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Revisiting Speed Management Strategies in Malaysia

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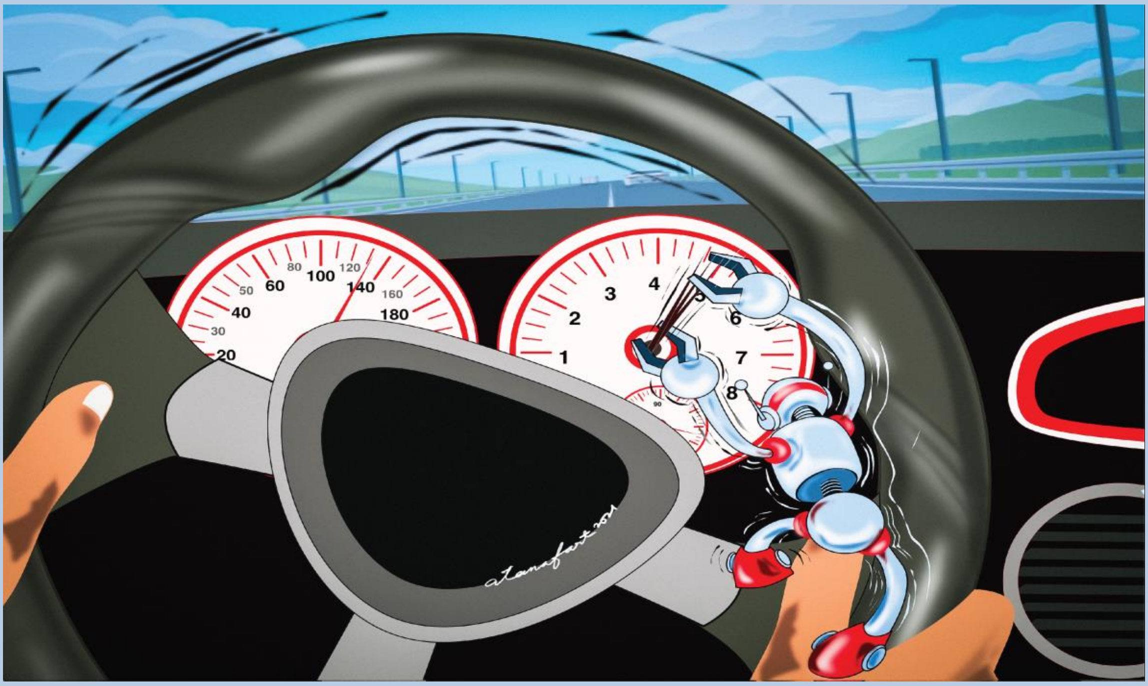

Speed, because of its centrality to mobility, deserves effective management approaches. This review examined the present approaches in Malaysia: speed zoning, enforcement, education, and physical engineering; before putting forward evidence of their limited effectivity. The discussion continued with a proposal for *preventive* approaches in managing speed. Instead of *reactive* measures, i.e. curbing the speeding, the proposal clutches on the elimination of room for speeding by advocating for vehicular speed management system – e.g. the intelligent speed adaptation technology, or top speed limiting by design. The potential regulatory mechanism, implementation challenges, and subsequent courses of action to realize the proposal concludes the article.

Graphic: Assoc. Prof. Ahamad Tarmizi Azizan (Atan Af) is a senior lecturer in Arts at Universiti Malaysia Kelantan (UMK), and the founding President of the ASEAN Digital Art Society (ASEDAS).

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The Speed, Safety, and Efficiency

Speed is central to mobility efficiency, but even so, it has become almost antonymous with crash risk and severity.

Despite various methods, studies revealed vehicles with higher speed have a higher crash rate (Fildes et al., 1991; Kloeden et al., 1997; Maycock et al., 1998; Quimby et al., 1999; Kloeden et al., 2001). Bowie and Walz (1991) indicated that speeding contributes to 12% of all reported crashes, and about a third of fatal crashes in the United States. In Australia, approximately 20% of fatal crashes are due to speeding (Haworth & Rechnitzer, 1993). Meanwhile, in Malaysia, in-depth crash reconstructions of high-profile crashes in Malaysia reveal excessive speed to contribute 21% of the crashes (Zainal Abidin et. al. 2012).

