

DEVELOPMENT OF DISTRACTION RISK INDEX (DRI) AMONG THE
INTRASTATE BUS DRIVERS IN KUALA LUMPUR, MALAYSIA

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To my precious Allah S.W.T,

Who gives me new life, hope and the purpose of life.

To my beloved father and mother,

Mr. Mohd Yunos Bin Abdullah and Madam Noraini Binti Md Said

For their support throughout my whole life.

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May the Almighty bless us.

ABSTRACT

Driver distraction has been found as one of the main causes of accident all around the world. Driver distraction represents a significant problem to personal driving as well as the public transportation sector. However, the sources of distraction especially in the context of public transport have yet to be widely explored. Thus, the objectives of this research are to identify the sources and investigate the categories of distraction among the intrastate bus drivers. Subsequently, Distraction Risk Index (DRI) would be developed to obtain the risk level of the sources of distraction among the intrastate bus drivers. This study had conducted focus group interview among 16 participants which included eight participants from expert management and eight participants from expert practitioner. In addition, this study has conducted survey method as well and the questionnaires were distributed to 215 respondents which are intrastate bus drivers from a prominent intrastate bus services company in Kuala Lumpur. From this research, it was found that there are 26 sources of distraction which had been discovered from the focus group interview. These sources of distraction are then used in the survey method. From the survey method, there are 6 categories of distraction being found and the most dominant categories are human factor which have 14.06 percentage of variance. Human factor consists of three sources of distraction which are driver's health, comfortability of the driver's seat and condition of the bus. Distraction Risk Index (DRI) had been developed and it was found that there are four sources of distraction that were classified as very high risk. These include the condition of the bus, traffic congestion, driver's welfare and driver's health. The result from this research could be used as a platform for future improvement on intrastate bus services company. In addition, it could provide assistance to future researchers to design and provide solution to overcome sources of distraction.

ABSTRAK

Gangguan terhadap pemandu telah dikenalpasti sebagai salah satu punca utama kemalangan yang berlaku di seluruh dunia. Gangguan terhadap pemandu merujuk kepada masalah ketara yang berlaku untuk kenderaan peribadi pengangkutan awam. Walau bagaimana pun, faktor-faktor gangguan terutama yang berkaitan dengan pengangkutan awam masih belum diteroki dengan meluas. Oleh itu, kajian ini dijalankan untuk mengenalpasti punca dan mengkaji kategori gangguan yang berlaku dikalangan pemandu bas dalam bandar. Selain daripada itu, pembangunan indeks risiko gangguan (DRI) dilakukan untuk mengenalpasti tahap risiko bagi setiap punca gangguan dikalangan pemandu bas dalam bandar. Kajian ini dijalankan melalui temubual kumpulan berfokus bersama 16 orang peserta, dimana lapan orang daripada kumpulan pakar pengurusan dan lapan orang lagi daripada kumpulan pakar pengamal. Kajian ini juga telah menjalankan kaedah soal selidik dan borang soal selidik telah dihantar kepada 215 orang pemandu bas dalam bandar daripada syarikat pengusaha bas dalam bandar yang terkenal di Kuala Lumpur. Hasil daripada kajian ini, terdapat 26 punca-punca gangguan yang telah dikenalpasti daripada temubual kumpulan berfokus. Punca-punca ini telah digunakan di dalam borang soal selidik. Hasil daripada soal selidik, sebanyak enam kategori gangguan telah dikenalpasti dan kategori yang paling dominan ialah faktor manusia yang mempunyai peratusan varians sebanyak 14.06. Faktor manusia mempunyai 3 punca gangguan iaitu kesihatan pemandu, keselesaan kerusi pemandu dan keadaan bas. Indeks risiko gangguan (DRI) telah dibangunkan dan mendapati 4 punca gangguan yang dikategorikan sebagai risiko sangat tinggi iaitu keadaan bas, kesesakan lalu lintas, kebajikan pemandu dan kesihatan pemandu. Hasil kajian ini boleh dijadikan sebagai panduan untuk penambahbaikan syarikat bas dalam bandar. Tambahan lagi, hasil kajian ini juga boleh dijadikan sebagai panduan kepada penyelidik di masa akan datang untuk mencari jalan penyelesaian untuk mengatasi punca-punca gangguan tersebut.

