

Road Traffic Accident Characteristics in Dhaka, Bangladesh

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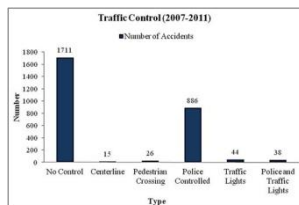
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Graphical abstract



Abstract

Over the next decade, developing countries like Bangladesh will experience an alarming increase in road accidents and this will continue to remain as a serious challenge. Developing countries are experiencing a very high growth rate of vehicles, which is doubling the vehicle fleet in some countries in even five years. The complexity of the road environment with mixed traffic is another reality of road transportation in Dhaka, Bangladesh, where road planning and designs are not appropriate for mixed traffic conditions. Of particular concern are the urban intersections where differential approach speed is a major problem. The heterogeneity of traffic exceeding the capacity, plying of modes with varying speed and maneuvering time make the road links as well as intersections of Dhaka even more complex. The objectives of the study are to determine the characteristics of the road traffic accidents of Dhaka city for the following parameters: a) Traffic accident trend b) Traffic Control Parameters c) Traffic Accident at Junctions d) Traffic Control and Road Dividers e) Traffic Accidents and Road Geometry. Traffic accident data for the period of year 2007-2011 were collected from the Police Stations of the Dhaka Metropolitan Police (DMP) area. The data were compiled from the Police Reports accident by accident and analyzed using an MS Access based database and additionally an ArcGIS software for the selected variables. All the roadway sections and intersections of Dhaka Metropolitan Police (DMP) were considered in the study. A total number of two thousand seven hundred twenty (2720) accidents that were recorded by police during the period of year 2007-2011 were analyzed. The study revealed that a) number of accidents in Dhaka is reducing by more than ten (10) percent every year b) Sixty three percent (63%) of the accidents took place where there was no traffic control c) Only twenty nine percent (29%) of the accidents took place at intersection areas and T-junctions were found to be the most vulnerable junction type d) Seventy three percent (73%) accidents occurred on divided roadways or where only one-way traffic movement existed e) Ninety seven percent (97%) of the accidents occurred on straight road sections. Improvement of the traffic accident data collection system in Dhaka is necessary. Detailed study on under-reporting of traffic accident is also recommended.

Keywords: Urban Road, accidents, statistics, crash, traffic, junctions, road dividers.

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1.0 INTRODUCTION

The global forecast has indicated that over the next ten (10) years developing countries like Bangladesh will experience a tremendous increase in road traffic accidents and casualties. Addressing the safety problems thus emerges as a serious challenge in the absence of requisite transport safety professionals and resources [1]. The poor countries have about forty (40) percent of world's motor vehicles but have eighty six (86) percent fatalities. The rapid economic growth, increasing disposable income and urbanization are raising the demands for transportation rapidly in developing countries. As a result, the numbers of vehicles on roads of developing countries are also increasing rapidly. Developing countries are experiencing an annual growth rate of about sixteen (16) percent, which is doubling the vehicle fleet in five years [2]. This factor along with the high proportion of two-and three-wheeler motor vehicles in the region and the relatively young age of the majority of the

population, is contributing to the serious road accident casualties. These comments are especially relevant to Bangladesh. Sixty five (65) percent of the road accidents in Bangladesh involve pedestrians. Of these pedestrian deaths, thirty five (35) percent are children [3]. This is, in part, a result of rapid increases in motorization without sufficient improvement in road safety strategies and lack of implementation of preventive measures.

Table 1 shows the respective shares in the global population, registered vehicles, and road traffic deaths of high, middle, and low income countries. The percentage of deaths in low income countries is high, whereas low income countries have a much lower share of the registered vehicle population [2]. Table 2 shows reported casualties and number of registered vehicles in Bangladesh. There is a very high fatality rate in road accidents – more than eighty five deaths per ten (10) thousand registered motor vehicles per year. Moreover, the number of registered vehicles is growing alarmingly as well.

