

Study on Car Speed Characteristics at 60km/hr Speed Limit Zone on Federal Route FT050

Roshasniza Omar¹, Noorliyana Omar^{1*}

¹Department of Civil Engineering, Faculty Of Civil Engineering and Built Environment,
Universiti Tun Hussien Onn Malaysia, Parit Raja, Batu Pahat, Johor, 86400,
MALAYSIA

*Corresponding Author Designation

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Abstract: Johor is one of the states in Malaysia that has recorded high accident statistics, especially on Federal Route FT050, Batu Pahat-Ayer Hitam. On average, this road has recorded more than 1000 accidents and 36 deaths every year since 2006 involving all types of vehicles and identified as a "dead road" by the Ministry of Works Malaysia. The attitudes of driver who refused to comply the speed limit and drive in high speed is the main factor contribute to accident while making car as a safe transport to the contrary. The study conducted to determine driver speed limit compliance through car driver speed analysis. The GPS DG 200 was used to record the speed data of 50 trips at Batu Pahat to Ayer Hitam (Direction 1) and 42 trips at Ayer Hitam to Batu Pahat (Direction 2). The data were analyzed using 2-Sample T-Test to compare the car speed data from both directions at Sekolah Kebangsaan Bukit Soga and Ayer Hitam Fire Station to determine the level of compliance of car drivers with the speed limit of 60 km/h. The result shows that the drivers from Direction 1 use higher speed, with speed range of 60 km/h - 100 km/h compared to Direction 2 which is 20 km/h - 90 km/h. Based on these findings, 97% drivers comply the speed limit and 3% drivers violated speed limits at Ayer Hitam Fire Station. Meanwhile, 79% complied while the other 21% violated speed limits at Sekolah Kebangsaan Bukit Soga. The overall findings found that the level of compliance with the driver speed limit is still at a weak level where the choice of driver speed is maybe influenced by environmental conditions and road geometry.

Keywords: Speed, Speed Limit, Car Driver, Federal Route FT050, 2-Sample T-Test

1. Introduction

Speed has been identified as a major risk factor in road traffic injuries, influencing both the risk of road accidents and serious injuries caused by accidents. Excessive speed is defined as exceeding the speed limit meanwhile improper speed is defined as driving at a speed that is not suitable for the road and the traffic situation which responsible for the high mortality rate and road safety morbidity resulting from road accidents. In high-income countries, speed contributes 30% of road deaths, while in some low and middle-income countries, speed is estimated to be a major contributor to about half of all road accidents. The severity of injuries can be reduce by controlling the speed which can prevent the accident and reduce impact from the accident [1].

In general, road accidents defined as an unwanted occurrence resulting from loss of driving control over a vehicle resulting in a collision with an object, or causing the vehicle to stray, whether resulting in property damage, injury to the driver, passenger and/or other road users or vice versa [2]. Road accidents are usually caused by a combination and interplay between the five factors, namely humans involving driver behavior; the vehicle itself, i.e. in terms of its size and condition; infrastructure in terms of road quality and intersection design; traffic volume and environmental factors [3][4]. The attitudes of driver who drive at high speed and did not comply with the speed limit has led to increasing accident rates in Federal Route FT050. In addition, the driver makes the road condition as a factor to increase the speed and decides that the speed limit that has been set in certain areas is too low and not suitable to be complied with. According to previous researcher [5], the increases of the amount and capacity of traffic and speed of vehicles along the Federal Route FT050 plays an important role in contributing to accident and traffic death factors. Besides, the Ministry of Transport has identified Batu Pahat as the district with the highest death toll due to accidents in the country since 2016 and, 44 lives were lost in the district in the first quarter of 2019 [6].

