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Ho Jen Sim
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Abstract

The issue of road hogging has become more prevalent on Malaysian roads and there are calls to the Malaysian Highway Authority (MHA) to impose a minimum speed limit on Malaysian expressways. In response to this, MIROS has been requested to review the feasibility of implementing minimum speed limit in Malaysia. A thorough review of literature shows that minimum speed limit is not practised as common as the maximum speed limit. The minimum speed limit (either at a fixed value or 20 km/h below the posted speed limit) is only exercised in certain countries such as the USA, UK, Portugal, Australia, Japan and Indonesia. It was also noted that there is a limited study on the effect of minimum speed limit on road safety.

In general, the objective of imposing minimum speed in those countries is to reduce the unsafe interactions between fast and slow moving vehicles by improving the uniformity of traffic flow and safety of operation. It is proven that the large speed differentials between fast and slow drivers contribute to the accident crashes. With the setting of minimum speed limit, those vehicles that cannot achieve the minimum speed are advised to use other alternatives than the freeway. Several studies have highlighted the hazard of the presence of slow moving vehicles on a high mobility road through cases involving vehicles travelling 10 mph below mean speed. Differences in speeds below mean speed was found to be of higher risk compared to differences in speeds above the mean speed. Setting of minimum speed can decrease the risk by reducing the differential speeds. Nevertheless, there are other concerns that introducing a minimum speed limit may increase unfavourable lane changing, rear end accident as well as complicating the enforcement activities.

In conclusion, the determination of minimum speed limits should be of sound from an engineering perspective. Thorough traffic investigation must be carried out beforehand to understand the locality effect of the expressway (i.e urban/rural), the rationale of

implementation (such as setting minimum speed on fast lane only on two-lane dual carriageway) as well as the practicality of enforcement activity. It is the responsibility of the authority to ensure that any changes in speed limits would not compromise the safety of users, community concern and traffic efficiency.

1. Introduction

In the past few years, the Malaysian public has raised the issue of road hogging, which the Merriam Webster dictionary defines road hogger as a driver of an automotive vehicle who obstructs others, especially by occupying part of another's traffic lane.

The obstruction of traffic or other vehicles is given as occupying more than one lane as well as driving at a speed that hinders other drivers. In an opinion article in The Star Online on the 4th September 2010, a road user was seen commenting, “It has become a habit among many Malaysian drivers to drive slowly on the right as well as on the middle lane of the road or expressway regardless of the type of vehicles they drive.”

Among the recommendation given to address this issue is the introduction of a minimum speed limit on expressways. Through a meeting between the Malaysian Highway Authority and other road related stakeholders, it was suggested that a minimum speed limit is applied on the fast lane of expressways to prevent incidences of road hogging.

Given the recurrence of lane hogging issue that road users claim to plague the Malaysian expressways, the Malaysian Highway Authority, MHA has requested a feedback and review on the implementation of a minimum speed limit on Malaysian roads from an empirical science-based perspective.

1.1 Objectives

The objectives of this study are to:

i. advise the authorities of the current issues and concerns in respect of minimum speed limit

ii. advise the authorities on the road safety implications of imposing a minimum speed limit

1.2 Scope of Study

The scope of this study only covers review on implementation of a minimum speed limit on expressways. The focus area of this review will be given to the influence of speed limit in regards to variance of speed within the traffic movement and the effect of minimum speed limit as experienced by other countries.

1.3 Methodology

Method of deliverance of this report will be based on secondary data that can be obtained from extensive literature reviews and case studies of countries that have implemented the use of a minimum speed limit.

1.4 Expected Output

The expected outcomes of this study will be the recommendations to the road authorities on the possible implementation of minimum speed limit on expressway.

2. Literature Review

Most countries have a set maximum speed limit that depicts the maximum speed a vehicle is legally allowed to travel on the specific stretch of road. Speed limits on roads are used as a common form of traffic control for road traffic management. Minimum speed limit on the other hand, is not practiced across the board throughout the world, but in certain countries and locations.

In understanding the implication on the implementation of a minimum speed limit, a desk study on reviewing available literature was conducted. Literature search is focused on the influence of speed limit, specifically, posted speed limit in regards to variance of speed within the traffic movement. Another area of focus is the effect of minimum speed limit and its type of implementation by other countries.

While the influence of speed variability on crashes is somewhat clear, it was found from the review of research literature that there are very few known studies on the effect of minimum speed limit on road safety. The few literatures available are from countries that have implemented a minimum speed limit such as the United States of America (USA).

