Journal of the Society of Automotive Engineers Malaysia
Volume 1, Issue 2, pp 94-102, May 2017
e-ISSN 2550-2239

An Observational Study on Speeding among Malaysian Express Bus Drivers

M. S. Ahmad[*1], Z. H. Zulkipli[1], W. Ameer Batcha[1], N. F. Paiman[1], S. A. Mohd Faudzi[1], I. Othman[1] and M. R. Osman[1]

[1]Vehicle Safety and Biomechanics Research Centre, Malaysian Institute of Road Safety Research (MIROS), 43000 Kajang Selangor, Malaysia

[*]*Corresponding author: m.suffianahmad@miros.gov.my*

ORIGINAL ARTICLE **Open Access**

Article History:

Received
2 Feb 2017

Received in revised form
31 Mar 2017

Accepted
11 Apr 2017

Available online
1 May 2017

Abstract – *Accidents involving express buses in Malaysia tend to attract a lot of local media attention. Based on statistics from the Royal Malaysia Police (RMP), express buses recorded the highest percentage of total bus crashes during the 3-year period from 2007 to 2009. In this study, data were collected from three different festive seasons in Malaysia with express bus drivers' behaviour being the main focus. Express buses and the journey they took were randomly selected regardless of the express bus company. Data collected from observations were analysed with respect to 'speeding'. Findings of this study reveal that drivers were more likely to exceed the posted speed limit during night-time. Smoking and eating while driving were significantly associated with speeding. The study suggests that further efforts aimed at reducing risky bus driver behaviour demand critical consideration and actions from relevant enforcement agencies and stakeholders. In addition, express bus operators are encouraged to monitor the risky driving behaviour of drivers using suitable monitoring system.*

Keywords: Speeding, express bus driver, inappropriate driving behaviour, driver behaviour

Journal homepage: www.journal.saemalaysia.org.my

1.0 INTRODUCTION

The Malaysian government aggressively promotes the use of public transport during festive seasons in order to reduce road traffic accidents and fatalities. In 2007, researchers from Malaysian Institute of Road Safety Research (MIROS) found that there was a modal shift between public and private transport users during festive seasons. According to their research, the number of motorcyclists dropped from 22.3% before the 2007 Hari Raya festive period to 4.7% during the festive period itself as they opted for other safer modes of transport which included cars (56%) and buses (19%). In addition, the ratio of private to public transport usage also decreased from 85:15 to 82:18 during the 2007 festive seasons (MIROS, 2007a).

Although a positive increase in modal shift was observed in 2007, local bus industry failed to capitalise on the encouraging trend due to the rising number of road accidents involving buses. In addition, the percentage of fatal bus crashes, based on the MIROS Road Accident Database System (MROADS), indicated an increasing trend from 23% in 2006 to 45% in 2011. This phenomenon will affect the public's confidence in public transport service. Express buses recorded the highest percentage (58%) of the total bus crashes during the three-year period from 2007 to 2009 (RMP, 2008, 2010). This is a cause for concern as express buses are normally fully loaded with passengers; thus when a crash occurs, it involves a lot of lives. In addition, the majority (55%) of crashes occurred along expressways (RMP, 2008, 2010).

There are a lot of contributing factors for such crashes and one of them is driving beyond the posted speed limit. Speed has been identified as the leading cause of road crashes not only among private vehicles but also commercial road transport and public passenger vehicles. According to statistics from the Royal Malaysia Police (RMP), the number of drivers or riders involved in road accidents caused by speeding was 4 % in 2010 and 4.4% in 2011 (RMP, 2010, 2011). In addition, based on MIROS' crash investigation from 2007 to 2010, about 7.2% of road accidents involving buses were identified to be related to speeding (Ahmad Noor Syukri et al., 2012).

