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Behavioral habits and attitudes of heavy vehicle drivers towards road safety

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Abstract

It is a rear event that road accidents accrue from a single cause. There are usually a myriad of causitve factors that might have caused a road accident at any given point of time. Researchers estimated that around 90% of all causative factors involve road users of which drivers are the principal controlling elements. It is also found the over involvement of heavy vehicle particularly buses and trucks, in road accidents. Therefore, understanding of complex and unpredictable physio-psychologycal human factors particularly those of drivers is essential to any endeavor towards devising satisfactory design and effective traffic control measures. Studies on the behavior of heavy vehicle drivers' of Bangladesh are few and isolated. The need for more systemic behavioral studies seems apparent, particularly to develop a factual and comprehensive database for devising effective accident countermeasure. In this paper an attempt has been made to understand in as much as practicable the overall profile, attitudinal and behavioral aspects of heavy vehicle drivers by conducting a comprehensive questionnaire survey. In this study drivers understanding of traffic control devices and their level of driving competency in various driving situations that are thought to cause road accidents are also assessed. The outcome of the research was utilized to identify the extent of heavy vehicle drivers' involvement in road accidents and to develop pragmatic, viable and effective accident countermeasures.

Keywords: Stable isotopes, meteoric water line, hydraulic connectivity, electrical conductivity, chloride.

1. Introduction

There have been very few studies in Bangladesh on the behavioral and attitudinal aspects of heavy vehicle drivers particularly of buses and trucks drivers. The behaviors of drivers of these commercial heavy vehicles are generally chaotic because presumably of

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low level of drivers education and training. Studies (Hoque, M.M. at el, 2003; Hoque, M.M., 1997 and Hoque M.M., 1991) on road accidents reveal that in Bangladesh heavy vehicles are major contributors to road accidents resulting in huge losses in monetary and immense human sufferings. In urban areas of Bangladesh accident involving trucks, buses and minibuses account for nearly 90% of total road accidents although heavy vehicles constitute only 4% of the total vehicle fleet Studies (Hoque, M.M. at el, 2003).They are also over involved in pedestrian accident, particularly fatalities accounting for around 80 percent of total accidents (trucks 37 percent, buses 20 percent and mini-buses 22 percent). The high incidence of fatal accidents by heavy vehicles clearly demonstrates the need for continual thorough and comprehensive in-depth studies on heavy vehicles drivers for devising effective countermeasures to enhance road safety. Since the safety and operational efficiencies of any highway system depend to a great extend on the ability of the human element of the road-traffic system to be functional in a desirable manner; extensive and continual evaluation of human factors is essential to both for highway design and effective traffic control measures.

As a principal controlling element, drivers emerge as the primary determining factor in the operational scenario of the road-traffic system. While transport and traffic engineers have considerable knowledge about vehicle characteristics, load factors, effects of environmental factors on road and pavements, they often have only a rudimentary and inconspicuous understanding of the driver's physical, psychological and more importantly the behavior of a driver while he is in the traffic stream. They fail to account for drivers error, the consequences of poor road designs that are beyond driver capabilities, maneuvers that are unusual and unexpected, decisions which are overly complex and information displayed in road signs and markings etc. that are often confusing and ambiguous. These suggest the urgent need for systemic and in-depth studies on behavioral aspects of heavy vehicle drivers, in order to develop a reliable factual database for formulating accident countermeasure in Bangladesh where traffic accidents has loomed as a serious national problem. So any research on the development of a comprehensive behavioral study of heavy vehicle drivers through a well-planned and well-conceived questionnaire surveys will help immensely to assess their involvement in a road-traffic accident which are very essential in an accident-prone country like Bangladesh.

2. Objectives

The overall objectives of this study are to understand the behavioral habits, attitudes and other physio-psychological and personal characteristics of heavy vehicle drivers in order to evaluate their driving habits, to ascertain their role in traffic accidents as well as to assess drivers understanding of traffic control devices and their level of driving skill in various driving situations that are thought to cause road accidents.

3. Methodology

A questionnaire survey entitled "Study on Heavy Vehicle Drivers and Their Understanding of Road Safety" was conducted at randomly selected representative bus and truck terminals strategically located throughout the whole country. The survey consisted of ninety nine questions, which were divided into seven sections. The questions included in the questionnaire survey form emphasized on drivers' understanding about road safety, their habits and opinions. The survey questions also focused on their current level of education, training, experience and limitations. Face-to-face interviewing of drivers was conducted as the method of collecting information by

appointed field enumerators. For the purpose of sampling, the random sampling technique was used. The survey sampled five hundred drivers including 279 bus and 221 truck drivers. The sample group was distributed proportionally at different bus/truck terminals and also tried to cover all important national corridor distributed throughout the country for the period from July 2003 to March 2004.

At first, a small sample of drivers was interviewed as a pilot survey. This survey helped in revising some basic patterns in the questionnaire and also helped to predict the amount of time that might be required for completing each questionnaire as well as to familiarize the field enumerators with the in-field experience of conducting the questionnaire survey. Each questionnaire was uniquely labeled with a number before it was distributed. A simple database was used to keep track of when and to whom the questionnaires were sent. In conducting the questionnaire survey the drivers were assured anonymity of his answer. This was done with a view to ensuring the naturality of the answers, considerations were also given to make the respondent fairly comfortable. For data verifications, random crosschecking was helpful in verifying the authenticity and accuracy of the collected data. As each questionnaire contained information about particulars of a driver including his name and address, it is possible at any time to verify the collected information. For data analysis the Microsoft Excel was used and correlations among different variables were made utilizing the statistical package SPSS. For ease of data handling and analyses the values that the variables might have taken were designated by numeric codes. For example, a specific answer of a question may take the value of yes or no, but was coded 0 or 1 for ease of handling. The quantitative answers were input to the package program as numbers. But the qualitative answers were grouped into several categories and a number was assigned to each category. To evaluate the behavior of drivers, several scales were devised for different types of questions.

