World Academy of Science, Engineering and Technology
International Journal of Economics and Management Engineering
Vol:4, No:11, 2010

Safety Practices among Bus Operators during Wee Hour Operations

M.R. Osman, F. Abas, M.S. Noh, A. Mohamad Suffian, O. Ilhamah, H.Z. Zarir,
A.B. Wahida, P. Noor Faradila, and M.F. Siti Atiqah.

Abstract**—**Safety Health and Environment Code of Practice (SHE COP) was developed to help road transportation operators to manage its operation in a systematic and safe manner. A study was conducted to determine the effectiveness of SHE COP implementation during non-OPS period. The objective of the study is to evaluate the implementations of SHE COP among bus operators during wee hour operations. The data was collected by completing a set of checklist after observing the activities during pre departure, during the trip, and upon arrival. The results show that there are seven widely practiced SHE COP elements. 22% of the buses have average speed exceeding the maximum permissible speed on the highways (90 km/h), with 13% of the buses were travelling at the speed of more than 100 km/h. The statistical analysis shows that there is only one significant association which relates speeding with prior presence of enforcement officers.

Keywords**—**Safety practices, speeding, wee hour.

I. INTRODUCTION

CRASHES involving commercial vehicles are of growing concerns in Malaysia and it significantly gives negative impact to various parties especially passengers of public buses. SHE Code of Practice (SHE COP) was developed to help road transportation operators to manage its operation in a systematic and safe manner. Over the past two years, MIROS have periodically conducted a few studies to investigate the effectiveness of SHE COP implementation among commercial bus operators during OPS Bersepadu period. MIROS have found that there is a need to investigate the implementation of SHE COP during non-OPS Bersepadu period since statistics show that there is a big difference of traffic profiles between OPS Bersepadu and Non-OPS Bersepadu program [1]. In conjunction with that, MIROS have conducted a study during the month of April 2009 to assess and evaluate the implementation of SHE COP among commercial bus operator during non-OPS Bersepadu period.

M.R. Osman is with the Malaysian Institute of Road Safety Research, Lot 125-135, Jalan TKS 1, Taman Kajang Sentral, 43000 Kajang, Selangor, Malaysia. (e-mail: rasid@miros.gov.my).

F. Abas is with the Malaysian Institute of Road Safety Research, Lot 125-135, Jalan TKS 1, Taman Kajang Sentral, 43000 Kajang, Selangor, Malaysia. (e-mail: fuad@miros.gov.my).

M.S. Noh is with the Malaysian Institute of Road Safety Research, Lot 125-135, Jalan TKS 1, Taman Kajang Sentral, 43000 Kajang, Selangor, Malaysia. (e-mail: msahrul@miros.gov.my).

This study is only focusing on the routes which have operations during wee-hours. Statistics show that there are a few tragic road crashes involving commercial vehicles during wee-hours. The main causes of these accidents might be the whole system itself which involve drivers, bus operators, roads, environment and other [2]. By implementing the SHE COP, it would help in improving the system since the gist of the SHE COP is related to those factors. The importance of evaluating the bus operations during wee-hours is to provide evidences of current practices for the buses travelling during wee hours. Normally, routes with long distance may require the wee-hour travelled time. Wee-hour is defined as [3], as a few hours after the midnight. Drivers who are involved in the operations during wee-hours might have experienced fatigue, sleep deficit and accumulate their sleeping debts [4]. The wee-hours are generally accepted as the period between 12 midnight to 6 am which is the normal sleeping hours for human beings. All normal humans have the biological clock program which requires sleep during night time and a normal person becomes very sleepy twice a day, between 1am-6am and between 2pm to 4pm [4]. If the drivers are working against their body clock, they are most likely to be physically as well as mentally fatigued and this could lead to accident. Hence, the operations during wee-hour should be investigated in order to understand an analyze issues related to express bus operations during that time period.

The objectives of this study are:

1. To evaluate the implementations of the SHE COP among bus operators during wee-hours bus operations.
2. To evaluate the speed profile of the observed buses.
3. To analyze relationship between speeding and inappropriate driving behavior (IDB) against on time arrival, prior presence of enforcement officers and SHE elements.

II. LITERATURE REVIEW

According to the National Accident data Analysis, accident during wee hours (0000 until 0600) involving buses was reported relatively low compared to other vehicle types [4]. However, once buses involved in accidents, most of the cases were severe case since it involved high casualty and fatality especially during 0200 to 0400 hours as reported in [4].