In addition, Aarts and van Schagen (2006) demonstrated power functions to describe the speed-crash relationship best. As a rule of thumb, according to the often-cited Nilsson's power function, a 1% increase in speed contributes approximately to 2%, 3%, and 4% changes in injury, severe, and fatal crash rates, respectively (Nilsson, 1982; Nilsson, 2004). Also, Richards (2010) reported the change of velocity upon impact (delta-v), which correlates closely with travel speed, determines the risk of fatality. In a frontal impact, the risk of fatality is 3% for a delta-v of 30 mph and rapidly increases to 17% when the delta-v reaches 40 mph. The risk of fatality is worse in side-impact — up to 25% and 85% for a delta-v of 30 and 40 mph, respectively. Similarly, in Malaysia, in-depth crash investigations supported these findings (Zainal Abidin et al., 2015).

On the other hand, in logistics, for instance, speed is inversely proportional to transit time. Higher speed translates to shorter transit time, which in turn contributes to more efficient transportation: more goods or people can be moved within the same period of time, resulting in more profit. With the development of the gig economy and e-commerce, transportation services including courier and logistics have become more prominent (Ibrahim et al., 2018). The government's policy to liberalize the market opens up stiffer competition among industry players in providing better (and certainly faster) service to the customers. Of course, this correlates with the need for higher travel speed.

The complex influence of speed in various factors demands an excellent management system. According to the Joint OECD/ECMT Transport Research Centre (2006), speed management encompasses various measures striking the right balance between various objectives and needs, and in particular safety, mobility, environment, and quality of life. Ultimately, good speed management achieves safety without much disruption to other related factors.

Therefore, this review intends to discuss the present speed management in Malaysia to identify potential gaps towards improvement. To achieve this, the article begins with consideration about the road transport system in Malaysia, re-examination of various speed management measures that are already in place, before proposing potential alternative measures. This article scopes its proposal discussion to only *vehicular-based* speed management measures.

Road Transport System in Malaysia

Figure 1: Framework of the road transport system in Malaysia

Road transport in Malaysia, similar to other systems, has inlet and outlet channels (Figure 1). The inlet node represents various kinds of channels allowing its components (i.e. road users, vehicles, road networks) to be part of the system. For example, road users who received a competent driving license, and other road users who completed rehabilitation programs enter the system through different channels; for simplicity, however, these are represented only by an inlet node in the figure. A similar situation is applicable for the outlet. Table 1 provides more details about the input and output across three elements of road traffic systems — users, vehicles, and roads.

Table 1: Input and output details to the road transport system for users, vehicles and roads

	Users	Vehicles	Roads
Input	- Users with competent driving license - Users completed rehabilitation programme - Non-registered users*	- New vehicles - Used vehicles - Refurbished/reconditioned vehicles	- New roads - Newly gazetted roads
Output	- Voluntary or forced retirees**	- Post-crash vehicles with high severity - Impounded vehicles	- Damaged roads

Note:
* Non-registered road users normally are human-powered mobility modalities including pedestrians, cyclists, etc.
** Retirees refer to road users who leave the road transport system either voluntarily or forced; the former normally includes older users while the latter encompasses those who are involved in a crash with severe injuries or fatalities or users whose driving licenses have been confiscated

Governance of these inputs and outputs involves various legislative actions and regulation measures. In Malaysia, the Road Transport Act 1987 governs most of the components in the system including the focus of this article, i.e. the vehicles. Any new vehicles entering the system are required to undergo a Vehicle Type Approval (VTA) process. This is to ensure the roadworthiness and crashworthiness of the vehicles by complying with regulations set. Only then vehicles are allowed to be in the Malaysian market for ownership transactions to the users to happen.

With regard to speed management, various measures have taken place within the system and are governed by the same act. The next section discusses the status quo of speed management measures in Malaysia.

