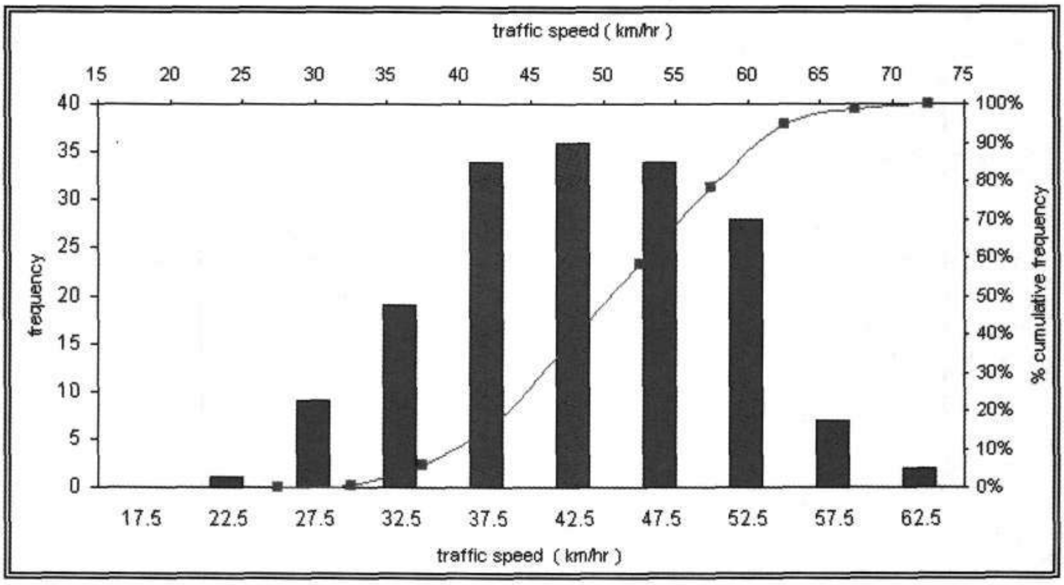


Figure 1 : Sketch of the location on speed study at Shahpadu Highway



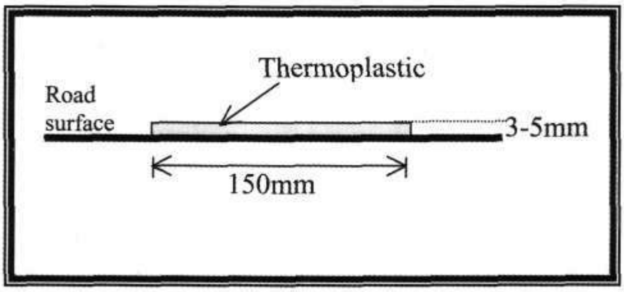
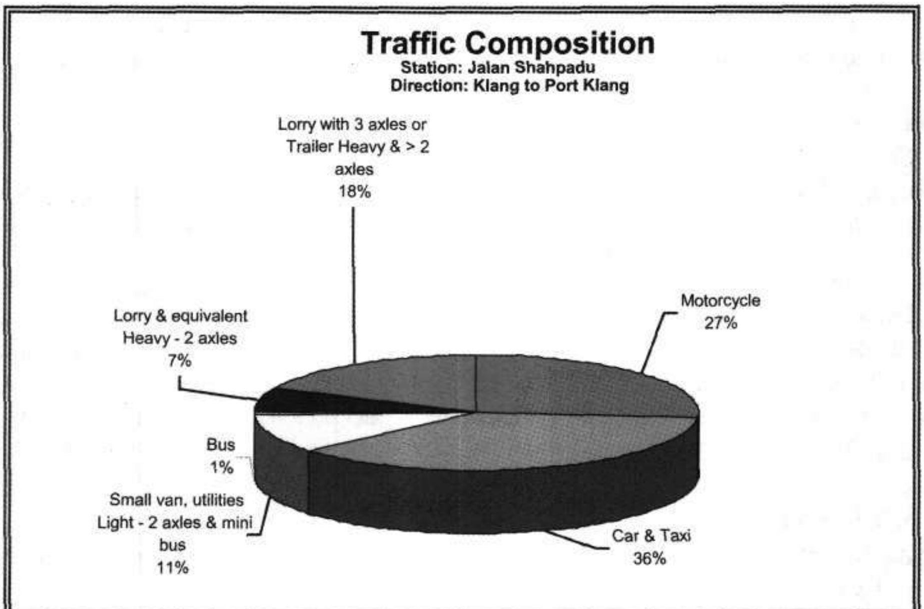
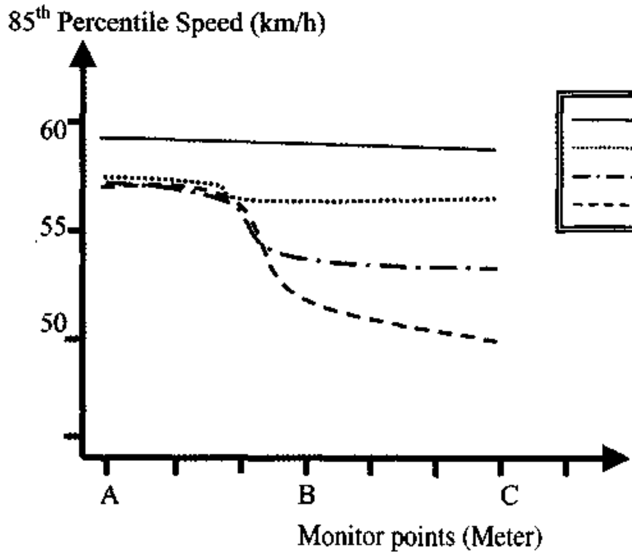


Figure 2: Section x-x, transverse bar



Graph 2 : Traffic Composition at Shapadu Highway



Summary Of The Findings

The markings are designed to alert drivers by inducing noise and vibration as their vehicle crosses the transverse bar due to uneven road surface by influencing the drivers to slow down in a situation which might not be obviously hazardous. From the results obtained, point C showed a large initial reduction in traffic speed after one week of installation of the device. However one year later the traffic speed recorded showed that the speed resumed to normal although not completely. The effect of driving over these markings is quite unique, "*the faster a driver passes through the device, the less uncomfortable they become*". This can be seen from the speed profile after one year of installation where drivers tend to increase speed while crossing the device. Probably, some drivers who are aware of the device can explain this phenomenon. Other factors such as traffic volume and composition may also affect the effectiveness of installing this device; through visual observation, impact on lorry and trucks is not effective for this type of device. However, significant reduction in speed by approximately 12% is observed when the performance of the thermoplastic is in good condition.

Conclusion

Care should be taken in the use of transverse bar due to the increase in the level of noise and vibration. Transverse bar is found to be ineffective in reducing vehicle speed, when drivers discover that the effect of the transverse bar is more limited at higher speeds. The suitable location for implementing this type of device would be on a road with a considerable slope or site where drivers are constrained by limited sight distance such as at a sharp corner. In locations where the percentages of heavy vehicle is high such as at Shapadu Highway the service life for thermoplastic road marking is about 6 to 8 months. The layout of the transverse bar seems to be quite important, the thickness of transverse bar should be greater than 5mm so that the impact on lorries and trucks is effective. It is suitable when the percentages of heavy vehicle is approximately 20% of the traffic composition.

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Appendix 1: Traffic volume vs. time