Study on Motorcycle Speed Characteristics at Various Speed Limit Zones on Federal Route FT050

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Abstract: Batu Pahat district recorded a very high increase in accident rates from time to time. KM1 to KM32 Federal Route FT050 is a road in Batu Pahat District that often has road accidents resulting in death. Among the factors contributing to the accidents were human factor which contributed 99.2%, followed by environmental factors of 5.4%, and vehicle factors of 0.5%. This study was conducted to determine the level of compliance of motorcyclists at hot spot locations on Federal Road FT050. This study used the Global Sat DG-200 GPS measurement tool for data collection and used Microsoft Excel software to analyze data of 36 trips from Batu Pahat to Ayer Hitam and 29 trips from Ayer Hitam to Batu Pahat. The research findings show that riders do not comply with the rules of the posted speed limits of 30 km/h and 60 km/h on Federal Route FT050.

Keywords: Speed, Riding, Accident, Behavior, Speed Limit

1. Introduction

Statistics show that Malaysia has the highest risk of road death (per 100,000 population) among ASEAN countries and more than 50% of road accident deaths involve motorcyclists[1]. Riding above the speed limit is a major contributor to road accidents including incompetence, carelessness, and impatience while operating a vehicle. Several earlier studies found that accidents involving motorcyclists are usually caused by the negligence of motorcyclists, inability to operate motorcycles, and riding motorcycles too fast [2]. And most researchers focused on 4 aspects of key areas namely: speed operation, vehicle stability, alignment index, and workload for motorcyclists [3]. Human error, traffic, vehicle and road conditions, as well as the surrounding environment have been identified as major factors influencing the behavior of motorcyclists [4]. Road accidents often occur in Malaysia, among the causes of road accidents are human factors, circumstances factors, carelessness, vehicle factor, and demographic factor. The human factor that contributed to the occurrence of accidents was 99.2%, followed by environmental factor of 5.4% and vehicle of 0.5% [5]. Among the categories caused by human is the use of seat belts, the use of helmets, speed, interference, and mistakes made by humans. The highest condition factor is accidents at intersections about 34%, followed by unusual conditions

passing through the area of 23% [6]. Road users who are not used to using the road can also cause road accidents such as turning left or right, wrong lane, and wrong intersection.

Carelessness is a common attitude among motorcyclists that causes accidents. Carelessness occurs due to accidental and unintentional situations. Bad practices that are often done by motorcycle users are; take off helmet while riding a motorcycle, do not wear a helmet when there is no enforcement, and ride fast [7]. Road geometry also affects the speed of motorcycle users. Speed will be affected by the shape of the road surface where the velocity will increase if there are no obstacles along the route [8]. Motorcyclists who ride above speed limit have an advantage in the possibility of getting involved in an accident. Motorcyclists riding over the high-speed limit and unsafe will have a higher probability of getting involved in a road accident. [9].

2. Materials and Methods

Determine the level of compliance of motorcyclists with the speed limit at the designated location, namely Sekolah Kebangsaan Bukit Soga, Sekolah Menengah Kebangsaan Seri Gading, Hospital Pantai, and Balai Bomba Ayer Hitam (Refer Table 1). The study was conducted at several locations at KM1-KM32 Federal Road FT050. Data collection was done according to the conditions, time, weather conditions, and conditions of the study area. The selected study time is beyond peak hours to obtain free-flow data.

The time taken was at 10.00 am on a working day for two weeks. The average journey time of a motorcycle from Batu Pahat to Ayer Hitam and Ayer Hitam to Batu Pahat is between 30 minutes to 35 minutes. The quality analysis data that was successfully collected was 131,226 observations was, the number of motorcyclists from Batu Pahat to Ayer Hitam was 36 trips and from Ayer Hitam to Batu Pahat was 29 trips. Location for study is Federal Route FT050 (Figure 1). GPS from the GLOBATSAT DG-200 model is used as a tool to record the actual data (Figure 2). This device is placed on the motorcycle to make it easier for GPS to get signals and record information of latitude, longitude, speed, date, and time at every 1-second interval of motorcycle movement. The analysis test used is 2 sample T-Test Analysis.