4. Analysis of Data

4.1 Drivers characteristics

In this section, the demographic characteristics of the participants as presented in Table 1 provides information on the age, marital status and level of education of the incumbent drivers who have been interviewed.

The sample comprised of 279 bus drivers and 221 truck drivers. Of these, the highest proportion i.e. 43.4% drivers belong to 31-40 years age group and there are only a few drivers whose age exceed 50 years. Marital status shows that 94% of the drivers interviewed were married and only 6% were yet unmarried. Responses of the drivers interviewed regarding the level of education shows that the majority i.e. 30.2% of the drivers (both bus and truck drivers) had education level upto 3 years of high school i.e. upto class eight. From the Table it can clearly be seen that nearly 19% of driver population do not have any formal education and the level of illiteracy is more in case of truck drivers than bus drivers. Table 2 portrays the demographic variables of the drivers interviewed.

The data in Table 2 reveals that the majority (45%) of the bus and truck drivers have monthly income in the range of Taka 4000 to 6000. The vast majority of the drivers i.e. 84.6% bus drivers and 85.1% truck drivers responded that they did not have any other source of income except driving i.e. the drivers have to depend only upon their income earned from driving. When the drivers' type of service is considered it is found that the bus drivers (56%) have more or less regular service while 62% truck drivers have

irregular service and in case of type of appointment it is evident that almost no drivers had any formal written contract of their job. Rather their appointment is made orally, which 96% and 90% in case of bus and truck drivers respectively. So it is well understood that the drivers do not have any certainty of their job and they had a feeling that they could lose their driving job at any time and this lack of self-confidence might have significantly affect in the subconscious mind, while driving. Moreover further analysis of data shows that only 25% of heavy vehicle drivers get monthly payment and 66% drivers are paid trip or daily basis.

Table 1
Summary of age, marital status and education level of survey participants

Item of Observation		% of Bus drivers (N=279)	% of Truck drivers (N=221)	% of Total Sample (N=500)
Age Distribution	20 –30	16.5	19.9	18
	31-40	46.2	39.8	43.4
	41-50	31.2	30.3	30.8
	51-60	5.7	8.1	6.8
	61-70	0.4	0.9	0.6
	71-80	0	0.9	0.4
Marital Status	Married	94.6	93.2	94
	Unmarried	5.4	6.8	6
Level of Education	No formal education	17.9	19.9	18.8
	Primary School	27.2	31.7	29.2
	Upto 3 yrs in high school	30.5	29.9	30.2
	4 to 6 yrs in high school	21.5	17.6	19.8
	More than Secondary School Certificate (SSC)	2.9	0.9	2

4.2 Accident involvement of drivers

The accident history of drivers is gleamed by asking whether or not they were involved in any major accident, which causes fatalities. Responses are either “Yes” or “No”. The data is shown in Table 3. According to self confession, it is observed form the Table that about 60% of the interviewees were involved in major accidents and the other 40% said that they were never involved in any major accident. In terms of accident history as a driver, the age cohort of the drivers, most likely to have been involved in an accident is 31 - 40 years. This age group constitutes 41% of the total accident-prone drivers. This finding may however, be due to the greater driving exposure reported by this group in the sampling process.

4.3 Relationship between Drinking and Driving

The drivers’ attitude in drinking while driving is assessed by asking respondents whether or not they are addicted to alcohol or any form of drugs. Responses are categorized as either “Yes” or “No”. These responses were correlated to that specific question about

involvement in any major accident in an attempt to verify the impact of driving under drunk condition as to involvement in accidents. The results are shown in Table 4. The Table fails to reveal any significant relationship between driving while drunk and accident involvement; only 9.7% who are addicted to alcohol are found to be involved in at least one major accident. Review of literature reveals (Fildes, B.N. al el, 1991) that in developed countries drunk drivers constitute a significant subgroup of a larger population of high-risk drivers. But it must be mentioned that this correlation is based upon drivers' responses only which may not reveal the actual scenario. Moreover, addiction to alcohol is not rampant in a country like Bangladesh where drinking is strictly prohibited.

4.4 Relationship between Driver Fatigue and Accident Involvement

It is often suggested that any driver should not drive more than 4/5 hours continuously and more than 8/10 hours a day without adequate rest and relaxation (Information Bulletin, 2001). Any driver who does not follow this suggestion may suffer from exhaustion, tiredness, and weakness or may feel dizzy which is termed as fatigue behavior of drivers in traffic engineering. Fatigue may result in sluggish reactions, blurred vision, poor concentration, impatience, driving at highly fluctuating speeds, letting the vehicle wander across the road etc. (ibid).