Many studies have shown that driving at night is more risky in terms of crash involvements per vehicle kilometer travelled than driving during the day. The reasons for crash at night are due to three main factors which include the more prevalent use of alcohol by drivers at night, the effects of fatigue on the driving task and the risk associated with reduced visibility [5].

A. Sleepy, drowsy, fatigue

It is reported in a study that sleep or drowsiness was a contributing factor in 3.9% of all accidents and recorded mostly during night time accident [6]. This could happened because human beings are influenced by a basic biological circadian rhythm with some depressive effect on performance in the late afternoon [7], and a marked depressive effect on performance in the late night/early morning hours [8]-[11] where at these period of times, a person will experience his worst physical and mental performance of the day [4]. In addition, according to [12], someone driving between 4 and 6 a.m. was 10 times more likely to be involved in a crash than someone who was driving in the middle of the morning or early in the evening.

A study at the University of South Australia [13], reports alcohol, sleepiness and fatigue lead to poor judgment and reaction time, not to mention the risk of dozing off. In fact, driving while being fatigued is just as dangerous as driving while intoxicated.

Reference [4] defines fatigue as the feeling of being tired, drained or exhausted. It costs poor judgment, impaired coordinations and slower reaction times. Fatigue can accumulate overtime leading to loss of alertness that could end up in falling sleep. Fatigue for drivers is usually occur ''when an individual cannot achieve performance goals but is forced to continue working under unfavorable situation by a sense of duty and/or the need to protect the lives of others'' [14]. Duty periods and shifts that are too long may cause an individual to take a longer time to respond to simple tasks. For more complicated perceptual-motor skills, responses become mistimed (right action but at the wrong moment).

In addition, inadequate rest and food intake are also cause of fatigue and further impairs driving performance [15]. Finally, fatigue symptoms could be derived from circadian rhythms dictating the daily cycle of activity which may be disturbed by rotating shifts patterns. Referring to [14], high demand from public lead to maximum drivers' schedule for haulage operation may causes breaking of European law arrangement of working shifts. Such pressures when applied to public transport services may well encourage drivers to drive even when they feel tired, which can increase driver's stress and lead to greater accident risk.

Reference [14] points out, driver may commit errors such as wrong gear selection, with slips increasingly turning into mistakes such as misjudging breaking distance at traffic lights, or attempting to overtake other vehicles where there is insufficient time to complete the maneuver when fatigue level is increased.

Reference [16] mentioned that most commercial vehicle drivers usually tend to violate the maximum hour of driving regulation because they generally believe themselves able to cope with possible driver fatigue and rarely consider it leading to an accident. Reference [17], as stated in [16], study found economic problem is the main reasons for the said violation.

Changes in time of work such as shift work, split shifts, sporadic work while 'on call' etc., will deteriorate the natural changes that are associated with circadian rhythms as highlighted by [18]. Reference [19] said that sources of drowsiness and related consequences are strongly associated with external factors (e.g., chronic sleep deficits) as with organization of work schedules especially among professional truck drivers.

B. Vision at night

Night visibility depends on the range of headlights being used and the contrast with the environment of the vehicle's path [20]. Although oncoming headlights help in increasing a vehicle's conspicuity [21] it also reduces the visibility of the driver due to the glare of the said headlights [22]. However, most drivers are not adjusting their speed sufficiently to counter these visual problems [20], contributing to higher risks when driving in the dark [23]. Reference [22] found that drivers only appeared to overcome the visibility problems when driving in challenging environments such as negotiating a curve and driving in the rain.

Visual acuity may gradually decline with age especially at night, due to the age-related changes in the eye, such that lens becomes yellowed, less flexible, and slightly cloudy [24] and pupils opening decrease to about one-third of the original size [25]. Older drivers' impaired night vision is often further compromised by their reduced ability to tolerate glare from other light sources, particularly oncoming headlights [26].

Glare can cause driver to squint, resulting in eye strain and eye fatigue. In extreme cases, glare can even result in temporary blindness [27] that has longer duration for older drivers. Many older people find that although their vision is good enough to drive during the day, they must give up night driving because of problems with glare, brightness, and darkness. Older drivers also find it more difficult to see low contrast features such as road edges and unlit obstacles on the road at night [28]. Perhaps as a result of these deficiencies, older drivers have elevated night time crash risks compared to all other age groups apart from young drivers [24].