Table 1 Global road accidents in different income level countries [4]

Parameter	High Income	Middle Income	Low Income
Population	15.6%	47.8%	36.7%
Registered Vehicles	52.1%	38.7%	9.2%
Road Traffic Deaths	8.5%	49.6%	41.9%

Table 2 Motor vehicles and road accident reported casualties in Bangladesh [5]

Year	Registered Vehicles	Deaths	Injury	Total Casualties
2000	28764	3430	3211	6641
2001	42510	3109	3172	6281
2002	54877	3398	3770	7168
2003	59248	3289	3818	7107
2004	61202	2748	1080	5621
2005	65878	3187	2754	5941
2006	80305	3193	2409	5602
2007	121272	3749	3273	7022
2008	144419	3765	3284	7049
2009	145243	2958	2686	5644
2010	161178	2847	1803	4449
2011	172484	2467	1631	3858

The main causes of road accidents in Bangladesh are over speeding, overloading, and overtaking by motor vehicles. Unregulated movement of non-motorized vehicles along with motorized vehicles on the same route is also one of the major causes for road accidents. Lack of awareness and reckless driving habits also result in frequent accidents claiming lives and causing anguish and grief to the affected families [5]. In other words the road safety problem has become one of the major issues for the transport regulators and traffic law enforcers in Bangladesh. In urban areas, the traffic roadway system is more complex where a mixed road user environment prevails and greater perceptual demands are placed on the road users. Of particular concern are the urban intersections, particularly the signalized ones that have problematic locations and have been identified as among the most hazardous locations on the roads which account for a substantial portion of traffic accidents. The heterogeneity of traffic, plying of modes with varying speed and maneuvering time make the intersections of cities of Bangladesh even more hazardous [6].

In the Mega-City Dhaka, with a population of fourteen (14) million (may rise to 22-25 million by 2020) rapid urban population growth has far outstripped the capacity of urban infrastructure, leading to low level of service delivery. The transport conditions in Dhaka are characterized by chronic traffic congestion and delays, high rate of accidents, low quality of public transport service, lack of comfort and safety for pedestrians and growing air pollution. In Dhaka, nearly fifty percent of the people are walking dependent, both for economic and efficiency reasons. A significant number of trips are made by bicycles and non-motorized three wheeler rickshaws. There is a high level of conflicts between motorized and non- motorized transport. Also,

seventy seven (77) percent of traffic accident fatalities were found to be pedestrians and (50) fifty percent of these fatalities involved buses in a previous study [3]. At the current growth rate, the number of vehicles in the country is expected to double in the next ten (10) years. In urban areas, the traffic roadway system is more complex where a mixed road user environment prevails and greater perceptual demands are placed on the road users. These specific natures make Dhaka city unique and different from other developing cities of the world.

The objective of the paper is to study the characteristics of the road accidents in a mixed traffic environment where most of the roads are congested during most times of the day and night. The study focused on few selected parameters a) Traffic accident trend b) Traffic Control Parameters c) Traffic Accident at Junctions d) Traffic Control and Road Dividers e) Traffic Accidents and Road Geometry.

■2.0 THE STUDY LOCATION

Dhaka City is surrounded by rivers that restrict the natural geographical growth of the city. Dhaka city area is under the jurisdiction of different authorities that are known as Dhaka North and South City Corporations (DCC), Dhaka Metropolitan Area (DMA), Dhaka Statistical Metropolitan Area (DSMA) and Dhaka Metropolitan Development Plan (DMDP) area. The study area for this study is Dhaka Metropolitan Area. The study area covers the whole DCC area, the oldest organic core part of Dhaka city (Old Dhaka), the planned areas and even the unplanned new generation organic areas that are called 'Informal Settlements'. This selected study area covers the biggest urban agglomeration and is the central part of Bangladesh in terms of social and economic aspects.

■3.0 DATA COLLECTION

The first step of the study was to collect accident data covering the years 2007 thru 2011 for the study area. After extensive field surveys, it was found that the responsibility of collecting traffic accident related data vests on the Police department of Bangladesh. The concerned Police Stations fill-up 'Accident Reporting Form' (ARF) for each accident. Those are the official source of accident information or data. A total of 2,720 ARFs were collected for the period 2007-2011.