'Speeding' can be defined in a number of ways. As described by Oppenlander (1966), 'speeding' occurs if there is a difference between average speed for a trip and the spot (instantaneous) speed at which a vehicle may be clocked at one point and place in time. Secondly, there is a distinction between speeding defined in terms of the traffic flow and other driving conditions, at the time which is inappropriate speed, and speeding defined with reference to posted speed limits (Zaal, 1994). As stated by World Health Organization (WHO) (2004), 'excess speed' means a vehicle exceeding the relevant speed limit. According to Michigan's Grand Valley Metropolitan Council (GVMC) (2010), speeding is "a deliberate and calculated behaviour where the driver knows the risk but ignores the danger". The term 'speeding' in this paper may refer to any of these interpretations. If a specific interpretation is being used, further details of this will be given in the related section.

Furthermore, Rietvald and Shefer (1998) considered road environment factors such as road type, road design and traffic flow as important factors in a driver's speed preference. Giles (2004) in his study suggested that the average speed of vehicles travelling on urban roads was about 2 km per hour lower compared to vehicles travelling on rural roads. An analysis conducted on crashes in Hualien Country revealed that speeding and driving under influence (DUI) accounted for one-fifth of the primary causes (Li, 2007). The author stated that a much higher percentage of speeding was reported out of the total crashes in rural districts compared to urban districts.

Besides road type and road design, Giles (2004) suggested that another factor under road environment is "time of travelling". Findings from multivariate analysis revealed that the partial effects of speed on time and weekend were relatively small at about 0.1 km per hour in absolute value. Even though the value was small, it appeared that vehicles travelling at night were faster compared to vehicles travelling during the day. Moreover, vehicles travelling on weekends were slightly slower than on weekdays.

In addition, it is conceptually difficult to describe speeding without relating it to inappropriate driving behaviour (IDB). For example, as reported by Mason et al. (1992), speeding was the most frequent IDB that caused accidents. IDB is deliberate driving behaviours

that, while not intended to physically harm, show disregard for the safety and well-being of other road users (NHTSA, 2009). These behaviours are motivated by impatience, frustration, rivalry and/or attempts to save time. Based on an observation of safety practices among bus operators during the festive season in 2009, it was revealed that tailgating, harsh braking, dangerous overtaking, and smoking were the most frequent IDBs. The study also found that 22% of the buses exceeded the speed limit of 90 km/hr (Osman et al., 2010a). It is therefore crucial to study speeding in the context of IDB.

Information on speeding and its related factors is important in order to identify key areas to tackle the problem of speeding among express bus drivers travelling along Malaysian roads. Thus, this study aims to describe the pattern of speeding among express bus drivers travelling during the main festive seasons. Speeding among the drivers was assessed in relation to several factors such as type of buses and number of drivers, factors of bus journey as well as the driver inappropriate driving behaviour (IDB).

2.0 METHODOLOGY

This section includes explanation of the data set, data collection and analysis as well as defining variables.

2.1 Data Set

Data for this study were collected during three different festive seasons in Malaysia namely Chinese New Year and Hari Raya from 2010 to 2011. Express bus drivers' behaviour was the primary focus of this study. The express buses and the journey they took were randomly selected by trained observers. Observation of the drivers was carried out using a checklist during the whole journey aboard the buses. A 'complete journey' is defined as a trip from a departing terminal to a destination terminal. A total of 270 observation data were collected in Peninsular Malaysia.

2.2 Data Collection and Data Analysis

Apart from observing bus drivers' behaviour, observation of the respective bus terminal was also carried out. Although this method has not been widely used in other studies, it does provide direct access to examine inappropriate driver behaviour (IDB) and the data have shown high natural validity (Glendon, 2007). Since the methodology has its advantages in terms of real time observation, it will provide data that are not available through other methods.

A checklist was used to record all observation elements required in this study. The checklist was developed based on selected elements of Safety Health and Environment Code of Practice (SHE COP) (MIROS, 2007b). This Code of Practice provides guidelines to all commercial vehicles operators including express bus companies on operation safety practices. The checklist is divided into several parts namely observation of bus terminal, bus condition, on-the-road driver behaviour as well as road condition. Besides that, passenger behaviour on board the bus such as seatbelt wearing was also incorporated in the checklist. The checklist was used in a few pilot studies and had been verified a few times before it was finalised.