TABLE OF CONTENT

ACKNOWLEDGEMENT	iv
ABSTRACT	v
ABSTRAK	vi
TABLE OF CONTENT	vii
LIST OF TABLES	x
LIST OF FIGURES	xi
LIST OF APPENDICES	xii
CHAPTER 1 INTRODUCTION	1
1.1 Background of the Study	1
1.2 Problem Statement	2
1.3 Research Objectives	4
1.4 Scope of the Study	4
1.5 Significance of the Study	5
1.6 Structure of the Thesis	5
CHAPTER 2 LITERATURE REVIEW	7
2.1 Introduction	7
2.2 Current Trend of the Study	7
2.3 Sources of Distraction	8
2.3.1 Internal Distraction	8
2.3.1.1 Technology Distraction	9
2.3.1.2 Operation Distraction	10
2.3.1.3 Passenger Distraction	11
2.3.1.4 Secondary Task Distraction	12
2.3.1.5 Personal Distraction	13
2.3.2 External Distraction	13
2.3.2.1 Infrastructure Distraction	13
2.3.2.2 Road-based Distraction	14



PTT AUTHM
PERPUSTAKAAN TUN AMINAH

2.3.3	Summary of Findings	14
2.4	Research Design	16
2.5	Distraction Risk Index (DRI)	18
2.6	Chapter Summary	19
CHAPTER 3	RESEARCH METHODOLOGY	20
3.1	Introduction	20
3.2	Research Methodology Flow Chart	21
3.3	Focus Group Interview	23
3.3.1	Research Design	23
3.3.2	Data Collection	24
3.3.3	Data Analysis	25
3.4	Survey Method	27
3.4.1	Research Design	27
3.4.2	Data Collection	27
3.4.3	Self-administered questionnaire	28
3.4.4	Respondent of the Survey	29
3.4.5	Preliminary Study	30
3.4.6	Data Analysis	31
3.4.7	Distraction Risk Index (DRI)	33
3.5	Chapter Summary	34
CHAPTER 4	RESULTS AND DISCUSSIONS	36
4.1	Introduction	36
4.2	Focus Group Interview	36
4.2.1	Sources of Distraction	37
4.2.1.1	Video advertising on the screen in the bus	38
4.2.1.2	Equipment recording in the bus	38
4.2.1.3	Technology Equipment	38
4.2.1.4	Traffic congestion	39
4.2.1.5	Other road user	39
4.2.1.6	Identifying bus stop	39
4.2.1.7	The effectiveness of working schedule	40
4.2.1.8	Changing of the route	40
4.2.1.9	Personal issue	40
4.2.1.10	Driver behaviour	41



PTT AUTHM
PERPUSTAKAAN TUN AMINAH

4.2.1.11 Less experienced driver	41
4.2.1.12 Driver's salary	42
4.2.1.13 Driver's welfare	42
4.2.1.14 Driver's health	43
4.2.1.15 Open trunked radio	43
4.2.1.16 Comfortability of the driver's seat	44
4.2.1.17 Condition of bus	44
4.2.1.18 Systematicity of the management system	44
4.2.1.19 Advertisement along the roadside	45
4.2.1.20 Special lane for bus	45
4.2.1.21 Location of the bus stop	46
4.2.1.22 Communication passengers and driver	46
4.2.1.23 Distracted by passengers' behaviour	47
4.2.1.24 Smell from the passengers	47
4.2.1.25 Under-age passengers	48
4.2.1.26 Troubled passenger	48
4.3 Survey Method	49
4.3.1 Category of Distraction	49
4.3.1.1 Factor Analysis	49
4.3.1.2 Reliability Test	52
4.3.2 Distraction Risk Index (DRI)	54
4.4 Chapter Summary	61
CHAPTER 5 CONCLUSION AND RECOMMENDATION	62
5.1 Conclusion	62
5.1.1 Sources of Distraction	62
5.1.2 Category of Distraction	63
5.1.3 Distraction Risk Index (DRI)	63
5.2 Recommendations	64
5.2.1 Future Research	64
5.2.2 Public Transportation Industry	64
5.2.3 Government Agency	65
REFERENCES	66



