

ACCIDENT RATE ANALYSIS IN SYLHET DISTRICT USING SPSS METHOD FOR HIGHWAY SAFETY EVALUATION

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ABSTRACT

Road traffic accidents are a major problem in the whole world. Almost 1.2 million people are killing in road traffic crashes each year. Sylhet is a densely populated city with around 0.64 million inhabitants living in an area of 26.5 sq.km i.e. some 2400 inhabitants per sq.km where population growth is very high. As direct consequences of rapid growth in population, motorization and urbanization process are causing a serious challenge for tackling the road safety problems. The safety problem is very severe by international standards. This research work presents an overview of the road traffic accident situation in Sylhet district which in particular, discusses the key road accident problem characteristics, identify the hazardous road and spot, most responsible vehicle and related body, conditions of driver and pedestrians, most victims of accident, safety priorities and options in Sylhet. Based on accident data using SPSS, a regression model is developed to predict the future accident. Where four variables are used - number of accident as dependent variable, registered vehicle, population & ratio of mostly accident vehicle to the total registered vehicles as independent variables.

Keywords: Traffic, Casualty, Fatality, SPSS, Regression Model

1. INTRODUCTION

Road accidents are one of the most important problems being faced by modern society. Apart from the humanitarian aspect of reducing road deaths and injuries in developing countries, a strong case can be made for reducing road crash deaths. The rapid population growth and increasing economic activities have resulted in the tremendous growth of motor vehicles. This is one of the primary factors responsible for road accidents in many metropolitan cities even in Sylhet. Roads, highways and streets are fundamental infrastructure facilities to provide the transportation for passenger travel and goods movement from one place to another. The provision of adequate transport infrastructure and services, along with macroeconomic stability and a long-term development strategy is one of the prime conditions for sustainable economic and social development. National and regional highways form the primary road network of Bangladesh Hoque M.M (2004) carry 38 per cent of freight traffic and 60 per cent of passenger traffic with overall modal share of about 60 per cent freight and 70 percent passenger on road. According to the *World Report on Road Traffic Injury Prevention* (2004) worldwide an estimated 1.2 million

people are killed in road accidents each year and as many as 50 million are injured. In fact, the road safety problem in developing countries may be much worse than the official statistics suggest because of widespread underreporting of road accident deaths and an over estimate of licensed vehicles resulting from scraped vehicles tending not to be removed from the vehicle register Quazi M (2003) have reported that poor people in developing countries have the highest burden of injuries and fatalities due to road traffic crashes. In 1998, more than 85 percent of deaths and 90 percent of disability adjusted life years lost worldwide because of road traffic accidents occurred in developing countries. According to the official statistics, there were at least 3334 fatalities and 3740 injuries in 4114 reported Mojumdar, Hossain (2008) accidents in 2003. It is estimated that the actual fatalities could well be 10000-12000 each year. Significant fluctuations in the numbers of fatalities and injuries as reported by police clearly reflect the problems of reporting and recording inconsistencies. Pedestrians and cyclists are the most vulnerable road users and account for majority of traffic deaths in low and middle income countries. In Dhaka city, Jacobs & Thomas (2000) pedestrians alone comprise almost 75 percent of road accident fatalities, in Delhi pedestrians and bi-cyclists amount for around 55 percent of the total traffic deaths, and the pattern is also similar in Colombo. According to World Bank and the World Health Organization independent studies (RHD), worldwide there are around 500,000 fatalities and 15 million injuries per annum as a result of road accidents.

2. METHODOLOGY

To determine the accident trend or status and identify most hazardous road in Sylhet [8] district and develop a regression model, the data collection was done with the help of questionnaire survey, news media, BRTA (Bangladesh Road Transport Authority) & SCC (Sylhet City Corporation). For questionnaire survey the participation is ensured from each and every level of pedestrian, drivers, traffic polices, typical accident victims and all types of vehicles. Traffic police was selected in a random manner. Also the information from news media was considered as one of the core database for this study. Finally accident data were analyzed and developed a regression model.

2.1 Survey Work for Data Collection

Questionnaire survey was based on the cordial talking and taking interview of the drivers, passengers/pedestrians and traffic police.

2.1.1 Regression Model

Regression analysis is the statistical technique that identifies the relationship between two or more quantitative variables: a dependent variable, whose value is to be predicted, and an independent or explanatory variable (or variables), about which knowledge is available. There are two types of regression.