■4.0 PLOTTING THE ACCIDENT LOCATIONS

At the beginning, a database was developed using 'Microsoft Access' for the selected variables. Later this database was exported to ArcGIS software for mapping and projecting the accident locations incorporating all the necessary information. One major problem plotting the accident locations in GIS platform was to match the unknown coordinate system of Dhaka Metropolitan Police (DMP) maps. DMP Headquarter uses quite old maps of Dhaka City with no geographic and projected coordinate system referred. To resolve this problem, the unknown coordinate system has been transformed into Bangladesh Transverse Mercator (BTM) projection system. The base maps (shape files) including the DCC boundary, water bodies, railway lines and road networks were collected from Rajdhani Unnayan Kartripakkha (RAJUK) i.e. the capital development authority. These maps were produced in 2010. The GPS and other surveying activities were conducted during 2005-2008. Therefore, these are the available latest and up- to-date maps of Dhaka city. At a later stage of the study, the database created in 'Microsoft Access' was exported to ArcGIS that made it possible to plot all the accident locations including the information generated for the selected

variables. Figure 2 shows road accidents in Dhaka city during 2007-2011 which was produced as a part of a bigger project [7].

■5.0 UNDER-REPORTING ISSUE OF TRAFFIC ACCIDENTS

An important factor in road safety management is the collection and use of accurate and comprehensive data related to road accidents. The interpretation of those data is a pre- requisite for an accurate diagnosis of accident problems, assists in the development of remedial measures and allows evaluating the effectiveness of road safety programs. However, data constraints and widespread underreporting of accidents prevent understanding of the real magnitudes of road accident problems. It is observed that the sources of accident data are biased due to under-reporting, particularly in the case of non-fatal accidents. A crash should be reported to the Police Department of Bangladesh in case of fatality, serious injury and when an insurance claim is involved. Only one accident out of 125 occurred is reported to the police. Figure 1 show that thirty four (34) percent of accident cases have been settled locally, either by paying some treatment cost or begging pardon or making some financial compensation [3].

Accident Research Institute (ARI) of Bangladesh University of Engineering and Technology (BUET) conducted a survey data on Dhaka-Aricha road to investigate the extent of underreporting. It is found that the extent of underreporting is as high as sixty (60) percent in some Police Stations. Moreover a thorough review of newspaper revealed that underreporting of fatality information is also highly prevalent [8]. A study finding of BRAC (former Bangladesh Rural Advancement Committee) [9] about under reporting in Bangladesh is shown in Figure 1.

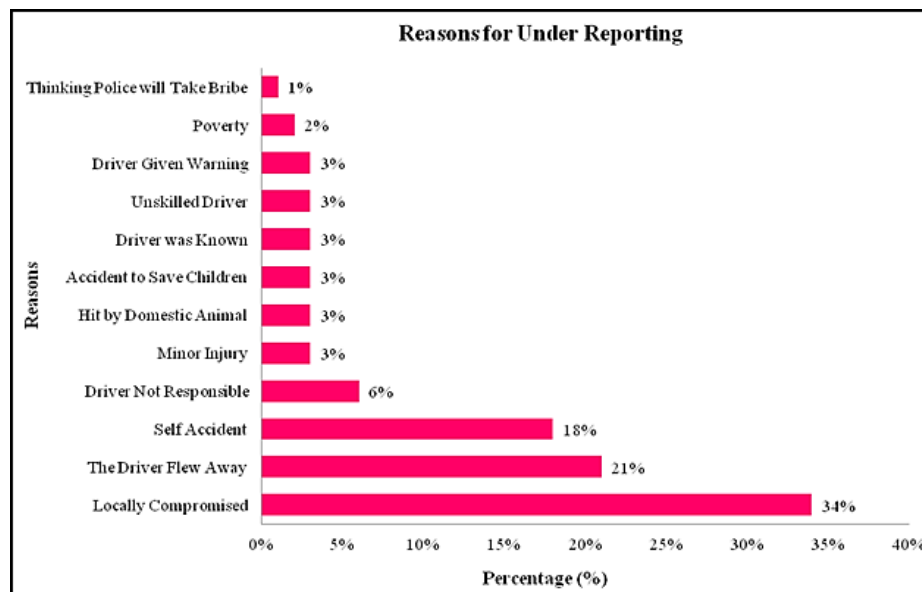


Figure 1 Reasons for under reporting of traffic accident [9]

