MRR No. 145

Research Report

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Published by:

Malaysian Institute of Road Safety Research (MIROS)
Lot 125-135, Jalan TKS 1, Taman Kajang Sentral,
43000 Kajang, Selangor Darul Ehsan, Malaysia.

Perpustakaan Negara Malaysia Cataloguing-in-Publication Data

Evaluation of SHE COP practices of a single bus operator practicing one man operation during ops bersepadu Chinese New Year 2010 : research report / Mohd Rasid Osman ... [et al.]
ISBN 978-967-5967-38-2
1. Bus driving--Research--Malaysia. 2. Traffic safety--Research--Malaysia.
I. Mohd Rasid Osman, 1979-.
388.3220720595

Printed by : Malaysian Institute of Road Safety Research

Typeface : Myriad Pro Light
Font size : 11pt/15pt

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List of Abbreviations

ATM	Automated Teller Machine
CCTV	Closed-Circuit Television
CNY	Chinese New Year
COP	Code of Practice
CVLB	Commercial Vehicle Licensing Board
DOSH	Department of Occupational Safety and Health
IDB	Inappropriate Driving Behaviour
KTM	Keretapi Tanah Melayu
MIROS	Malaysian Institute of Road Safety Research
NAA	National Anti Drug Agency
OMO	One-Man Operation
PDCA	Plan Do Check Act
RMP	Royal Malaysian Police
RSD	Road Safety Department
RTD	Road Transport Department
POPEA	Policy, Organisation, Planning and Implementation, Evaluation and Action
SHE	Safety Health and Environment
WiFi	Wireless Fidelity

Project Contributors

Mohamad Sahidi Mushawir
Mohd Sukri Arifin

Acknowledgement

This study would not have been possible without the participation of Bus Operator A; to them we wish to place on record our thanks. We would also like to express our gratitude to all the agencies and individuals for their invaluable time and the important role they played in shaping this comprehensive report. The government agencies involved are the Royal Malaysian Police (RMP), Road Safety Department (RSD), Public Worts Department (PWD), Lembaga Lebuhraya Malaysia (LLM), Ministry of Transport (MOT), Road Transport Department (RTD), Commercial Vehicle Licensing Board (CVLB), Kementerian Pelajaran Malaysia, Ministry of Health (MOH), PUSPAKOM and PLUS Expressways Berhad (PEB).

Last but not least, we wish to extend our gratitude to the former Director-General of MIROS, Prof. Dr. Ahmad Farhan Mohd Sadullah; the former Director of Vehicle Safety and Biomechanic, Prof. Dr. Wong Shaw Voon; and the Research and Ethics Committee, Malaysian Institute of Road Safety Research (MIROS) for approving and funding the study and to all research assistants, enumerators, and drivers for their role in data collection. We are confident that this study will offer several compelling reasons for the continuation of the intervention strategies and the improvement of road safety in our nation.

Abstract

The Safety, Health and Environment (SHE) Code of Practice (COP) was initiated by the relevant agencies such as the Royal Malaysian Police (RMP), Department of Occupational Safety and Health (DOSH), Road Transport Department (RTD), Road Safety Department (RSD), Commercial Vehicle Licensing Board (CVLB), Bus Operators' Associations and Logistics Operators to ensure that bus operators take responsibility of the safety of their operation. SHE COP has been introduced as one of the road safety intervention programmes that guides bus operators in ensuring safety and health in their working environment. A study was conducted to determine the effectiveness of SHE COP implementation among selected bus operators that adopt a one-man operation. The first objective is to evaluate the level of implementation of SHE COP based on selected SHE Elements. The second objective is to evaluate the speed profile of the observed buses. The third objective is to assess facilities and services provided at bus terminals, and the fourth objective is to determine the relationship between certain SHE COP elements and the affected variables. The data was collected by MIROS researchers using a provided set of checklist, while the speed reading was recorded using portable Global Positioning System (GPS) units. The results show that the four widely practiced SHE COP elements are: the use of antiglare film, a uniform and shoes by the drivers, the use of dedicated tolls and platforms, and the availability of signages inside the bus. In addition, the results show that 46% of the buses travel faster than the maximum permissible speed on the highways (90 km/h), and all the maximum speed exceed the highway speed limit for buses. The observation at the terminals identified three elements which need to be addressed, namely, ticket touts, dedicated pedestrian pathways, and facilities for the disabled and senior citizens. The statistical analysis shows that there is no significant association between SHE COP elements and the selected variables.

1.0 Introduction

The Safety, Health and Environment (SHE) Code of Practice (COP) was developed by MIROS and relevant agencies such as the Royal Malaysian Police (RMP), Department of Occupational Safety and Health (DOSH), Road Transport Department (RTD), Road Safety Department (RSD), Commercial Vehicle Licensing Board (CVLB), Bus Operators' Associations and Logistics Operators to ensure that road transport operators take responsibility of the safety of their operation. SHE COP has been introduced as one of the road safety intervention programmes to guide bus operators in the implementation of safety and health in the working environment. SHE COP consists of five key elements: Policy, Organisation, Planning and Implementation, Evaluation and Action for continual improvement (MIROS 2007). This study focuses more on the Standard Operation Procedure (SOP) which falls under the Planning and Implementation element in the SHE COP. In this SOP there are procedures aimed at developing good driver management, vehicle management, journey and risk management and good data management (MIROS 2007).

This study was carried out during the 2010 Ops Bersepadu Chinese New Year (CNY) that was conducted from 8 to 22 February 2010. A similar study was periodically conducted during Ops Bersepadu in order to monitor and assess the implementation of the above mentioned SHE COP elements. Currently a few bus operators have requested to operate a one-man operation system due to the shortage of manpower. In terms of research interest, MIROS is conducting this study to evaluate the compliance of SHE COP elements among bus operators that practice the said one-man operation system.

A study conducted by Brown *et al.* (1972) identified the reason of a one-man operation by bus operators. The study stated that the one-man operation has been used successfully on rural routes for many years, but it has only recently begun to be used to a great extent on the more heavily used urban routes (particularly since the legalisation in 1966 of one-man operation of double-decker buses) to save costs. Generally, this one-man operation arose as one of the options to overcome staff shortage and to reduce labour requirement.

In Malaysia, one-man operation is only applicable for driving durations that do not exceed four hours of continuous driving or not exceeding 300 km. This is due to Rule 10b prohibition of drivers of goods vehicles or public service vehicles on driving exceeding four consecutive hours or 300 km (Rules of The Road, Road Traffic Rules 1959).

10B. Prohibition on drivers of goods vehicles or public service vehicles from driving more than four consecutive hours or three hundred kilometers.

(1) No driver shall drive a goods vehicle or public service vehicle on any road or highway more than four consecutive hours from the time he was driving the vehicle or more than three hundred kilometers from where he was driving the vehicle.

(2) Driver of a goods vehicle or public service vehicles who travel in excess of four consecutive hours or more than three hundred kilometers to have a second driver and the first driver to be replaced for every four hours or after three hundred kilometers.

(3) Four consecutive hours mentioned in subrule (1) and (2) shall include any rest time taken during that period.

(4) Notwithstanding subrule (1) and (2), a driver of goods vehicle or public vehicles is limited to driving for a period of eight hours in twenty-four hours.

(5) The driver of a goods vehicle or public vehicle shall record in a log book the movement of vehicles and replacement of the driver of the vehicle and driver needed to bring the log book with him in the vehicle.

In order for the bus operators to practice one-man operation for journey exceeding 300 km, the operators must follow the recommendation as stated clearly in SHE COP (MIROS 2007). Driving and working hours are the most important components that need to be followed by bus operators and their drivers in order to maintain drivers' fitness while driving. The elements for driving and working hours are:

1. maximum continuous driving hours is four hours;
2. total driving hours for a day is eight hours (maximum);
3. total working hours for a day is 12 hours (maximum);
4. for every four hours of driving, 30 minutes of rest is compulsory;
5. for every six working days, one rest day is compulsory; and
6. a minimum of 12 hours' rest before the start of the first journey.

The objective of the present study is to provide information on the level of SHE COP compliance among the express bus operators that practice one-man operation. The findings would give some recommendations for bus operators to improve their services and also as a source for updating or upgrading the current SHE COP.