-Simple Regression

-Multiple Regressions

A simple regression analysis can show that the relations between an independent variable X and a dependent variable Y is linear, using the simple linear regression equation:

$$Y = \beta_0 + \beta_1 X$$

Where, β_0 is regression constant and β_1 is regression coefficients.

Multiple regressions will provide an equation that predicts one variable from two or more independent variables. So the multiple regression model is of following form:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3$$

Where, β_0 = regression constant. $\beta_1, \beta_2, \beta_3$ = regression coefficients. X_1, X_2, X_3 = independent variables.

To predict the future accident multiple regression model is used in this model study. Four variables were used in this model. The used dependent variable is number of accident and independent variables are registered vehicle, population & ratio of most accident vehicle to the total registered vehicle. Based on seven years (2001-2007) accident data from newspaper, registered vehicles data from BRTA and population data from SCC the multiple linear regression model is developed. Using statistical software "SPSS" this model is developed and a regression equation is obtained by which one can easily predict future accident.

3. RESULTS AND DATA ANALYSIS

3.1 Figures and Graphs

A questionnaire survey lead to the analysis of the overall study for driver, passenger, pedestrian and major accident aspects. Study of newspaper "The Daily Sylheta Dak" lead to the analysis of main causes of accidents, accident casualties, hazardous roads and thana of Sylhet district and comparison of Sylhet district accident casualties with Sylhet division. Questionnaire survey was conducted among the concerned personnel who were related to the road accident and took their experiences, opinion about road accident. Study results are analyzed statistically and presented graphically.

3.1.1 Education Condition of Driver

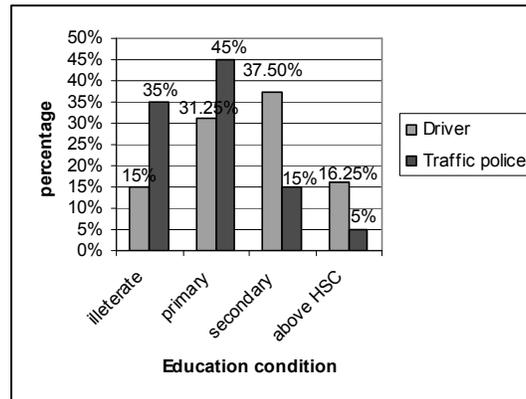


Figure 1: Education Qualification of Driver

Figure 1 represents the education condition of driver. According to Traffic police, 35% driver are illiterate, 45% driver are primary level, 15% are secondary level and 5% are above H.S.C .while according to interview of the driver,15% driver are illiterate,31.25% driver are primary level, 37.50% are secondary level and 16.25% are above H.S.C. There is a large gap between the statistics of education from two sources although primary level education in the range of 31.25 to 45% shows the serious lack of education of the drivers. Due to lack of education, the drivers don't know the basic aspects of safe driving and often fail to recognize the basic difference between the triangular, circular, rectangular signs and hardly understand pavement markings. The drivers are also not well aware of impacts of road accidents & precautionary measures to minimize road accidents. They drive the traffic with careless driving and face the traffic accidents frequently.

3.2 Alcohol Involvement with driver

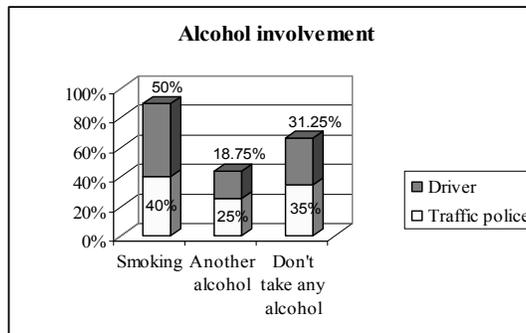


Figure 2: Alcohol Involved driver

Figure 2 depicts the drivers involved in alcohol. Opinion of traffic police in this fig; it is well of that the maximum 40% driver are involved in smoking, after wards 25% driver are involved in alcohol and drugs and 35% driver who do not take any alcohol. Similarly from Driver, it is clear that the maximum 50% driver are involved in smoking, after wards 18.75% driver are involved in alcohol and drugs and 31.25% driver who do not take any alcohol. By taking alcohol or drugs driver are not always in the normal sense and lose the temper during driving which lead to the increase rate of road accidents. High rate of smoking of the driver indirectly increases the rate of accidents by the driver. Lack of illiteracy and unawareness about bad impacts of smoking and alcoholing is the main reason for involvement of drivers in alcohol, drug and smoke.