Table 1: Speed Limit Location

Speed	Location	Latitude	Longitude
30 km/j	Sekolah Kebangsaan Bukit Soga	1.86320	102.95565
	Sekolah Menengah Kebangsaan Seri Gading	1.85090	103.05034
60 km/j	Hospital Pantai	1.86093	102.95114
	Balai Bomba Ayer Hitam	1.900409	103.16609

Figure 1: Study Sites

Figure 2: Portable GPS device (DG200)

3. Results and Discussion

The data collected was used to determine the speed limit. The analysis test was used is 2 Sample T-test to compare the speed population between two locations at both speed limit 30 km/h and 60km/h.

Table 2: Comparison Speed between Sekolah Kebangsaan Bukit Soga and Sekolah Menengah Kebangsaan Seri Gading (30 km/h speed limit zone)

	Sekolah Kebangsaan Bukit Soga	Sekolah Menengah Kebangsaan Seri Gading
Mean	56.65231481	75.10555556
Variance	10.46992703	7.318047619
Observations	36	36
Hypothesized Mean Difference	0	
df	68	
t Stat	-26.25189431	
P(T<=t) one-tail	1.30547E-37	
t Critical one-tail	1.667572281	
P(T<=t) two-tail	2.61094E-37	
t Critical two-tail	1.995468931	

Hypothesis:

Null Hypothesis: μ Sekolah Kebangsaan Bukit Soga = μ Sekolah Menengah Kebangsaan Seri Gading
Alternative Hypothesis: μ Sekolah Kebangsaan Bukit Soga ≠ μ Sekolah Menengah Kebangsaan Seri Gading

i. **Speed Limit 30 km/h.** Table 2 shows the comparison speed of motorcyclists at Sekolah Kebangsaan Bukit Soga and Sekolah Menengah Kebangsaan Seri Gading. The results for t-Test can be drawn are: t Stat (26.251) > t Critical (1.995). Null hypothesis is rejected while Alternative Hypothesis is accepted. Mean speed at Sekolah Kebangsaan Bukit Soga not equal to Sekolah Menengah Kebangsan Seri Gading. Based on the overall results, the motorcyclists at the two schools did not abide with the motorcyclist speed limit rules at the school grounds. The mean speed at Sekolah Menengah Kebangsaan Seri Gading (75.10 km/h) is higher than that mean speed Sekolah Kebangsaan Bukit Soga (56.65 km/h) and the *p value = 1.30 > a = 0.05*. The average speed indicates the mean difference (75.10-56.65) is insignificant which 18.45. Based on observations, there is a crosswalk bridge at Sekolah Menengah Kebangsaan Seri Gading. While before passing through Sekolah Kebangsaan Bukit Soga area there is a traffic light. The speed at Sekolah Menengah Kebangsaan Bukit Soga is reduced. The difference in street furniture in each area may significantly affects the speed in the school area. Figure 3 shows before entering the school area, there have traffic lights and speed limit signage in front of the Sekolah Kebangsaan Bukit Soga. Figure 4 shows there have intersection signage and Crosswalk Bridge in front of Sekolah Menengah Kebangsaan Seri Gading.

Figure 3: Signage and Road Facilities at Sekolah Kebangsaan Bukit Soga

Figure 4: Signage and Road Facilities at Sekolah Menengah Kebangsaan Seri Gading

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Table 3: Comparison Speed between Hospital Pantai and Balai Bomba Ayer Hitam (60 km/h speed limit zone)

	Hospital Pantai	Balai Bomba Ayer Hitam
Mean	49.22320408	73.5
Variance	229.1389498	20.42617647
Observations	35	35
Hypothesized Mean Difference	0	
df	40	
t Stat	-9.09145599	
P(T<=t) one-tail	1.39806E-11	
t Critical one-tail	1.683851013	
P(T<=t) two-tail	2.79612E-11	
t Critical two-tail	2.02107539	