Table 2
Summary of other demographic variables

Item of Observation		% of Bus drivers (N=279)	% of Truck drivers (N=221)	% of Total Sample (N=500)
Monthly Income	0-2000	0.4	0.9	0.6
	2000-4000	8.6	18.1	12.8
	4000-6000	40.1	51.6	45.2
	6000-8000	32.3	19.9	26.8
	8000-10,000	15.4	4.5	10.6
	10.000-12.000	1.1	1.8	1.4
	12.000-14,000	0.4	0.5	0.4
	14,000-16,000	1.8	0	1
	16,000-18,000	0	0	0
	18.000-20.000	0	1.8	0.8
	Above 20.000	0	0.9	0.4
Sources of income other than driving	No income	84.6	85.1	84.8
	Business	5.4	4.5	5
	Repairing vehicle	0	0	0
	Others	10	10.4	10.2
Type of Service	Regular	55.6	38.5	48
	Irregular	38	51.1	43.8
	Conditional	1.4	0	0.8
	Not defined	3.6	5	4.2
	Others	1.4	5.4	3.2
Type of Appointment	By joining letters	2.9	4.5	3.6
	Orally	96.1	89.6	93.2
	Others	1.1	5.9	3.2

Table 3
Number of drivers involved in accident and age group

Item of Observations	20-30 yrs	31-40 yrs	41-50 yrs	51-60 yrs	61-70 yrs	71-80 yrs	% of total
% of drivers involved in accident	16.6	41.2	32.8	8.4	0.7	0.3	59.6
% of drivers not involved in accident	19.9	46.8	27.9	4.5	0.5	0.5	40.4
% of Total	17.9	43.5	30.8	6.8	0.6	0.4	100

Table 4
Number of drivers involved in accident and probable involvement with alcohol

Item of Observations		No of drivers addicted to alcohol	No of drivers not addicted to alcohol	Missing Value	Total
% of drivers involved in accident	Sub-Total	48	246	2	296
	% within involved in accident	16.2	83.1	0.7	100.0
	% within Alcohol Addicted	75.0	57.5	40.0	59.6
	%	9.7	49.5	0.4	59.6
% of drivers not involved in accident	Sub-Total	16	182	3.0	201
	% within involved in accident	8.0	90.5	1.5	100.0
	% within Alcohol Addicted	25.0	42.5	60.0	40.4
	%	3.2	36.6	0.6	40.4
Total	Grand Total	64	428	5.0	497
	%	12.9	86.1	1.0	100.0

To understand such fatigue related behavior of drivers, respondents were asked a few related questions such as “Usually how many hours do you drive daily?” or “Do you have to drive more than 8/10 hours in a day under duress or any unavoidable circumstances?” Findings from responses of the drivers are summarized in Figure 1 which clearly shows that about 54% of the responsees drive more than 8/10 hours in a day and mentioned they often suffer from fatigue related problems. From the interview it

is also evident that quite a few number of drivers often do drive as long as even 20 hours in a day under owners' compulsion.

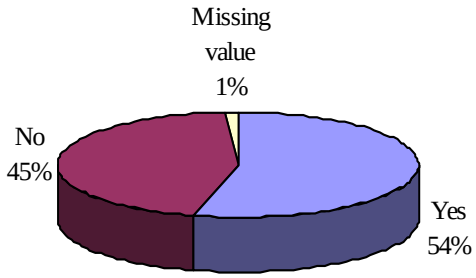


Fig. 1. Number of Drivers who Drive more than 8/10 hours in a Day

In order to find the relationship between driver fatigue and consequential accident involvement, an attempt was made to correlate these two variables using the standard statistical package SPSS and the results are shown in Table 5. The Table reveals that those drivers who drive more than 8/10 hours in a day are more likely to be involved (33.3%) in accidents than the rest who drive less than this stipulated time period.

Table 5
Number of Drivers who drive more than 8/10 hours and Involved in Accidents

Item of Observations		No of drivers involved in fatigue	No of drivers not involved in fatigue	Missing Value	Total
% of drivers involved in accident	Sub Total	165	129	1	295
	% within involved in accident	55.9	43.7	0.3	100.0
	% within involved in fatigue	61.1	57.3	100.0	59.5
	%	33.3	26.0	0.2	59.5
% of drivers not involved in accident	Sub Total	105	96	0	201
	% within involved in accident	52.2	47.8	0.0	100.0
	% within involved in fatigue	38.9	42.7	0.0	40.5
	%	21.2	19.4	0.0	40.5
Total	Grand Total	270	225	1	496
	%	54.4	45.4	0.2	100.0

4.5 Drivers habit

Drivers were asked a series of questions about their driving habits. These questions were designed to examine the general habits of drivers in various driving situations that are thought to cause road accidents. For each of these driving situations, drivers were asked

first to rank the frequency of their habitual activities as “Always”, “Sometimes” and “Never”. Based on the responses drivers’ ranking with frequency of activities in various driving situations is summarized in Figures 2(a) to 2(f).

Fig. 2(a) shows that in case of speeding in free road approximately 70% drivers responded that they do it sometimes. But in relation to other driving habits such as “Not obeying speed limit”; “Wrong side driving”; “Competitive attitude”; “Following slow leader” and “Crossing the turning at high speed” most of the drivers respond that they are never involved in such activities. It should however be borne in mind that driver’s responses appears as somewhat conservative while describing their habitual activities in various driving situations.

4.6 Drivers attitude

The vehicle over speed in driving continues to attract considerable attention of the researchers at large. Yet, extensive research on this crucial issue in order to identify and explain the effect of vehicle speed and the underlying causes of drivers’ behavior and attitude has not been made (Fildes, B.N. al el, 1991). Research on this aspect in Bangladesh is conspicuously almost absent. For assessing drivers' attitudes towards over speeding, the drivers were asked about the operational speed they usually maintain while driving in free roads and highways in Bangladesh. The operational speed values as reported by the interviewees were separately analyzed for buses and trucks and their respective frequency distributions are shown in Figures 3. It is revealed that average operational speed for bus is around 73.0 kmph where that for truck is 52.6 kmph respectively. In addition to the wide difference between the operational speed of buses and trucks respectively, the modal speed for bus is found to be 75.0 kmph while that for trucks is 48 kmph. The percentile cumulative speed distributions for buses and trucks are presented in Figure 4.

