

Relationship between Driving Hazard, Driving Risk and Driving Distraction in Commercial Bus Traffic Accident.

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Abstract— The main purpose of this study is to identify the relationship between driving hazard, driver distraction and driving risk and commercial bus accident. 120 bus drivers from a bus transport company were selected as a sample, survey questionnaire was used for data collection for a period of two months, majority of the drivers (52.7%) were in the age category of 36 to 44 years old, with 145(96.7%) having driving education with training and 5(3.3%) without education. 30(20%) of the respondent has more than 20years driving experience with 125(83.3%) drives 4 to 6 days per week while 97(64.7%) of the respondent prefers day journey. 73 (48.7%) never has accident while 77 (51.3%) have had accident once, twice, thrice and even more than four times. There were significant relationship between driving hazard, driver distraction ($r=0.619$, $p<0.01$) and driving risk ($r=0.579$, $p<0.01$). Result from multiple regression analysis shows that 20.7% can be explaining by driving hazard, driving distraction and driving risk contributed to bus traffic accident with significant relationship between driving hazard, driving distraction ($r=0.619$, $p<0.01$) and driving risk ($r=0.579$, $p<0.01$). It was also recommended that commercial transport company needs to do a lot of hazard preventive measure among novice drivers by conducting training and risk perception seminar from time to time.

Index Terms—Driving distraction, driving risk, fatigue and bus accident.

I. INTRODUCTION

The driver is a major and critical component of the traffic system, many attempts have been previously made to estimate the importance of the driver as the major cause of accident [1], it has been estimated that road user factors are the major contributory factors of road accident, while speeding behaviour of bus drivers is chosen as an indication of good driver management. According to [2]. Drivers who adhere to speed limits will always be aware of limitations on the road, a good driving behaviour and adherence to traffic rules will definitely reduce the probability of being involved in accidents. With more trained drivers, the accident rate is expected to drop and importantly, the severity of accidents is

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expected to decline, especially in accidents involving buses which usually claim many lives. Commercial buses are considered a major mode of transportation in most developing countries. In Malaysia, they are privately owned and operated generally by individuals and transportation firms as contain in Nailul et al (2011) [3] in their work on factors of fatigue and bus accident which stated that driver fatigue is a concern safety issue of general concern to the bus transportation industries which may be cause by a combination of factors including inadequate rest or disrupted sleep, displaced biological rhythms, excessive physical activity or mental and cognitive work as well as stress. Commercial bus safety is a major concern both in developing and developed countries even in US and Europe where, although bus transport is considered a safe mode of transport, yet the number of injuries and fatalities is still very high [4]. In the U.S between 1999 and 2005 about 63,000 buses were involved in traffic accidents that resulted in 14,000 injuries and 325 fatalities every year [5] and in Europe, about 20,000 buses were implicated in traffic collisions that led to 30,000 injuries and 150 fatalities every year. Commercial bus safety is also a concern in Demark, where in 2000 the Danish Commission on Road Safety prepared a national plan for road safety covering the period between 2001 and 2012.

The review of road transport policy was carried out in India and observed there is a steady increase in traffic fatalities in spite of the presence of traffic rules, regulations and legislative systems all over the country and stated that one possible reason for this is the increasing number of vehicles on the road [6] [7]. Elke Hermans et al,2008 [8] belief that the higher accident rate among commercial buses result from their operating characteristics as a result of multiple driving task and distractions from some passenger like the rate of loading and unloading particularly in urban areas. The bus driver out of curiosity and pressure to increase profit and continuously fears the loss of his job, the driver therefore compels to work long hours and therefore more stressful as compare to other types of driving.

This study has provided valuable insights regarding commercial bus traffic accident under three major identified driving factors as driving hazard, driving task and driving risk.