Eleven elements of inappropriate driving behaviour were observed and recorded namely dangerous overtaking, queue jumping, overtaking at double line, unauthorised heavy vehicle overtaking, harsh braking, disembarking outside terminal, tailgating, red light running,

smoking, mobile phone usage and eating and drinking while driving. These IDBs were selected based on common inappropriate behaviours demonstrated by commercial vehicle drivers in Malaysia. The frequencies of IDBs were also recorded.

In order to accurately and consistently capture the bus travelling speed, a small calibrated hand-held Garmin Oregon 300 Global Positioning System (GPS) device was utilised. Each observer was provided with the fully charged GPS device together with extra batteries at the start of each journey.

A briefing was given to the observers before each data collection session in order to ensure consistency. Training on GPS operating and handling was also provided to the observers to ensure they were sufficiently prepared for handling the GPS. During the observation aboard the bus, observers must ensure they have a good view of the driver. The bus driver, however, must not be made aware of the observation.

Data were then analysed using SPSS 17 software (SPSS Inc.). Descriptive and chi-square analysis were applied in this study with the statistical significant values set at $p \leq 0.05$.

2.3 Defining Variables

In this study, 'speeding' is defined as exceeding 10% of the posted speed limit, and occurring more than 10% of the total GPS captured points exceeding the posted speed limit. 'Day time' is defined as the period between 7.00 a.m. until 6.59 p.m. while night time ranges from 7.00 p.m. till 6.59 a.m. If the travelling time is more than 51% in the range of 7.00 a.m. until 6.59 p.m., it will be considered as day time and vice versa. 'Departure delay' is defined as any journey starting more than 15 minutes after the scheduled time. 'Unauthorised overtaking' is defined as a bus illegally overtaking any vehicle over a predefined stretch of road.

3.0 RESULTS

During the observation, the overall average speed of 270 buses was 66.2 km/h. 60% of the observed buses were deemed to be speeding based on the definition provided earlier. 27 out of 270 buses were recorded speeding more than 50% of their total GPS captured points. 14.4% of the buses recorded speed exceeding 120 km/hr or 30 km/hr more than the permissible speed limit for bus.

3.1 Bus Factors

In this study, 'bus factors' were only limited to the type of buses and number of drivers. Table 1 shows that out of the 270 observed buses, the majority of them (85.6%) were single deck bus. 69.3% were observed to have a single driver throughout the entire journey. Speeding between the two types of buses and the number of driver were not significantly different. Speeding behaviour was more prevalent regardless of the type of bus or the number of driver.

Table 1: Bus factors influencing speeding among bus drivers

Bus factors	Total (n = 270) n (%)	Speeding				P-value
		Yes (n = 160)		No (n = 110)		
		n	%	n	%	
Type of bus						
Single deck	231 (85.6)	136	85.0	95	86.4	0.754
Double deck	39 (14.4)	24	15.0	15	13.6	
Number of drivers						
One	187 (69.3)	113	70.6	74	67.3	0.557
Two	83 (30.7)	47	29.4	36	32.7	

3.2 Bus Journey Factors

Table 2 shows that the majority of journeys were made during weekdays (61.5%). However, there was no significant difference in terms of speeding behaviour between weekday and weekend journeys. On the other hand, speeding was frequently observed during night journeys compared to during the day, as bus drivers were 2.5 times more likely to drive beyond the posted speed limit. Furthermore, 50 out of 270 buses delayed their departure. However, delayed departure did not significantly influence speeding behaviour among the drivers.