Obviously, as all these speed values obtained are based on driver’s responses in reality it would be much higher. From Figures 3 and 4 it is also evident that bus drivers exercise much higher 85^{th} percentile speed (80 kmph) as well as modal speed (75 kmph) as compare to trucks drivers speeds (60 kmph & 48 kmph) and this might be due to technological advancement in design of buses and most importantly according to drivers responses it is partly due to present nature of fixed time based trip operation as imposed by owners association. Moreover, survey data also reveals that many drivers, particularly truck drivers, often do talk, smoke and take refreshment while driving to avoid drowsiness and sleeping. While asking about their attitude towards other road users, it is evident that a large number of drivers (42%) have little respect to light vehicles, particularly to passenger cars and sarcastically named these vehicles as ‘plastic’ and ‘sharee’.

4.6 Drivers’ understanding

To evaluate drivers understanding and awareness regarding operationalities in road and road safety, they were asked a series of questions and in some cases crosschecking was done to verify whether or not the responses are merely positive responses or responses that goes in favor of the responding drivers which might be apt in concealing actual driving speeds and actual drivers behavior while in the traffic stream. To verify whether or not their responses were factual they were asked if they knew the basic difference between a triangular and a circular sign and overtaking marking. It was found that 69% drivers do not know the fact that circular signs are mandatory and triangular signs are

warning signs in nature while at the same time interviewees mentioned that they follow road sings and marking. To overcome this disparity, a good number of questions were added to the questionnaire survey.

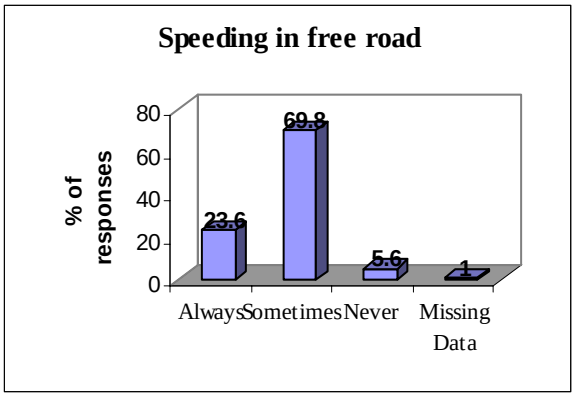


Fig 2(a)

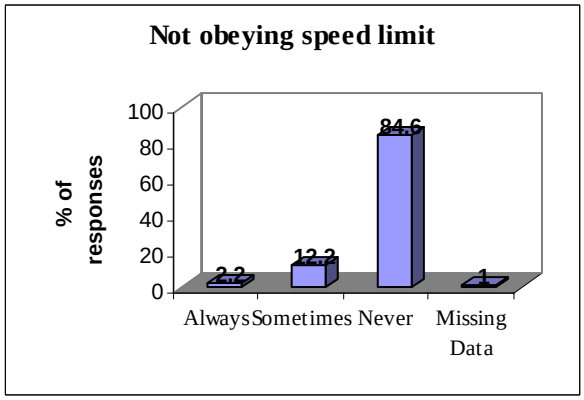
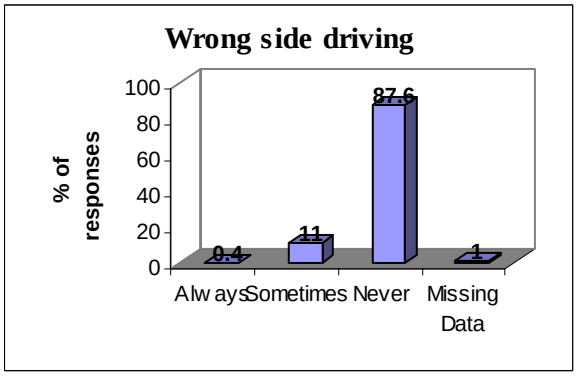


Fig 2(b)



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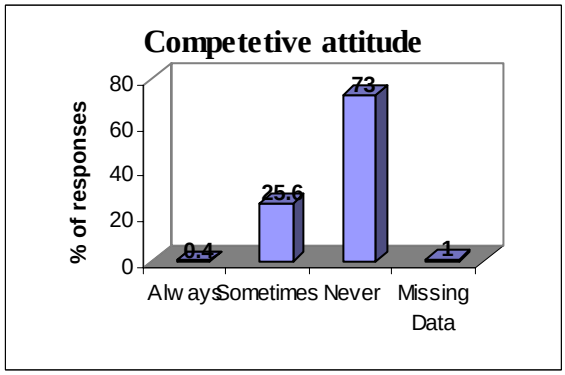

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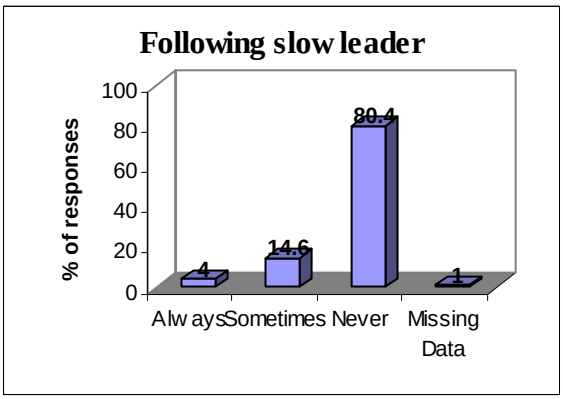