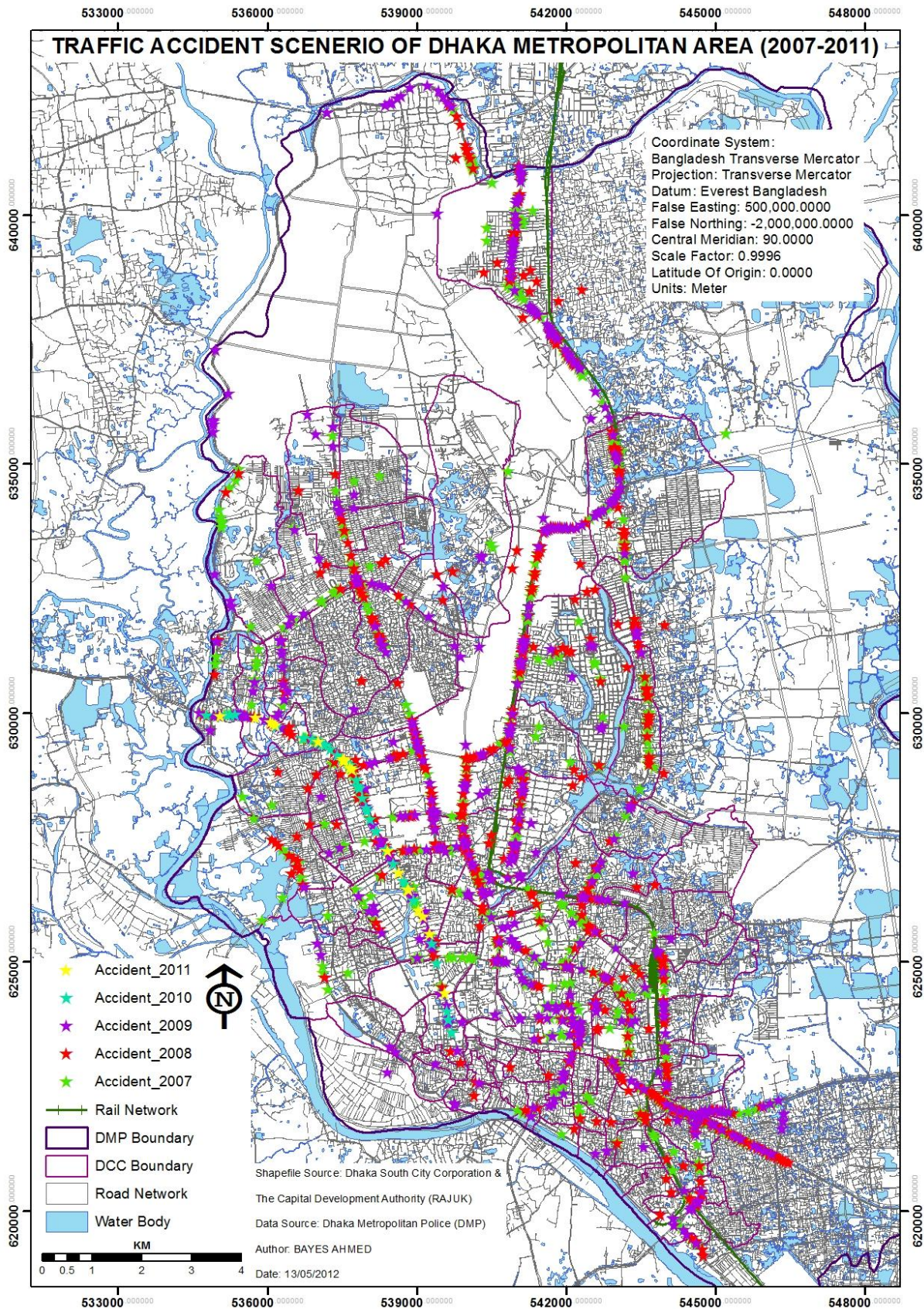


Figure 2 Road accidents on a Dhaka city map (2007-2011) [7]