C. Smoking

Smoking is also often attributed to relieving feelings of stress while driving. As stated by [29], levels of smoking for bus drivers have been reported in various studies [30]-[33]. To be specific, smoking habit is increased by the increased levels of on-the job strain especially in bored working conditions [34]. Moreover, [29] also found in [35] study, it is unexpected that an interruption to the opportunity to smoke as well as trying to give up smoking has been connected to greater levels of strain in airline pilots as a result of plasma nicotine depletion in the blood, may be related to lowered performance.

D. Strategies to overcome fatigue and drowsiness

Reference [36] had carried out a phone interview survey to acquire information on attitudes, opinions, and professed practices related to fatigued or drowsy driving. A list of 14 possible strategies to cope with fatigue or drowsiness while driving was presented to respondents. As found in [36], the most frequent strategy that drivers choose to overcome fatigue or drowsiness is opening windows or turning on the air conditioner or fan. Other strategies that also being used for

addressing fatigue and drowsiness are; talk to passengers, stopped to eat, exercise, relax but without napping/sleeping and changed radio station or CD. The lowest countermeasure to negotiate the fatigue and drowsy driving are talking on cell phone, pouring water on face or neck or slap/hit/pinch oneself and taking a stimulant. However the most effective tactic is ask passenger to drive (assuming the passenger is fit and well rested). Ironically, the most effective tactic is not the most popular one.

In addition, [37] found that drivers are well aware that the most effective countermeasure to prevent sleepiness while driving is stopping and taking a nap but most of them did not choose this method. Instead, they prefer to engage in activities such as opening up the window, putting on music which they consider less effective [37].

III. Methodology

This study was conducted during a two week period from 13th April to 26th April 2009. The design of this study is basically similar to the previous OPS Bersepadu studies. However, for this study, buses operating during night time were observed. The sampling was done by using random sampling of express buses travelling more than four hours per trip. The sample consists of certain number of bus companies which are offering the selected trips during that period.

The study began with revising existing checklist, followed by sample and site selection, data collection and ended with data analysis and report writing. Data collection was carried out by trained researchers following a set of checklist regarding compliance of selected elements of the SHE COP. The researchers were required to observe and assess three elements of SHE COP which are the vehicle management, journey management, and driver management.

The above mentioned SHE COP elements were categorized into four sections in the checklist which are;

a) Section 1: Vehicle Inspection Evaluation,
b) Section 2: Details of Journey,
c) Section 3: Journey and Driver Evaluation,

To complete the checklist, the researchers were firstly required to observe the SHE elements related to the vehicle at terminals before departure. The entire journey was observed by the personnel to complete the assessment on journey and driver management. Analyses were carried out according to the objectives of the study. In addition, descriptive analysis and cross tabulation were done to get the distributions and profiles of the data. Finally, a report was produced to present all findings and to highlight outcomes from the study.

IV. Results and Discussions

This section discusses sample population, SHE COP elements, driving behavior and practices, and statistical analyses of variables.

A. Sample Population

A total number of companies involved in this study are 14 and the number of buses being observed is 55. From the results, 50 out of 55 trips have two drivers in the observed buses.

B. SHE COP Elements

Findings shows that bus operators are closely observing the five SHE elements, namely; usage of antiglare film, wearing of uniform by drivers, availability of fire extinguishers, rest after 4 hours driving, and drivers' seatbelt availability. In addition, it was observed that usage of illegal cruise control tools such as bricks, brooms and rocks is not prevalent. Only 1 bus was found to have these illegal cruise control tools in the driver's compartment.

TABLE 1
Criteria Observed for Bus Facilities and Services

		Frequency		Percentage, %	
		Yes	No	Yes	No
Seatbelt's availability	Driver	27	28	49	51
	Front Row	18	37	33	67
	Others	1	49	2	98
Fire Extinguisher		43	11	80	20
Display of Emergency Number		48	7	87	13
Display of Customer Service Number		19	34	36	64

From Table 1, it can be seen that 49% of the observed buses provide seatbelts for drivers. However, only 30% of the drivers in the buses with driver's seatbelt used them. This percentage is considered low and it is not acceptable because wearing of seatbelt is compulsory for all drivers. This trend is the same for front row seats. Percentage of the fire extinguishers availability is high; however most of the fire extinguishers are hidden and are difficult to access. The companies need to ensure that fire extinguisher should be made available and easily accessible. Majority of the buses did not display the emergency number and this is not a good practice and needs to be improved immediately. From the observations, only 36% of the buses display the customer service number, and this practice needs to be improved.