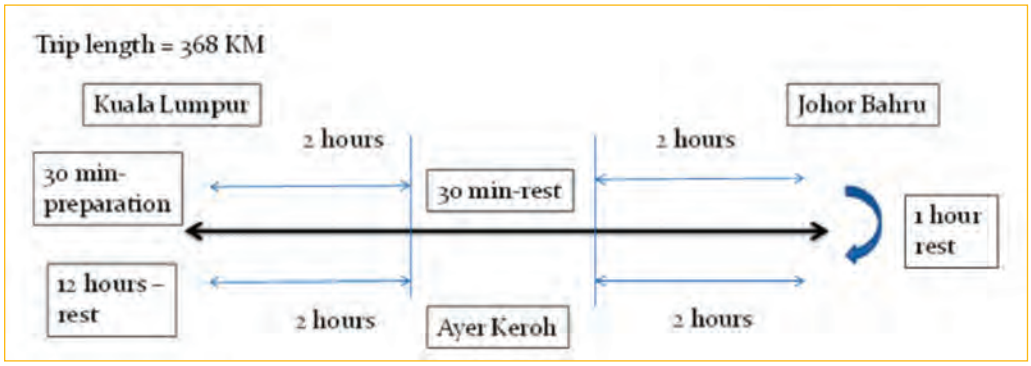

Figure 1 Recommendation of driving and working hour for one-man operation system if more than 300 km (*Source*: MIROS 2007)

1.1 Objectives

The objectives of this study are as follows.

1. General objective:

To study the compliance of SHE COP among operators of express buses in Malaysia that practice one-man operation (OMO).

2. Specific objectives:

i. To evaluate the level of implementation of SHE COP based on selected SHE elements.
ii. To evaluate the speed profile of the observed buses.
iii. To assess the facilities and services provided at bus terminals.
iv. To determine the relationship between certain SHE COP elements and the affected variables.

1.2 Limitation

1. The study only covers one bus operator that practices one-man operation for journeys of more than 300 km and more than four hours' journey per trip.
2. The results from this study would not represent the whole industry due to the fact that the collected data is based on only one bus company and not from the whole registered bus companies in Malaysia.
3. There is no result from other bus operators for comparison purposes.

2.0 Literature Review

2.1 Bus Operator A

Bus Operator A is one of the major players and engages primarily in the bus transportation system comprising stage and express bus operations within the Peninsular Malaysia. The stage and express bus operation provides the most extensive coverage throughout Peninsular Malaysia, covering almost all major cities and towns as well as Singapore. The nationwide network is serviced by a fleet of more than 1,500 buses that covers more than 250 routes, generating more than 1,000 trips daily and this translates to around 60 million passengers a year.

In 2008, Bus Operator A participated in a study with the Malaysian Institute of Road Safety Research (MIROS) on the project entitled 'The Effect of Driver Management System According to SHE COP in Reducing Speed Violations'. The study objective is to verify the effectiveness of SHE COP implementation in preventing speed violations.

2.2 SHE Elements

According to the SHE COP there are five main elements known as POPEA (Mohd Rasid *et al.* 2011) and the scope of this study is related to the third element which is Planning and Implementation. Within this element there are four sub-elements namely Driver Management, Vehicle Management, Routes Management and Documentation Management. In this study, the focus is on driver and vehicle management. Under the driver management sub-element, there are a few aspects to be observed.

2.2.1 Driving Hour Rules

The main aspect of driver management is the driving hour or the work schedule for a driver because of its obvious relation to driver fatigue. Driver fatigue is one of the biggest causes of crashes involving heavy vehicles. Currently, there is no literature that describes and compares the advantages and disadvantages of single manned and multi-manned commercial vehicles other than in terms of its economic benefits. However, the international best practice is to have a regulation on the duration of service for all commercial vehicle drivers. In general for a single-manned or one-man operation the maximum working hours in a day is 15 hours which includes driving and other activities. Table 1 shows the summary of the driving hour rules and duration of service rules in the United States, Europe and Australia.

Table 1 Summary of drivers' hours rules in the United States, Europe and Australia (*Source*: Rules on Drivers' Hours and Tachographs 2007)

United States[a]	Europe[b]	Australia[c]
15-hour on-duty limit May not drive after having been on duty for 15 hours, following eight consecutive hours off duty. Off-duty time is not included in the 15-hour period.	**12 to 15 hours maximum daily working hour (driving + other work + break)** A continuous rest period of at least nine hours	**Maximum daily working hours of 12 hours** Seven continuous hours stationary rest
10-hour driving limit May drive a maximum of 10 hours after eight consecutive hours off duty.	**Nine hours maximum daily driving hours** A continuous rest period of at least nine hours	
60/70-hour on-duty limit May not drive after 60/70 hours on duty in seven/eight consecutive days.	**The maximum weekly driving limit is 56 hours**	**In any period of seven days (168 hours)** Six multiply by night rest breaks

[a] United States Department of Transportation, Federal Motor Carrier Safety Administration Part 395.5: Maximum driving time for passenger-carrying vehicles (2005)
[b] Rules on Drivers' Hours and Tachographs, Passenger-carrying vehicles in the UK and Europe (2007)
[c] Heavy vehicle driver handbook, New South Wales Government, RTA/Pub. 07.353 (2009)

A few crash studies show an increase in crash risks with the increase in the hours of driving. Campbell (2002) concludes that the relative risk of fatigue in a fatal accident "gradually increases during the first eight hours, doubles after the ninth hour and is higher by a factor of six by the 12th hour." Moreover, Frith (1994) shows that a crash is 2.6 times more likely to happen if the drivers have driven eight or more hours. In Malaysia, it was found out that 50% of the drivers would experience fatigue as early as 6.2 hours of driving if they work for 12 hours (Norlen *et al.* 2008).

2.2.2 Inappropriate Driving Behaviour (IDB)

Inappropriate driving behaviours commonly exhibited by drivers include tailgating, careless lane changing, driving at an inappropriate speed and failure to obey traffic signals. According to Leistikow (2000) road traffic accidents could be caused by distractions and impairment in attention during driving due to smoking. Nicotine deprivation from the cigarettes may directly impair attention as well as cognitive responses (Heishman 1998). Nicotine may also increase stress level and this would lead to an increase in aggressive behaviour (Verona 2008) that could evoke road rage responses (James, 1997). Furthermore, the smoke, ashes and/or burning embers from the smouldering cigarettes may reduce vision range as well as affect the smokers' attention during high-risk tasks such as driving. Leistikow *et al.* (2000) reported that many smokers have difficulty in coping with a smouldering cigarette when one is accidentally dropped onto their lap while driving. Thus, it is proven that smoking while driving is a danger – at least as hazardous as some other distractions that have been banned such as the use of hand phone whilst driving.

NHTSA survey (Harris 1999) on unsafe driving behaviours found out that tailgating is the second most common IDB committed after weaving. Tailgating is a common poor driving behaviour that is very dangerous and irritating to other drivers. Existing studies have shown the relationships between driver stress, frustration, irritation, negative mood and tailgating.

A study on motorcar vehicles revealed that tailgating occurs frequently in frustrating conditions that elicit anger in drivers especially under time pressing situations (Hennessy and Wiesenthal 1997). As for bus drivers, making up for lost time is the primary reason drivers gave for this unsafe behaviour. In addition, 46% of drivers force themselves to rush in order to maintain operational schedules, with 57% admitting to exceeding speed limits regularly in the suburbs, and 15% of drivers confessing to ignoring local traffic regulations occasionally or regularly (Meijman and Kompier 1998). This behaviour could lead to rear-end collisions in vehicle crashes. In Malaysia, rear-end collisions account for 30% of vehicle crashes and over 12.7% of the fatal traffic crashes in 2008 (RMP 2008) Royal Malaysia Police (PDRM)(2008), Statistical report of road accidents in Malaysia Traffic Branch, Bukit Aman, Kuala Lumpur.