2. Literature Review.

Roads used as a connecting route to a places, but roads are now dangerous and the environment is not suitable for living. Roads need to be redefined as a suitable place for the community to live [7]. Each individual has a different feeling while driving. Therefore, road furniture is placed along the road to ensure the safety of the public where it gives signals related to the way of detection and aims to attract the attention of risky driver [8]. Speed is an important factor for road operations where it has positive and negative effects on road users. The risk of accidents due to speed is high [9]. According to [10] reducing 10% of speed can reduce 40% death rate. Over speed is the main contributor to accidents which is 12% of the total number of accidents and 28% of the total are fatal accidents, road accident caused by high speed on rural area and is double the accident in urban area [11]. Road geometry, vehicle characteristics, and weather conditions are all factors that influence driver perceptions of safe speed [12] and traffic environment, risk perception and possible enforcement play important role in driver speed limit violations [13].

Speed limit is determined by road conditions, geological features, land use, weather conditions, road design, road images, traffic flow and characteristics [14][15]. According to [16], there is significant interactions between speed limit and curve road, also speed limit and lane width. Drivers tend to use higher speed in straight road than curve road meanwhile the minimum speed at narrow road is lower when the road is wider. Speed is also influenced by psychological and social while driving [17] where male driver more likely to have accident related to speed and traffic violence than female driver[18][19]. Driver attitude influence the speed and speed limit compliance which affects accident rate [20], individual behaviour is depending on the individual perceptions and environment condition [21] where the behaviour of road user should change from negative to positive thinking because the negative thinking will lead to accident and traffic congestion later. Changes in the behavior of road users are said to be a necessary condition for improvements in road safety [22]. According to [1], 90% driver believe that they a low-risk driver, based on that driver confidently assume travel over the speed limit is allowed and not causing a high risk. Beside that, many driver many consider the speed limit arbitrary and do not understand the greater the risks associated with speed increase although small[1].

3. Research Setting and Approach

3.1 Research Aim

The aim of this study is to analyse the variation of car driver speed and to determine the car driver's speed limit compliance at the speed limit zone of 60 km/h.

3.2 Research Approach

The study was conducted at Sekolah Kebangsaan Bukit Soga and Ayer Hitam Fire Station in both directions. Direction 1 is from Batu Pahat to Ayer Hitam and Direction 2 is from Ayer Hitam to Batu Pahat. Car driver's speed data was recorded using GPS DG 200 that placed inside the car. The data used based on the 50 meter distance through study road with 50 trips at Direction 1 and 42 trips at Direction 2. The road is well known as one of the 'Black Spot' of accident zone in the district of Batu Pahat.



Figure 1: Study Road

3.3 Data Analysis

Speed data were analyzed using Spot Speed study and Microsoft Excel 2016. Spot Speed study according to [23], used to determine the distribution of traffic flow at a particular location. The data collected was used to determine the percentage of vehicle speed which is important to determine the speed limit. The results were discussed based on the analysis. The analysis test used is 2 Sample T-Test Analysis to compare the speed population between Direction 1 and Direction 2. The car speed was observed in both directions. Two sample t-tests were performed for repeated measurements and then used to determine if there was a difference between the mean of the two data sets obtained from the test. Using the null hypothesis (H_0) and alternative hypothesis (H_a) are as follows:

H₀: Speed Direction 1 = Speed Direction 2

H_a: Speed Direction 1 ≠ Speed Direction 2

If the results of the analysis $p\text{ value} < \alpha = 0.05$ (significant level) then the null hypothesis (H_0) is rejected and alternative hypothesis (H_a) will be accepted. By comparing the mean of the two directions, the mean difference will be obtained.

4. Results and Discussion

4.1 Speed Distribution

Figure 2 present the distribution of speed at the Sekolah Kebangsaan Bukit Soga and Figure 3 at the Ayer Hitam Fire Station for both direction. Based on Figure 2, the distribution speed at Direction 1 peaked at 60 km/h and 50 km/h at Direction 2. Meanwhile, the speed distribution in Direction 1 at Ayer Hitam Fire Station peaked at two distinct peak which are at 75 km/h and 85 km/h, and 85 km/h at Direction 2. The results in Figure 2 and Figure 3 show that the car driver speed is different on both directions. The road geometry plays an important role affect the car driver speed choice since the

majority road at the study road is straight, wide and long. According to [16] drivers use higher speeds on straight road than curved road and the minimum speed higher on wide road than narrow road.