Most of the observers are satisfied with the cleanliness of the buses (either interior or exterior), seats adjustability, spacious legroom and comfortable interior temperature of the buses. In terms of arrival time, majority of the observers agreed that the buses were punctual most of the time. However for departure time, high percentage of the buses did not depart on time. A significant number of observers experienced vibrations while travelling on the buses. This indicated that many of the buses are either not well maintained or had reached their service life.

C. Driving Behavior and Practices

It is observed that tailgating, harsh braking, dangerous overtaking, and smoking are the four highest categories. Although the other categories are not widespread, they are still considered as unsafe which can lead to accidents. It can be generalized that the drivers as perceived by the observers are not driving at high speed throughout the journey but only on certain occasions. Based on the samples, the speeding for entire journey is low (9%), but for "part of the journey" the percentage is quite high (27%). Although the speed of the buses is difficult to be verified quantitatively, most of the observers felt that the drivers are driving at high speed. The

perception could have come from the observation during overtaking, which is necessary. However the high percentage of high speed driving during overtaking is considered acceptable. 84% of the drivers are complying with this requirement of the SHE COP. This practice is commendable and should be adopted by all bus operators.

Fig. 1 shows the calculated average speed for all the buses. It can be seen that 22% of the buses were exceeding the speed limit of 90 km/hr. In addition, 13% of the buses were travelling at the speed of more than 100 km/h.

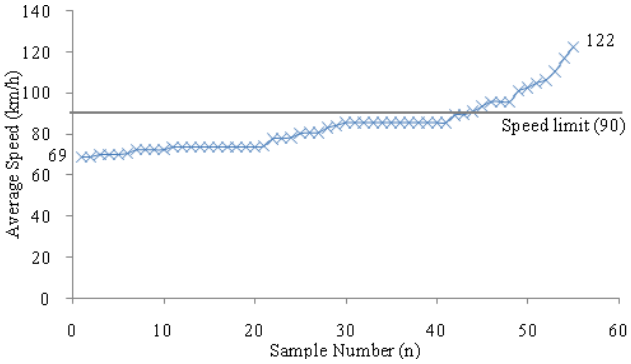

Fig. 1: Calculated Average Speed of Buses

D. Statistical Analyses of Variables

The cross tabulations among speeding and IDB with other relevant variables such as arrival time, present of Related Government Agencies officers at terminals and compliance to SHE elements are presented in the Table 2 to 4. Speeding and Inappropriate Driving Behaviors (IDB) have been chosen as critical elements to be evaluated among the bus drivers.

Study on motorcar vehicles revealed that tailgating occur frequently in frustrating conditions that elicit anger in drivers especially under time pressing situation [38]. This behavior could leads to rear-end collision in vehicle crashes. Overtaking accidents is a serious problem on single-carriageway trunk roads, where vehicle occupant deaths are at their highest [39]. Study conducted by [40] shows that the risk of having a collision was four times higher when using a mobile phone compared to when the mobile phone was not being used. For every 1 mile per hour (mph) reduction in average speed, collisions are reduced between 2% and 7% [41]. Hence, excessive speeding behaviour and IDB among drivers can be a major determinant of road traffic accidents.

Speeding in this study is defined as driving beyond the speed limit and the speed limit for buses travel on express highway is 90km per hour. Speed of the buses is calculated using the distance and time taken between two tolls along the highway. Meanwhile the IDB elements consist of speeding, harsh braking, dangerous overtaking, red light running, tailgating, queue jumping, changing lane without signaling, use of emergency lane, weaving, using mobile phone, smoking, picking and dropping passengers outside assigned terminal and feeling sleepy or fatigue.