Breaking the speed limits is a serious traffic offence. There is evidence that excessive speed leads to an increased frequency and severity in road traffic crashes. In the United Kingdom, exceeding the speed limit is endemic (DETR 2000) Department of the Environment, Transport and the Regions (2000) New Directions in Speed Management: A Review of Policy, London and it is believed that speeding is acceptable, particularly on highways (Lex Service 1997). A study by Rudin-Brown (2006) shows that drivers of tall vehicles tend to drive faster when they are not able to refer to the speedometer, as they view the road from higher ocular-height as compared to passenger car drivers. The drivers need to be educated since low driving speed is effective in reducing the frequency of collision. For every one mile per hour (mph) reduction in the average speed, the risk of collisions is reduced between 2% and 7% (Taylor *et al.* 2000). Hence, excessive speeding behaviour among drivers can be a major determinant of road traffic accidents. Therefore, it is vital to identify and prevent speeding among commercial bus drivers.

Overtaking, when prohibited on certain sections of the road can improve the safety margin in various ways by reducing the risk of accidents involving overtaking and also by increasing following distance and distance from the centre line. A study by Farber and Silver (1967) suggested that drivers are able to make good judgments regarding the distance of an oncoming car, but are unable to respond effectively to the oncoming vehicle's speed, suggesting problems with speed perception among drivers. This is the main reason why overtaking accidents is a serious problem on single-carriageway trunk roads, where vehicle occupant deaths are at their highest (PACTS 1994). Drivers' perception of the road environment is also a factor in road traffic accidents. In addition, drivers show little or no reduction in speed during conditions of reduced visibility caused by the road geometry, for example when overtaking in the vicinity of bends, dips in the road and hill crests (Hills 1980).

Talking on mobile phones is a possible safety hazard during driving as conversing can distract the driver. In fact, the relative risk of being involved in accidents is 38% higher for mobile phone users than for those who do not use it while driving (Ishigami and Klein 2009; Laberge-Nadeau *et al.* 2003). Moreover, a study conducted by Redelmeier and Tibshirani (1997) shows that the risk of getting involved in a collision is four times higher when using a mobile phone as compared to when a mobile phone is not used. Referring to Ontario Medical Association (OMA) (2008), over 30 countries have banned the use of hand-held devices while driving due to the increase in the risk of traffic collision. Australia, Italy, England (Goodman *et al.* 1997), Brazil, Israel, Portugal and Iran (Mohamaddi 2008) have established laws against the use of mobile phones while driving (Matthews *et al.* 2003).

Cognitive competition between driving and operating a mobile phone can contribute to accidents. Matthews *et al.* (2003) and Schneider *et al.* (1984) said in their studies that a person's ability to divide their attention between two simultaneous tasks is generally limited to one task requiring conscious effort

(controlled processing) and one or more tasks requiring little or no conscious effort (automated processing). Crash reports have shown some of the incidents related to mobile-phone-related crashes are inattention to the traffic, veering and striking of another vehicle, failure to give way, failure to stop and running off the road (Mohammadi 2009; NHTSA 1997 and 2003). Thus, it is vital to evaluate the extent of mobile phone use by commercial vehicle drivers in Malaysia, especially bus drivers, as the lives of many passengers are at stake.

Red light running is an aggressive act 'that allows the frustrated driver to move ahead at the cost of infringing on other road users' rights (Shinar 1998). It is a serious traffic hazard at signalised intersections which can result in numerous road crashes (Huang and Hoong 2009; McGee 2003). Red light running is the cause of 22% of urban crashes (Retting *et al.* 1995). In Malaysia, the number of accidents related to red light running for year 2008 is 2.3% (RMP 2008).

A study conducted by Retting and Williams (1996) found out that red light runners as a group who are younger, less likely to use the seatbelt, and had poorer driving records than drivers who stop at red lights. Moreover, red light runners are more than three times as likely as compliers to have multiple prior speeding convictions. Besides the situation, frequent unavoidable violations of red light may be caused by driver's inability to stop or inattention. The violation is committed by a driver who either believes that he or she is unable to safely stop and consciously decides to run the red, or is unaware of the need to stop (Bonneson and Zimmerman 2004).

2.2.3 Bus Terminal

In this study, facilities and services of bus terminals were assessed for safety and convenience. In Bus Stop Safety and Design Guidelines, the design of a bus stop can affect a person's actual or perceived sense of safety, comfort and convenience (Kimley-Horn and Associates 2004). The design

of bus stop and provision of facilities that enhance security and comfort plays a significant role in a person's decision to use transit. In the Intermodal Transport Interchange For London Best Practice Guidelines (Tfl 2001) suggested that provision of facilities and security for waiting passengers as well as handicapped passengers at interchanges should be considered depending on the passenger volume, typical waiting time, and local condition. The facilities are clear signage (signage should be clearly and consistently identified to provide guidance and reassurance), weather protection and heating, seats, luggage, information centre; help points, telephones, toilets, clocks and parking. In addition to the facilities and security, provision of supplementary facilities or services such as shops, cafe, post office, cash machine, and internet services is a good practice.

3.0 Methodology

This study was conducted during Ops Chinese New Year (CNY) 2010 over a two-week period from 6 to 22 February 2010. The design of this study is generally similar to the previous Ops Bersepadu. However, this present study only focused on bus operators' implementation of SHE COP as well as One-Man Operation (OMO). OMO is defined as buses which travel a distance that is not more than 300 km and/or with the travelling time of less than four hours per trip, driven by one driver. The selection of the sample for this study was carried out using a simple random sampling on listed routes implementing OMO during Ops CNY provided by the sample company. The sample consists of selected routes that were manned by OMO of the said company.

Figure 2 shows the overall flow of the study. Data collection was carried out by MIROS' researchers following a set of checklist regarding compliance to selected elements of the SHE COP. The

researchers were required to observe and assess three elements of SHE COP; vehicle management, journey management, and driver management as well as the facilities and services provided at the terminals.

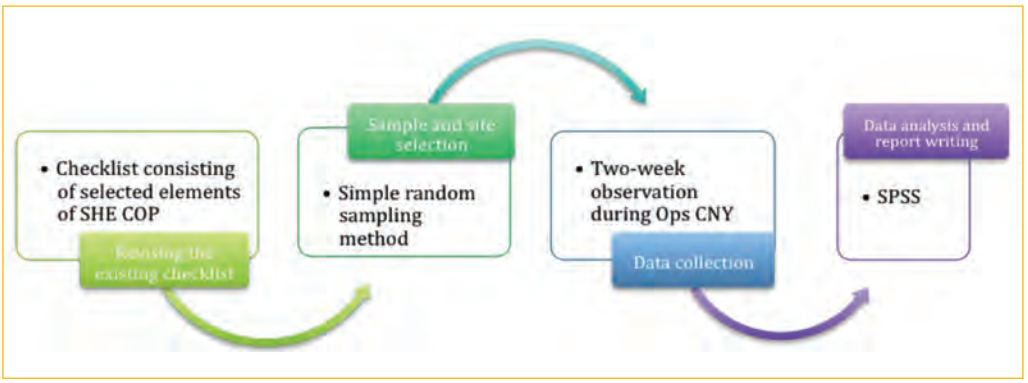

Figure 2 Methodology framework

The above mentioned SHE COP elements and terminals are categorised into four sections in the checklist which are;

- Section 1: Vehicle Inspection Evaluation,
- Section 2: Details of Journey,
- Section 3: Journey and Driver Evaluation, and
- Section 4: Terminal Observation.

To complete the checklist, MIROS' personnel were firstly required to observe all the facilities and services provided for the users at the terminals before departure. Then, the researchers were made to observe the pre-departure inspection done by the related government agencies' officers on each bus before the buses began their journey. The entire journey was observed by the personnel to complete the assessment on journey management and driver management. Moreover, each researcher is provided with a portable Global Positioning System (GPS) to record the speed of the respective buses for the entire journey.

Analyses were carried out according to the objectives of the study. In addition, descriptive analysis and cross tabulation were performed to acquire the distribution and profiles of the data. Finally, a report was produced to present all findings and to highlight the outcomes of the study to the stakeholders and respective related agencies. Conclusions were then made and some recommendations were proposed in order to improve the implementation of SHE COP in the road transportation industry.

