Accidents through Road Environment in Khulna Metropolitan City, Bangladesh

F. RUNA[1], Q. S. HOSSAIN[2]

[1]Department of Civil Engineering, KUET, Bangladesh (nilkotha60@gmail.com)
[2]Department of Civil Engineering, KUET, Bangladesh (sazzad1999@yahoo.com)

Abstract

Increasing road traffic accidents are a major threat to life in many parts of the world. In Khulna buses are the main mode of public transport. This paper presents the various aspects of traffic accidents in Khulna Metropolitan city. Data on accidents were collected from different police stations in the city for fifteen years. It was found that a total 508 accidents occurred during this period and 64% was fatal. Buses are involved in 32% of fatal crashes. Pedestrian were the most vulnerable in road section as pedestrian accidents were found to the largest amount having 52%. The analysis results show that mid-blocks are most hazardous locations where accidents occurred most frequently. The study suggests that segregated pedestrian and bicycle lanes can have a major impact on reducing fatal crashes. Therefore, some safety measures and long term recommendations are made to improve the situation of Khulna city.

Keywords: Khulna Metropolitan City; Fatality; Mid-Block; Hazardous Intersection; Pedestrian.

1 Introduction

Road accidents are one of the major causes of death, injury and disability all over the world both in developed and developing countries. With a broad estimation, in every one minute, two people are killed and 95 people are severely injured or permanently disabled in traffic accidents worldwide. Nearly 1.3 million people die in road crashes each year, on average 3,287 deaths a day. An addition 20-50 million are injured or disabled. More than half of all road traffic deaths occur among young adults ages 15-44. Over 90% of all road fatalities occur in low and middle income countries, which have less than half of the world's vehicles. (Association for Safe International Road Travel, n.d).

The estimated global economic cost of traffic accidents is $518 billion per year. The share of the developing countries is $100 billion which account for 1 to 3% of their gross national product (Peden et al. 2004).
Each year more than 500000 people die in road accidents around the world (Mannan and Karim, 1992). The majority of these deaths (about 70%) occur in developing countries, 65% of deaths involve pedestrians and 35% of pedestrian deaths are children. About 15-20 million people suffer severe injuries. The "Study Global Burden of Disease" undertaken by the World Health Organization (WHO), Harvard University, and World Bank, showed that traffic accidents were the world's ninth biggest cause of deaths during 1990. The study forecasts that by the year 2020, road accidents would move up to third place in the table of major causes of death and disability (Murry and Lopez, 1994). This problem draws significant attention in Bangladesh where road accidents are extremely high and still increasing.

Each year as reported to police, more than 3300 individuals lose their lives in road traffic accidents in Bangladesh and many more sustain disabling injuries. Almost 2% of Gross Domestic Product (GDP) is lost in road traffic accidents in our country which itself demonstrates the severity both in terms of deaths and injuries as well as in monetary terms. Although Bangladesh is one of the lowest motorized countries (motorization level 2.3) in the world, it has, however, the worst road fatality rates in the Asia-Pacific region (Anjuman and Hoque, 2007).

In Khulna city, till to date, research works has not been carried out with a detailed spectrum of analysis of road accidents for a full understanding of accident problems and thereby developing effective countermeasures. In

Bangladesh, the most scientific and modern research was conducted by Hoque (1981 to 1991), which provide some important and factual information about the extent and nature of accidents. In urban areas road fatalities involved with pedestrians is about 60%, while in rural area pedestrians accounted for about 40% of total accidents (Hoque, 1991). The total number of registered motor vehicles in Khulna metropolitan city has increased from about 10015 in 2000 to about 36500 in 2015. The basis of this figure is the number of new vehicles registered each year.

Table 1. Number of registered motor vehicles

Year	Number of vehicles	Year	Number of vehicles
2000	9235	2008	17220
2001	10015	2009	19030
2002	10895	2010	21400
2003	11655	2011	24250
2004	12475	2012	27590
2005	13605	2013	30710
2006	14985	2014	34300
2007	15815	2015	36500

In Bangladesh fatality rates per 10,000 vehicles are about 86 persons (Ross, 1998), which is 33% higher than India and over three times greater than Thailand. The traffic accident situation in Khulna Metropolitan city as well as Bangladesh is really alarming and the loss of lives and property damages are expected to continue if suitable corrective measures are not taken accordingly by applying proper engineering measures through extensive research and investigations. This situation is very dangerous particularly in metropolitan cities. About 20 percent of road accident occurred in Metropolitan cities viz. Dhaka, Chittagong, Khulna and Rajshahi (Hoque, 1991). Therefore, it is important that accident studies should be carried out for these cities on a priority basis. The major objectives of this study are to provide information on characteristics of accidents (types, distribution and location of accidents), the location of most hazardous intersections and mid-blocks, and provide recommendations to improve traffic safety in Khulna city.