TABLE II
CROSS TABULATION OF SPEEDING AND IDB AGAINST ON TIME ARRIVAL

		On time arrival		
		Yes n (%)	No n (%)	Total
Speeding	Yes(>90kmh)	9(16.4)	3(5.5)	12(21.9)
	No(<90kmh)	30(54.5)	13(23.6)	43(78.1)
IDB	Yes	31(56.4)	12(21.8)	43(70.9)
	No	8(14.5)	4(7.3)	12(29.1)
Total		39(70.9)	16(29.1)	55(100.0)

N = 55

Table 2 shows the distribution of speeding and IDB against on time arrival. The data shows that almost 71% of the observed buses arrived at the arrival terminals on time. The finding indicates that arrival time is not influenced by speeding behavior as more than 50% of the buses which arrived on time did not exceed the speed limit. However, data in Table 3 shows 31 out of 39 buses which arrived on time exhibit IDB. The association between the two variables are not significant with p value more than 0.05.

TABLE III
CROSS TABULATION OF SPEEDING AND IDB AGAINST PRIOR PRESENCE OF OFFICERS

		Officer		
		Present n (%)	Absent n (%)	Total
Speeding	Yes(>90kmh)	5(9.1)	7(12.7)	12(21.8)
	No(<90kmh)	4(7.3)	39(70.9)	43(78.2)
IDB	Yes	9(16.4)	34(61.8)	43(78.2)
	No	0(0)	12(21.8)	12(12.8)
	Total	9(16.4)	46(83.6)	55(100.0)

Meanwhile Table 3 shows association of speeding and IDB with prior presence of enforcement officers at bus terminal. The result shows more than 70% of the drivers were not speeding when enforcement officers were not present at bus terminals. There is significant association of speeding with prior presence of enforcement officer (p value < 0.05).

In contrast to speeding, the data for IDB shows that about 62% of the observed drivers demonstrate IDB when enforcement officer were absent at bus terminal. However, there is no significant relationship of IDB with prior presence of enforcement officer where p value is more than 0.05.

Distribution of speeding and IDB in relation with compliance to SHE element is presented in Table 4. The data shows 34 out of 44 buses which complied with SHE elements did not exceed the speed limit. In contrast, association between IDB and compliance to SHE element shows that more than 60% of the buses which adopted SHE elements exhibit IDB. The association of speeding and IDB by SHE elements is not significant where p value is more than 0.05.

TABLE IV
CROSS TABULATION OF SPEEDING AND IDB AGAINST SHE ELEMENTS

		SHE Element		
		Yes, n (%)	No, n (%)	Total
Speeding	Yes(>90kmh)	10(18.2)	2(3.6)	12(21.8)
	No(<90kmh)	34(61.8)	9(16.4)	43(78.2)
IDB	Yes	34(61.8)	9(16.4)	43(78.2)
	No	10(18.2)	2(3.6)	12(21.8)
	Total	44(80.0)	11(20.0)	55(100.0)

V. CONCLUSIONS AND RECOMMENDATIONS

This study has three main objectives. The first objective relates to the level of implementation of SHE Code of Practice among express bus operators which are operating during wee. The evaluation is based on compliance with selected SHE elements.

From the observations, SHE COP elements that are widely practiced include; usage of antiglare film, wearing of uniform by drivers, availability of fire extinguishers, rest after 4 hours driving, and drivers' seatbelt availability. In addition, it was observed that usage of illegal cruise control tools such as bricks, brooms and rocks is not prevalent. However, the followings need attention; drivers are not using seatbelts, the majority of buses do not have seatbelts for front row passengers, usage of front row passengers' seatbelts, usage of drivers' seatbelts, and display of emergency hotline. It can be concluded that the level of implementation is still at the early stage. This finding is similar to the 2009 OPS Chinese New Year.

The second objective is to evaluate the speed profile of the express buses. 22% of the buses have average speed exceeding the maximum permissible speed on the highways (90 km/h). It can also be seen that 13% of the buses were travelling at the speed of more than 100 km/h.

The third objective is to analyze relationship between speeding and inappropriate driving behavior (IDB) against on time arrival, prior presence of enforcement officers and SHE elements. There is only one significant association which relates speeding with prior presence of enforcement officer (p value < 0.05).

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

1. Top management of bus companies should improve awareness of SHE practices in their operations such as usage of seatbelts for drivers and front row passengers, display of emergency and customer service hotlines and easily visible and accessible of fire extinguishers.
2. Tailgating and harsh braking issues should be addressed by top management.
3. Bus companies are encouraged to install GPS monitoring system on their buses in order to monitor their buses.
4. Increase the number of enforcement officers' availability at bus terminals prior to departure.