4.0 Results and Discussions

This section discusses the results of this study. It is divided into sections on the distribution of sample, SHE COP elements, facilities and services, driving behaviour and practices, pre-departure inspections, assessment of bus terminals, and distribution of variables.

4.1 Distribution of Samples

Figure 3 shows the tabulation of three bus companies under Bus Operator A that were observed in this study. The total number of observed buses is 94.

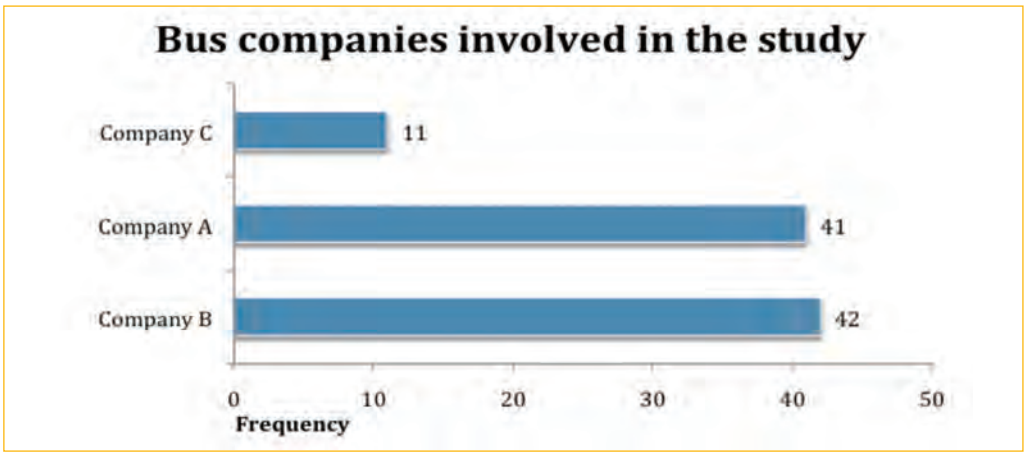

Figure 3 Bus companies observed in the study

The present study is focused on Bus Operator A which practices one-man operation on long distance trips for certain routes. A long distance trip is defined as a trip covering the distance of more than 300 km or exceeding four hours' driving time. A one-man operation indicates the use of only one bus driver in a trip.

Figure 4 shows the number of drivers per trip for the three different companies. It can be seen that, 64 out of 94 routes is manned by one-man operations.

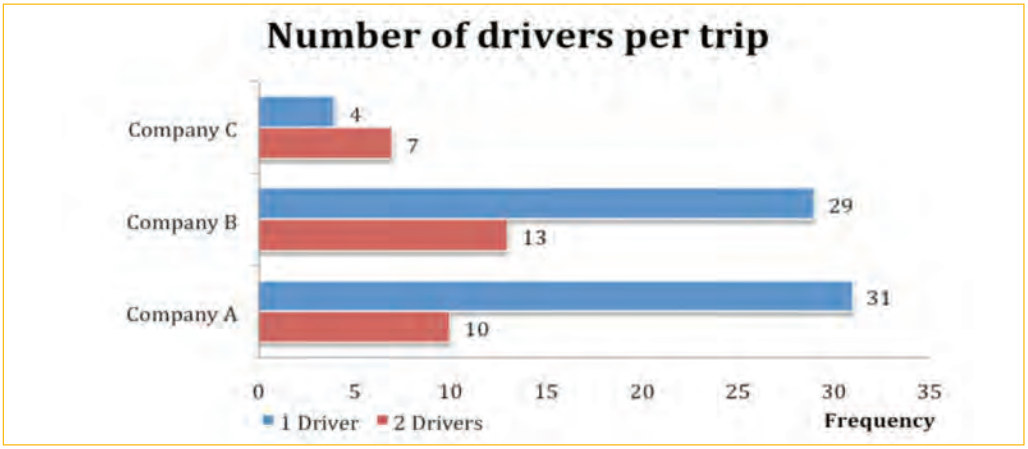

Figure 4 Number of drivers per trip

4.2 SHE COP Elements

Figure 5 shows the compliance of the buses and drivers to selected SHE elements. The elements are the use of antiglare film, uniform and shoes by drivers, designated tolls and platforms, availability of signages inside the buses, use of dedicated luggage storage, and functionality of lamp. In addition, it was observed that the use of illegal, makeshift cruise control tools such as bricks, brooms and rocks is still being practiced although the number is small. Only seven out of the 94 observed buses were found to possess these tools in the drivers' compartment. It can be seen that a large proportion of the buses' emergency exits have reduced effective pathway. The availability of first aid kits is not satisfactory since a majority of the buses are not furnished with them.

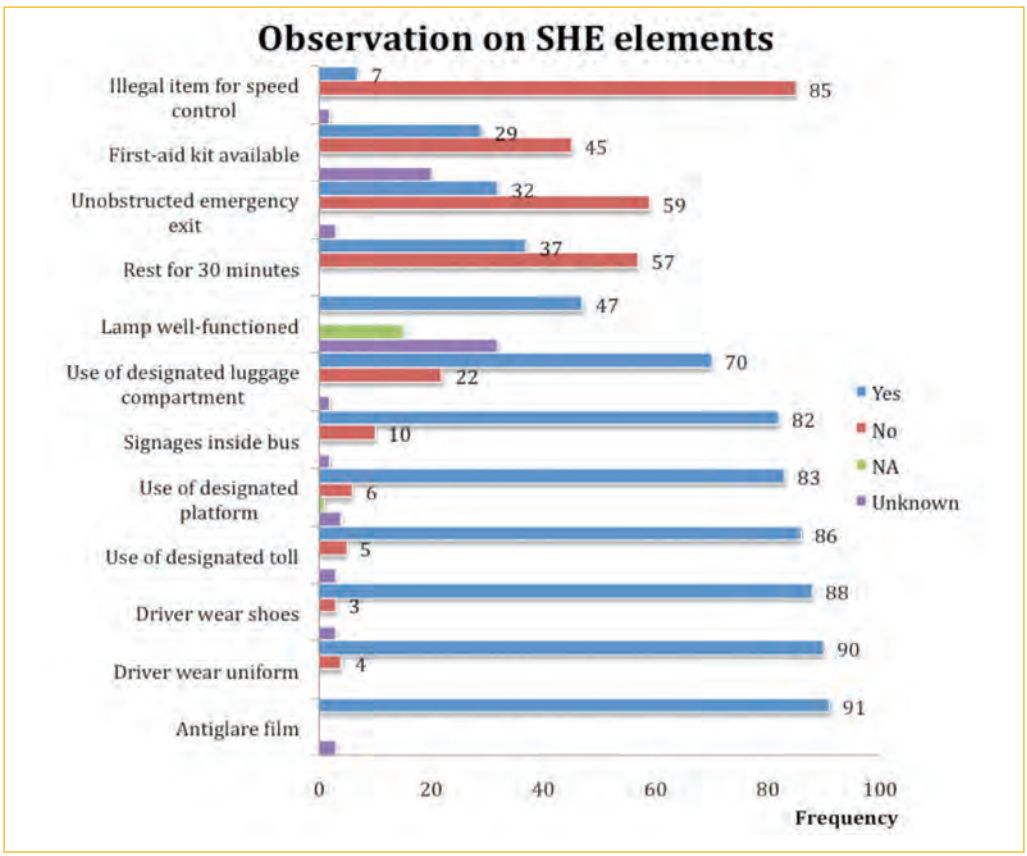

Figure 5 Observation of selected SHE elements

From Figure 6, it can be observed that more than 50% of buses are installed with seatbelts for the driver, front row seats and other seats. In addition, although seatbelts are available, only a few drivers and none of the front passengers were using them. The gap in compliance is not acceptable because the use of seatbelt is compulsory for drivers and the front row passengers.

It was also observed that the displaying of emergency hotline number is very limited and this should be quickly improved (Figure 7). A majority of the buses did not display the emergency number and this is not a good practice and needs to be remedied immediately. From the observation, 50% of the buses display the customer service number, and this practice needs to be maintained or improved upon.

The percentage of fire extinguisher availability is high, however most of the fire extinguishers are hidden and are difficult to access (Figure 8). The companies need to ensure that fire extinguishers should be made available and easily accessible.