2.1 Traffic Law

Many states in the USA based their minimum speed limits on the Uniform Vehicle Code (UVC) published by the National Committee of Uniform Traffic Laws and Ordinances (National Committee 1954). An example is the Californian Vehicle Code (CVC) 22400 where it is clarified that unless the speed limit is reduced in compliance with the law, road users are not permitted to drive on a highway at such a slow speed that it impedes

the normal flow of traffic. Drivers are made aware as to not obstruct fast-moving vehicles that may prove to be dangerous and may result in collisions.

In light of the minimum allowable speed on a highway, the CVC 22400 also states that vehicles are not permitted to be completely still on a highway. The great difference between the speed of a stationary vehicle (0 km/h) and a high speed moving traffic is dangerous to road users. The only instances where drivers are permitted to stop is if it is in compliance with the law, possibly shown by posted signs or traffic guards. Occasionally a vehicle may breakdown on the highway, and the driver must carefully figure out the fastest way to remove the vehicle from blocking the movement of traffic. The CVC 2400 also states that a minimum speed limit may be declared on certain highways, which no driver is permitted to drive below. Factors such as engineering and traffic surveys are the basis on which the decision is derived by. These factors point out to areas of the roads where it may be hazardous when drivers block or slows down normal traffic flow.

2.2 Minimum Speed Limit and Variable Speed Limit

The minimum speed limits on interstate freeways in the USA are used to increase uniformity of traffic flow and the safety of operations by reducing speed variations within the traffic. Minimum speed limit on a road is also used to address inappropriate driving speed where slow moving vehicles impede the flow of traffic.

Studies showed that, by 1962, many states had adopted slow speed laws in their statutes in compliance with the UVC (National Committee 1964). Florida was among the states adopting slow-speed provision, making 40 mph (63 km/h) the minimum on the four-lane interstate system, the Turnpike, and defense highways.

Driving at a speed that is far below the posted speed limit on a road is considered as inappropriate driving speed. According to the NCHRP Report 504, inappropriate operating speed of vehicles is a result of the influence of human factors, whether through conscious driver behaviours or through driver's response to the road

environment. High-speed variability as a result from substantial amount of slow moving traffic within the traffic flow increases the risk of vehicle conflicts, which further increases risk of crashes (Mussa & Price, 2004).

Prior to the Enactment of the National Highway System (NHS) Designation Act of 1995, the maximum national speed limit on the interstate freeways in the USA was set at 55 mph (88 km/h). The minimum speed that was adopted was 40 mph (63 km/h) giving a difference of 25 km/h between the maximum posted speed limit. However, upon the repeal of the national maximum speed limit, many states raised their maximum speed limits on their interstate freeways whilst the minimum speed was not revised.
According to literature, the implementation of a minimum speed limit law is applied across all lanes on a particular stretch of road. However, a survey by Muchuruza and Mussa (2005) reported that South Dakota denoted the minimum speed of 40 mph (63 km/h) was only applicable to the shoulder lane.

A study for the Florida Department of Transportation in 2003 on the minimum speed practices in different states in the USA reveals that, following the 1995 National Highway System Designation Act, 43 states raised their maximum speed limit on their interstate freeways. In retrospect, the minimum speed on the systems remained the same. The survey also reveals that, half of the states (25 states) do not post minimum speed limit signs where it was stated that slow driving was not a major issue on their highways. These states also claims that use of enforcement to warn or cite drivers can be carried out should instances of traffic disturbance resulting from slow moving vehicles do occur.

2.3 Setting of Minimum Speed Limit

The posting of minimum speed limits on a highway is aimed at achieving a uniform traffic flow through reducing extreme differences in speed between fast and slow vehicles. The use of minimum speed limit is to dissuade slow drivers as well as slow speed vehicles from using a high speed highway, thus reducing large variance in vehicle speeds.

A research conducted by Solomon (1964) and Cirillo (1968) as recorded by Mussa and Price (2004) reports that vehicles travelling close to average operating speed were safer than vehicles travelling at either end of the speed spectrum (slower and faster). The findings highlighted the hazard of the presence of slow moving vehicles on a high mobility road through cases involving vehicles travelling 10 mph below mean speed. Differences in speeds below mean speed was found to be of higher risk compared to differences in speeds above the mean speed.