Fig 2(e)

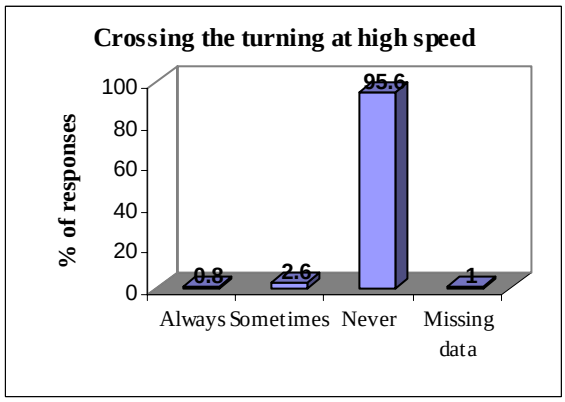


Fig 2(f)

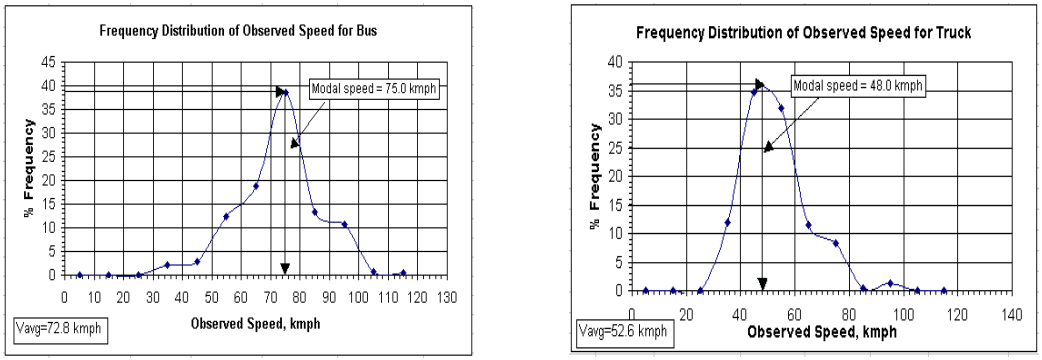


Fig. 3. Frequency distribution of observed speed for buses and truck

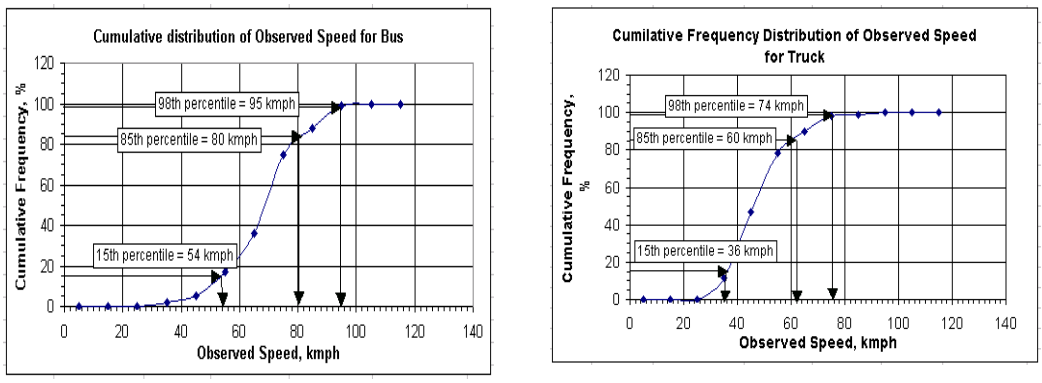


Fig. 4. Cumulative percentile distributions of reported operational speeds for buses and trucks

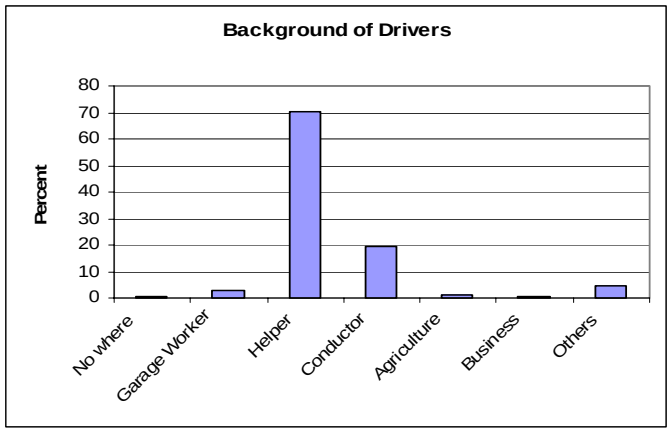


Fig. 5. Heavy vehicle drivers' background

Moreover in order to understand the extent of involvement of those drivers to accidents who do not have ever the preliminary knowledge of road signs and road marking etc. an attempt was made to correlate these two variables. The result shows that drivers (65.4%)

who do not have any idea of road signs and markings etc. are more likely to be involved in an accident than those (34.6%) who are as somewhat aware of the implications of road signs and markings. To assess drivers' practical driving experience and skill, they were asked about where and by whom they received training in driving. It is interesting to note that 92% drivers responded that they got training from their so called "ostaad" i.e. guru or master, while most of them (70%) were acting as a helper. So it is clear that they have no institutional training in driving and they derived their on-the-road driving experience and skill only by following their "ostaad".