Table 2: Journey factors influencing speeding among bus drivers

Factors	% Total (n = 270)	Speeding				Odd Ratio	P-value
		Yes (n = 160)		No (n = 110)			
		n	%	n	%		
Week							
Weekday	166 (61.5)	102	63.8	64	58.2	1.26	0.356
Weekend	104 (38.5)	58	36.3	46	41.8		
Time of the day							
Daytime	221 (81.9)	123	76.9	98	89.1	2.46	0.010
Night-time	49 (18.1)	37	23.1	12	10.9		
Delay							
Yes	50 (19.7)	31	20.5	19	18.4	1.14	0.682
No	204 (80.3)	120	79.5	84	81.6		

3.3 Speeding Association with IDBs

Table 3 shows the eleven IDBs displayed by the bus drivers chosen. 47.0% of the drivers disembarked passengers outside the assigned terminal, 39.6% of them displayed harsh braking, 27.0% tailgated other vehicles, 24.1% used mobile phone and 22.6% of them committed dangerous overtaking. Higher frequencies of IDBs were observed for speeding buses compared to non-speeding buses. Among the IDBs observed, only smoking and eating were found significantly associated with speeding. Smoking and eating were 2.4 and 3.7 times more likely to be the most associated IDBs among drivers who were speeding, respectively.

Table 3: Inappropriate driving behaviours (IDBs) of bus drivers associate with speeding

IDBs	Total (n = 270) n (%)	Speeding				Odd Ratio	P-value
		Yes (n = 160)		No (n = 110)			
		n	%	n	%		
Dangerous overtaking	61 (22.6)	38	23.8	23	20.9	1.17	0.583
Queue jumping	22 (8.1)	15	9.4	7	6.4	1.52	0.374
Overtaking at double line	35 (13.0)	23	14.4	12	10.9	1.37	0.405
Overtaking at lane where heavy vehicle not allowed to overtake	52 (19.3)	36	22.5	16	14.5	1.71	0.103
Harsh braking	107 (39.6)	63	39.4	44	40	0.97	0.918
Disembarking passenger outside terminal	127 (47.0)	73	45.6	54	49.1	0.87	0.575
Tailgating	73 (27.0)	44	27.5	29	26.4	1.06	0.836
Red light running	27 (10.0)	18	11.3	9	8.2	1.42	0.409
Smoking	26 (9.6)	20	12.5	6	5.5	2.48	0.054
Mobile phone use	65 (24.1)	41	25.6	24	21.8	1.24	0.472
Eating*	16 (7.8)	13	11.4	3	3.3	3.73	0.033

*Note: Total observation, n = 204.

4.0 DISCUSSION

The type of buses and the number of drivers did not significantly influence speeding behaviours. Surprisingly, the probability of speeding among the relatively less stable double deck buses with taller/higher centre of gravity was the same as single deck buses. Speeding among bus drivers may be due to the feeling of being safe in a larger vehicle. This corresponded with previous studies which showed that drivers of larger cars felt better protected compared to drivers of smaller vehicles. In turn, they were likely to accept a higher level of risk (Wilde 1988, 2001). Furthermore, the presence of another driver in a bus did not provide any form of preventive action against speeding. This was supported by a study which showed that speed violations for buses with dual drivers was higher compared to single driven buses (Osman et al., 2009).

As for the journey factors, only 'the time of day' had significant correlation with speeding. Drivers were 2.5 more likely to speed during night-time due to lack of enforcement and low traffic volume compared to during the day. Hence they were more likely to display risky behaviours including speeding. This is worrying because in Malaysia, as in other developing countries, serious road accidents are more likely to occur at night. As reported by Norlen et al. (2009), accident data in 2006 revealed that bus crashes at night tend to be more serious and were associated with a higher number of fatalities and injuries.

In this study, the five highest IDBs were disembarking passengers outside the assigned terminal, harsh braking, tailgating, mobile phone usage and dangerous overtaking. The findings are broadly consistent with Glendon (2007) which found that drivers of 'commercial' vehicles were more likely to engage in miscellaneous violations such as using a hand-held mobile phone, carrying unsafe loads, having their view obstructed and driving a polluting vehicle. Furthermore, harsh braking, tailgating, and dangerous overtaking were also common behaviours resulted from over speeding (Tasca, 2000). Additionally, the use of mobile phone

among bus drivers tends to distract drivers' attention and increase the risk of accident (NHTSA, 2010; Redelmejer & Tibshirani, 1997). Due to the normal practice of Malaysian bus drivers, passengers were allowed to disembark outside designated terminal, which was normally nearer to their intended destination. Bus operators and enforcement agencies have not seriously looked into this problem. According to Osman et al. (2010b), most of the bus operators audited did not conduct route and risk management which included ensuring that passengers embark and disembark at the assigned terminals. Another study conducted by Osman et al. (2011) found that the pre-departure inspection by enforcement agencies was limited to only checking documents and vehicle conditions.