Criterion on the setting of maximum and minimum speed limits was proposed by the Federal Highway Administration (FHWA, 1985) to be based on percentage of mean speed. This enables the control of large variations of speed on highways. A combination of speed variance and risk involvement in a crash made up the FHWA criterion as depicted in Figure 1.

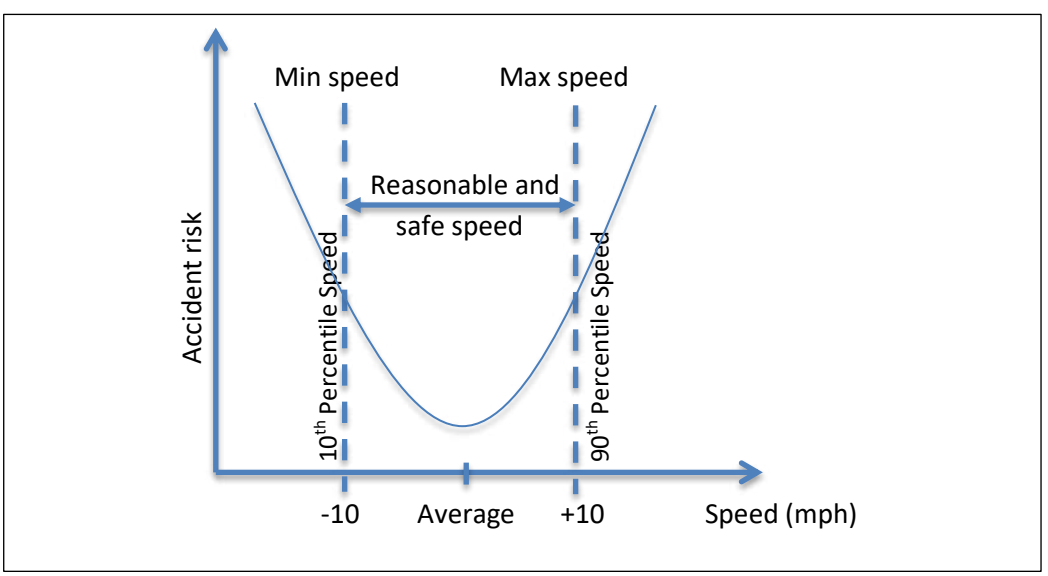

Figure 1 Speed and accident risk (reproduced from Reference FHWA, 1985)

Plotting the speed of vehicles against accident risk shows that range of safe driving speed lies within ±10 mph the mean speed. These boundaries corresponded with the 10^{th} and 90^{th} percentile of free flowing vehicle speed for the lower and upper end of speed

distribution, respectively. It is thus hypothesised that the setting of speed limit based on accident involvement and speed variance could homogenise speed of vehicles into a reasonable speed group that complies to the law. This may positively impact enforcement activities by reducing enforcement on speed as well as reducing crash risk by narrowing variations amongst slow and fast vehicles.

2.4 Effect of Minimum Speed Limit

Evaluation of traffic flow due to the change of speed limits on roadways may be derived from the difference in average vehicle travel speeds, reduction in the number of total travel times, changes in speed pattern of vehicles as well as dispersion from the average speed. A before and after analysis of the vehicle speeds due to the change in speed limit may give light to the effect on road users of speed limit signs displayed on a particular roadway.

Application of a minimum speed limit should be referred to road safety aspect. The effect of minimum seed limit on traffic operations in low to moderate traffic conditions is minimal as indicated by the Highway Capacity Manual (2000).

Mussa and Price (2004) suggested that although only a small percentage of vehicles (0.14%) were found to travel below the minimum speed, at 9% involvement in crashes, they significantly impact the safety characteristics of the roadway. Introduction of a minimum speed limit can contribute to a reduction of speed variance between vehicles. It was established that in approaching uniformity of vehicle speeds on a road way, the number of crashes were recorded to be significantly lower. The increase in speed difference between fast and slow moving vehicles significantly increased crash rate (Mussa & Price, 2004).

2.5 Enforcement and Compliancy

A questionnaire study conducted in the US revealed that less than half of the state's respondents indicated enforcement activity on minimum speed limit offence, whilst 17 states (55%) were unsure of any enforcement activities conducted for minimum speed limit offence. It was also reported that frequency of enforcement were not regular and enforcement were sometimes carried out through verbal warning by law enforcers. Some states gave the impression that enforcement were not carried out for minimum speed limit offence as slow vehicles were given the opinion of having no significant safety implication to the road system (Muchuruza & Mussa, 2005).