Hypothesis:

Null Hypothesis: μ Hospital Pantai = μ Balai Bomba Ayer Hitam
Alternative Hypothesis: μ Hospital Pantai ≠ μ Balai Bomba Ayer Hitam

ii. **Speed Limit 60 km/h.** Table 3 shows the comparison speed of motorcyclists at Hospital Pantai and Balai Bomba Ayer Hitam. The results for t-Test can be drawn are: *t*- Stat (9.091) > *t*-Critical (2.021). Null Hypothesis is rejected while Alternative Hypothesis is accepted. Mean velocity at Hospital Pantai not equal to Balai Bomba Ayer Hitam. Based on the overall results, the motorcyclists riding around the hospital comply with the speed limit rules with a mean of 49 km/h compared to the riders riding passing the fire station with a mean of 73.5 km/h and the *p value = 1.39 > a = 0.05*. The average speed indicates the mean difference (73.5-49.22) is insignificant which 24.28 is. This results explain, motorcyclist's speed are at significant differences between the hospital area and the fire station area. Based on the observations, there are traffic lights in the hospital area and this can give a clear picture that the motorcyclists to slows down the speed of the hospital area while the alignment of the road in the fire station area is straight without interference from such as traffic lights and intersections. The differences in road furniture and the alignment of the road in each area significantly affect the speed at the speed limit area. Figure 5 shows the signage in front of Hospital Pantai and Balai Bomba Ayer Hitam.

Figure 5: Signage at Hospital Pantai dan Balai Bomba Ayer Hitam

4. Conclusion

Most motorcyclists do not comply with the rules of the road i.e. riding a motorcycle above the speed limit in a particular area. The speed limit on federal roads is 90 km/h but the speed limit will automatically go down if it passes through urban areas, towns, and housing to avoid road accidents. The speed limit will be reduced to 30 km/h up to 60 km/h. But the attitude of users who still do not care about the importance of the use of signage is the reason that the attitude of compliance of road users should be worried. Socio-economic characteristics can influence road users by adding information and traffic signs because there are differences in the way road users when looking at changing conditions and there is more information [10].

A comparison study between two schools with a speed limit zone of 30 km/h had been carried out, Sekolah Kebangsaan Bukit Soga and Sekolah Menengah Kebangsaan Seri Gading. Mean speed value at Sekolah Kebangsaan Bukit Soga is 56.65 km/h and mean speed value at Sekolah Menengah Kebangsaan Seri Gading is 75.10 km/h. Sekolah Menengah Kebangsaan Seri Gading, has Crosswalk Bridge while Sekolah Kebangsaan Bukit Soga does not have a crosswalk bridge. Crosswalk bridge can eliminate conflicts between vehicles and pedestrians, which will result in disrupted traffic flow [11]. Therefore, the speed at the Sekolah Menengah Kebangsaan Seri Gading area changes to avoid traffic disruptions. From the perspective of human behavior, road users know the speed limit in the school zone and agree to the installation of speed limit signage. However, their behavior on the road is contrary to the ideal speed limit environment and cannot comply with the speed limit of 30km/h in the school zone [12].

A comparison study between Hospital Pantai and Balai Bomba Ayer Hitam with a speed limit zone of 60 km/h showed the road alignment at Balai Bomba Ayer Hitam is a straight without any traffic disturbances such as traffic lights compared to the road at the Hospital. The speed at the curved segment is lower than the straight segment, and the average speed gap between the straight segment and the curved segment becomes larger with increasing visibility [13]. On average, motorcyclists speed are faster on a straight open road, followed by a straight road in bad weather, a curved open road, a straight road in bad weather, a straight road in the dark, and, finally, a closed bend road [14]. Finding of this study showed that motorcyclist speed influenced by road geometry.