LIST OF TABLES

2.1	Summary of the Factors of Distraction (Previous researches)	15
2.2	Summary of the Methodology (Previous research)	17
2.3	Classification of Sources of Distraction (Kelwyn et al, 2012)	19
3.1	Brief Description of the Questionnaire	29
3.2	Sampling table of Preliminary Study	30
4.1	Sources of Distraction	37
4.2	Factor Analysis (First run)	50
4.3	Factor Analysis (Second run)	51
4.4	Factor Analysis (Third run)	52
4.5	Category of distraction	53
4.6	Dominance of the factor of distraction	53
4.7	Average rating of the Source of Distraction	54
4.8	Number of drivers based on Visual Distraction	55
4.9	Number of drivers based on Cognitive Distraction	56
4.10	Number of drivers based on Manual Distraction	57
4.11	Average percentage for source of distraction	58
4.12	Classification into Risk Zone.	59

LIST OF FIGURES

2.1	Research Trend (Source from ScienceDirect)	8
2.2	Intrastate bus driver using phone (Norbaiti Phaharoradzi, 2016)	9
2.3	Communication with Bus Control Centre (Nunnelee, 2005)	10
2.4	Intrastate bus driver issuing ticket (Fazlina, 2016)	11
2.5	Passenger talking on the phone loudly (Dreamstime, 2000)	12
2.6	Intrastate bus driver eating (Hobson, 2015)	12
2.7	Distracting billboard (B Media, 2017)	14
2.8	Internal and external sources of distraction	16
3.1	Research Flowchart	22
3.2	Flowchart of the Focus Group Interview	25
3.3	Flowchart of the Content Analysis Process (Song & Oh, 2016)	26
3.4	Flowchart of the survey method for this research.	28
3.5	Flowchart of the data analysis	32
3.6	Development of Distraction Risk Index (Kelwyn et al, 2012)	34
4.1	Distraction Risk Zone	60

LIST OF APPENDICES

A	Interview Protocol	73
B	Expert Review on Interview Protocol	75
C	Consent Letter	77
D	Sample of Transcript	80
E	Expert Review on Modified Questionnaire	104
F	Modified Questionnaire	106
G	Calculation of Sample Size	102
H	Result of Preliminary Study	104
I	Profile of the Interviewees	107
J	Evidance of Proofread	110



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CHAPTER 1

INTRODUCTION

1.1 Background of the Study

In this era of globalization, developing countries are constantly improving their public transport system especially on the bus services due to the high demand (Nur et al., 2017). Department of Economic and Social Affairs (DESA) of United Nation projected that the population in Asia will increase approximately 1.4 million by upcoming 2050 and about 86% of the world population will live in urban areas (United Nations, 2014). This trend would be closely related to the traffic congestion (Ewing et al., 2018). Rapid urbanization will result in serious traffic congestions (Le & Trinh, 2016; Zhou et al, 2016).

In conjunction with this issue, a few previous studies suggested that the usage of bus services by citizens could significantly reduce traffic congestion (Bachok et al, 2014; Le & Trinh, 2016). In many countries, public bus service is the most popular public transport service for citizens due to its affordability (Ponrahono et al, 2016). Besides that, a study conducted by Feng et al (2016) found that bus services are commonly chosen by citizens due to the safety attributes provided (Feng et al, 2016). Likewise, Bachok et al (2014) mentioned in his study that public bus services are required to provide effective services to cater the growth of urban activities (Bachok et al., 2014). Similarly, a study by Filho et al (2015) described that the usage of public transport especially public buses has become fundamental nowadays in order to satisfy the basic needs of citizens as cities are significantly expanding and the populations are growing rapidly (Filho et al., 2015). In Malaysia, the most common public transport chosen by the passengers are Rapid KL Bus, as being reported in the Annual report by Land Public Transport Commission (SPAD) in 2014. However, the performance of

bus drivers could be degraded due to the huge amount of tasks required (Klein et al, 2010).

A report from World Health Organisation (WHO) has shown that there is approximately 1.24 million fatalities and around 20 to 50 million injuries annually due to road crashes (Ellison et al, 2015). Additionally, Evgenikos (2016) reported that in European Union (EU), more than 4,500 persons were killed in road traffic accidents involving Heavy Goods Vehicles (HGVs) or bus/coach in 2013, constituting almost 18% of all road accident fatalities for that year (Evgenikos et al., 2016). On top of that, buses have been identified as one of the main public transport with a large proportion being involved in Road Traffic Crashes (La et al, 2015). Based on the annual report by Social Security Organization Malaysia (SOCSO), the reports of accidents involving buses are increasing gradually from 2009 to 2014.