2 Methodology

2.1 Study Area and Data

The study area is under seven police stations of Khulna Metropolitan Police (KMP), which are: Khulna Sadar, Khalispur, Daulatpur, Sonadanga, Horintana, Aranghata and Khan Jahan Ali. The data regarding road accidents for the years 2000 to 2015 were collected from the Head Quarter of Khulna Metropolitan Police (KMP), Accident Research Institute of Bangladesh University of Engineering and Technology (BUET). The data included accident date, time, location, collision type, number of vehicles involved, number of deaths and cost of property damage pertaining to each accident. The numbers of registered motor vehicles for each year were collected from Bangladesh Road Transport Authority (BRTA). The only official source of accident data in Khulna is the traffic division of the Khulna Metropolitan Police (KMP). In Khulna very few accidents between non-motorized vehicles are reported to police. This is because damage form the accidents are usually minor and compensation costs are settled immediately. So, it is likely that many accidents are not in police records.

3 Results and Discussion

The number of fatal vehicular crashes in cities is on the rise, and a significant number of these fatal crashes involve public transport buses. The main objectives of this study are to collect data pertaining to the each type of all road traffic accident, to investigate accident characteristics such as accident distribution, accident location characteristics and to locate hazardous mid-blocks. The results are discussed below.

3.1 Characteristics of Accidents
3.1.1 Yearly Distribution of Accidents

Figure 1 shows the statistics regarding fatal crashes for the years 2000-2015. A total 508 accidents occurred within the years 2000-2015. The maximum number of accidents (67) occurred in the year 2007 and the least number of accidents (15) occurred in the year 2004.
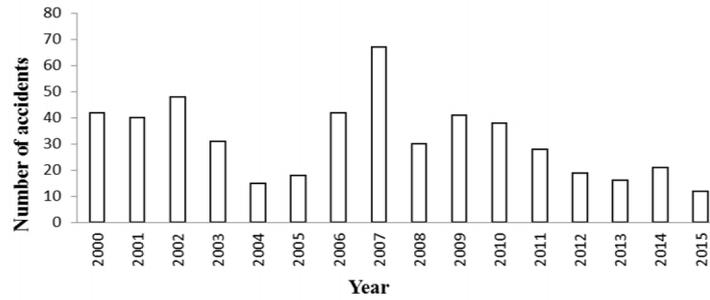
Figure 1. Yearly distribution of accidents

3.1.2 Time of Accidents

The result related to road crashes occurrences at different times is shown in Figure 4.4. Most of the accidents occurred between 4 pm to 6 pm about 25% of the total accidents. Time between 12 pm to 2 pm take the second place of accidents occurrences about 23%. 11% accidents occurred between 6 pm to 8 pm and 8% accidents occurred between 6 am to 8 am.
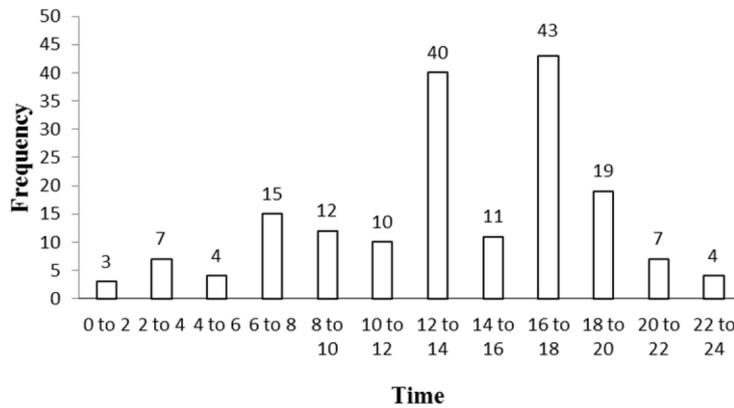

Figure 2. Time of road crashes

3.1.3 Distribution of Accidents by Junction and Collision Type

The distribution of accidents by junction type is shown in Figure 3. Most of the accidents occurred at Not junction having 46%. 28% of the accidents occurred at other junction. 11% of the accidents occurred at T-junction and 9% at crossing. A total 141 accidents occurred at not junction was fatal and grievous is also high at this section. Other junctions constitute 101 fatal accidents.
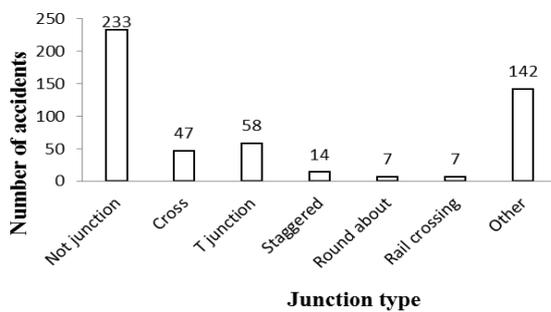