In order to assess the overtaking performance of drivers, a four-point scale was used viz. "Excellent", "Good", "Fair" and "Bad". They were asked to identify the key steps that must be maintained before any overtaking action. Those who can identify all the steps are rated as excellent and consecutively as good, fair and bad. It revels that 61% driver's performance is bad and not a single driver could be rated as excellent. They were also asked "how to make a right turn to and from highway?", "where not to overtake?", "how to park on highway at nigh time?", "what is safe gap and why is it needed to maintain?", "what are the extra precautions needed while driving at night and in poor visibility?" etc. In all respects not a single driver could be found fully conversant with the safe way of doing any maneuver. This finding on deficiencies in driving knowledge reveals that drivers are at high risk while driving on the road and pose a serious threat to overall safety of traffic operation. Most of the interviewees candidly confessed that their leaning has not been complete as they were taught by their "ostaads" rather than by any formal driving instructor. In this respect they were asked about any training needs and requirements that they feel are necessary for them. Seventy nine percent of the drivers responded that they are willing to get some training and the remaining 21% opined that what they know is enough for safe driving and they do not need any further training to improve their driving skill. In addition, they were further asked as to on what subject they are willing to undertake training. Drivers' opinions are summarized in Table 6 which reflects their feeling about the fields in which they need formal training. It is indicated in Table 6 that majority (55.6%) of the drivers feel that they should have more formal education and training about road signs, markings and signals, 42%of the drivers feel they need more training on-the-road to acquire more skill in safe driving.

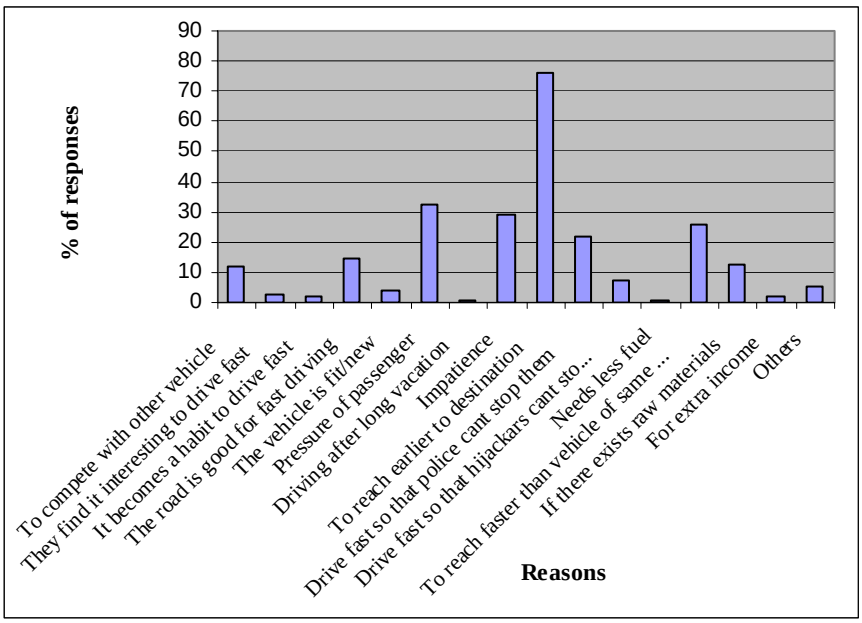
Table 6
Subjects on which Drivers are willing to Undertake Training

Field of Training	No of responses	% of responses
Training on more skilled driving	210	42
Training on vehicle maintenance	155	31
Training about road signs, markings and signals	278	55.6
Training on traffic laws and regulations	202	4.04
Others	9	1.8
Note: Multiple responses question- total may exceed 100%		

The others need practical training in vehicle maintenance (31%) and formal education and training about traffic laws and regulations (4%).

4.8 Drivers opinion

A variety of questions were devised to obtain drivers opinion to test the psychology of driving, individual differences, education, reasons for accidents, traffic law enforcement, improvement in driving skill and rehabilitation as well as road and vehicle designs. A few of them are discussed here. For example drivers were asked about the reasons for over speeding. The opinions are summarized in Figure 6.



Note: Multiple responses question- total may exceed 100%.

Fig. 6. Reasons of over speeding

The majority of the drivers stated that they drive fast in order to reach their destination as quickly as possible. Moreover, many-a drivers pointed out that while they transport perishable goods e.g. vegetables or fruits etc. from the northern part of the country to Dhaka they drive fast to reach the destination before 8.00 am in order to avoid existing entry restriction regulation. In order to reach their destinations in time often they are compelled to drive fast. The next highest opinion is that due to the psychological pressure from agonizing passengers which is often caused by immense delay due to poor roadway and traffic jams, drivers particularly those of buses are compelled under duress to drive speedily and often in excess of desired operational speed. Besides, drivers expressed that they sometimes suffer from harassment by traffic enforcement personal and to get rid of them they have to speed up their vehicles.

Finally, drivers were asked about the reasons which they feel lie at the root of road traffic accidents in Bangladesh. The summary of responses is shown in Figure 7. Drivers themselves feel that aggressive driving behavior is the most important reason for the occurrence of road traffic accidents which often resulting from over speeding and undue overtaking maneuvers. Majority of drivers, particularly bus drivers opined that unhealthy competition attitude among vehicles of same destination induces both aggressive over speeding and over taking behavior. Besides, according to the drivers' opinion defective

vehicles, faulty design of roads, lack of experience and training of drivers also contribute immensely to road traffic accidents in Bangladesh.