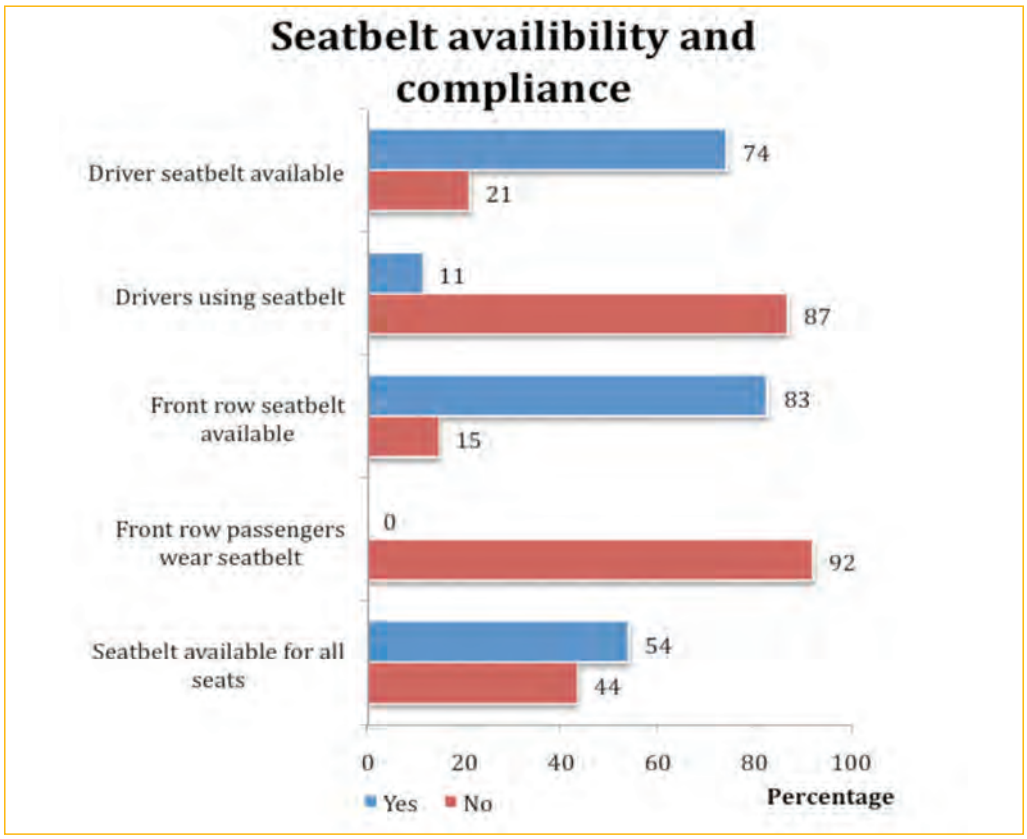

Figure 6 Seatbelt availability and compliance

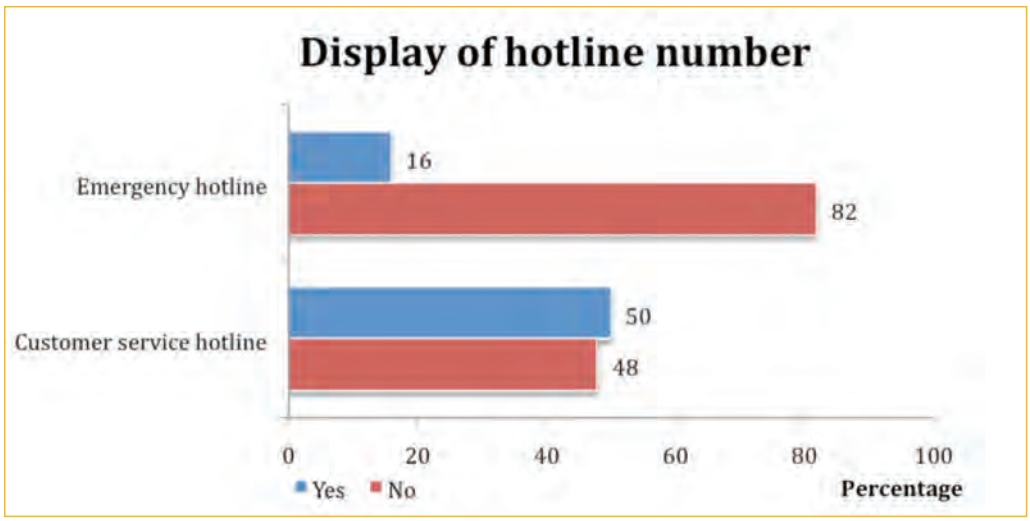

Figure 7 Display of hotline number

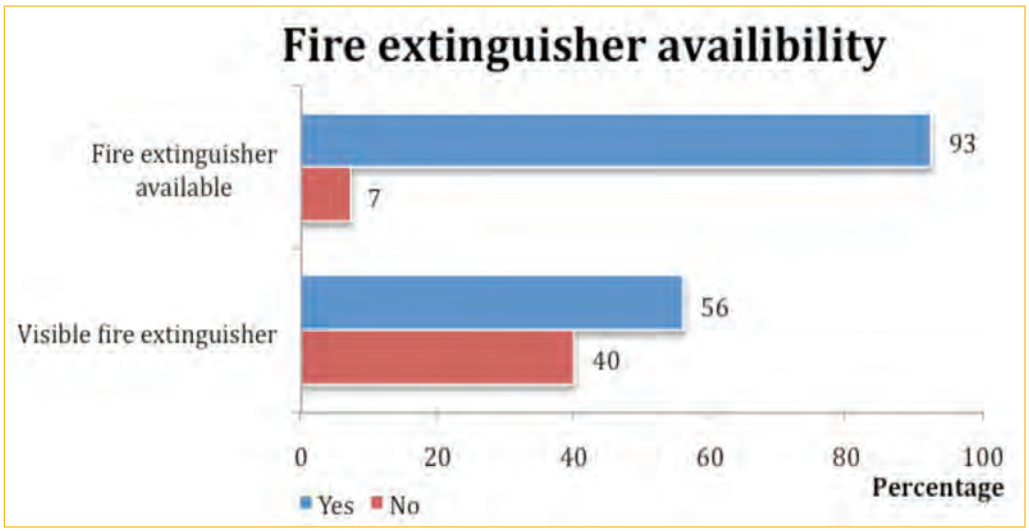

Figure 8 Fire extinguisher availability

4.3 Facilities and Services

Figure 9 shows the observers' perception on the housekeeping of the buses. Most of the observers are satisfied with the cleanliness of the buses (either interior or exterior), seats' adjustability, safety during the journey, legroom and the interior temperature of the buses. In terms of departure times, a majority of the observers agreed that the buses were not punctual most of the time.

A significant number of observers experienced vibrations while travelling on the buses. This indicated that many of the buses were either not well maintained or had reached the end of their service life.