6.0 ANALYSES AND FINDINGS

Detailed analyses of the GIS based traffic accident maps were performed. This includes analyses of all the maps containing accident details of years 2007-2011 of Dhaka City. The cause and effect scenario of traffic accidents are depicted in Table 3 and Table 4. A total number of 2,720 accidents caused a total of 1,481 numbers of pedestrian fatal accidents with 1,562 pedestrian fatal casualties during 2007-2011. The scenarios for Non-Motorized

Vehicle (NMV) and Motorized Vehicle (MV) are also visible in these tables. It is interesting to note that the total number of traffic accidents is decreasing over the years as shown in Figure 2 and between 2007 and 2011; the traffic accidents have decreased by forty eight percent. Each year the total number of traffic accidents is reducing by eleven percent on an average. Figure 3 shows that the total number of accidents in Dhaka reduced from 731 in 2007 to 382 in 2011.

Table 3 Traffic accident scenario of Dhaka metropolitan area (Cause)

Year	* Total Number of Recorded Accidents	Number of Fatal Accidents			Number of Injury Accidents (Grievous and Simple)			Number of Motor Collision
		Pedestrian	**NMV	***MV	Pedestrian	**NMV	***MV	
2007	731	361	46	47	78	32	59	109
2008	655	367	40	56	20	28	56	88
2009	518	307	26	45	14	23	40	65
2010	434	249	31	32	30	17	48	44
2011	382	197	29	42	41	17	50	28

Table 4 Traffic accident scenario of Dhaka metropolitan area (Effect)

Year	* Total Number of Recorded Accidents	Number of Fatal Casualties (Passengers or Drivers)			Number of Injury Casualties (Passengers or Drivers)			Total Number of Vehicles Involved in Traffic Accidents
		Pedestrian	**NMV	***MV	Pedestrian	**NMV	***MV	
2007	731	395	53	62	84	57	115	997
2008	655	382	45	80	20	47	122	918
2009	518	315	33	59	15	39	73	721
2010	434	262	36	45	44	22	85	587
2011	382	208	29	53	45	22	80	528

Note: One accident may cause fatality and injury at the same time. Moreover, one accident can cause more than one casualties.