Speed Management Status Quo

A variety of speed management measures fall into either of these categories: zoning, enforcement, education, and physical engineering.

(i) Zoning and Speed Limit

Zoning involves setting appropriate speed limits for all types of roads in the network. Speed limits that consider functions of the road and its surrounding are the foundation of speed management. Different localities require an approach to achieve effective management.

In Malaysia, the Road Transport Act 1987 conferred the enforcement of the National Speed Limit Order 1989 on expressways, federal roads, state roads, and municipal roads. This is in addition to the Motor Vehicles (Speed Limit) Rules 1989 that proscribes any vehicles to travel exceeding the set limit on roads in the networks.

The National Speed Limit Order 1989 provides 110 km/h and 90 km/h, respectively, as the speed limits on highways and for other roads. The 110 km/h limit is applicable for the highway in rural areas while 90 km/h or 80 km/h limits are for urban highways, depending on the type of development nearby. For other road types, including the federal and state roads, the speed limit varies from 30 km/h to 90 km/h. The federal roads connecting most big towns across the states normally have a 90 km/h limit. Meanwhile, the speed limits for state roads are at 80 km/h. In more populated areas the limits are lower: 60 km/h within the town area, 40 km/h to 50 km/h within residential areas, and 30 km/h in the vicinity of school.

Besides the road hierarchy of functions, speed limits are also a function of vehicle type. Table 2 contains a summary of speed limits based on the vehicle class and the type of roads, taken from the Motor Vehicles (Speed Limit) Rules 1989. In general, classification in Table 2 depends on the types of traction vehicles use when traveling on the roads, and whether the roads are declared in the National Speed Limit Order 1989. This results in 24 classifications with speed limits ranges from 20 km/h to 110 km/h.

In addition, the Road Transport Act 1987 empowers the Minister of Works, the State Government, the Director-General of the Malaysian Highway Authority, and the local government who may, by order published in the Gazette, set the speed limits under their jurisdictions. The limits, however, must not exceed the limits specified in the National Speed Limit Order 1989. Normally, customization of the speed limits takes place because of the in-situ environment and traffic conditions, and are usually posted at the roadside.

(ii) Enforcement

Any driver is guilty of an offense under the Road Transport Act 1987 when he or she drives at a speed exceeding the posted speed limit for a specified type of vehicle. When being reasonably suspected of having committed the offense, a driver is offered a compound up to RM300 (in accordance with section 69(1A) of the act). The offer remains in force until a legal action — usually by serving a notice to the driver to appear before the nearest Magistrate — takes place if the payment is not received. After that, the demerit system takes place where drivers fulfilling certain criteria would face confiscation of their driving licenses. Figure 2 summarizes this flow.

Table 2: Speed limits based on vehicle class and the type of roads

	Class of Vehicle	Maximum Speed (km/h)	
		Roads described in the National Speed Limit Order 1989	**Other roads**
1.	Motor vehicles with pneumatic tires on all wheels:		
	a. Passenger vehicles -		
	i) Having a seating capacity up to 12 persons including driver and used for hire or reward.	110	90
	ii) Having a seating capacity of more than 12 persons including driver.	90	80
	iii) When drawing a trailer.	80	70
	iv) Motor van.	90	80
	b. Goods vehicles (rigid or articulated) -		
	i) Without a trailer or semi-trailer with maximum permissible laden weight not exceeding 7,500 kg.	90	80
	ii) Without a trailer or semi-trailer with maximum permissible laden weight exceeding 7,500 kg.	80	70
	iii) When drawing a trailer or semi-trailer, excluding a trailer drawn by a land tractor.	80	70
	iv) 3 wheelers including motorcycles with side cars.	70	60
	c. Recovery trucks, mobile cranes and other mobile machinery, vehicles drawing mobile machinery trailers or semi-trailers.	80	70
	d. Land tractors with or without a trailer.	50	40
2.	Motor vehicles fitted with solid rubber tires.	Half the speeds specified in paragraph 1 above.	Half the speeds specified in paragraph 1 above.
3.	Motor vehicles not fitted with either pneumatic tires or with solid rubber tires.	20	20