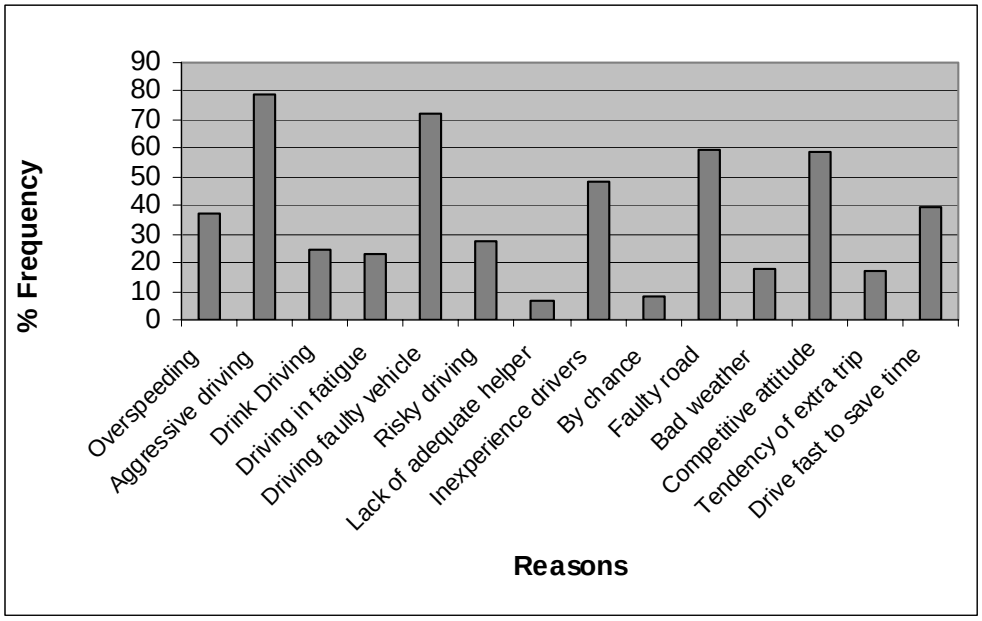


Fig. 7. Reasons of accident according to drivers' opinion

5. Conclusions

The road safety domain is lacking in predictive models of driver behavior to discern causality and association that is cause and effect relationship with the myriad of factors which are in general involved in a traffic accidents situation. Understanding driver behavior to achieve enhanced road safety provides as a basic platform for the development and installation of new, innovative and cost-effective traffic accident countermeasures. There are many approaches to study multifarious physio-psychological aspects of heavy vehicle drivers in order to understand their behavior so as to develop cost-effective countermeasures to improve road safety and improved road operations. This paper deals with one of such approaches. Based on this study, the following several conclusions are drawn, keeping in mind the limitations in statistical sampling as well as probable bias in answering the questions by the interviewees.

It is evident that nearly 19% of driver population do not have any formal education and the level of illiteracy is found to be more in case of truck drivers than bus drivers. It is observed that 96% bus and 90% truck drivers have no formal written contract of their job, their appointment is made orally. About 44% of the drivers are found to be paid irregularly and 25% of drivers get monthly payment while 66% drivers are paid trip or daily basis.

A vast majority (nearly 60% of the drivers interviewed in this survey) were involved in one or more major accident which tends to indicate over involvement of heavy vehicles (buses and trucks) operators in road accidents in Bangladesh; the age group of drivers that was involved in accidents is 31 - 40 years. In general no significant relationship would be discerned drunk driving with accident involvement in this country, although in

most developed countries drunk drivers constitute a major subgroup of accident prone drivers. It is found from the study that most of the drivers cannot afford to enjoy the legitimate rest when driving at night. This survey reveals that the average driving time for drivers of all categories approximately ten hours in a day and more than half of the drivers drive continuously under fatigue conditions for a period exceeding ten hours without any relaxation, break or rest. Most obviously, the drivers who drive during extended hour under duress suffer from fatigue and are more likely to be involved in accidents. Cross tabulation reveals that those drivers who drive more than 8/10 hours in a day are more likely to be involved (33.3%) in accidents than the rest who drive less than this stipulated time period.

Drivers' responses are discerned to be somewhat conservative while describing their habitual activities in different driving situations. In case of over speeding in free road, approximately 70% of the drivers responded that they do it sometimes. But in case of other driving habits, such as not obeying posted speed limit; driving in the wrong side of the road; competitive attitude; following slow lead vehicles and crossing a turning at an unreasonably high speed, most of the drivers responded that they never do this kind of activities. This answers considered to be a-bit biased. Truck drivers reveal that they often do talk, smoke and take refreshment while driving to avoid drowsiness and sleeping. Regarding attitude towards other road users, it is observed that a large number of drivers have little respect towards light vehicles and as compared to heavy vehicles, sarcastically they feel that these vehicles are as light as 'plastic' or 'sharee'.

This survey also reveals that only 31% of the drivers have the basic knowledge about road signs, road markings, although 97% of the drivers responded that they always maintain a careful look at road signs while driving. Moreover, cross tabulation analysis shows that those drivers (65.4%) are not aware of road signs, road markings etc. get involved in accidents more easily than those who are fairly acquainted with them. It is also explicitly evident that all most all drivers (92%) acquired their skill and driving experience from their so-called 'ostaad' (that is the master or guru) rather than being trained formally from a registered institution for driving. Among them 70% were acted as helper of vehicle under supervision of several 'ostaads' before becoming drivers. One of the encouraging findings of the survey is that the majority of the drivers admit that they are lack of institutional and formal training and are very willing to undertake such basic training on the fundamentals of driving techniques as well as knowledge about safe driving practices, road signs, road markings, traffic signals, priority rules etc.