Many researchers had agreed that driver distraction has become the main cause of road crashes all around the world (Thomas, 2008). Distractions while driving has been cited as one of the most dangerous error that drivers could make while driving (Craft & Preslopsky, 2009). With reference to the analysis done by United State Department of Transportation, it was found that the significant cause of total motor vehicle crashes is driver distraction (NHTSA, 2010).

Therefore, this research would be useful for future researches related with public bus transportation services in order to improve the performance and reduce the risks of being involved in road crashes.

1.2 Problem Statement

Sources of distraction is defined as any sources that is distracting the performance of the intrastate bus drivers (Regan et al, 2009). Meanwhile, driver distraction is a situation where the attention of the driver is diverted to any other activities which may generally affect the safety of the drivers and passengers (Regan et al, 2009). The driver distraction represents a significant problem to the public transportation sector. This is supported by the analysis done by Fatality Analysis Reporting System (FARS) in 2008 stated that driver distraction was identified as the factor for approximately 16% of all fatal crashes (Ascone et al, 2009). Besides that, a report from The National Highway Traffic Safety Administration (NHTSA) has stated that the driver distraction

contributes approximately 424,000 injuries which is 18 % of total injury crashes and 3,154 crash related with fatalities which is about 10% of the total fatal crashes (Ranney et al, 2000). Driver distraction has been estimated to be 80% of the factors of traffic crashes which were directly or indirectly caused by the drivers (Dingus et al., 2006).

In Malaysia, a statistic report from the Ministry of Transport of Malaysia (MOT) had mentioned that an approximately 96,786 accidents that had happened in Malaysia which involved the bus services from 2003 until 2016 (MOT, 2016). A research from Malaysian Institute of Road Safety Research (MIROS) had found that the environmental factor has become one of the main causes of traffic crashes in Malaysia. The research included the road segments which are off-ramp and curved road sections which require longer drivers' response time than the expressway (Borhan & Wong, 2015). In addition, the net flow of air temperature between human body and environment could also affect the bus drivers' performance (A.R. Ismail, 2015). Besides, bus drivers would also tend to have lower back pain and musculoskeletal disorder while driving the bus as the seats for Malaysian busses are not able to absorb high pressure (A.R. Ismail, 2012). In addition, the mechanical failure which focused on the brake failure had become one of the major causes of accidents related with the bus services in Malaysia (Oluwole, et al, 2015).

A previous study conducted by Young et al (2009) had stated various factors of distractions that could affect the performance of intrastate bus drivers including the number of hours driven, gender, experience and age (Young et al., 2009). Besides that, Treffner and Barret (2004) have mentioned that only a few researches had discussed on the distraction of bus drivers and most of them focused on the usage of mobile phone by the bus drivers (Treffner & Barrett, 2004). In addition, the route being used by intrastate bus drivers are generally high density-populated areas. Thus, the intrastate bus drivers would face a great number of external sources of distraction as there will be more passengers riding the bus, resulting to more frequent stops (Stutts & Gish, 2003). There are more than 70% of distractions which are considered voluntary actions such as the usage of mobile phones, adjusting the in-vehicle systems as well as interacting with the passengers while driving the vehicle (Beanland et al, 2013).

Although some previous researches have conducted investigation related to distraction, there are still several other sources of distraction that have yet to be covered. Thus, this study will identify the sources of distraction and investigate the most dominant factors of distraction among the intrastate bus drivers.

1.3 Research Objectives

The objectives of this research are:

- i. To identify the internal and external sources of distraction among intrastate bus drivers via focus group interview.
- ii. To investigate the categories of distraction among the intrastate bus drivers through the survey method.
- iii. To develop the Distraction Risk Index (DRI) among the intrastate bus drivers based on the focus group interview and survey method.