II. IDENTIFIED DRIVER'S FACTORS

A. DRIVING RISK

Driving risk is the subjective judgment that people make about the characteristics and severity of a risk driving especially for young novice drivers are at a significantly

higher risk of having a fatal vehicle crash than experienced drivers. According to Rosoff & John 2009 [9], one of the main causes of accident is that novice drivers lack risk perception skills, they have not developed the ability to efficiently perceive or predict risks while driving. Some of the items used in the survey includes, 1. Overconfident in driving is a powerful source of bias in the perception of risk, 2. Subjective perception of risk plays an important role in driver safety, 3. over speeding is an involvement in risk behaviour, 4. Fixate more on stationary object is a risk behaviour, 5. Overloading and passenger's pressure. According to risk factors influencing crash severity [9] seven factors of driving risk were identified as: human tolerance factors, inappropriate or excessive speed, seat-belts and child restraints not used, crash-helmets not worn by users of two-wheeled vehicles, roadside objects not crash-protective, insufficient vehicle crash protection for occupants and for those hit by vehicles and presence of alcohol and other drugs.

B. DRIVING DISTRACTION

Distracted driving is the act of driving while engaged in some other activities like eating snacks, texting, talking on phone or to passenger or reading map that take the driver's attention away on the road. All distractions compromise the safety of the driver, the passenger's bystanders and those in other vehicles [8]. United State Department of Transportation says texting while driving creates a crash risk 23 times higher than driving while not distracted inspite of this statistics shows that more than 37% of drivers have admitted to sending or receiving text messages while driving and 18% admit doing so regularly. According to U.S. Department of Transportation, 2009 [13] on driver's distraction on commercial vehicle five major categories of human direct causes were identified: recognition errors, decision errors, performance errors, critical non-performance errors, and non-accident/intentional involvement. In addition, five specific human causes were identified: improper lookout (18–23 percent), excessive speed (8–17 percent), inattention (10–15 percent), improper evasive action (5–13 percent), and internal distraction (6–9 percent). It can be seen that two of the five specific human causes were related to inattention and distraction, indicating their prevalence during vehicle crashes.

C. DRIVING HAZARD

A hazard can be any possible source of danger on or near the road that could lead to a crash, and it can come from any source or direction. It could be a child chasing a ball unto the road, parked car door opening, vehicle merging into your lane or stopping suddenly in front of you, slippery road after rain. According to the department of transport and main roads says

a driver gain experience they develop skills in scanning the road ahead and around them and they become better at recognizing that a potentially dangerous situation is developing [11]. This early detection gives them more time to make a decision about the hazard and respond to it adequately. The following can be source of hazard identification 1. Identifying hazards when driving through business areas, 2. Identifying hazards when driving through

roadworks, 3. Identifying hazards when driving through school zones, 4. Identifying hazards when sharing the road with other road users, 5. Identifying hazards when driving through suburban streets, 6. Identifying hazards when driving as night is approaching.

III. METHODOLOGY

The data required for this study was collected from 150 commercial bus drivers through a self – designed questionnaire contained three parts was developed to study the relationship between the driving factors. Part A was used to collect demographics factors of respondents covering gender, age, marital status, driving education, accident history, nature of accident, driving experience, driving per week, vehicle age, and types of journey prefer. On the other hand part B contain 29 self – designed questions about factors influencing driving and bus traffic accident which was divided into the factors of driving hazard (8 statements), driving task (8 statements), and driving risk (7). While part C contain 6 statements regarding the frequency and severity of accident which also include the period of accident. The five – point Likert scale assigned points 1,2,3,4 and 5 to terms of “Strongly disagree”, ”Disagree”, “Neutral”, “Agree” and “Strongly Agree”. From the analysis conducted, it shows that the reliability coefficient for each factor was more than 0.7 (Driving Hazard: Cronbach's Alpha is 0.737; Driving Task: Cronbach's Alpha is 0.821; Driving Risk: Cronbach's Alpha is 0.845; Depended variable: traffic Accident is 0.769) and the overall reliability coefficient was found to be 0.889. There were 148 male drivers that represent 98.7%, 2 female drivers representing 1.3% of the total 150 bus drivers that the questionnaire was administered to which took a period of one month to collect back. After collection Statistical package for social science (SPSS) version 16 for windows was used to analyse the data. Descriptive statistics (frequency and percentage) was used to describe the demographics factors (Gender, Age, Marital status, Driver education, Accident history, Nature of accident, Driving experience, Driving per week, Vehicle age and Types of journey). Inferential statistics (Pearson Product Moment Correlation Coefficient and Multiple Regression Analysis) was used as well for data analysis.