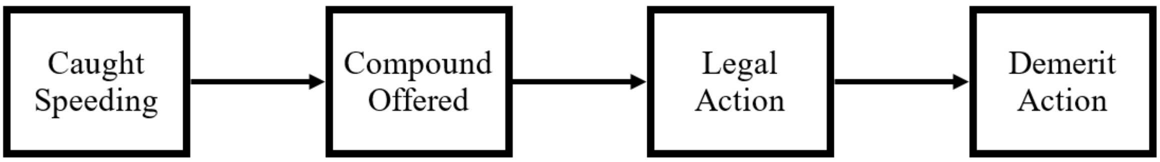

Figure 2: Flow of speeding offense and its punishment

In Malaysia, the enforcement agencies responsible for speeding offenses are the Road Transport Department (JPJ[1]) and the Royal Police Malaysia (PDRM[2]). Speed enforcement begins with speed measurement using verified speed detectors at certain locations and times. The identification of location and time is based on the crash history showing a high prevalence of speeding. Whenever the enforcement activity is coupled with a roadblock down the road, the tickets are either handed to the offenders; otherwise, it is posted to the car owner's address.

Besides the mobile roadside speed enforcement is the Automated Enforcement System (AES). Unlike the previous covert approach, the AES involves placing speed detectors with a camera, at certain locations made known to road users in advances. There are at least three signages about the presence of a speed camera beforehand. In the situation when speeding is detected, the AES automatically measures the speed, takes photos of the offenders, and transmits the data for JPJ's verification before the compounds are posted to the offender's address. The non-reliance of officers on the ground puts AES advantageous as round-the-clock enforcement.

Relative to 14 units when it was first started in 2021, the number of AES units has increased to 29 units relative to 14 units when it was first started in 2012. Research shows the positive impact of the system towards when compliance to the speed limit escalated nearly two-fold to 96% after the installation of the cameras (Rahim et al., 2014). There are, nevertheless, arguments among the public that AES is mainly for generating revenue than for road safety.

(iii) Speed Education

Various educational approaches to combat speeding include both non-formal and formal methods. The former includes campaigns and other advocacy programs, while the latter refers to structured formal programs such as the Road Safety Education program (RSE) for Malaysian schoolers. The RSE approach embeds road safety knowledge and values in the national curriculum of the Malay (*Bahasa Melayu*) subject. Students, as early as seven years old, are exposed to road safety during the subject contact hours. Because the target audiences (i.e. the students) are yet to actively control vehicles within the road transport system, the exposure they receive about speed is rather limited.

Although not specifically focused on speeding, studies related to road safety issues revealed that, *in isolation*, public education and campaigns lack tangible and sustained reductions of fatalities and serious injuries (Trinca et al., 1988; Duperrex et al., 2002; Zaza et al., 2001; O'Neill et al., 2002; Ker et al., 2003). In contrast, educational approaches have proven to be effective when combined with other measures (see Table 3; Elvik et al., 2009).

Consider closer to the home scenario. A community-based program for road safety took place in Putrajaya (Ghani, 2012). The 'Safe City Concept' branded program is aimed at achieving higher compliance of seatbelt and helmet wearing. The 6-month intervention programs involved not only social marketing campaigns but also enforcement activities. Evaluation of the program revealed positive results: the seatbelt and helmet compliance increased from 42% to 58%, and from 70% to 85%, respectively. This example, however, is not specific to speeding.

[1] JPJ is the Malay acronym of *Jabatan Pengangkutan Jalan*
[2] PDRM is the Malay acronym of the police, *Polis Diraja Malaysia*

Table 3: Effects of road safety campaigns on road crashes (originally from Elvik et al., 2009)

	Best Estimate	95% Confidence Interval
General effect	-9%	(−13; −5)
Mass media alone	1%	(−9;+12)
Mass media + enforcement	-13%	(−19; −6)
Mass media + enforcement + education	-14%	(−22; −5)
Local individualized campaigns	-39%	(−56; −17)

(iv) Physical Engineering

A wide range of engineering measures is applicable for addressing speed. They work for different purposes: to lower speeds, to make the roads more forgiving, to separate users from potential severe crashes leading to a worse injury. With regard to speed, traffic calming measures are applied to encourage or force drivers to reduce their speed by making the drivers feel uncomfortable driving faster than the specified limit.