1.4 Scope of the Study

This study is conducted by referring to the following scope and limitations:

- i This research focuses on intrastate bus drivers only and excludes interstate bus drivers and school bus drivers. Intrastate bus driver is a bus driver who drives a bus for public usage only within a certain city, while the interstate bus driver is a driver who drives a bus for public usage but travelling from one city to another. School bus driver is a driver who only drives the bus to pick up and drop the students from their houses to their schools and vice versa.
- ii The population of the participants in the survey method are 490 intrastate bus drivers and the calculated number of sample size is 215 intrastate bus drivers after considering 95% of confidence interval and 5% margin error.
- iii This research has conducted a focus group interview where the participants are from the group of experts of management and practitioner from a prominent intrastate bus company at Kuala Lumpur, Malaysia.
- iv This research has adapted the survey method from Hampton University Transportation Centre Bus Driver Distraction Survey. The 215 respondents are from a prominent intrastate bus company in Kuala Lumpur, Malaysia.
- v The analysis that was conducted on data collection focus group interview is content analysis tool which is a tool to abstract and categorise information within a text, while for the survey method are factor analysis and reliability test in version 23 SPSS.

- vi The development of Distraction Risk Index (DRI) was based on the Risk Index which included four level of risks which are very high risk, high risk, moderate risk and low risk. All the risk range levels were determined from the mean and standard deviation of the average percentage of each source of distraction.

1.5 Significance of the Study

A study by Young et al (2012) mentioned that drivers who are giving their full concentration on vehicles controlling tasks tend to have less attention on the visual scanning element (Young et al, 2013). Similarly, this research aimed to identify several other sources of distraction among intrastate bus drivers. It will provide a prominent understanding to the bus operating company especially in Malaysia about the sources affecting the performance of bus drivers. Through the findings of this study, the bus company in Malaysia could improve the performance of the bus drivers and reduce the rate of accidents in Malaysia. At the same time, it would indirectly increase ride comfort of passengers and confidence of the service being provided to the passenger. Therefore, the performance of the intrastate bus will be improved, and this can ensure a better service to the citizens of Malaysia and reduce any unwanted problems related with intrastate bus especially in urban areas. This research could be a reference for future researches about the influential factors for distraction of bus drivers.

1.6 Structure of the Thesis

This thesis is divided into five chapters. Chapter One provides an introduction regarding this research. It would include the overall background of this research which is related to the distraction and its significance towards safety. This chapter would also discuss about the problem statement, research objectives and the scope of this study. The significance of the study would also be highlighted in this chapter.

Chapter Two provides a brief review of the research related to driver distraction. This chapter would also discuss about several relevant literatures which are related to the sources of distraction among the intrastate bus driver. A conclusion would be discussed at the end of this chapter which would include the summary of the literature review for this research.

Chapter Three would review about the overall flow of this research. It would also discuss about the method that has been used in this research in order to achieve all the research objectives. There are two main methods that are being use in this research which are focus group interview and survey method. This chapter explained about the aim and planning of these two methods along with the research being done.

Chapter Four would present the results and discussion of the focus group interview as well as the survey method. It would also include the analysis that was done with the raw data that have been collected via those two methods. Besides, this chapter would discuss on the development of Distraction Risk Index (DRI) among the intrastate bus drivers. In addition, this chapter would also provide discussions on the findings of all the analysis that have been done.

Chapter Five would provide a summary and conclude the overall findings of this research and offer a few suggestions for future researches and industry.



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CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter would discuss on the literature review about all the sources of distraction and any previous literatures related to the distraction of the intrastate bus drivers.

2.2 Current Trend of the Study

Over the last few years, distraction has been widely discussed by many researchers around the world. However, most of the studies have only focused on conventional passenger vehicles and very few researches had discussed about public transportation (Horberry et al, 2006). Based on Regan et al (2009), driver distraction is recognised as a significant road safety issue that would influence the rate of traffic crashes (Regan et al., 2009). The number of researches related to the distraction of bus drivers have been increasing gradually throughout these several years. This trend has provided a significant indication on the importance of studies on bus driver distraction. The main key word that were being used while undergoing the literature review processes are “Bus Driver Distraction”. Figure 2.1 illustrates the findings from the one of the famous search engines which is Science Direct (www.sciencedirect.com) to obtain previous researches as reference since 2000.

Based on Figure 2.1, the number of researches which focused on distraction of the bus drivers has been increasing. Thus, the distraction of bus drivers is a widely discussed topic among researchers. This situation occurred due to the global statistic showing that driver distraction has become one of the main sources of traffic crashes (Craft & Preslopsky, 2009). On top of that, traffic crashes involving bus have been increasing gradually over the years (La et al., 2015). Therefore, it is mandatory for

researchers to identify the sources of distractions among intrastate bus drivers while operating the bus in order to ensure a good performance as well as the safety of the public transport passengers.