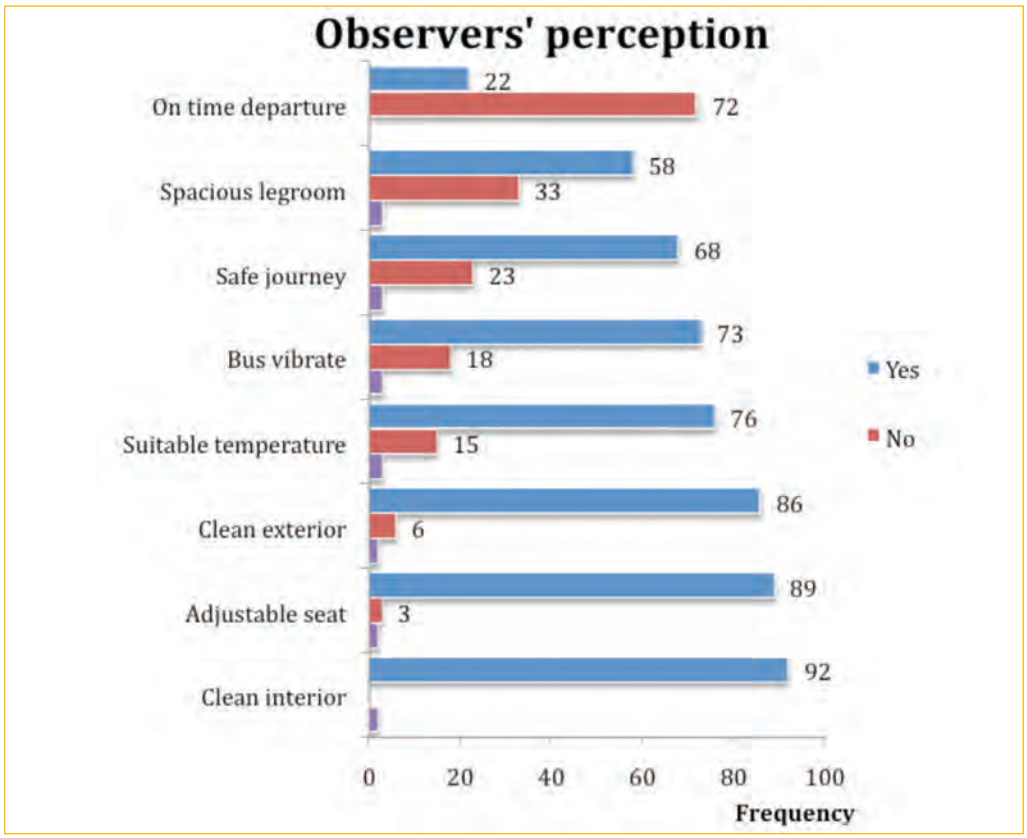

Figure 9 Observers' perception of bus services and facilities

4.4 Driving Behaviour and Practices

Table 2 shows the categories of Inappropriate Driving Behaviours (IDB) as observed during the study. Picking and dropping passengers outside of assigned terminals, sudden braking, overtaking at prohibited areas, tailgating, the use of a mobile phone, changing lanes without signal, and dangerous overtaking are the seven highest categories. Dropping and picking passengers outside of the assigned terminals are unsafe practices and should be stopped. Harsh braking, the use of hand phone and smoking while driving, tailgating and reckless overtaking are quite frequent. These unsafe behaviours can lead to accidents.

Table 2 Inappropriate driving behaviours

Style of driving	Frequency
Picking/dropping passengers outside assigned terminal	42
Harsh braking	28
Overtaking at prohibited areas	17
Tailgating	14
Using hand phone while driving	11
Changing lanes without signal	7
Overtaking dangerously	7
Smoking while driving	5
Weaving	4
Use of emergency lane	1
Sleepy	1
Queue jumping	1
Red-light running	1
Overtaking at double line	0

Figure 10 shows parts of the journey during which the drivers speed. It can be generalised that the drivers are not perceived by the observers as speeding throughout the whole journey but only on certain occasions. Based on the samples, the percentage of speeding throughout entire journey is low (6%), which is similar with the percentage of "part of the journey". Although the speed of the buses is difficult to be verified quantitatively, most of the observers felt that the drivers had been driving at high speed.

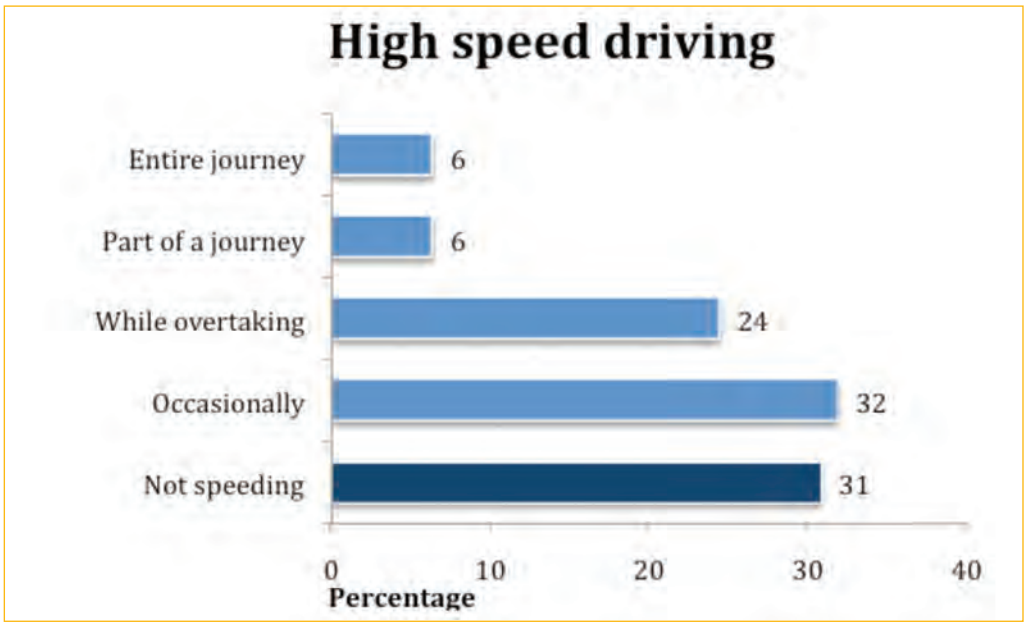

Figure 10 Observation of speeding

Figure 11 shows the manually calculated average speed for all the buses. It can be seen that 40% of the buses had travelled faster than the speed limit of 90 km/h. In addition, 12% of the buses were travelling at a speed of more than 100 km/h.

Figure 12 shows the average speed for the whole journey of the selected buses as measured by the GPS. On these selected buses, GPS devices carried by the observers were used to measure the average and maximum speed. The mean value for the average speed is 82 km/h which is just below the speed limit. 40% of the buses have an average speed exceeding 90 km/h, but the average values are low since the measurement is from the departure place to arrival point and not between two expressway toll gates.