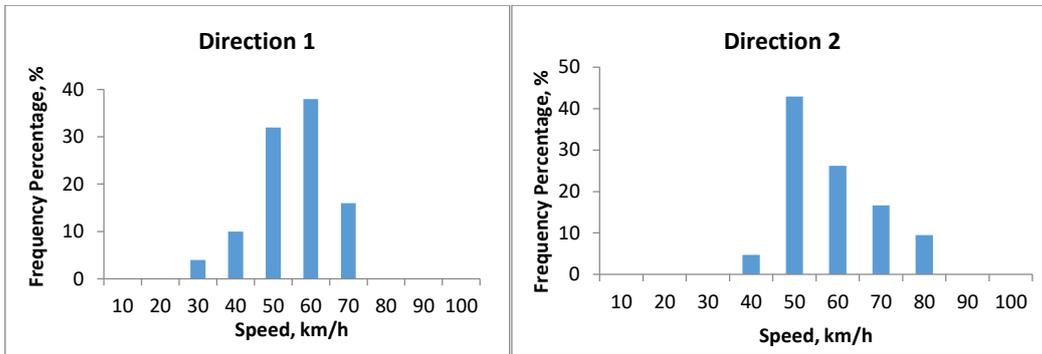


Figure 2: Speed Distribution at Sekolah Kebangsaan Bukit Soga

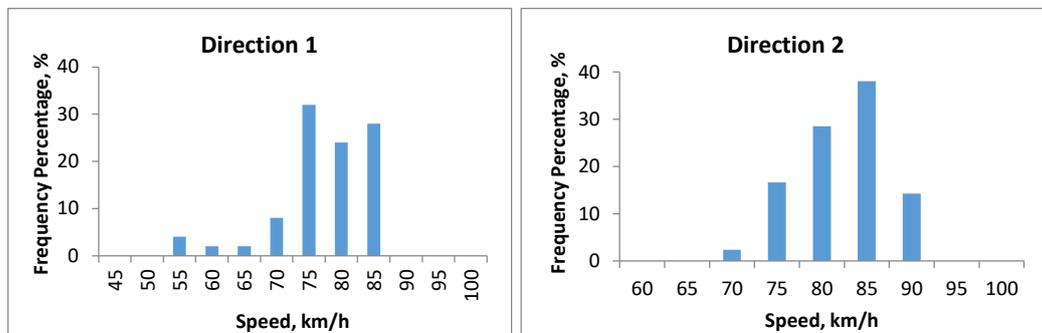


Figure 3: Speed Distribution at Ayer Hitam Fire Station



Figure 4: Signage at Sekolah Kebangsaan Bukit Soga

The speed limit set in the school area is supposed to be at 30km/h to 40km/h but based on the observation at Figure 4, the speed limit set at Sekolah Kebangsaan Bukit Soga is 60km/h, same as the speed limit at Ayer Hitam Fire Station. The results of the driver speed compliance shows in the form of a pie chart as shown in Figure 5.