A separate study in India (Bains et al., 2013) revealed that increase in compliancy to speed limit increases the roadway capacity. It was also found that travel time decreases relative to the increase of driver's compliance with the posted speed limit. Incompliance to the set maximum speed limit (driving at a higher speed) was found to impede on traveling performance, increasing travel time for both compliant and noncompliant vehicles for volumes nearing capacity. In this regard, over speeding is also seen to impede on traffic flow.

2.6 Speed Limit in Malaysia

In Malaysia, the speed limit regulations comprises of maximum speed limits, variable speed limits, and advisory speed limits. The Had Laju Kebangsaan or the National Speed Limits in Malaysia is a set of maximum speed limits that is applicable on Malaysian expressways, federal roads, state roads and municipal roads.

Motorists are subjected to be compliant to speed limits where incompliancy results in an offence which can be fined up to RM300 under the Malaysian Road Safety Act 1987. The default speed limits, which are posted along Malaysian roads for different road classification, are listed in Table 1.

Table 1 Gazette speed limit on Malaysian roads

Road type	Speed limit
Expressways	110 km/h May be reduced to 90 km/h or 80 km/h depending on the road geometry
Federal roads	90 km/h in rural area and 60 km/h in town area. During festive season such as Hari Raya or Chinese New Year, a reduction of 10 km/h is subjected on the 90 km/h to 80 km/h.
State roads	

Variable speed limits in Malaysia are set by the type of vehicle likely to use the road and vary according to the type of road the vehicle is travelling on. Speed limit variation or differential speed limits are speed limits that restrict all heavy vehicles, or at least heavy vehicles of a specific size, weight, or axle configuration, to traveling at lower speeds than the rest of the traffic stream. Currently, there are no legislated minimum speed limits in Malaysia.

3. International Practices

The maximum or minimum speed limit is imposed on a road segment rather than on lane basis. Thorough review of literature shows that there are very few countries (to the best of our effort) adopting different speed limits for fast lane and slow lane of a highway. The concerns are mainly on the road safety issues as different speed limits on different lane may encourage unfavourable lane change, rear end accident as well as complicate the enforcement effort.

3.1 United States of America (USA)

The United State of America implements different speed limits across the states. Since 1995, most of the States (except three (3) States and the District of Columbia) have maximum posted speed limit above 55 mph (63 km/h) for passenger vehicles, trucks or for both (FHWA, 2010). The maximum speed for 19 States is 70 mph (112 km/h) while 11 States have established maximum posted speed limits of 70 mph (112 km/h) and only one State imposes 80 mph (128 km/h). Table 2 shows the speed limits for different states in US.

Table 2 State speed limit law in miles per hour (*Source*: Wikipedia)

State or territory	Freeway (rural) (mph)	Freeway (urban) (mph)	Divided (rural) (mph)	Undivided (rural) (mph)	Residential (mph)
Alabama	70	60	65	35 – 55	15 – 25
Alaska	65	65	65	50 – 65	20 – 25

Arizona	75	65	65	65	15 – 25
California	70	55 – 65	60 – 65	50 – 65	25 – 30
Colorado	65 – 75	55 – 65	65	35 – 65	20 – 35
Connecticut	65	45 – 55	55	45 – 55	20 – 40
Delaware	65	50 – 55	55	50	20 – 35
Florida	70	55 – 65	65	55 – 60	10 – 30
Georgia	70	55 – 65	65	55	25 – 45
Hawaii	55 – 60	50	45	45	25
Idaho	75	65	65	50 – 65	20
Illinois	65	55 – 65	65	55	20 – 30
Indiana	70	50 – 65	60	55	20 – 30
Iowa	70	55 – 65	65	45 – 55	25
Kansas	75	65	65 – 70	55 – 65	20 – 30
Kentucky	70	50 – 55	55	55	25 – 45
Louisiana	70 – 75	60	65	45 – 55	10 – 45
Maryland	65	55 – 65	55	50 – 55	15 – 25
Massachusetts	65	55	55	55	20 – 30