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References

[1]   Z. Sultan, N. I. Ngadiman, F. D. A. Kadir, N. F. Roslan, and M. Moeinaddini, "Factor analysis of motorcycle crashes in Malaysia," *Plan. Malaysia*, vol. 4, no. Special Issue 4, pp. 135–146, 2016, doi: 10.21837/pmjournal.v14.i4.154.

[2]   T. R. Jaafar, M. F. Mustafa, S. Kemin, and R. Kasiran, "Kemalangan Jalan Raya: Analisis Data Membabitkan Pengguna Motosikal," *J. Teknol.*, vol. 38, no. 1, 2003, doi: 10.11113/jt.v38.485.

[3]   F. J. Camacho-Torregrosa, A. M. Pérez-Zuriaga, J. M. Campoy-Ungría, and A. García-García, "New geometric design consistency model based on operating speed profiles for road safety evaluation," *Accid. Anal. Prev.*, vol. 61, pp. 33–42, 2013, doi: 10.1016/j.aap.2012.10.001.

[4]   R. Asih and A. Soemitro, "Accident Analysis Assessment To the Accident Influence," *Proc. Estern Asia Soc. Transp. Stud.*, vol. 5, pp. 2091–2105, 2005.

[5]   E. K. Adanu and S. Jones, "Effects of Human-Centered Factors on Crash Injury Severities," vol. 2017, 2017.

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[6]   I. Makarova and E. Belyaev, "Analysis of periodical technical inspection systems in automotive transport . The experiences of Poland and Russia Automotive Transport . The Experiences Of Poland And," no. January, 2018, doi: 10.21307/tp-2015-053.

[7]   S. Kulanthayan, R. S. Radin Umar, H. Ahmad Hariza, M. Mohd Nasir, and H. Singh, "Compliance of Proper Safety Helmet Usage in Motorcyclists Motorcyclist Fatalities by Part of Body Injured," *Med. J. Malaysia*, vol. 55, no. 1, pp. 40–44, 2000.

[8]   C. W. Yuen, M. R. Karim, and A. Saifizul, "Analysis of motorcyclist riding behaviour on speed table," *Sci. World J.*, vol. 2014, no. June, 2014, doi: 10.1155/2014/236396.

[9]   P. S. Broughton *et al.*, "Conditions for speeding behaviour: A comparison of car drivers and powered two wheeled riders," *Transp. Res. Part F Traffic Psychol. Behav.*, vol. 12, no. 5, pp. 417–427, 2009, doi: 10.1016/j.trf.2009.07.001.

[10]   S. Bortei-doku, S. Kaplan, C. Giacomo, and O. Anker, "ScienceDirect Road signage comprehension and overload : the role of driving style and need for closure," *Transp. Res. Procedia*, vol. 24, no. 2016, pp. 442–449, 2017, doi: 10.1016/j.trpro.2017.05.065.

[11]   R. Hasan and M. Napiah, "Utilization of footbridges : Influential factors and improvement proposals Utilization of footbridges : influential factors and improvement proposals," no. July, 2017, doi: 10.4399/97888255077374.

[12]   M. F. H. Raha Abd Rahman, Nazurah Lausman, Lim Wei May, Nordiana Mashros, Mohd Idrus Bin Mohd Masirin, Mohammad Sukri Bin Mustapa, "The Compliance of Road Users with the Speed Limit at School Zones on Federal Road FT50," vol. 50, no. 5, pp. 922–929, 2019, doi: 10.35940/ijeat.E1131.0585C19.

[13]   Weihua Zhang and Zhongxiang Feng, "Research on the classification for road traffic visibility based on the characteristics of driving behaviour – a driving simulator experiment," vol. 1, no. December 2019, pp. 30–36, 2020, doi: 10.1108/JICV-10-2019-0011.

[14]   N. H. M. Maksid and A. A. K. Hamsa, "Evaluating The Effects Of Road Geometrical Design Towards Spot Speed Distribution On Arterial Road," vol. III, pp. 111–126, 2014.