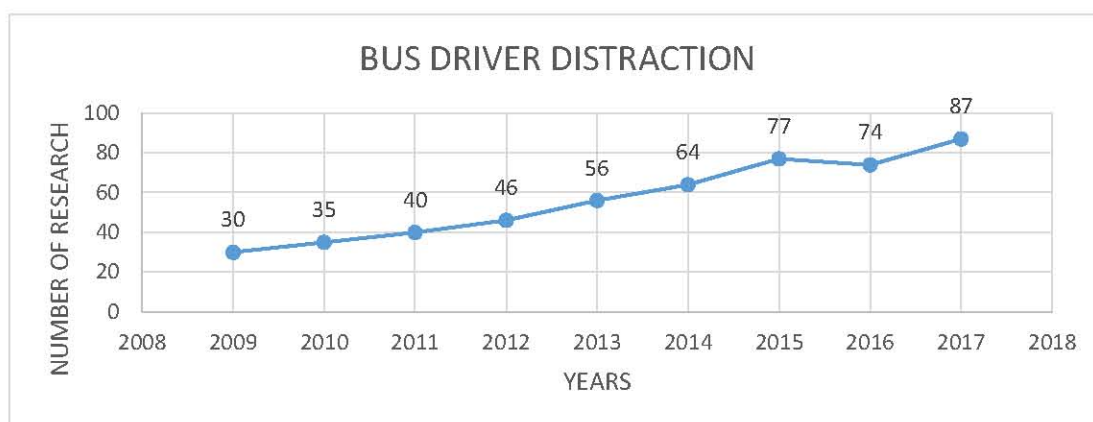


Figure 2.1: Research Trend (Source from ScienceDirect)

2.3 Sources of Distraction

Driver distraction is one of the main factors of traffic accidents. Driver distraction can be defined as any activities that could divert the attention and focus of the drivers from the task of driving safely (Ranney et al., 2000). There are lots of distractions that have been identified by previous researches. Sources of distraction could come from inside or outside of the vehicle (Salmon et al., 2011). Based on the previous literatures, sources of distraction could be classified into 2 factors which are internal and external distractions.

2.3.1 Internal Distraction

Internal distraction is referred to any distractions that would occur from inside of the vehicle which will divert the driver's attention. These activities would occur inside the vehicle and could affect the performance of the bus drivers (Klauer et al., 2014). Besides, the slight period when the driver glanced the inside of vehicle to the roadway would also affect the reaction of the driver during alarming situations (Borowsky et al., 2016). The moment when the driver glanced away from the roadway must be less than two seconds in order to ensure a safe driving procedure (Borowsky et al., 2016). The longer the period of time for the drivers' eye off the road, the greater the risk of

crashes would occur (Peng & Boyle, 2015). Therefore, it is deduced that there are many sources inside the vehicle which could cause distractions to the intrastate bus drivers.

2.3.1.1 Technology Distraction

Technology is an invention that could assist human. Nevertheless, technology could sometimes cause distraction to the human. In the context of intrastate bus drivers, technologies such as mobile phones, broadcast radios as well as the ticketing machine could be factors of distraction. There are a lot of researches on technology distraction towards the bus drivers mainly on mobile phones. The rating of distraction towards the drivers caused by mobile phones is 91% (D'Souza & Maheshwari, 2012). The usage of mobile phones while driving was proven to affect the performance of the bus drivers (Olapoju, 2016; Törnros & Bolling, 2005). Mobile phone distraction has resulted in 5% of injury and 18% of fatal crashes based on the police crash report in United States (Caird et al, 2014). Based on Stutts et al (2005), the distraction caused by the mobile phone is measured by observing the position of the hands of the drivers on the steering wheel, eyes of the driver which were directed inside the vehicle more than focusing on the road and the lane wandering while driving the vehicle (Stutts et al., 2005). Figure 2.2 shows the examples of real cases where the intrastate bus driver was using his mobile phone while operating the bus.