Michigan	70	55 – 70	55 – 65	55	25
Minnesota	70	45 – 65	55 – 65	55 – 60	30
Mississippi	70	60 – 70	65	55	25
Missouri	70	45 – 65	55 – 70	55 – 65	20 – 25
Montana	75	65	70	55 – 70	15 – 25
Nebraska	75	60	65	50-65	25
Nevada	75	60 – 65	65 – 70	55 – 70	15 – 25
New Hampshire	65	55	55	35 – 55	20 – 30
New Jersey	65	55	55	30 – 55	15 – 35
New Mexico	75	65 – 75	65 – 70	25 – 65	15 – 55
New York	65	35 – 55	55	55	15 – 45
North Carolina	70	60 – 65	65 – 70*	55	20 – 35
North Dakota	75	55 – 75	70	40 – 70	15 – 55
Ohio	65 – 70	55 – 65	55 – 65	55	20 – 35
Oklahoma	70 – 75	55 – 65	60 – 70	45 – 65	25
Oregon	65	50 – 60	55	55	20-25
Pennsylvania	65	55 – 65	55	40 – 55	15 – 35

Rhode Island	65	55	55	50	20 – 25
South Carolina	70	60	60	55	30
South Dakota	75	55 – 75	65 – 70	35 – 65	15 – 45
Tennessee	70	55 – 70	65	35 – 55	30
Texas	75 – 85	55 – 75	70 – 75	30 – 75	15 – 55
Utah	75 – 80	65	65	65	20 – 35
Vermont	65	55	55	50	
Virginia	65 – 70	55 – 65	55 – 60	55	15 – 35
Washington	70	60	65	50 – 65	20 – 50
West Virginia	70	60 – 65	65	55	15 – 55
Wisconsin	65	55 – 65	55 – 65	55 – 65	15 – 35
Wyoming	75	65	65	65	

When a driver commits speed violation, the sentence can be a fine or jail term. Apart from this, most of the states employ point systems on the driver's licence and a driver's licence can be suspended or revoked based on the level of violation.

Some of the states impose minimum speed policy on their expressways and highways based on the Uniform Vehicle Code (UVC) published by the National Committee of Uniform Traffic Laws and Ordinances (National Committee 1954) (Muchuruza & Mussa, 2010). This rule prohibits a person from operating a motor vehicle at such a slow speed as to impede the normal and reasonable movement of traffic. Nevertheless, a slow

speed is allowed if a vehicle reduces speed to avoid any potential collision with other road users. The underlying objective of implementing minimum speed limits on interstate freeways in US is to reduce the unsafe interactions between fast and slow moving vehicles by improving the uniformity of traffic flow and safety of operation. It is proven that the large speed differentials between fast and slow drivers contribute to the accident crashes. With the setting of minimum speed limit, those vehicles that cannot achieve the minimum speed are advised to use other alternatives than freeway. Apart from this, some of the states may establish different highway speed limits under various conditions such as for different types of vehicles, different times of the day and various weather conditions. Figure 2 shows the types of speed limit signs while Table 3 illustrates the States which impose minimum speed laws.

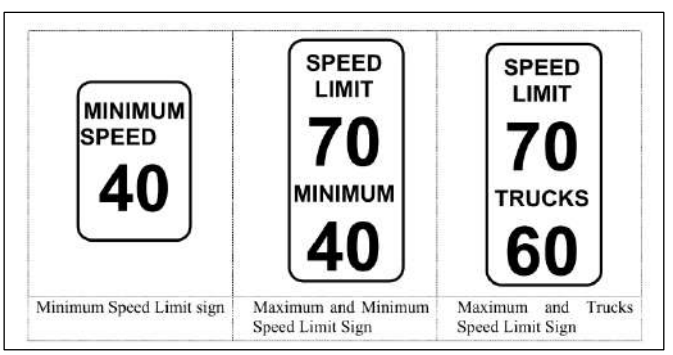

Figure 2 Types of speed limit signs used (FHWA, 2001)

Table 3 Table states with specific definition on minimum speed (NHTSA, 2011)

State	Minimum speed rule	Posted minimum speed	Penalty on violating minimum speed law	
			Fine	Point
Colorado	*		$50	-
Connecticut	*	40 mph on a limited access divided highway	$50	4 points
District of Columbia	*		$15	