ACKNOWLEDGMENT

We would like to express our gratitude to Road Transport Department (RTD), Commercial Vehicle License Board (CVLB), Royal Malaysia Police (RMP) and individuals for their invaluable time and the important role they played in making this study a success. We also would like to express our deep appreciation to the Director General of the Malaysian Institute of Road Safety Research (MIROS) for extending his full support towards completing this study. Our appreciation also goes out to Mohd Sukri Arifin, and Muhammad Sahidi Musyawir and other MIROS personnel for their assistance.

REFERENCES

[1] M.Y. Mohd Faudzi, P. Sumangala, and R.S. Radin Umar, 2007, *The Effectiveness of OPS Bersepadu Conducted over the Hari Raya Period from 7-21 October 2007*, Kuala Lumpur, Malaysian Institute of Road Safety Research, MRR 03/2007

[2] A.M Abdul Rahmat, A. Aqbal Hafeez, R. Mohd Khairuddin, M. I. Mohd Hafzi, Z. Zarir Hafiz, S. Mohd Syazwan, and R.S. Radin Umar, 2007, *Bukit Gantang Crash Investigation*, Kuala Lumpur, Malaysian Institute of Road Safety Research, MIR 04/2007(restricted report).

[3] Macmillan Online Dictionary, 2009.

[4] M. Norlen, Y. Fadhli, O. Ilhamah, Z. Zarir Hafiz, M.R. Osman, and S.V. Wong, 2009, *An impact assessment of banning wee-hour express bus operation*, Kuala Lumpur. Malaysian Institute of Road Safety Research, MRR 10/2009.

[5] D. M. Keall, W. J. Frith, and T. L. Patterson, 2005, "The contribution of alcohol to night time crash risk and other risks of night driving", *Accident Analysis and Prevention*, 37: 816–824

[6] S. Fridulv, 1999, "Road accidents caused by drivers falling asleep", *Accident Analysis and Prevention* 31: 639–649

[7] S. Folkard, 1975, "Diurnal variation in logical reasoning", *British Journal of Psychology*, 66: 1-8

[8] W.P. Colquhoun, 1970, *Aspects of Human Efficiency: Diurnal Rhythm and Loss of Sleep*, Medical Research Council Applied Psychology Unit, Cambridge, UK.

[9] J. Rutenfranz, and W.P. Colquhoun, 1979, "Circadian rhythms in human performance", *Scandinavian Journal of Work, Environment & Health*, 5: 167-177.

[10] T. H. Monk, 1982, "The arousal model of time of day effects in human performance efficiency", *Chronobiologica*, 9: 49-54.

[11] J. Horne, 1992, "Stay awake, stay alive", *New Scientist*, 1802: 20–24.

[12] M.T. Corfitsen, 1999, "`Fatigue' among young male night-time car drivers: is there a risk-taking group?", *Safety Science* 33: 47-57

[13] D. Dawson, K. McCulloch, and A. Baker, 2001, *Extended Working Hours in Australia: Counting the Costs*, The Centre for Sleep Research, The University of South Australia.

[14] I. D. Brown, 1994, "Driver fatigue", *Human Factors*, 36 (2): 298–314.

[15] H. O. Lisper, and B. Eriksson, 1980, "Effects of the length of a rest break and food intake on subsidiary reaction-time performance in an 8-hour driving task", *Journal of Applied Psychology*, 65: 117–122.

[16] H. Ha¨kka¨nen, and H. Summala, 2001, "Fatal traffic accidents among trailer truck drivers and accident causes as viewed by other truck drivers", *Accident Analysis and Prevention*, 33: 187–196

[17] E. R. Braver, E. R. Preusser, C. W. Preusser, D. F. Baum, H. M. Beilock, and R. Ulmer, 1992, "Long hours and fatigue: a survey of tractor–trailer drivers", *Journal of Public Health Policy*, 13: 341–366.

[18] M. Chipman, and Y. L. Jin, 2009, "Drowsy drivers: The effect of light and circadian rhythm on crash occurrence", *Safety Science*, 47: 1364–1370

[19] A. M. Williamson, A. M. Feyer, and R. Friswell, 1996, "The impact of work practices on fatigue in long distance truck drivers", *Accident Analysis and Prevention*, 28: 709–719.