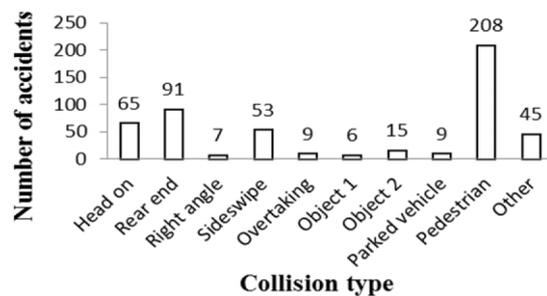Figure 3. Accidents by junction type

Figure 4. Accidents by collision type

Figure 4 shows accidents for each type of collision. It is seen that pedestrian were the most vulnerable in road accidents as pedestrian accidents were found to be the largest amount having 41%. Head on type collisions constitute 13% and rear end type collisions constitute 18%.

3.1.4 Location of Crash Spot

Table 2 shows the distribution of crashes by type of junction and mid-block locations. A total of 77% percent of the fatal crashes were at mid-block, and 17% at mid-block. This indicates that much more attention needs to be focused on safety at mid-block sections and also the location of bus stops.

Table 2. Location of crash spot

Victims	Bus Stand	Roundabout	Intersection	Midblock	Total
Four wheeler	1	1	4	4	10
Passenger		2	9	22	33
Pedestrian	2	1	9	108	120
Two wheeler	3		5	10	18
Auto		3	4	10	17
Van			3	4	7
Cyclist	1		2	5	8
Total	7	7	36	163	213

3.1.5 Distribution of Different Type of Vehicle Involved in Accidents

From figure 5 it is seen that 32% of the involved vehicles were buses. 24% of the involved vehicles were trucks. 10% of the vehicles were motor cycles. The rest of the involved vehicles were of mixed types.
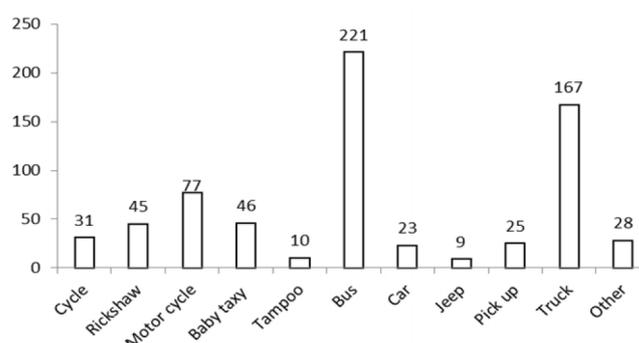

Figure 5. Vehicles involved in accidents

3.2 Analysis Through Road User's Perspective

The distribution of casualties by severity is shown in Figure 6. More than half of the casualties were fatalities as fatalities were 54% of the total casualties. 31% of the casualties were grievously injured and 15% of the casualties were simply injured. Pedestrian are the biggest road user. From figure 7 it is seen that last 7 years, 120 pedestrian casualties are occurred through the highway about 52% of the total casualties. Passenger casualties are contributed 31% and driver casualties are contributed are 17% of the total casualties.
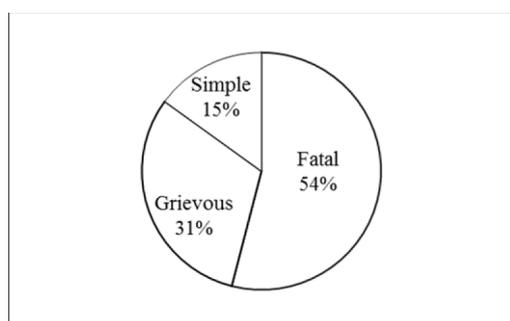

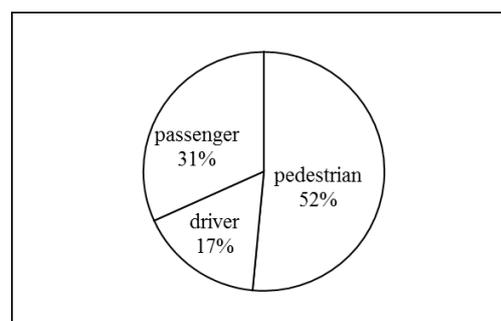Figure 6. Distribution of casualties by severity

Figure 7. Distribution of casualties by road users

3.3 Accidents through Road Environment

The distribution of accidents by road divider is shown in Figure 8. It can be observed that 86% of the accidents occurred where there was no divider. 14% of the accidents occurred where there was divider.