Table 4 contains 12 speed-controlling measures in the Highway Planning Unit (HPU) published guidelines (2002). Among the most common calming measures on Malaysian roads include the speed humps or raised platforms across the road, road markings, and roundabouts, *inter-alia*.

Table 4: Categories of traffic calming measures

Vertical Measures	Horizontal Measures
Speed bump Speed hump Transverse bar or alert bar Speed table Texture pavement Raised crosswalk Raised intersection	Traffic circles Roundabout Chicane Choker Centre island

Studies on road humps revealed that, regardless of their type, the humps are impactful in reducing vehicle speed (Yaacob & Hamsa, 2012; Mashros et al., 2020). Further, Yaacob and Hamsa (2012) demonstrated that a 70-meter spacing between two road humps reduces the 85th percentile speed to about 30 km/h before and after the second hump. This, in particular, is an appropriate speed for the school vicinity.

Nevertheless, Abdul Manan and Poi (2010) reported the implementation of traffic calming is primarily installed on an ad-hoc basis raising the issue of standards compliance. Despite its effectiveness in reducing speed, and regardless of the issues, physical engineering measures require a relatively higher cost to build and maintain them.

Effectiveness of the Present Speed Management

The above-mentioned discussion revealed speed management measures in Malaysia. The big question remains on whether they are effective in addressing speeding at the macro level.

Analyses of the 2017 and 2018 data from PDRM revealed that, respectively, 19.1% and 19.2% of at-fault drivers involved in fatal crashes were speeding. A roadside measurement of speed along the FT050 Jalan Kapar, Klang revealed the operating speed has exceeded the posted speed limit (Rahim et al., 2018). This situation is comparable even in the school area (Abd Rahman et al., 2019).

Furthermore, a survey among Malaysian drivers found that the majority of the respondents perceived the risk of being caught if speeding to be less than 70%. Also, 71% of them exceed the speed limit by 20 km/h (Isah et al., 2015). A more recent study resonates with the findings – 45.3% of Malaysian drivers are involved in speed infringement (Mohamad et al., 2018). A simulation study of FT050 Jalan Batu Pahat – Kluang road segment revealed that most participants traveled 40.01% faster than the speed limit even when approaching the U-turn facility (Nemmang et al., 2017).

Similar situations are evident for heavy vehicles. A preliminary study reported that 45% of 1,041 buses exceeded the speed limit (MIROS, 2010). A MIROS (2011) unpublished work revealed that most of the trucks were driving above 90 km/h in the vicinity of Port Klang. Ho et al. (2017) conducted observations on different types of road hierarchy and found that most of the heavy vehicles (4.39% – 98.61%) failed to comply with the speed limits posted.

Speed Management Proposal

Speeding happens – is the summary of the previous section. Despite various measures in place, the room for improvement is glaring. Taking a step back reviewing the present measures alongside the road transport framework exhibit a trend that all of the speed management measures take effect within the system. In other words, presently, speeding is managed only when the vehicles *have entered* the system. Alternatively, speed management can take place even before vehicles entering the system. This is our proposal.

The road transport system (see Figure 1) has a gatekeeping mechanism (i.e. the VTA with respect to vehicle component of the system) to ensure all vehicles entering the system comply with the standards set by the government via the Road Transport Act 1987. The gatekeeping possesses an opportunity to enforce a speed management measure by setting up a vehicular standard to combat the problem. Relative to the present *reactive* approach where measures are in place to curb speeding from happening; the proposed *preventive* approach of speed management gives no to very limited opportunity for speeding to even happen by proscribing related regulations to speeding.