[20] H. W. Leibowitz, D. A. Owens, and R. A. Tyrrell, 1998, "The assured clear distance ahead rule: implications for night time traffic safety and the law", *Accident Analysis and Prevention*. 30(1): 93–99.

[21] M. Sivak, and M. Flannagan, 1991, "Human factor considerations in the

design of vehicle headlamps and signal lamps". In B. Peacock & W. Karwosky (Eds.), *Automotive ergonomics*. London: Taylor & Francis.
[22] J. Theeuwes, J. W. A. M. Alferdinck, and M. Perel, 2002, "Relation between glare and driving performance", *Human Factors*, 44(1): 95–107.
[23] J. M. Sullivan, and M. J. Flannagan, 2002, "The role of ambient light level in fatal crashes: inferences from daylight saving transitions", *Accident Analysis Prevention*. 34: 487–498.
[24] R. G. Mortimer, and J. C. Fell, 1989, "Older drivers: their night fatal crash involvement and risk", *Accident Analysis and Prevention*, 21(3): 273–282.
[25] C. S. Saunders, 1997, "Eye-opening hazards of night time driving", *Traffic Safety*, 44–47.
[26] G. Maycock, 1997, *The safety of older car-drivers in the European Union*. European Road Safety Federation ERSF and AA Foundation for Road Safety Research.
[27] R. A. McFarland, and R. G. Domey, 1958, "Experimental studies of night vision as a function of age and changes in illumination", *Highway Resolution*. Board Bulletin, 191: 17–32.
[28] B. Fildes, N. Pronk, J. Langford, M. Hull, W. Frith, and R. Anderson, 2000, *Model licence re-assessment procedure for older and disable drivers*, Austroads Project no. N.RS.9802.
[29] J.L.M. Tse, R. Flin, and K. Mearns, 2006, "Bus driver well-being review: 50 years of research", *Transportation Research Part F*, 9: 89–114
[30] M. Bovenzi, and A. Zadini, 1992, "Self-reported low back symptoms in urban bus drivers exposed to whole-body vibration", *Spine*, 17: 1048–1059.
[31] G. E. Hedberg, K. A. Jacobsson, U. Janlert, and S. Langendoen, 1993, "Risk indicators of ischemic heart disease among male professional drivers in Sweden", *Scandinavian Journal of Work, Environment and Health*, 19: 326–333.
[32] I. Holme, A. Helgeland, I. Hjermann, P. Leren, and P. G. Lund-Larsen, 1977, "Coronary risk factors in various occupational groups: The Oslo study", *British Journal of Preventive and Social Medicine*, 31: 96–100.
[33] N. Maciulyte, 2000, *Bus drivers' health and conditions of work*. Symposium conducted at the European Centre for Occupational Health, Safety and the Environment, Kaunas, Lithuania
[34] B. A. Greiner, D. R. Ragland, N. Krause, and S. L. Syme, 1997, "Objective measurement of occupational stress factors—an example with San Francisco urban transit operators", *Journal of Occupational Health Psychology*, 2: 325–342.
[35] T. Sommese, and J. C. Patterson, 1995, "Acute effects of cigarette smoking withdrawal: A review of the literature", *Aviation, Space & Environmental Medicine*, 66: 164–167.
[36] W. Vanlaar, H. Simpson, D. Mayhew, and R. Robertson, 2008, "Fatigued and drowsy driving: A survey of attitudes, opinions and behaviors", *Journal of Safety Research*, 39: 303–309
[37] S. Nordbakke, and F. Sagberg, 2007, "Sleepy at the wheel: Knowledge, symptoms and behaviour among car drivers", *Transportation Research Part F*, 10: 1–10
[38] D. A. Hennessy, and D. L. Wiesenthal, 1997, "The relationship between traffic congestion, driver stress and direct versus indirect coping behaviours", *Ergonomics*, 40: 348-361.
[39] PACTS (1994). Press release and minutes from working party meeting 12/1/94, *U.K. Parliamentary Advisory Council for Transport Safety*.
[40] D. A. Redelmeier, and R. J. Tibshirani, 1997, "Association between cellular-telephone calls and motor vehicle collisions", *The New England Journal of Medicine*, 336: 453-8.
[41] A. Baruya, D. A. Lynam, and M. C. Taylor. 2000, "The effects of drivers' speed on the frequency of road accidents", *TRL Report* 421, prepared for the Road Safety Division, DETR.