Drivers' opinions about various issues which have been addressed in this research are quite self defending. For example, for finding the reasons of over-speeding tendencies, the majority of the drivers identified "intention to reach earlier to destination with their perishable products within the stipulated time limit" as one of the primary reasons to compel them to drive aggressively which are often causes dangerous road accidents.

From the analysis of data it is also clearly understood that a vast majority of drivers are not conversant with the safe way of performing different delicate driving operations which are thought to cause of many road accidents, viz. "how to make a right turn to and from highway?", "where not to overtake?", "how to park on highway at nigh time?", "what is safe gap and why is it needed to maintain?", "what are the extra precaution needed while driving at night, wet weather and in poor visibility?" This finding on deficiencies in driving knowledge reveals that drivers are at high risk while driving on the road and pose a serious threat to overall safety of traffic operation.

6. Recommendations for countermeasure development

It is reiterated here that the results obtained in this research are based on drivers' responses and the understanding of drivers' behavior which is highly complex should be pursued on a continuing basis with utmost importance. Hence, some of the findings of this research need further verifications through more intensive field work by observing actual behavior while driving. However, a few suggestions for the development of effective road accident countermeasure which were discerned on the basis of this questionnaire survey are presented below:

- The content of any driver-training program should focus on the development of such skills as are known to be important for safe driving and the targeted group should particularly be drivers of young to mid age group. It has been revealed that drivers develop their skill mainly from informal training while acting as helpers of their 'ostaads', that is their master. This looms as the primary reason why most of the drivers lack sufficient skills and ability to drive and control their vehicles. They often fail to understand various basic road-traffic signs and markings that are used to warn and guide drives toward safe driving. Although the basic purpose of drivers training programs should aim at training, especially in-field, to develop their ingenuity through extensive practical exercise along with formal underlying theoretical background so as to be able to drive safely. Driver training should not be limited only to simply make drivers aware of the marking and guiding messages but driver should also be educated to familiarize them with driving rules and regulations and their implications for punishing violators and should reinforced it through the continual process of training and most importantly, practical field training.

- Revelation of poor understanding of basic road signs and markings of heavy vehicle drivers and their self confession on over speeding tendency in free roads essentially suggests that at present situation improvement of road safety could not be achieved merely by installing traffic control devices particularly when there are a larger of illiterate drivers for whom displaying traffic regulation in text form has no meaning what so ever. As an immediate countermeasure policy, besides continuous object oriented driver training program and effective enforcement measures, the physical or self-enforcing speed calming measures should be given preference over conventional traffic regulation type measures, because of their special advantages in drawing force attention as well as compliance of ignorant and careless drivers. In general there is a common belief that over-speeding by drivers could be contained through the installation of properly designed and built speed humps on the highways. But it must be clearly born in mind that the fundamental objectives of highways are to ensure smooth and uninterrupted travel through ambient speed control and most importantly installation of speed breakers on high speed roads are not without consequence. In contrast, the installation of speed calming devices like rumble area, bar marking etc. in the form of rumble strips and jiggle bar markings have the potential to improve road safety significantly (TRL Guide, 1991) as bar or profile markings rely for their effect on the visual impression of speeds given to drivers as they pass over them.

- Even with self defending type of responses, the evidence of large number of drivers having no or minimal formal education, also implies that any endeavor towards improving overall roadway safety is bound to fail unless the issue of drivers' literacy level is not considered seriously. In this regard, setting of minimum education level and

introduction of written test as prerequisites to obtain driving license has become very urgent.

- Heavy vehicle drivers, particularly truck drivers in expressing their own opinion strongly responded that the existing "entry restriction rule" during day time to Dhaka city often force them drive aggressively particularly when they carry perishable goods and incur unexpected delay. Though this entry restriction is intended to increase the road capacity with enhanced mobility for the city dwellers, it appears that the regulation is not without consequence particularly from the overall safety point of view. As such, revision of existing truck access control regulation become essential.

- Driving is quite a strenuous occupation, particularly driving at high speed and ill design road; as such drivers must be allowed to get adequate relaxation, sleep and rest. Study findings of extended hour driving practices suggest that drivers working schedules must be kept within reasonable limits and it must be enforced and monitored by law enforcing agencies.

- To reduce constant fear of drivers' job losses and resulting insecurity and mental disturbances, the present wide spread verbal appointment practice in driver recruitment process should be gradually abolished by enacting laws. The drivers should be allowed to exercise their moral rights through formal service contractual agreement in keeping with the service rules of Bangladesh with a decent minimum salary and other fringe benefits along with insurance for life and other compensations. Moreover, harassment of drivers by ill motive of extracting tolls and bribes by different groups should be immediately and strictly controlled.

- In order to reduce dangerous competition attitude among bus drivers of same destinations and resulting aggressive overtaking and over speeding behavior, in line with interviewees responses it is recommended that present route permit practices followed by BRTA need to be revised by addressing the safety problems associated with the fragmented ownership of the bus companies. Besides this, immediately the present practice of fixed travel time based bus services and penalty system for drivers as set by owners association should be revised. Moreover, in order to make road safer, present ironical attitude of heavy vehicle drivers towards lighter vehicles as well as inherent competition habit need to be rectified by proper education and sustain campaign with focused messages.

- Extensive further research on human factors is necessary to identify the gaps and deficiencies in the perceived traffic safety knowledge of drivers.

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