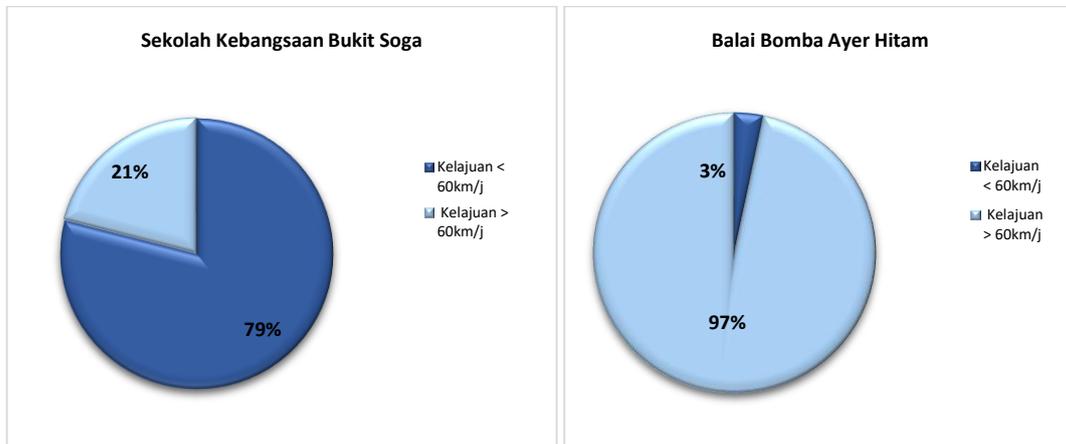


Figure 5: Speed Limit Compliance At Sekolah Kebangsaan Bukit Soga and Balai Bomba Ayer Hitam

4.2 Speed Limit Compliance at Sekolah Kebangsaan Bukit Soga

Figure 5 shows that 79% drivers at Sekolah Kebangsaan Bukit Soga using speed below the speed limit which is higher compared to 21% drivers who drive at speeds that exceed the set speed limit. The location of the study route which is in the downtown and beside the school area is one of the factor affect drivers to drive at safe speeds. Besides, the traffic flow is congested and activities in and out of the junction encourage drivers to slow down. Drivers on the main road tend to slow down when approaching small road/lane and vice versa [24]. In addition, the presence of signage along the study road is used as a warning message to drivers. However, the drivers at Sekolah Kebangsaan Bukit Soga who drive at high speeds where exceeding the speed limit is very worrying because the route one of the hotspot location and at the same time nearby school area. This poses a danger not only to road users but also school children who use the road and pedestrian facilities on the sidewalk to get to the nearby bridge. Speed reduction is the most important parameter to reduce the level of injury and the number of collisions with pedestrians [25]. Results from the 2-Sample T-Test which is to compare the speed data both directions at Sekolah Kebangsaan Bukit Soga in Table 6 shows the speed data of Direction 1 and Direction 2 are the same based on the $p\text{ value} = 0.08 > \alpha = 0.05$. However, driver speed from Direction 2 is higher than from Direction 1 based on the value of $\mu\text{ Direction 1} < \mu\text{ Direction 2}$ and the average speed indicates the mean difference (53.17-50.12) is insignificant which is 3.05.

4.3 Speed Limit Compliance at Ayer Hitam Fire Station

The percentage of drivers at Ayer Hitam Fire Station who violate the speed limit is 97% (see Figure 5). Only 3% driving below the speed limit. Based on observations at the study location, there are signs placed on the sidewalk as a reminder to driver [26] but this action is considered futile because the majority of drivers are still driving at high speeds. Based on the observation, the driver's driving attitude is influenced by the road structure approaching the study location and passing a relatively straight location into a factor of driving at high speed [16] double lanes facilities where drivers do not need to slow down or give way to other vehicles to exit the junction or when to overtake another vehicle. In addition, the study route is not provided with road dividers where the probability of collisions from opposite directions is very high and is one of the hot spots of accidents on the study route. The divider/median road separates two directions of traffic on the same road thus improving road quality

and safety [24]. Besides, Figure 7 shows the warning signage provided which ignored by most of the driver. The results of the 2-Sample T-Test at Ayer Hitam Fire Station in Table 6 shows that the speed data of Direction 1 and Direction 2 are different where drivers from Direction 2 are found to be driving at higher speeds than from Direction 1 through analysis results of $\mu_{Direction 1} < \mu_{Direction 2}$ and the value of $p=0.00 < \alpha=0.05$. The average speed indicates the mean difference (79.59-74.64) is insignificant which is 4.95.