IV. FINDINGS AND DISCUSSION

A. RESPONDENT'S DEMOGRAPHIC FACTORS

In this study there are 150 respondents consisting of 148 males and only 2 females, the respondent were in the age range from 25 years old to more than 55 years old majority (52.7%) were in the age category of 36 to 44 years old, 8% were in age category of 25 to 35 years old, 27.3% were of age category 45 to 54 years old while 12% were more than 55 years old as shown in table I below.

Table 1. Demographic Factors

| Variables | Frequency | Percent | Categories | Frequency | Percent |
|---|--------------------------------|--|---|----------------------------|---------------------------------------|
| 1. Gender Male Female | 148 02 | 98.7% 1.3% | 2. Age 25 – 35 36 – 44 45 – 54 More than 55 | 12 79 41 18 | 8% 52.7% 27.3% 12% |
| 3. Marital Married Single | 134 09 07 | 89.3% 6.0% 4.7% | 4. Education Driving Education No driving Education | 145 05 | 96.7% 3.3% |
| 5. Accident History Never Once Twice Thrice 4 times | 73 43 17 8 9 | 48.7% 28.7% 11.3% 5.3% 6.0% | 6. Nature of Accident Never No Injury Injury Sever Fatal | 69 43 34 02 02 | 46% 28.7% 22.7% 1.3% 1.3% |
| 7. Driving Experience Less than 1 year 1 – 3 years 4 – 6 years 7 – 10 years 11 – 15 years more than 20 years | 1 8 36 32 43 30 | 7% 5.3% 24% 21.3% 28.7% 20% | 8. Driving per week Every day 4 – 6 days 2- 3 days Once per week | 20 125 4 1 | 13.3% 83.3% 2.7% 0.7% |
| 9. Vehicle Age 1- 3 years 4 – 6 years 7 – 10 years 11 – 15 years | 22 108 16 04 | 14.7% 72% 10.7% 2.7% | 10. Type of Journey Day Journey Night Journey | 97 53 | 64.7% 35.3% |

There were 134 (89.3%) married bus driver, 9 (6%) divorced and 7.0 (4.7%) single with 145(96.7%) having driving education with training and 5(3.3%) without education with their training. 30(20%) of the respondent has more than 20years driving experience with 125(83.3%) drives 4 to 6 days per week while 97(64.7%) of the respondent prefers day journey. 73 (48.7%) never has accident while 77 (51.3%) have had accident once, twice, thrice and even more than four times.

B. PEARSON PRODUCT MOMENT CORRELATION COEFFICIENT'S RESULTS.

There were significant relationship between driving hazard, driving distraction ($r=0.619$, $p<0.01$) and driving risk ($r=0.579$, $p<0.01$) in the same manner distraction correlate significantly with driving hazard and driving risk ($r=0.631$,

$p<0.01$). This is because many identified hazard on the road such as hazards when driving through business areas, identifying hazards when driving through road works, hazards when driving through school zones, hazards identification when sharing the road with other road users, hazards when driving through suburban streets, and hazards when driving as night is approaching all these result into driving distraction and risk on the part of the driver. In addition, the findings revealed that there was also a significant relationship between driving risk and traffic accident ($r=0.259$, $p<0.01$).

C. MULTIPLE REGRESSION ANALYSIS RESULTS

Table 2. Model Summary of Dominant Factors (Driver Hazard, Driver Distraction and Driver Risk)

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics | | | | |
|-------|-------------------|----------|-------------------|----------------------------|-------------------|----------|-----|-----|---------------|
| | | | | | R Square Change | F Change | df1 | df2 | Sig. F Change |
| 1 | .455 ^a | .207 | .180 | .90566662 | .207 | 7.531 | 5 | 144 | .000 |

a. Predictors: (Constant), Road Factors, Driver Factors, Vehicle Factors, Driver Task, Driver Risk