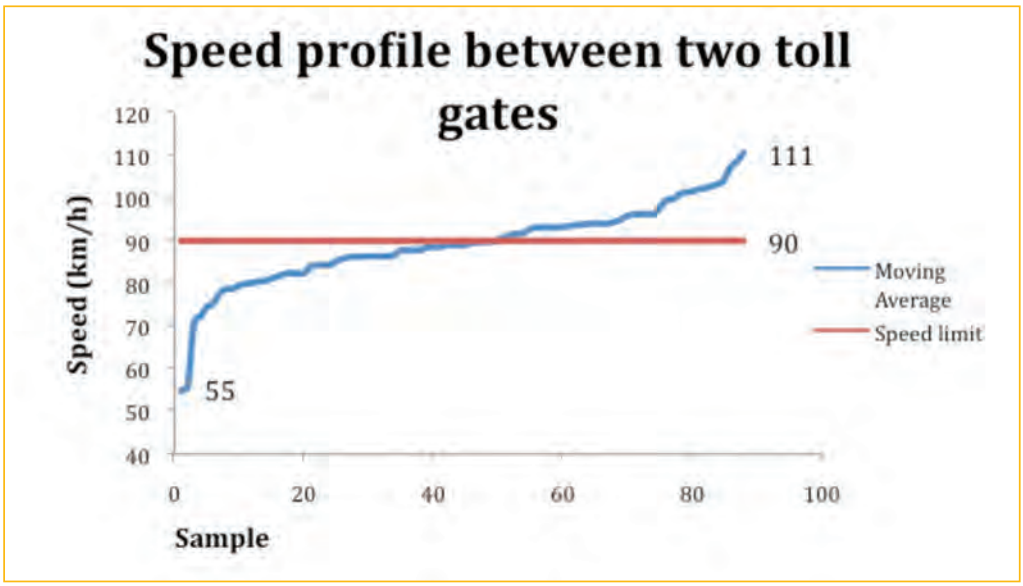

Figure 11 Calculated average speed of buses

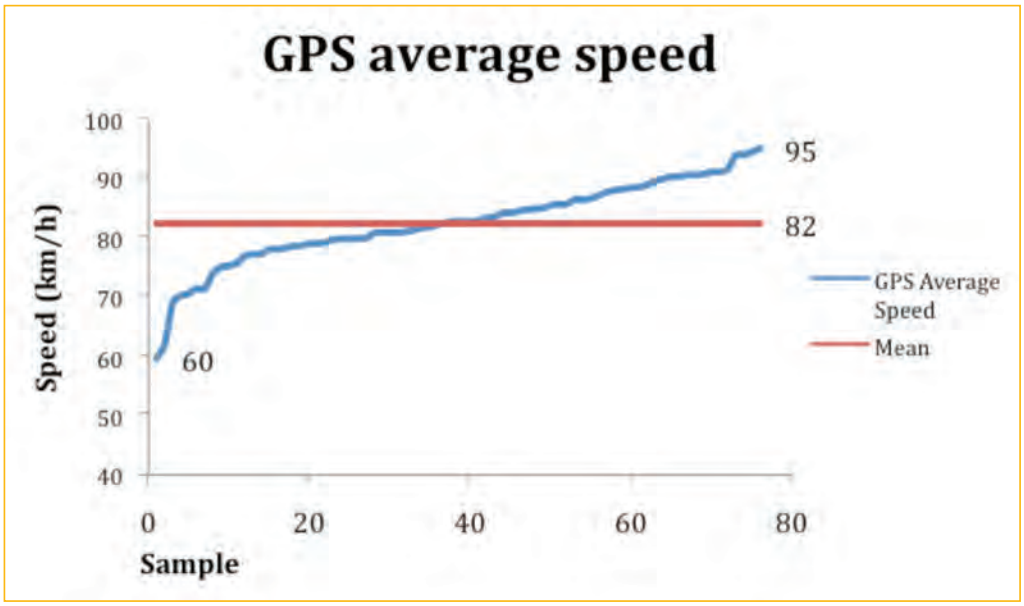

Figure 12 GPS average speed

Figure 13 shows the maximum speed recorded on the GPS. The mean value of the maximum speed is 114 km/h. It can also be seen that the lowest maximum speed is 98 km/h and the highest is 130 km/h. Clearly all the maximum speeds exceed the highway speed limit for buses. However, these results do not indicate the occasion and duration during which the buses were moving at the maximum speed. All the maximum speed is more than the allowable maximum speed limit on the highway.

Figure 14 shows the average speed of driving. More than 30% of the journeys have an average speed exceeding 90 km/h, which is the speed limit. In addition, 1% of them have an average speed exceeding 110 km/h.

Figure 15 shows the percentage of the drivers who wore their uniforms. 96% of the drivers complied with this requirement of the SHE COP. This practice is commendable and should be adopted by all bus operators.

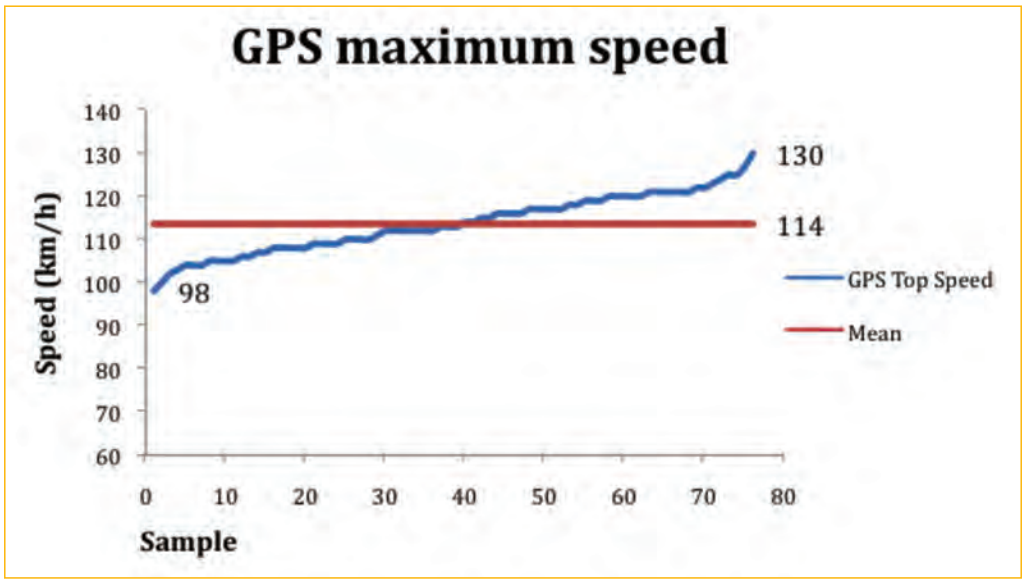

Figure 13 GPS maximum speed

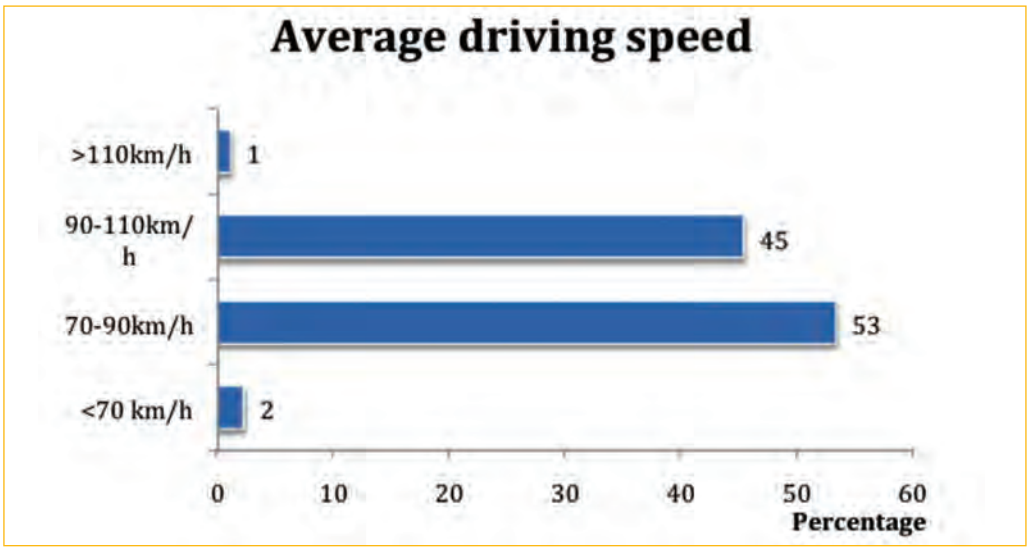

Figure 14 Average speed

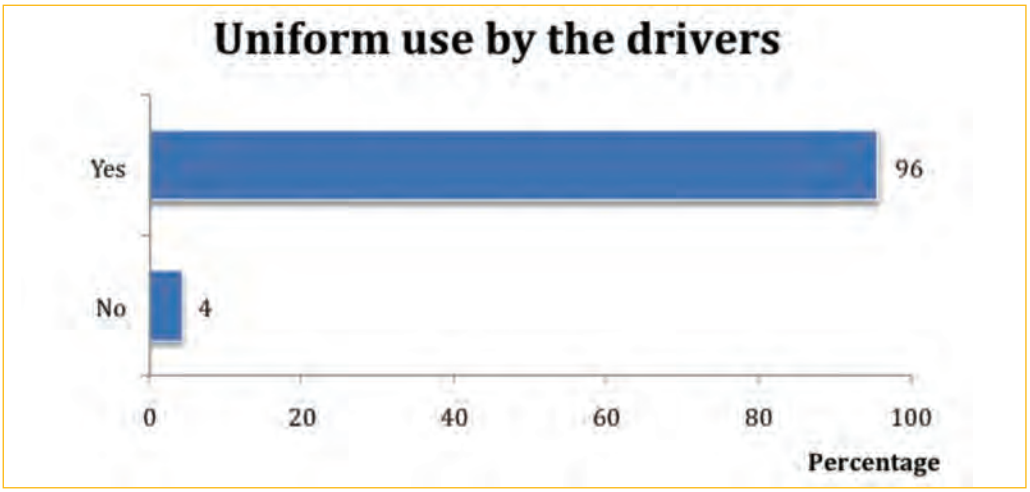

Figure 15 Percentage of drivers who wore uniforms

4.5 Pre-departure Inspections

Table 3 shows related government agencies officers' activities that have been observed at the listed terminals. From the diagram, the officers were visible at the terminals only 27% of the time. It is noted that, although the officers were available at the terminals,

most of them did not conduct the pre-departure inspection. It can be seen that the presence of the officers is inconsistent. This might be due to the duty schedule of officers being different for different terminals.