Table 6: 2-Sample T-Test of Sekolah Kebangsaan Bukit Soga and Balai Bomba Ayer Hitam

	SEKOLAH KEBANGSAAN BUKIT BROGA		AYER HITAM FIRE STATION	
	Speed, km/h		Speed, km/h	
	Direction 1 (Batu Pahat - Ayer Hitam)	Direction 2 (Ayer Hitam- Batu Pahat)	Direction 1 (Batu Pahat - Ayer Hitam)	Direction 2 (Ayer Hitam- Batu Pahat)
Mean	50.12	53.17	74.64	79.59
Varian	116.16	91.81	52.87	23.14
Observation	50	42	50	42
Hypotesis	0		0	
df	90		86	
t Stat	-1.44		-3.91	
P(T<=t) one-tail	0.08		0.00	
t Critical one-tail	1.66		1.66	
P(T<=t) two-tail	0.15		0.00	
t Critical two-tail	1.99		1.99	



Figure 5: Signage at Balai Bomba Ayer Hitam

5. Conclusion

Findings of this study showed that the compliance with speed limits found that drivers tend to violate the speed limits 60 km/h. Drivers tend to violate speed limit at the study road although a lot of signage placed along both study locations. According to [26], signage aims to guide drivers on the road laws that need to be followed while driving to improve safety but here it can be seen that drivers do not pay attention to it and this attitude shows the level of compliance with driver speed limits is still weak. Road geometry and road environmental condition play a main role affect driver speed choice and speed limit compliance at study road. The study shows drivers at rural area (Ayer Hitam Fire Station) using higher speed than driver at urban area (Sekolah Kebangsaan Bukit Soga) base on the highest maximum speed used at both direction. The maximum speed at Ayer Hitam Fire Station is 85km/h and 90 km/h meanwhile in Sekolah Kebangsaan Bukit Soga with maximum speed of 70 km/h and 80 km/h.

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References

- [1] WHO (2004), World Report On Road Traffic Injury Prevention: Summary. (assessed on November 1, 2020)
- [2] Heinrich, H. W. Petersen. D. & Roos, N. (1980). Industrial Accident Prevention. A Safety Management Approach.
- [3] Li, L., Zhu, L., & Sui, D. Z. (2007). A GIS-based Bayesian approach for analyzing spatial-temporal patterns of intra-city motor vehicle crashes. *Journal of Transport Geography*, 15(4), 274-285. 19/12/20
- [4] Miaou, S. P., Song, J. J., & Mallick, B. K. (2003). Roadway traffic crash mapping: a space-time modeling approach. *Journal of transportation and Statistics*, 6, 33-58. 19/12/20
- [5] Rohani, M. M., Buhari, R., David Daniel, B., Prestijo, J., Ambak, K., Abd Sukor, N., & Hasan, S. A. (2015). Car driving behaviour on road curves: A study case in Universiti Tun Hussein Onn Malaysia. In *Applied Mechanics and Materials* (Vol. 773, pp. 990-995). Trans Tech Publications Ltd.
- [6] Harian Metro, mymetro, Batu Pahat rekod kematian kemalangan tertinggi (Jun 18,2019). <https://www.hmetro.com.my/mutakhir/2019/06/466578/batu-pahat-rekod-kematian-kemalangan-tertinggi> (assessed on July 05, 2020)
- [7] Appleyard, D. (1980). Livable streets: protected neighborhoods. *The ANNALS of the American Academy of Political and Social Science*, 451(1), 106-117.
- [8] Candida Castro dan Tim Horberry, (2004) *The Human Factor of Transport Sign*. United State.
- [9] Gregório, N., Silva, A. B., & Seco, A. (2016). Speed management in rural two-way roads: speed limit definition through expert-based system. *Transportation Research Procedia*, 13, 166- 175
- [10] Elvik, R. (2009). Potensmodellen for sammenhengen mellom fart og trafikksikkerhet En oppdatering (TØI-rapport 1034/2009). Oslo.Transport Economics Institute
- [11] Mosedale, J., Purdy, A., & Clarkson, E. (2004), *Contributory factors to road accidents*.
- [12] Gargoum, S. A., El-Basyouny, K., & Kim, A. (2016). Towards setting credible speed limits: Identifying factors that affect driver compliance on urban roads. *Accident Analysis & Prevention*, 95, 138-148.