Florida	The minimum speed limit on Interstate and Defense Highways with at least 4 lanes is 40 mph. However, when the post speed limit is 70 mph, the minimum speed limit is 50 mph.		$60	
Illinois	*			5 – 20 points
Iowa	A vehicle which cannot attain and maintain a speed of 40 mph cannot be driven on the interstate system.		$35	
Kansas	*		$60	
Louisiana	A person who is operating a motor vehicle on a multilane highway at a speed slower than 10 mph than the posted speed limit shall drive in the right-hand lane than available for traffic or as close as practicable to the right hand curb or edge of the roadway			
Michigan	The minimum speed limit on freeways is 45 mph			
Mississippi	i. 30 mph on Federal designated highway when no hazard exists. ii. 40 mph on Interstate freeways and on four-			

	lane U.S. designated highways which have a posted maximum speed limit of 70 mph. iii. Note: Via signs, slower moving traffic may be directed to use designated lanes.			
Missouri	*	40 mph on Federal Interstate freeways		
Montana	*			2 – 3 points
Nebraska	40 mph on Federal Interstate freeways.			
Nevada	*			
New Jersey	*			2 points
New Mexico	*		$10	3 points
New York	*		$150 – $450	
North Carolina	*	i. 40 mph on interstate and primary highways with a posted speed limit of 55 mph351 ii. 45 mph on interstate and primary highways with a posted		3 points

		speed limit ⩾ 60 mph		
Oklahoma	*			1 – 2 points
Pennsylvania	*		$25	
Rhode Island	*		$75	
South Dakota	It is unlawful to operate a motor vehicle at <40 mph on an Interstate freeway.			
Tennessee	On interstate and four-lane controlled-access highways, it is unlawful for a person to operate a motor vehicle in the left lane at a speed <55 mph.			3 points
Virginia	*			3 points
Washington	*		$37	
Wisconsin	*		$20 – $100	2 points

*Note**

i. No person shall drive a motor vehicle at a speed so slowly as to impede the normal and reasonable movement of traffic.

ii. A person driving at less than the normal speed of traffic shall drive in the right-hand lane then available for traffic or as close as practicable to the right-hand curb or edge of the roadway.

3.1.1 California

Wingerd (1998) conducted a feasibility study on the minimum speed on multilane highways, on lane-by-lane basis. The minimum speed on left (median) lane was 60 mph while the right lane was 45 mph. For three (3) or four (4) lanes sites, the posted minimum speed at middle lanes was set at 55 mph. Data were collected from four (4) different sites throughout the California freeway systems. The results concluded that there was no difference in average speeds by lane due to speed signing and it has shown some deficiencies in traffic operation. The setting of minimum speed has seen increased

number of vehicles shifting to the fast lane. It was found that the vehicles traveling in the left lane at 60 mph were obstructing traffic which causes drivers to overtake. There was evidence of increase in minimum speed violation. In general, the findings of the study concluded that the application of minimum speed limits by lane is not feasible.

3.1.2 Florida

Since the cancelation of the federally sanctioned 55 mph maximum speed limit, Florida was among the pioneer states that raised the maximum speed limit on interstate freeways to 70 mph. Prior to the change, Florida adopted 40 mph minimum speed limit on rural interstate freeways (Renatus & Price, 2004).

Renatus and Price (2004) conducted a study on the rural interstate freeways. The results show that only 0.14% of the vehicles traveled below 40 mph while the crash data had noted that 9% of vehicles involved in crashes were forecasted to be travelling below 40 mph. This implied that the minimum speed limit had some impact on safety.

3.1.3 Idaho

Idaho adopted differentiated speed limit policy in 1998 where certain classes of trucks travel at lower speed on interstate freeways (Novotny, 2005). A study has been conducted by the National Institute for Advanced Transportation Technology to assess the effect of differential speed limit on highway safety in the State of Idaho between 1997 to 2000. The findings revealed that in general, there was no significant change in crash data due to speed limit change. The speed differential between trucks and passenger cars increased from 5.5 mph to 7.4 mph whereby passenger car speeds increased by 0.85 mph while truck speeds declined by 1.0 mph.

3.1.4 Louisiana

Qi (2009) carried out a study to evaluate the traffic characteristics and truck compliance behavior on 18-mile elevated segment of I-10 highway. Along the segment, trucks are limited to the left lane and differential speed limit law is imposed. The results revealed that the lane restriction compliance rates varied between 60% to 80%. The compliance rates dropped at the entry of the freeway segment. In terms of truck speed limit compliance, it was found that the trucks on the right lane tend to travel higher than 55 mph but less than 60 mph in mixed traffic stream. The speed of trucks on the left lane were even higher, more than 60 mph. This suggested that trucks violated the speed limit as well as the lane restriction rule. The study noted that the higher compliance rates were achieved when there were enforcement activities.