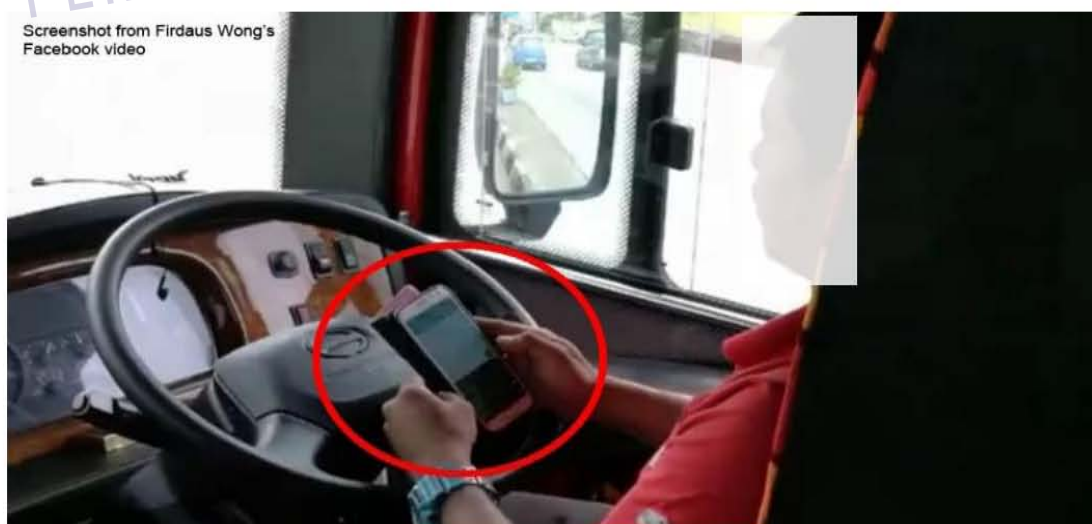


Figure 2.2: Intrastate bus driver using phone (Norbaiti Phaharoradzi, 2016)

Besides that, Stavrinou (2013) stated in his paper that safe driving is affected when the drivers were texting while driving (Stavrinou et al., 2013). Thus, this gave a negative impact on traffic operation. Likewise, it was reported that activities of handheld devices such as texting would require high mental focus. This would result on frequent and longer glances away from the road which can affect the drivers' performance (Owens et al., 2011). The drivers' sensitivity towards upcoming events and awareness of the road environment could also be affected even when the drivers are using hands-free mobile phone (Treffner & Barrett, 2004). Other than that, the entertainment system in the vehicle would also provide a negative impact on the drivers' performance (Horberry et al., 2006).

2.3.1.2 Operation Distraction

The next source of distraction which is related to the operations that would have to be conducted by the intrastate bus drivers while operating the bus. Salmon et al (2011) found that one of the sources of distraction among the intrastate bus drivers is the communication with the bus control centre (Salmon et al., 2011). Figure 2.3 shows the example of intrastate bus driver who was communicating with the bus control centre via trunk radio.

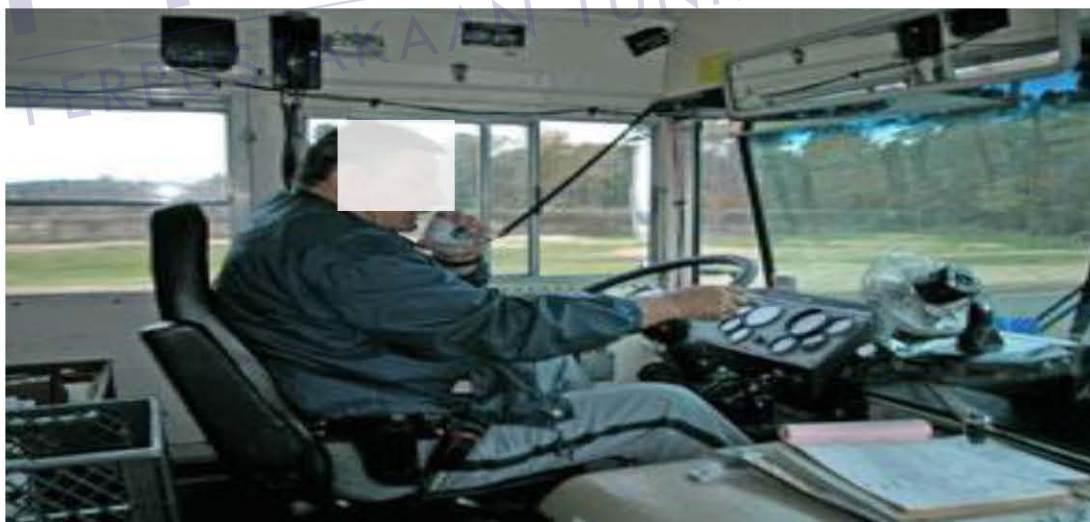


Figure 2.3: Communication with Bus Control Centre (Nunnelee, 2005)