Results of this study show that smoking and eating were not among the highest frequencies of IDBs, although they were significantly associated with speeding. Eating and drinking were reported to increase mental workload, which can increase the risk of crash. (Young et al., 2006).

5.0 LIMITATIONS

Due to the observational nature of the study, other important factors such as motivation to violate, driving experience, driver stress, alcohol/other drugs use, fatigue and medical conditions were not considered. Furthermore, since the demographics of the drivers were not recorded, the effect of variables such age could not be ascertained. Previous studies have shown that younger drivers were more likely to speed compared to older drivers. In addition, the sample for this study was subjected to the availability of bus ticket as well as the seat nearer to the driver.

6.0 CONCLUSION

Findings of this study reveal that drivers were more likely to drive over the posted speed limit at night. Smoking and eating while driving were significantly associated with speeding. Meanwhile, the type of bus and number of drivers did not influence speeding behaviour. Given the high prevalence of IDB and ineffectiveness of common enforcement strategies in Malaysia, further efforts aimed at reducing risky bus driver behaviour require critical consideration by relevant enforcement agencies and stakeholders. In addition, express bus operators are encouraged to monitor behaviour of their drivers using suitable monitoring system.

ACKNOWLEDGEMENTS

Special thanks go to the Research and Ethics committee of the Malaysian Institute of Road Safety Research (MIROS) for approving and funding the research. The authors' appreciation is also extended to the Director-General of MIROS and Director of Vehicle Safety and Biomechanics (VSB) Research Centre for their guidance and support toward this study.

REFERENCES

Ahmad Noor Syukri, Z.A., Siti Atiqah, M.F., Fauziana, L., & Abdul Rahmat, A.M. (2012). *MIROS crash investigation and reconstruction annual statistical report 2007–2011* (MRR 05/2012). Kuala Lumpur: Malaysian Institute of Road Safety Research.

Giles, M.J. (2004). Driver speed compliance in Western Australia: A multivariate analysis. *Transport Policy*, *11*, 227-235. doi.org/10.1016/j.tranpol.2003.11.002

Glendon, A.I. (2007). Driving violations observed: An Australian study. *Ergonomics*, *50*(8), 1159-1182. doi.org/10.1080/00140130701318624

GVMC (2010). Strategic safety planning process: "Keeping us moving efficiently, reliably, and safely". Grand Rapids, Michigan: Grand Valley Metropolitan Council.

Li, Y.M. (2007). Road traffic casualties and risky driving behavior in Hualien County, 2001–2005. *Tzu Chi Medical Journal*, *19*(3), 152-58. doi.org/10.1016/S1016-3190(10)60008-0.

Mason, J.M., Fitzpatrick, K., Seneca, D.L., & Davinroy, T.B. (1992). Identification of inappropriate driving behaviors. *Journal of Transportation Engineering*, *118*(2), 281-298. doi.org/10.1061/(ASCE)0733-947X(1992)118:2(281).

MIROS (2007a). *The effectiveness of OPS Bersepadu conducted over the Hari Raya period from 7-21 October 2007* (MRR 03/2007). Kuala Lumpur: Malaysian Institute of Road Safety Research.

MIROS (2007b). *Safety health and environment code of practice for transportation sector* (MCP 1/2007). Kuala Lumpur: Malaysian Institute of Road Safety Research.

NHTSA (2009). *Analysis of lane-change crashes and near-crashes* (DOT HS 811 147). Washington, DC: U.S. Department of Transportation.