3.1.5 Oregon

The Centre for Transportation Studies (Portland State University) carried out a study to evaluate the impact of differential speed limit changes on safety (Novotny, 2005). The study looked into the effect of speed limit change from 65 mph to 70 mph for cars and 55 mph to 65 mph. The results showed that more severe collisions might occur due to the combination of higher truck speeds and mass of trucks. The small variation of speed limit will likely reduce speed dispersion between cars and trucks and have a positive effect on safety. Nevertheless, the relationship between differential speed limits and safety is not conclusive and more research needs to be carried out in order to determine the safety impact of differential speed limit.

3.1.6 Virginia

A study conducted by Garber (1995) on Virginia highways showed that show the effect of combined changes in mean speed, standard deviation of speed, flow per lane, and shoulder width on the crash rate are very complicated. For example, on interstate

freeways, the crash rate may increase or decrease as the standard deviation of speed increases, depending on the flow rate (Garber & Ehrhart, 2005).

Another study carried out by the University of Virginia in 2002 compared the safety effects between uniform speed limits and differential speed limit on rural interstate freeways (Novotny, 2005). The result showed that the overall mean speed, 85th percentile speed, median speed and crash rates tended to increase over the ten (10) years period regardless of type of speed limit.

3.2 United Kingdom

In general, there is no minimum speed law on freeways in UK (Driving Tips, 2014). However, at some areas where emergency service vehicles have difficulty to travel through, a minimum speed of 30 mph is imposed. However, a driver will be fined if he is driving too slow and become a hazard to other traffic. The fines range from a verbal warning by traffic police to anything up to £5000 and 3 - 9 points. Figure 3 shows the minimum speed sign in UK.

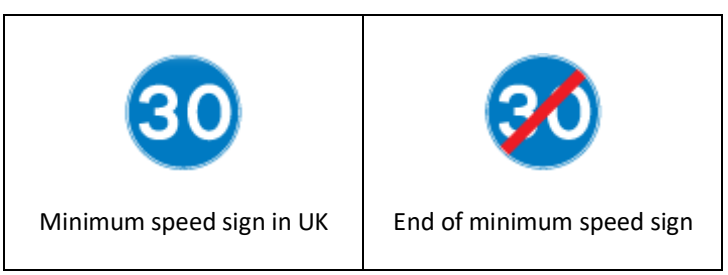

Figure 3 Minimum speed sign in UK

3.3 Spain

The speed limit on Spain highways is set at 120 km/h yet there is still high proportion of drivers exceeding the speed limit (Robuste et al., 2003). Figure 4 shows the speed

profiles on a highway in north Barcelona, by lane (right, middle and left lane where the minimum speed for right lane is 60 km/h). It was found that all the drivers on the left lane travelled above 120 km/h. This is consistent with the police traffic offence records where speeding related traffic offences reported at 39.3%.