Another source of distraction based on the operation distraction is issuing ticket. Nowadays, majority of the prominent bus companies require the bus drivers to do extra tasks which is not only limited to driving the bus. The bus drivers were also required to operate the ticketing machine when the passengers board on the bus

(Salmon et al., 2011). The activity to issue tickets by the bus driver is classified as high risk as it is one of the distracting activities (D'Souza & Maheshwari, 2012). Salman et al (2011) found that the trunk radio in the bus which is for communication between the bus drivers to the bus traffic controller can distract the bus drivers as well. Figure 2.4 shows the intrastate bus driver who was issuing ticket to a passenger.



Figure 2.4: Intrastate bus driver issuing ticket (Fazlina, 2016)

2.3.1.3 Passenger Distraction

Passengers could also be a source of distraction to the drivers. Passenger distraction is defined as any distractions that were caused by the passengers such as situations where the passengers are talking on their phone with a loud voice. This would cause the bus drivers to feel distracted and reduced their focus on driving the bus. The conversation between the passengers could also distract the drivers (Horberry et al., 2006). The attention of the bus drivers could also be distracted due to passengers behaviour such as fights among the passengers, children who are crying loudly and unruly kid (Caird et al, 2014). Based on a previous research, approximately 10.9% of the distractions come from the other occupants in the vehicles (Stutts et al, 2001). McEvoy et al (2007) reported that conversation between the bus drivers and the passengers could also be one of the sources of distraction towards the driver (McEvoy et al, 2007). Similarly, Patel et al (2008) stated that talking to the passenger could cause distraction to the driver (Patel et al, 2008). Figure 2.5 shows the example of a situation where the passenger is talking on the phone loudly.



Figure 2.5: Passenger talking on the phone loudly (Dreamstime, 2000)

2.3.1.4 Secondary Task Distraction

Secondary task is something that the driver's do while driving such as adjusting their seat. Based on Stevens & Minton (2001), the activity such as adjusting the seat belt and driver's seat can distract the driver as well (Stevens & Minton, 2001). These kinds of distractions are related to the ergonomics factors as it involves the comfort of the drivers. Eating and drinking inside the vehicle while driving could also be considered as one of the sources of distraction to the drivers (Stutts et al., 2005). The secondary tasks that are done by the driver instead of driving would distract them (Stevens & Minton, 2001). Figure 2.6 shows the example of the bus driver eating while driving the bus.



Figure 2.6: Intrastate bus driver eating (Hobson, 2015)

2.3.1.5 Personal Distraction

Other than that, personal problems of the driver could also be a source of distraction to the driver. The health of driver is a serious factor that requires attention as it is a great distraction to the bus driver. Tse et al (2006) reported that bus driver is one of the professions that have poor health conditions based on the health indicators such as cholesterol level, blood pressure and body weight (Tse, 2006). Some studies found that the bus drivers have cardiovascular disease (Wood, 2001). Sources of distraction that could refer to the conditions of the driver are fatigue, sickness and medication (Salmon et al., 2011).

2.3.2 External Distraction

Distractions could occur from the activities not only inside the vehicle but outside the bus as well (Edquist et al, 2011).

2.3.2.1 Infrastructure Distraction

The infrastructure along the road is related to driver distraction as well. Infrastructure distraction is a type of distraction that occurs to the intrastate bus drivers due to the infrastructure outside of the vehicle. It is reported that roadside advertisements are infrastructures outside of the vehicle that could distract the intrastate bus drivers (Crundall et al, 2006). Ranney et al (2000) stated that looking at billboards had become one of the sources of crashes based on the police report in the National Highway and Traffic System Analysis (NHTSA) data (Ranney et al., 2000). Salmon 2011 also said that distraction related to the infrastructure include roadside advertisement (Salmon et al., 2011). When there is a presence of billboard, the drivers tend to make errors and this would increase the response time for the driver should there be any dangerous events on the road (Edquist et al., 2011). The billboard could also make the drivers to be in dangerous situations while driving the vehicle (Bendak & Al-Saleh, 2010). Figure 2.7 shows the example of a distracting billboard to the drivers.

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