NHTSA (2010). *Distracted driving 2009*. *Traffic safety facts research note* (DOT HS 811 379). Washington, DC: U.S. Department of Transportation.

Norlen, N., Fadhli, Y., Ilhamah, O., Zarir Hafiz, Z., Osman, M.R., & Wong, S.V. (2009). *An impact assessment of banning wee-hour express bus operations* (MRR 10/2009). Kuala Lumpur: Malaysian Institute of Road Safety Research.

Oppenlander, J.C. (1966). Variables influencing spot-speed characteristics (Special Report No. 89). Washington, DC: Highway Research Board.

Osman, M.R., Rohayu, S., Zarir Hafiz, Z., Noor Faradila, P., & Wong, S.V. (2009). *The effect of driver management system according to SHE COP in reducing speed violations* (MRR 11/2009). Kuala Lumpur: Malaysian Institute of Road Safety Research.

Osman, M.R., Abas, F., Noh, M.S., Mohamad Suffian, A., Ilhamah, O., Zarir Hafiz, Z., Wahida, A.B., Noor Faradila, P., & Siti Atiqah, M.F. (2010a). Safety practices among bus operators during wee hour operations. *World Academy of Science, Engineering and Technology*, *4*(11), 2148-2153.

Osman, M.R., Abas, F., Mohamad Suffian, A., & Wong, S.V. (2010b). Safety practices of bus operators. *The Ingenieur*, *48*, Dec 2010-Feb 2011.

Osman, M.R., Abas, F., Noor Faradila, P., Mohamad Suffian, A., Zarir Hafiz, Z., Wahida, A.B., Ilhamah, O., & Siti Atiqah, M.F. (2011). Evaluation of the effectiveness of OPS Bersepadu Chinese New Year 2009 with respect to selected SHE practices (MRR 04/2011). Kuala Lumpur: Malaysian Institute of Road Safety Research.

Redelmejer, D.A., & Tibshirani, R.J. (1997). Association between cellular telephone cause and motor vehicle accident. *The New England Journal of Medicine*, *336*, 453-458. doi: 10.1056/NEJM199702133360701.

Rietvald, P., & Shefer, D. (1998). Speed choice, speed variance, and speed limits: A second best instrument to correct for road transport externalities. *Journal of Transport Economics and Policy*, *32*(2), 187-202.

RMP (2008). Statistical report of road accidents Malaysia 2008. Kuala Lumpur: Bukit Aman Traffic Branch, Royal Malaysia Police.

RMP (2010). Statistical report of road accidents Malaysia 2010. Kuala Lumpur: Bukit Aman Traffic Branch, Royal Malaysia Police.

RMP (2011). Statistical report of road accidents Malaysia 2011. Kuala Lumpur: Bukit Aman Traffic Branch, Royal Malaysia Police.

Tasca, L. (2000). *A review of the literature review on aggressive driving research*. Paper presented at the 1st Global Web Conference on Aggressive Driving Issue. Retrieved from http://www.aggressive drivers.com/papers/tasca/tasca.pdf

WHO (2004). Risk factors. In Peden, M., & Scurfied, R. (Eds.), *World report on road traffic injury prevention* (pp. 133-158). Geneva: World Health Organization.

Wilde, G.J.S. (1988). Risk homeostasis theory and traffic accidents: Propositions, deductions and discussion of dissention in recent reactions. *Ergonomics*, *31*, 441–468. doi.org/10.1080/00140138808966691.

Wilde, G.J.S. (2001). *Target risk 2*: *A new psychology of safety and health - What works? What doesn't? And why?* Toronto: PDE Publications.

Young, M.S., Mahfoud, J.M., Walker, G.H., Jenkins, D.P., & Stanton, N.A. (2008). Crash dieting: The effects of eating and drinking on driving performance. *Accident Analysis & Prevention*, *40*, 142-148. doi.org/10.1016/j.aap.2007.04.012.

Zaal, D. (1994). *Traffic law enforcement: A review of the literature* (Report No. 53). Canberra: Federal Office of Road Safety.