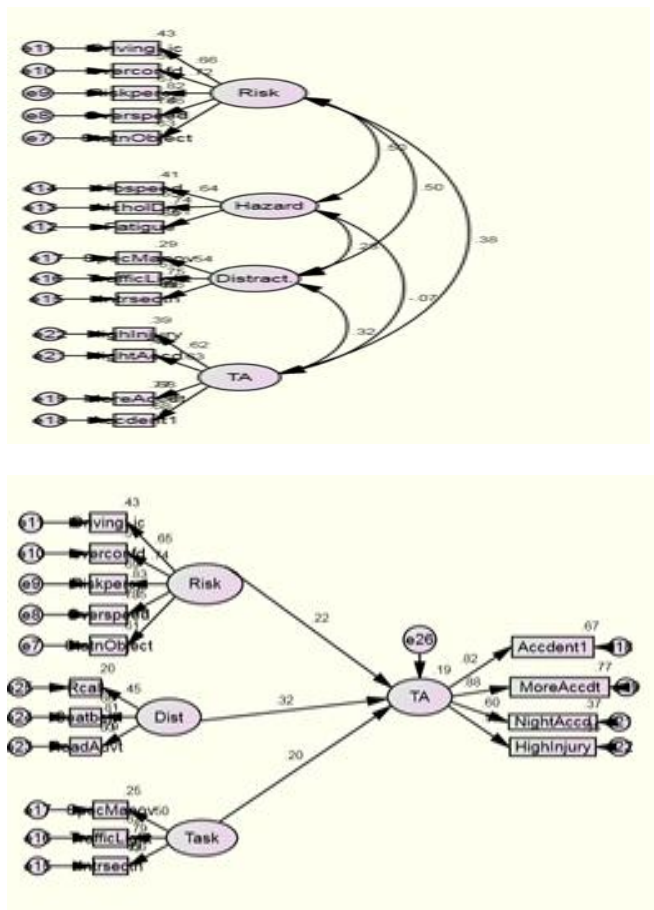
Table 3. Coefficient of Dominant Factors (Driver Hazard, Driver Task and Driver Risk) Affecting Bus Accident.

| Variable in Equation | Unstandardized Coefficients B | Standard Error | Standardized Coefficients Beta | t | sig. |
|----------------------|----------------------------------|----------------|-----------------------------------|-------|-------|
| (Constant) | 10.011 | 0.074 | | 0.000 | 0.000 |
| Driving Hazard | 0.034 | 0.104 | 0.034 | 0.323 | 0.000 |
| Driving Distraction | 0.204 | 0.112 | 0.204 | 1.829 | 0.000 |
| Driving Risk | 0.310 | 0.118 | 0.310 | 0.264 | 0.008 |

Table 3 showed that driving hazard, driving distraction and driving risk were the dominant factors that contribute to bus accident. Therefore 20.7% can be explaining by driving hazard, driving distraction and driving risk variables in the table above. However, driving risk made the strongest unique contribution as it produced the highest beta coefficient result (beta = 0.310). Driving risk and traffic accident could be very serious among commercial bus accident occurrence. According to Carsten (2007) [13] one of the main causes of accident is that novice drivers lack risk perception skills, they have not developed the ability to efficiently perceive or predict risks while driving. Thus a good risk perception among commercial driver will reduced the level of traffic accident among commercial bus drivers.

D. MEASUREMENT AND STRUCTURAL MODEL ASSESSMENT

Model assessment can be achieved by the measurement and structural working model analysis, running the maximum likelihood estimate for the model revealed significant Chi – square statistics where $\chi^2 = 201.453$ with 84 degree of freedom, the model fit indices for the total sample in the initial CFA run produced the following indices: GFI = .903, CFI = .918 and RMSEA = .091, CMIN/DF = 2.233.



The value .50 is the correlation between hazard and risk and between risk and distraction .24 is the correlation between task and hazard while .53 is the correlation between hazard and risk. Distraction correlate with traffic accident by .32 while risk correlate with traffic accident by .38.

V. CONCLUSION

Stake holders plays an important role in the prevention of commercial bus traffic accidents, especially commercial transport company needs to do a lot of hazard preventive measure among novice drivers by conducting training and retraining time to time. Drivers has a big influence on the rate of accident; statistics obtain from the Malaysian Institute of Road safety (MIROS) database for 2003 and 2012 shows an increase in total number of road accident on yearly bases in which buses claim more lives due to high numbers of passengers on board.

This study has provided valuable insights regarding traffic accident under three major identified driving factors (driving hazard, driver distraction and driving risk) that influence commercial bus traffic accident. This knowledge is important so as to reduce the rate of accident among commercial bus drivers.

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