3.3: Traffic Rule Followed

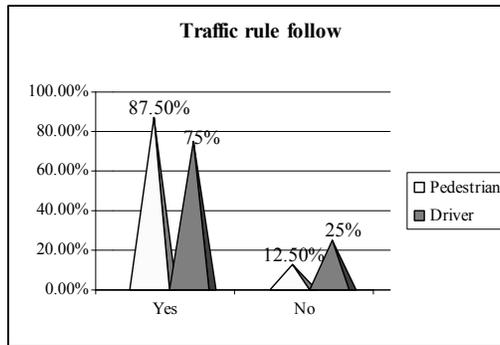


Fig 3: Traffic Rule followed by Driver and Pedestrian

Figure 3 depicts the percentage of pedestrian and driver follows the traffic rule. Here it is seen that the maximum 87.5% pedestrians and 75% driver follow the traffic rule properly, 12.5% pedestrians and 25% driver do not follow the traffic rule properly, Lack of obeisance of traffic rule properly by the pedestrians is one of the main causes of pedestrians fatality in the road accidents while non-obeisance of traffic rule properly by the drivers is the main reasons of the passengers fatality in the road accidents although drivers protect them too from the accidents tactfully. The main causes for non-obeisance of traffic rule are the unawareness and lack of proper knowledge about traffic rules to be followed in the streets. Proper trainings are not provided to the drivers in the traditional driving courses. Such courses are not well organized or not rich with latest knowledge of road safety measures like signaling, markings and road signs that to be well aware of and well disseminated to the drivers who tends to go to road with driving license from BRTA

3.4: Vehicle Responsible for Accident and Disobeying Traffic Rule

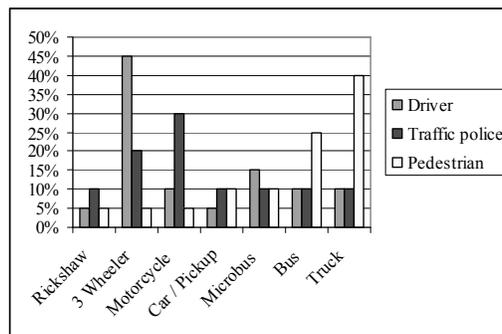


Figure 4: Vehicle Responsible for Accident and Disobeying Traffic Rule

Figure 4 shows the opinion of driver, traffic police and pedestrian about the vehicle responsible of accident. From driver view recently three-wheeler (locally called CNG) is the most threatening to other vehicle for movement in the road. Pedestrian had expressed that bus and trucks are most responsible for accident. From traffic police opinion three-wheeler (locally called CNG) & Motorcycle disobey the traffic rule mostly and from their disobeying activities they are griped to accident occurrences. It is also seen from the Figure that about 30% traffic police says that motor cycle mainly involved for disobeying traffic rule, 20% traffic police says that three-wheeler (locally called CNG) disobeys traffic rule, about 10% says Rickshaw and another 10% of Car /pick up, Bus and truck do not follow traffic rule. Due to temporary inactivity of Traffic rule properly which is one of the main cause of the road accident. The quantity of motor cycle in Sylhet district is high and most of the motorcyclist is young. Their tendency is to go fast without tolerating the existing traffic rule.

3.5: Most Responsible for Accident

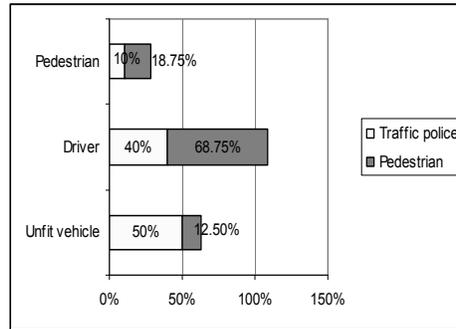


Figure 5: Most Responsible for accident

From figure 5 it is realized that pedestrian, driver & unfit vehicles are most responsible for accident. According to traffic police opinion, 10% pedestrian are responsible for accident, 40% drivers are responsible for accident & 50% unfit vehicles are responsible for accident. According to pedestrian opinion 18.75% pedestrian are responsible for accident, 68.75% drivers are responsible for accident & 12.5% unfit vehicles are responsible for accident. One thing is clear from pedestrian opinion that drivers are mostly responsible for accident and from traffic police opinion that unfit vehicles are mostly responsible for accident.