- [13] Christer Hydén (2020) Speed in a high-speed society, *International Journal of Injury Control and Safety Promotion*, 27:1, 44-50, <https://doi.org/10.1080/17457300.2019.1680566>
- [14] Wilmot, C.G., Khanal, M., (1999). Effect of speed limits on speed and safety: a review. *Transp. Rev.* 19 (4), 315–329.
- [15] Aarts, L., van Nes, N., Wegman, F., Van Schagen, I.N.L.G., Louwrese, R., (2009). Safe speeds and credible speed limits (SaCredspeer): a new vision for decision making on speed management. *Compendium of papers of the 88th TRB Annual Meeting*, pp. 11–15
- [16] Goralzik, A., & Vollrath, M. (2017). The effects of road, driver, and passenger presence on drivers' choice of speed: a driving simulator study. *Transportation research procedia*, 25, 2061-2075.
- [17] Kanellaidis, G., Zervas, A., & Karagioules, V. (2000). Drivers' risk perception of road design elements. *Transportation Human Factors*, 2(1), 39-48.
- [18] Clarke, D. D., Ward, P., Bartle, C., & Truman, W. (2007). The role of motorcyclist and other driver behaviour in two types of serious accident in the UK. *Accident Analysis & Prevention*, 39(5), 974-981.
- [19] Corbett, C.(2000), The social construction of speeding as not 'real' crime. *Crime prevention and community safety*, 2(4), 33-46.
- [20] Alhomaidat, F., Kwigizile, V., Oh, J. S., & Van Houten, R. (2020). How does an increase freeway speed limit influence the frequency of crashes on adjacent roads? *Accident Analysis & Prevention*, 136, 105433.
- [21] Aarts, L., van Nes, N., Wegman, F., Van Schagen, I.N.L.G., Louwrese, R., (2009). Safe speeds and credible speed limits (SaCredspeer): a new vision for decision making on speed management. *Compendium of papers of the 88th TRB Annual Meeting*, pp. 11–15
- [22] Terje Assum, (1997). Attitude and road accident risk. *Accident Analysis & Prevention*, 153-159
- [23] Robertson, H. D. (1994). Spot Speed Studies. *Manual of Transportation Engineering Studies*, 33-51.
- [24] Qu, Z., Xing, Y., Hu, H., Duan, Y., Song, X., Chai, T., & Zhang, H. (2013). The Departure Characteristics of Traffic Flow at the Signalized Intersection. *Mathematical Problems in Engineering*, 2013, 671428. <https://doi.org/10.1155/2013/671428>
- [25] Malin, F., & Luoma, J. (2020). Effects of speed display signs on driving speed at pedestrian crossings on collector streets. *Transportation Research Part F: Traffic Psychology and Behaviour*, 74, 433–438.
- [26] Noor Hafizah Binti Mat Nor (2004). *Pembangunan Inventori Jalan Kawasan Kampus UTM Menggunakan Fotogrammetri Udara*. Universiti Teknologi Malaysia: Projek Sarjana Muda
- [27] Rozaidi, Y., Rohaizan, B., & Mashros, N. (2011). Effect of Posted Speed Limit On Drivers Speed Choice During Off-Peak Period. 326–338. <http://civil.utm.my/wp-content/uploads/2016/12/Effect-of-Posted-Speed-Limit-On-Drivers-Speed-Choice-During-Off-Peak-Period.pdf>