* Number of Filled-Up Official Accident Reporting Forms during a Year

** NMV = Non-Motorized Vehicle

*** MV = Motorized Vehicle

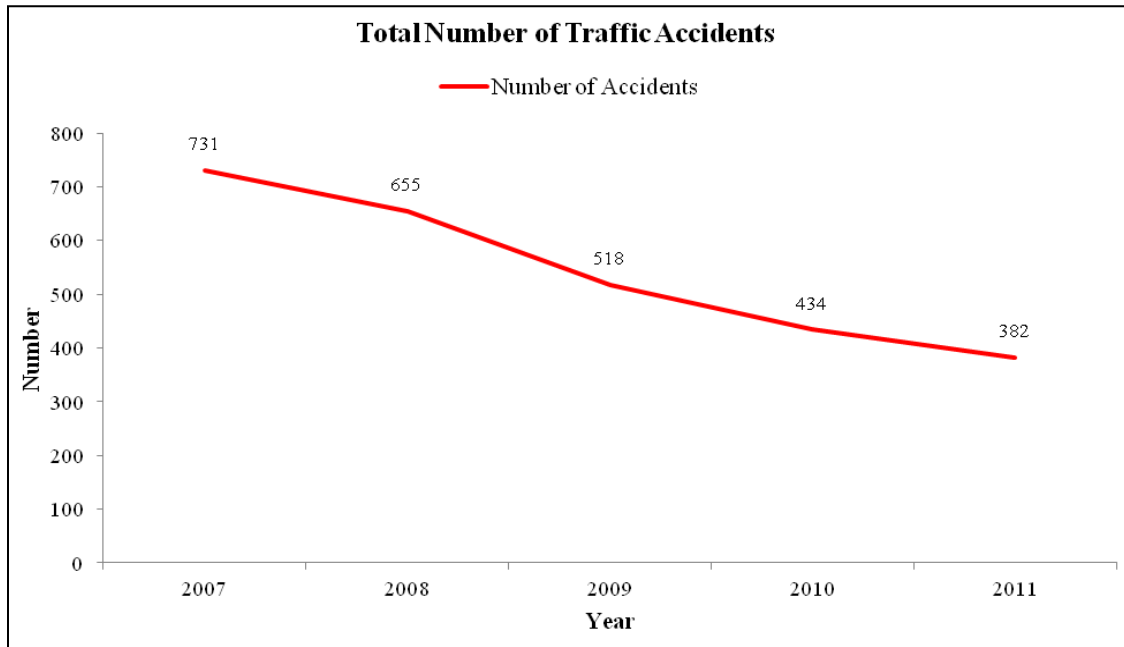


Figure 3 Total Number of accidents in Dhaka City

7.0 TRAFFIC CONTROL PARAMETER

In DMP area, over the years (2007-2011), most accidents occurred where there was no traffic control. This is nearly 63%, which means 1711 accidents out of 2720. Again, accidents in the presence of Police Control were also evident (33%). Traffic accidents both in the existence of traffic lights and police control are also high as shown in Figure 4.

The finding of the study was that most accidents take place in no junction area. Figure 5 illustrates that about 71% accidents (1925 out of 2720) occur where there is no junctions. Then ‘Tee-Junction’ is in second position (16%). Another vulnerable junction type is ‘Cross-Junction’ (12%). As shown in Figure 5, accidents in ‘Staggered-Junctions’ and Railway Crossings are the least.