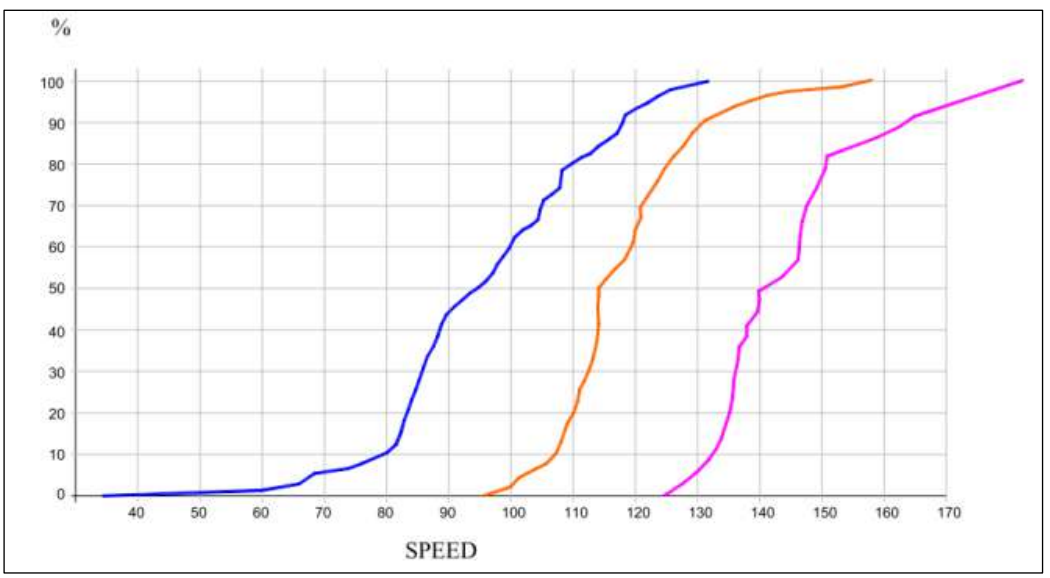

Figure 4 Speed profiles on a highway in north Barcelona, by lane

3.4 Portugal

As an effort to reduce road accident, the government of Portugal approved the National Plan for Road Accident Prevention in 2005 (Portugal, 2003). One of the changes was to increase the minimum speed on highways from 40 km/h to 50 km/h. No study on the impact of minimum speed limit on highway was available, thus it was not able to review the effect on road safety.

3.5 Australia

Under the Western Australian Consolidated Regulations, the minimum speed law is imposed on the freeways in Western Australia. The Road Traffic Code 2000 – Reg 12 states that the minimum speeds on freeways is:

"In a freeway speed zone, a person shall not drive a vehicle at a speed that is more than 20 km/h below the speed limit unless – (a) traffic congestion prevents the person from driving the vehicle at a speed that is within 21 km/h of the speed limit; or (b) for any other reason, it is unsafe or imprudent for the person to drive the vehicle at a speed that is within 21 km/h of the speed limit. The modified penalty for committing minimum speed violation is 1 PU (penalty unit)."

No study was obtained to review the impact of minimum speed on the safety in Australia so far.

3.6 ASIAN Countries

Japan and Indonesia are two of the countries in Asia adopting minimum speed limits on their expressways. The minimum speed in Japan expressways is 50 km/h with the maximum speed limit is 100 km/h. On the expressways in Indonesia, the minimum speed limit is usually 20 km/h lower than the posted speed limit. Study on the impact on minimum speed on road safety was not available.

4. Summary

Over the years, many efforts have been devoted to make the roads safer. The review of literature and international case studies provide evidences that speed is the key factor contributing to crash. Numerous initiatives have been taken to tackle the safety issues, including the implementation of minimum speed on highways. Nevertheless this measure is debatable. The proponents support the act as it has reduced the speed variation and improved safety levels. However, the opponents insist that the minimum speed rule encourages unwanted lane changing, increases rear end/side swipe accidents and complicates enforcement activities.

The request for minimum speed limits is often triggered over the frustration of slow moving vehicles on Malaysia's expressways, as it consistently impedes the normal and reasonable movement of traffic. Review of literature on implementing minimum speed on expressways either by section or by vehicle types (truck restriction) did not reveal significant change in accident crashes. Nevertheless, the determination of minimum speed limits should be of sound from an engineering perspective. Thorough traffic investigation must be carried out beforehand to understand the locality effect of the expressway (i.e urban/rural), the rationale of implementation (such as setting minimum speed on fast lane only on two-lane dual carriageway) as well as the practicality of enforcement activity. It is the responsibility of the authority to ensure that any changes in speed limits would not compromise the safety of users, community concern and traffic efficiency.

In other countries, there are few different methods in setting the minimum speeds. The minimum speeds for some states/countries are 20 km/h lower than the posted speed limit while some set the minimum speed within 10 mph of the mean speed (FHWA) which is equivalent to the 10^{th} percentile of the free vehicle flowing speeds. Some studies pointed out that the minimum speed limit should be at 15^{th} percentile of the free

vehicle flowing speeds. All in all, a detailed study which covers the following considerations should be carried out before determining the feasibility of implementation:

i. Road geometry such as number of lanes, alignment, lane width
ii. Traffic volume and its vehicle composition
iii. Operating speeds by types of vehicles on the section
iv. Environmental conditions
v. Period of analysis
vi. Weather conditions
vii. Any other prevalence conditions

Should the minimum speed is suitable to be implemented on Malaysia expressway, it is important to ensure that proper signage, treatment to eliminate potential hazard and awareness campaign to be carried out for the betterment of road safety.

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MIROS
MALAYSIAN INSTITUTE OF ROAD SAFETY RESEARCH
ASEAN ROAD SAFETY CENTRE

Malaysian Institute of Road Safety Research
Lot 125-135, Jalan TKS 1, Taman Kajang Sentral,
43000 Kajang, Selangor Darul Ehsan.
Tel: +603 8924 9200 **Fax:** +603 8733 2005
Website: www.miros.gov.my **E-mail:** dg@miros.gov.my

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