Table 3 Officers availability

Terminal	Frequency	Yes	No	Unknown
Puduraya	33	6	20	7
Larkin	25	8	16	1
Sungai Nibong	10	6	3	1
Seremban	8	2	6	0
KTM Kuala Lumpur	5	3	4	1
Kulim	3	0	1	2
Mersing	2	0	0	2
Parit Buntar	2	2	0	0
Pasir Gudang	2	0	2	0
Others	4	1	3	0

4.6 Assessment of Bus Terminals

An assessment of bus terminals was conducted using a checklist. Table 4 shows the status of basic facilities/characteristics among the assessed bus terminals. It can be seen that there are five main items that need to be addressed. They are:

1. dedicated pedestrian pathways;
2. facilities for the disabled/senior citizens;
3. rest facilities for drivers;
4. ticket touts; and
5. availability of terminal supervisors.

Table 5 shows the availability of supplementary facilities made available at the assessed terminals. It can be seen that Puduraya and Larkin offer most of the assessed facilities.

Table 4 Availability of compulsory facilities/characteristics at selected assessed bus terminals

Terminal / Terminal characteristics	Butterworth	KTM	Kuantan	Kulim	Larkin	Mersing	Pasir Gudang	Puduraya	Seremban	Sg. Nibong	Shah Alam
Strategic location	✓	○	✓	✓	✓	✓	○	✓	✓	✓	○
Organised platform	✓	○	✓	✓	✓	✓	✓	✓	✓	✓	○
Ticket touts	✓	○	○	○	✓	○	○	✓	○	○	○
Dedicated pick up/drop off points	✓	○	○	✓	✓	✓	✓	✓	✓	✓	○
Defined pathway for pedestrians	○	○	✓	○	○	✓	○	✓	○	○	○
Availability of terminal's supervisor	✓	○	○	○	✓	○	○	✓	✓	✓	○
Easily accessible ticket counters	✓	✓	✓	✓	✓	✓	○	✓	✓	✓	✓
Effective signages	✓	○	✓	✓	✓	○	✓	✓	✓	✓	✓
Comfortable waiting area	○	✓	○	✓	○	✓	○	✓	✓	✓	○
Facilities for disabled/senior citizens	○	○	○	○	○	○	○	○	○	✓	○
Rest facilities for drivers	○	○	○	○	○	○	○	○	○	○	○
Easy accessibility to other public transport	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Facilities for enforcement officers	✓	○	○	○	✓	✓	○	✓	○	○	○

✓ = Fulfilled ○ = Not fulfilled

Table 5 Availability of supplementary facilities at selected assessed bus terminals

Terminal / Facilities	Butterworth	KTM	Kuantan	Kulim	Larkin	Mersing	Pasir Gudang	Puduraya	Seremban	Sg. Nibong	Shah Alam
Prayer room	✓	O	✓	✓	✓	✓	✓	✓	✓	✓	✓
Restroom	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Shopping centre	O	O	O	O	✓	✓	✓	✓	✓	O	O
Public phone	✓	O	✓	✓	✓	✓	✓	✓	✓	✓	✓
Post office	O	O	✓	O	✓	✓	O	✓	O	O	O
Money changer	O	O	O	O	✓	O	O	✓	O	O	O
Information counter	✓	✓	✓	O	✓	O	✓	✓	✓	✓	O
Complaints counter	✓	✓	O	O	✓	O	O	✓	O	O	O
Baggage storage facility	O	O	O	✓	✓	O	O	✓	✓	O	O
ATM	O	O	✓	O	✓	O	O	✓	✓	O	O
WiFi	O	✓	O	O	✓	O	O	O	✓	O	O
Public parking	✓	O	✓	✓	✓	✓	✓	✓	✓	O	✓
CCTV	O	O	O	O	✓	O	O	✓	O	O	O
Security monitoring services	✓	O	O	O	✓	O	O	✓	✓	O	O

✓ = Available O = Not available

4.7 Distribution of Variables

Table 6 shows the cross tabulation of officers' availability by speeding and IDB. From the table, the data shows that the percentage of speeding is more than 50% when officers are

absent. However the association between the two variables is not significant with the *p* value more than 0.05 (*p*=0.69). The data shows a similar trend since the percentage of IDBs is more than 50% when officers are absent. Similarly the association between the two variables is not significant with a *p* value of more than 0.05 (*p*=0.63).

Table 6 Cross tabulation of officers by speeding and IDB

		Speeding		IDB		Total
		Yes	No	Yes	No	
Officers	Presence n, (%)	16(28.1)	9(24.3)	18(25.4)	7(30.4)	25(26.6)
	Absence n, (%)	41(71.9)	28(75.7)	53(74.6)	16(69.6)	69(73.4)
Total		57(100.0)	37(100.0)	23(100.0)	71(100.0)	23(100.0)

$p > 0.05$

Table 7 shows the cross tabulation of on time departure by speeding and IDB. From the table, the data shows that the percentage of speeding is 78.9% when the buses did not depart on time. This finding is expected since drivers tend to speed when they do not depart on time. This is supported by Meijman and Kompier (1998) who found out that 46% of the drivers force themselves to rush in order to maintain the running schedule. In addition, 57% admitted to regularly exceeding the speed limit in the suburbs. However the association between the two variables is not significant with a *p* value more than 0.05 (*p*=0.50). For cross tabulation between on-time departure and IDBs, the data shows a similar trend since the percentage of IDBs is more than 50% when the buses did not depart on time. Similarly the association between the two variables is not significant with a *p* value of more than 0.05 (*p*=0.83).

Table 7 Cross tabulation of on time departure by speeding and IDB

		Speeding		IDB		Total
		Yes	No	Yes	No	
On time	Yes n (%)	12(21.1)	10(27.0)	17(23.9)	5(21.7)	22(23.4)
	No n (%)	45(78.9)	27(73.0)	54(76.1)	18(78.3)	72(76.6)
Total		57(100.0)	37(100.0)	71(100.0)	23(100.0)	94(100.0)

$p > 0.05$

5.0 Conclusions and Recommendations

This study has achieved its three objectives. The first objective relates to the level of implementation of the SHE Code of Practice for a specific express bus operator. The evaluation is based on the compliance with selected SHE elements. From the observation, it was found out that the SHE COP elements that are widely practiced include the use of antiglare film, uniform and shoes by the drivers, the use of dedicated tolls and platforms, availability of signages inside the bus, the use of dedicated luggage storage, and properly functioning lights. In addition to this, it was observed that the use of illegal makeshift cruise control tools such as bricks, brooms and rocks are quite prevalent. However, the following needs attention; drivers who do not use their seatbelts, the failure to use front row passengers' seatbelts, use of driver seatbelts, and the displaying of emergency hotline number.

The second objective is to evaluate the speed profile of the express buses. The results show that 46% of the buses were travelling faster than the maximum permissible speed on the highways (90 km/h). It can be seen that all the maximum speed of the buses had exceeded the highway speed limit for buses.

The third objective is related to the assessment of bus terminals in terms of facilities and terminals. From the findings, five elements need to be addressed; ticket touts, dedicated pedestrian pathways, facilities for the disabled and senior citizens, rest facilities for bus drivers, and availability of a terminal supervisor.

The fourth objective is to determine the relationship between certain SHE COP elements and the affected variables. It can be seen that there is no significant association between the SHE COP elements and the selected variables.

As a consequence of this study, the following recommendations are proposed.

1. The higher management of any bus company should improve the awareness on SHE practices in their operations such as the use of seatbelts for drivers and front row passengers, the displaying of emergency and customer service hotlines and easily visible, accessible fire extinguishers, and the speed of their drivers.
2. The prohibition of hand phone use and smoking while driving must be enforced by the company.
3. Better facilities are provided at bus terminals and the menace of ticket touts are addressed by terminal authorities and the relevant enforcement agencies.
4. Any practice of OMO should be implemented together with all elements of SHE to ensure total safety of the bus operations.

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Research Report

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ISBN 978-967-5967-38-2

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