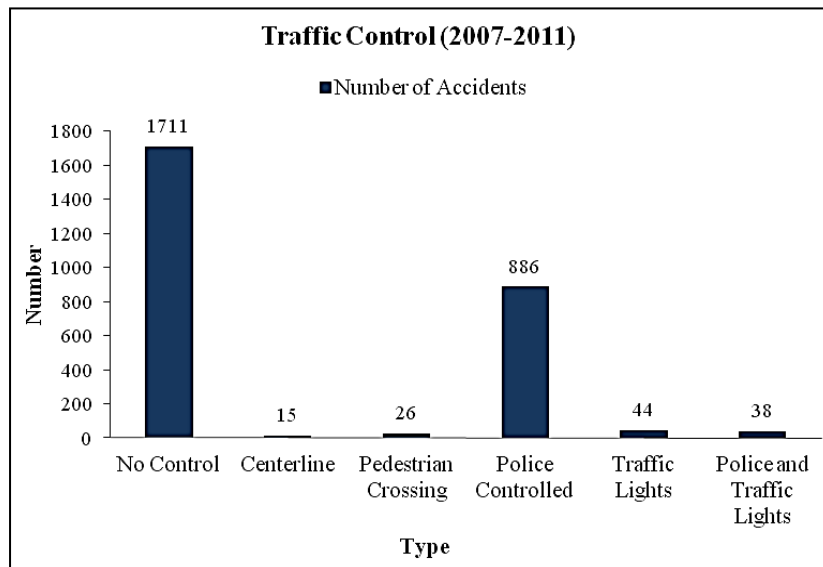


Figure 4 Traffic accidents with various types of traffic controls at junctions

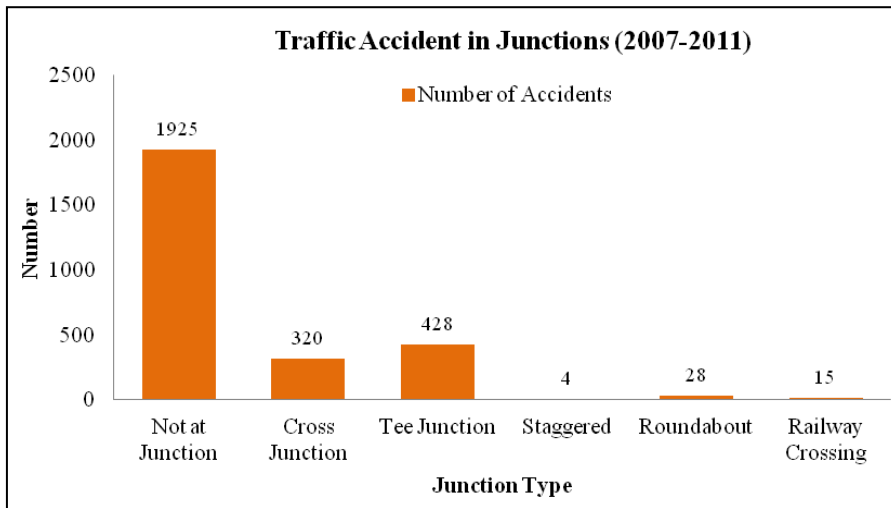


Figure 5 Traffic accident in intersections

8.0 TRAFFIC MOVEMENT AND ROAD DIVIDER

It is evitable from Figure 6 that most accidents seventy three (73) percent take place in one-way streets. It means streets with road

divider is more accident prone than streets without dividers. About eighty (80) percent accidents occur where road dividers exist as shown in Figure 6.

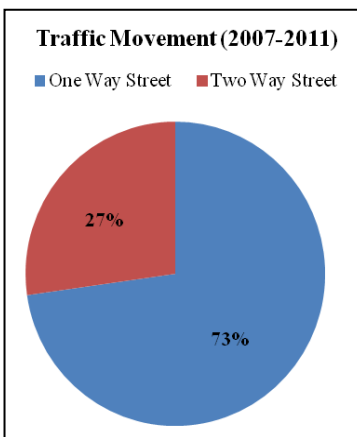


Figure 6 Traffic accidents with traffic movements

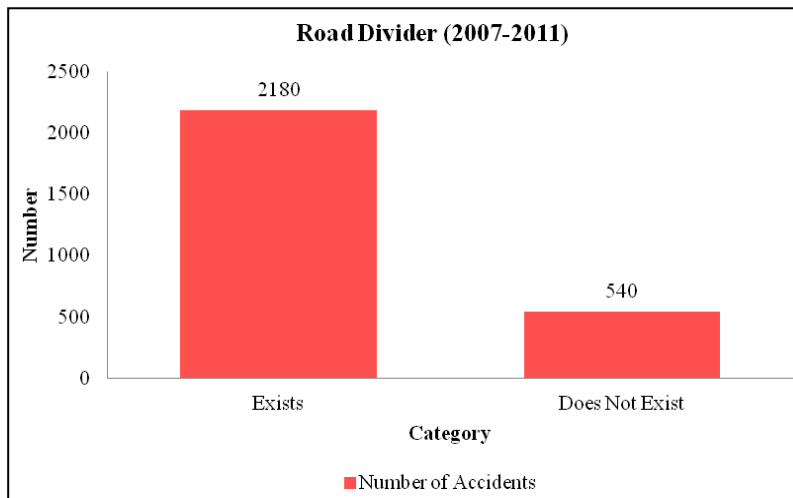


Figure 7 Traffic accident with road dividers

9.0 TRAFFIC ACCIDENTS AND ROAD GEOMETRY

Traffic accidents are dominant in straight and flat roads (97%) of Dhaka City (Figure 8). Out of 2720 accidents, 2635 accidents

took place in flat roads over the years of 2007-2011 while only 2% accidents occurred in curve streets as shown in Figure 8.