Despite focusing only on heavy vehicles, the United Nations ECE regulation No. 89 – speed limiting devices – is supportive of the proposal. Intelligent Speed Adaptation (ISA), for instance, is a potential technological measure that fits with the above proposal. While the presence of the technology is not new, its implementation into the road transport system especially in Malaysia is. ISA receives input from the Global Positioning Satellite (GPS) system of the vehicle's whereabouts and speed and compares it with the speed limit at the location before deciding on the response. The response determines the type of an ISA system:

At one end an advisory system provides an auditory or visual response to the drivers if the vehicle exceeds the speed limit; whereas at the other extreme is a mandatory system which leaves no room for override making the vehicle to strictly comply with the limit. Of course, there are systems in between these extremes that allow the driver to go over the speed limit in certain conditions.

Table 5: Best estimates of crash savings from ISA system (adapted from Oei & Polak, 2002)

ISA Type	Speed Limit Type	Best estimate of injury crash reduction	Best estimate of fatal and serious crash reduction	Best estimate of fatal crash reduction
Advisory	Fixed	10%	14%	18%
	Variable	10%	14%	19%
	Dynamic	13%	18%	24%
Driver Select	Fixed	10%	15%	19%
	Variable	11%	16%	20%
	Dynamic	18%	26%	32%
Mandatory	Fixed	20%	29%	37%
	Variable	22%	31%	39%
	Dynamic	36%	48%	59%

The effectiveness of (ISA) varies depending on its function. Table 5 contains the best estimates of crash savings the ISA system potentially provides (Oei & Polak, 2002). ISA is expected to bring more benefits to the reduction of fatal crashes relative to injury crashes. The biggest anticipated benefit is about 59% fatal crashes reduction using a mandatory system with a dynamic speed limit.

In Malaysia, studies on the effect of ISA are scarce. A study involving an advisory ISA among bus drivers revealed the marginal impact of the system on respondents' speed profiles (Makhtar et al., 2012). Further, preliminary studies in Penang provided stronger evidence on the feasibility of ISA in Malaysia (Ghadiri et al., 2011; Ghadiri et al., 2013).

Besides the ISA, another form of the preventive approach of speed management with more possibility of implementation is the vehicle top speed limit by design. The idea of this is such that all of the vehicles coming into the Malaysian market are only be allowed to hit specified maximum speed. Currently, there is no regulation prescribing the top speed limit despite the presence of the UN ECE regulation No. 89. Therefore, imposing such a regulation would be a smoother start before sanctioning any aggressive speed limitation in the future.

Nevertheless, Volvo Malaysia has announced its commitment to producing new cars with a top speed of 180 km/h beginning 2020 (Volvo, 2019). This move, furthermore, is not exclusive for Volvo as Japanese manufacturers, as part of a good faith agreement between competitors, have adopted the 180 km/h limit since the 1970s (Covington, 2019). Meanwhile, most German automakers have adopted the 250 km/h limit, with the exception of performanceoriented models (Rufiange, 2020). Of course, in Malaysia, the feasible top speed limit is debatable considering the highest speed limit is 110 km/h on a certain stretch of the highways.

As speed is a good marketing point for car manufacturers, these ideas are not without any challenges. The glimpse of safety and users' acceptability dilemma (Blum & Eskandarian, 2006), for instance, is already evident (e.g. Hafriz Shah, 2015; Lim, 2016). Therefore, to realize this proposal, all parties have to work in hand to (i) convince road users of the benefit vehicular speed limiting can bring to them and their families, (ii) persuade the policymakers by providing collective pieces of evidence supporting the initiative, (iii) ask vehicle manufacturers to commit on developing an effective and trustworthy vehicular speed management system.

Conclusion

The article reviews and discusses speed management in Malaysia with a focus on the vehicular improvement approach. The reactive measures have been effective to a certain extent, but the room for improvement demands a newer and radical approach: hence the proposed preventive speed management. Clutching on empowerment of the gatekeeping mechanism of the road transport system in Malaysia, the proposal includes adopting regulations of speed limiting devices, the intelligent speed adaptation for example, or imposing a top speed limit for all vehicles entering the system as a start.

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