Figure 9 shows the accidents by road geometry. Majority of road crashes occurred in straight highway section which constitutes 96% accident. Curve section of highway constitutes 4% accident. There is no accident during last 7 years in slope and curve plus slope areas of highway.
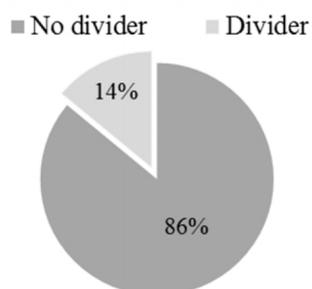
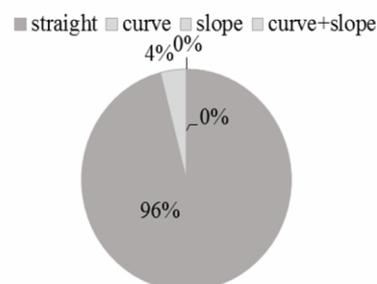

Figure 8. Accident by road divider

Figure 9. Accident by road geometry

3.4 Monthly Accidents Severity

The results on the basis of reported accident cases are shown in Table 3. The highest occurrences of accident are reported in the month of October about 26 crashes, representing 15% of the total crashes. The month of January and September are also accident prone.

Table 3. Accident severity by month

Month	Year							Total
	2009	2010	2011	2012	2013	2014	2015	
January	5	5	4	2	2	2	0	20
February	2	2	4	1	1	2	1	13
March	3	2	3	1	1	0	2	12
April	2	4	1	2	0	2	0	11
May	3	1	4	1	2	1	1	13
June	6	2	1	2	1	0	1	13
July	2	2	3	1	0	3	1	12
August	2	3	0	3	3	1	0	12
September	6	3	1	0	1	4	2	17
October	6	6	5	2	3	2	2	**26**
November	1	6	1	1	0	4	0	13
December	3	2	2	3	1	0	2	13
Total	41	38	29	19	15	12	12	175

4 Conclusions

Based on the findings of this study, the following conclusions are summarized.

- A total 508 accidents occurred within the years 2000-2015 in Khulna Metropolitan City. About 64% of the accidents were fatal.
- Pedestrian were the most vulnerable in road section as pedestrian accidents were found to the largest amount having 52%.
- Buses are involved in 32% of fatal crashes.
- About 86% of the accidents occurred where there was no divider.
- Mid-blocks are most hazardous locations where accidents occurred most frequently.
- Majority of road crashes occurred in straight highway section which constitutes 96% accident.

- The highest occurrences of accident are reported in the month of October about 26 crashes, representing 15% of the total crashes.
- At last, by analyzing the data, it is recommended that segregated infrastructure for bicycles and pedestrian would go a long way in reducing the number of fatal crashes involving public buses.
- Road with divider, more careful in rural highway, at not junction and midblock will also reduce a significant number of fatal crashes.

References

Anjuman, T. and Hoque, M.M. (2007). Road Traffic Accident: a Leading Cause of the Global Burden of Public Health Injuries and Fatalities.

Hoque, M.M. (1991). Accident investigation for the safety improvement of Dhaka-Aricha highway: A section of Asian highway. Final Report, Department of Civil Engineering, Bangladesh University of Engineering & Technology, Dhaka, Bangladesh.

Mannan, M.S. and Karim, M. (1999). Road accidents in Metropolitan Dhaka, Bangladesh. **IATSS Research**, Vol. 23, No. 2, pp. 90-98.

Murray, C.J.L. and Lopez, A.D. (1994). The Global Burden of Disease. Volume 1: A comprehensive assessment of mortality and disability from disease, inquires and risk factors in 1990 and projected to 2020, Harvard University Press.

Peden M, Scurfield R, Sleet D, Mohan D, Hyder AA, Jarawan E, and Mathers C (eds), (2004). The world report on road traffic injury prevention, World Health Organization, Geneva, Switzerland.

Ross, A. (1998). Road safety in developing countries, Highways and Transportation, April, pp.26-28.

WHO (2003). *Report of the Regional Director to the Regional Committee for the Western Pacific*, pp.96-99.