3.6: Experience in Accident

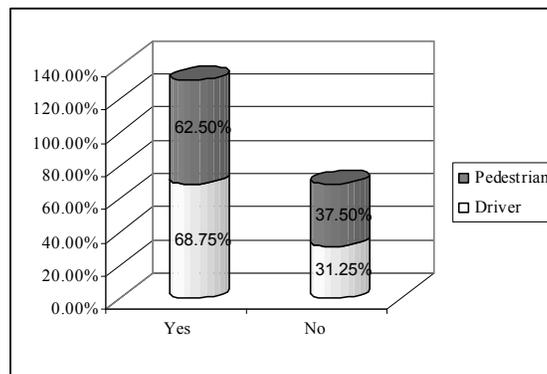


Fig 6: Experience in Accident

It is obvious from the figure 6 that about 68.75% drivers have fallen in accident, 31.25% driver have not fallen in accident. Again about 62.50% pedestrians have fallen in accident, 37.50% driver have not fallen in accident. High rate of falling in accidents by both of the drivers and pedestrians ensure that they are not well aware of traffic rules and regulations.

3.7: Fitness of the Vehicle

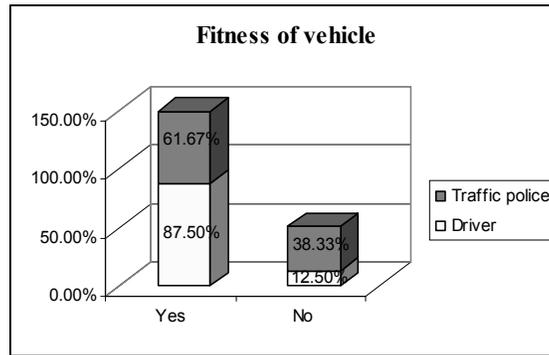


Figure 7: Fitness of the Vehicle

Figure 7 represents the percentage of the fitness of vehicle. From the above figure it is shown that according to traffic police opinion, 61.67% drivers drive the fit vehicles in the road while 38.33% vehicles are not fit for the driving on the roads. According to driver opinion, 12.5% drivers drive the unfit vehicle while 87.50% driver drive fit vehicles. Thus there is a large gap of information from both the source. Considering the information of the traffic police reliable, unfit vehicles may be one of the main causes of traffic accidents on the roads.

4. REGRESSION MODEL DEVELOPMENT

The development of a transportation system has been the generative power for human beings to have the highest civilization above creatures in the earth. However, this growth has caused safety problems that the transportation systems for our efficiency and comfort rob us of our lives, so efforts to overcome this issue have been and will be made by many a person in various fields. Especially, transportation engineers have made passionate researches to analyze accidents and predict potential accidents in our systems. From the accident data analysis it is seen that the hazardous thana is Sylhet Sadar & hazardous road is Dhaka- Sylhet highway (up to Sherpur). Based on hazardous location, accident data & other factors such as registered vehicle, population, ratio of most accident vehicle to the total registered vehicles; a regression model is developed for Sylhet district.

4.1 Model Formulation:

Multiple regression model is selected for this study. Here, dependent variable is number of accident; independent variables are registered vehicle, population & ratio of most accident vehicle to the total registered vehicles. So the multiple regression model for this study is of the following form:

$$\text{Accident, } A = \beta_0 + \beta_1 * RV + \beta_2 * P + \beta_3 * r$$

Where, β_0 = regression constant

$\beta_1, \beta_2, \beta_3$ = regression coefficients,

RV = registered vehicle

P = population

r = ratio of most accident vehicle to the total registered vehicles.