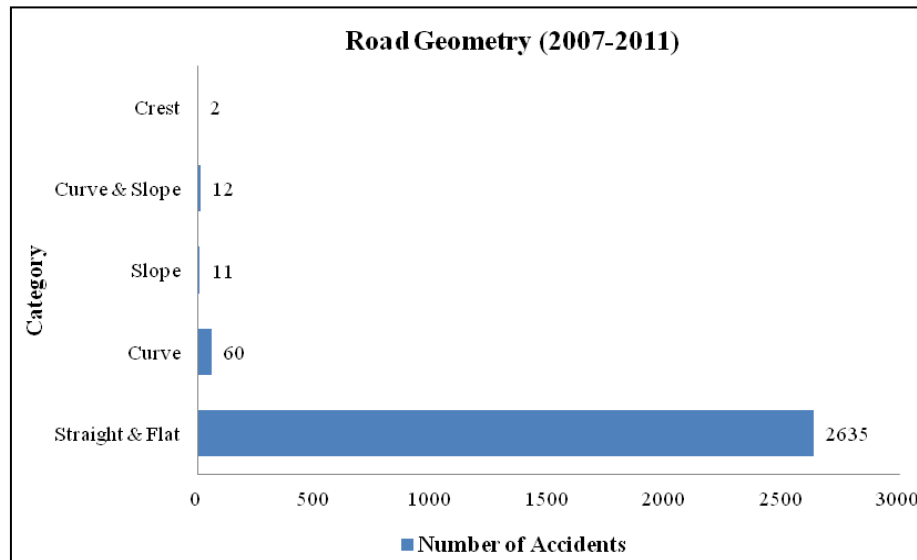


Figure 8 Traffic Accident with different road geometry

10.0 CONCLUSIONS AND RECOMMENDATIONS

From the study finding the following conclusions can be drawn: Dhaka Metropolitan Police (DMP) is the only Government authorized legal source for collecting accident information. Under-reporting, under-recording and improper transcription of accident reporting forms are some of the major drawbacks for accident data collection.

- The total number of traffic accidents is decreasing and between 2007 and 2011; the traffic accidents have decreased by forty eight (48) percent. Each year the total number of traffic accidents is reducing by eleven percent on an average.
- Sixty three percent (63%) of the accidents took place where there was no traffic control
- Twenty nine percent (29%) of the accidents took place at intersection areas and T-junctions were the most vulnerable junction type
- Seventy three percent (73%) accidents occurred on divided roadways or where only one-way traffic movement existed.
- Ninety seven percent (97%) of the accidents occurred on straight road sections.

Based on the experience gathered during the study and findings of the study, it is recommended that incorporating modern technologies (e.g. using GIS techniques instead of MAAP5 software) in collection and recording of data is necessary. The prevalence of underreporting is a common developing country problem and it is recommended to conduct further detailed study on this topic.

References

[1] Hoque, M.M. 2004. The Road to Road Safety: Issues and Initiatives in Bangladesh. *Regional Health Forum*. 8(1): 39–51.

- Hoque, M.M., M. McDonald, and R.D. Hall. 2001. Road Safety Improvements in Developing Countries: Priority Issues and Options. *Proceedings of the Twentieth Australian Road Research Board (ARRB) Conference*. Australia.
- Document of the World Bank. Report No: 45055-BD. 2009. *Project Appraisal Document On A Proposed Credit In The Amount Of US\$ 62.2 Million Equivalent To The People's Republic Of Bangladesh For The Clean Air And Sustainable Environment Project*. Dhaka, Bangladesh.
- Land Transport Authority Academy (LTA). 2012. Cluster 7/Module 3 (C7/M3): *Safety Issues, Capacity Building Program: Building Leaders in Urban Transport Planning (LUTP)*. Singapore.
- National Road Safety Council, Bangladesh Road Transport Authority, Ministry of Communications. 2011. *National Road Safety Strategic Action Plan (NRSSAP) 2011–2013*. Government of the People's Republic of Bangladesh.
- Anowar, S., M.D Alam, and M.A. Raihan. 2008. Analysis of accident patterns at selected intersections of an urban arterial. *Proceedings of the 21st ICTCT Workshop*. Melbourne, Australia.
- Ahmed, I., B. Ahmed, and M.R. Hainin. 2013. High-risk Road Accident Corridors in Dhaka, Bangladesh. *Jurnal Teknologi*. 65(3): 61–65.
- Ahsan, H.M., M.A. Raihan, M.S. Rahman, and N.H. Arefin. 2011. Reporting and recording of road traffic accidents in Bangladesh. *Proceedings of 4th Annual Paper Meet and 1st Civil Engineering Congress*. Dhaka, Bangladesh.
- Bangladesh Rural Advancement Committee (BRAC). 2004. *Promoting Road Safety through Community Education Programmes*. Study Report: Betila (Bangladesh), BRAC Centre, 75 Mohakhali, Dhaka 1212, Bangladesh.