4.1 Data for Model Development

Table 5.2: Total Registered Vehicle (2001-07)

Year	Registered Vehicle, RV
2001	2480
2002	2926
2003	3775
2004	2826
2005	3548
2006	5768
2007	5439

Source: BRTA

Table 5.3: Total No. of Accident Data (2001-07)

Year	No. of Accident, A
2001	48
2002	52
2003	57
2004	60
2005	62
2006	65
2007	102

Source: The Daily Sylhet er Dak

Table5.4 : Total population (2001-07)

Year	Population ,P
2001	316311
2002	356166
2003	401043
2004	451574
2005	508506
2006	572577
2007	644722

4.1.2 Output of Regression Model from SPSS

Regression Model:

Model		Variables Entered/Removed		Variables Removed	Method
1		Ratio, r, Population, P, Registered vehicle, RV ^a		.	Enter
		a. All requested variables entered.			
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	
1	.931 ^a	.867	.734	9.20749	
		PrediPredictors (Constant), Ratio, r, Population, P, Regi registered vehicle ,RV			

ANOVA^b

Model	Model	Sum of Squares	df	Mean Square	F	Sig.	Sig.
1	Re Regression	1659.095	3	553.032		6.523	.079 ^a
	R Resid Residual	254.333	3	84.778	0.79		
	Tota Total Total	1913.429	6				

a. Predictors: (Constant), Ratio, r, Population, P, Registered vehicle, RV

b. Dependent V Depen dependent variable: Accident, A

Model	Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Sig.
		B	Std. Error	Beta			
1	1 Constant	5.550	15.805		.351	0.749	.749
	R Registered Vehicle	-.011	.009	-.831	-1.341	0.273	.273
	P Population, P	.000	.000	1.584	2.754	0.070	.070
	Ratio, R	-	1.305	-.467	-1.534	.223	.223
		2.002					

a. D Dependent Variable, Accident A

So, the regression equation for accident,

$$A = 5.550 - 0.011 * RV + 0.000 * P - 2.002 * r$$

From the above regression equation we can see that registered vehicle (RV) and ratio of most accident vehicle (r) have negative correlation with accident for that reason regression coefficient showing negative value but population (P) has no direct correlation with accident in regression model. During model formulation we have taken population as a variable but population is not directly correlated with accident for that reason population coefficient showing zero in regression equation.

5. CONCLUSIONS

Road traffic accidents end hundreds of thousands of lives across the world every year. Very often death and injury is the result of drivers who did not take the road seriously enough. The cost to the economy is huge, and the financial effect of personal injury can ruin families. Something that can't be measured is the emotional cost to family members and friends when a person is killed or injured. Road traffic accidents are a serious problem all over the world and the safety situation is very severe by international standards. The global forecast has indicated that over the next ten years developing countries like Bangladesh will experience the alarming increase in road accidents and casualties. Pedestrian vehicle conflicts are clearly the greatest problem with significant involvement of trucks and buses and the children are highly vulnerable in the traffic situation compared with many other countries of the world. As a growing city, accident situation is deteriorating day by day due to unavailability of the accident information of Sylhet District. Besides necessary records regarding road safety including traffic law enforcement, maintenance of traffic, vehicle inspection; emergency medical services etc. are also not available with relevant departments. In addition, sufficient number of speed breakers, traffic signs, light posts with streetlights are not available in major roads of Sylhet city. Also zebra crossings, signs, markings and traffic signals are rarely found. Roads do not have adequate facilities for the current large volume of pedestrian traffic. From this study we find that Traffic police was not trained and they need to be trained. Drivers literacy rate is too low and government should formulate a rule to apply on this part.

REFERENCES

- Hoque, M. M. (2004), "The Road to Road Safety: issues and initiatives in Bangladesh" Regional Health Forum – Volume 8, Number 1, 2004 pp 39-51.
- World Health Organization (2004) World Report on Road Traffic Injury Prevention. Geneva
- Jacobs, G.D. (1997). "Towards strategy of improving road safety in developing countries" Annual Review 1996, Transport Research Laboratory, UK
- The Bangladesh Country Paper (2007) "Road Safety Problems in Bangladesh".
- Quazi, M. (2003), "Road Safety in Bangladesh an Overview", Seminar on Road Safety Organized by Center for Rehabilitation of the Paralyzed (CRP), 19th January, 2003, Dhaka, Bangladesh.
- Mojumdar, Bhabi and Hossain, Emran (2008) "Road Accident in Sylhet District and a Typical Cost Analysis" B.Sc. Thesis, Department of Civil and Environmental Engineering, Shahjalal University of Science and Technology, Sylhet.
- Jacobs, G.D. & Thomas, A.A. (2000), "A Review of Global Road Accident Fatalities" Sixty- fifth Road Safety Congress, 6-8th march 2000.
- Roads and Highway Department, "Report on a Map" Sylhet Division, RHD, Sylhet.