

Contemporary Issues and Priorities in Addressing the Road Safety Problems of Dhaka Metropolitan Area, Bangladesh

Bayes Ahmed¹

Abstract

Road traffic accidents are the world's number one cause of death among young people between 16 and 24. Bangladesh has one of the highest fatality rate in road accidents in the world. Moreover, Dhaka, the capital of Bangladesh, is the most vulnerable city both in terms of total number of accidents and accident rates. A total number of 2,720 accidents occurred within 2007-2011. This has caused a total of 1,481 numbers of pedestrian fatal accidents with 1,562 pedestrian fatal casualties.

At this backdrop, road safety problem has become one of the major issues for the transport regulators and traffic law enforcers in Dhaka. The objective of this research is to identify the most accident-prone roads, the victims as well the in-depth reasons for traffic accident in Dhaka Metropolitan Area. In this article, the road safety situation and traffic accident trends are discussed elaborately. It also discusses some contemporary issues and priorities in addressing the road safety problems.

Based on the findings of this study, some recommendations related to Engineering, Enforcement, Educational and Emergency Response aspects are made. This kind of research will help generating new ideas to find out the parameters for reducing road traffic accidents in greater Dhaka City.

Introduction

More than one-third of the population of Bangladesh lives in cities. It is projected that, by the middle of the century, more than half of the population of Bangladesh will be urban-based. Most of the population growth is concentrated in and around Dhaka, the Capital of Bangladesh. Since 1971, it has seen an eightfold increase in population that stands at more than 14 million, making it the eighth largest city in the world. It is projected to become the fourth largest city by 2015 with a population of approximately 22 million (World Bank Report, 2009).

Moreover, the transport conditions in Dhaka are characterized by chronic traffic congestion and delays, low quality of public transport service, lack of comfort and safety for pedestrians and growing air pollution (MOEF, 2009). In Dhaka, nearly 50% of the people are walking dependent, both for economic and efficiency reasons. Also, 77% of traffic accident fatalities are pedestrians and 50% of these fatalities involve buses (World Bank Report, 2009). Therefore it is important to focus on reducing conflict between motorized and non-motorized transport, reducing congestion and providing safer and cleaner mobility for those who walk and use public transport.

The objective of this article is to identify the most accident-prone roads, the victims as well the in-depth reasons for traffic accident. In this article, the road safety situation and traffic accident trends of Dhaka Metropolitan Area (DMA) are discussed elaborately. It also discusses some contemporary issues and priorities in addressing the road safety problems within DMA.

¹ PhD Student, Institute for Risk and Disaster Reduction, University College London (UCL), Gower Street, London WC1E 6BT, United Kingdom (UK). E-mail: bayesahmed@gmail.com; bayes.ahmed.13@ucl.ac.uk

Literature Review

According to the World Health Organization (WHO) estimation, road traffic injuries are a leading cause of death, killing nearly 1.3 million people annually more than 3000 deaths each day. More twenty to fifty million people sustain non-fatal injuries from a collision, and these injuries are an important cause of disability worldwide. Approximately 90% of these deaths occur in low and middle-income countries-70% of total road traffic deaths occur in low income countries, which claim less than half the world's registered vehicle fleet (WHO, 2011).

Bangladesh, a country having an area of 1,47,570 sq.km and a population of 160 million, has about 1.6 million motorized and could be over 3 million non-motorized vehicles. Road accidents in Bangladesh claim, on an average, about 4000 lives and injure another 5000 every year (Hoque, 2004).

The statistics reveals (Table 1) that Bangladesh has one of the highest fatality rate in road accidents – higher than 85 deaths per ten thousand registered motor vehicles every year, whereas, in developed countries the number of motorized vehicles is many times more, the rate is below 5; as compared with the rates of 2.0 in USA and 1.4 in UK (NRSSAP, 2011). Moreover, the number of registered vehicles is also growing alarmingly in Bangladesh (Table 1).

Table 1: Growth of Motor Vehicles and Road Accident Casualties in Bangladesh.

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

Source: Bangladesh Road Transport Authority (BRTA), 2012.

Statement of Problem

The global forecast has indicated that over the next 10 years developing countries like Bangladesh will experience an alarming increase in road accidents and casualties. Addressing the safety problems thus emerges a serious challenge in the absence of requisite transport safety professionals and resources (Hoque, 2004).

The poor countries have about 40 percent of world's motor vehicles but have 86 percent fatalities (Hoque *et al.*, 2001). The rapid economic growth, increasing disposable income and urbanization are raising the demands for transportation in developing countries. As a result, the numbers of

vehicles on roads of developing countries are also increasing gradually. Developing countries are experiencing an annual growth rate of about 16% to 17%, which is doubling the vehicle fleet in five years. This factor along with the high proportion of two- and three-wheeled motor vehicles in the region and the relatively young age of the majority of the population are contributing to the serious road accident casualties. These comments are especially relevant to Bangladesh (Kamruzzaman *et al.*, 2013).

At the current growth rate, the number of vehicles in the country is expected to double in the next ten years. The complexity of road environment with mixed traffic is another reality of road transportation in Bangladesh, where road designs are not appropriate for mixed traffic standards (Najmul, 2003; Ishtiaque and Ahmed, 2013).

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 (Hoque, 2004). 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 are problematically located. These 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 makes the intersections of cities of Bangladesh even more complex (Anowar *et al.*, 2008; Ishtiaque *et al.*, 2013).

Study Area Profile

Dhaka is located in central Bangladesh at 23°43'0"N and 90°24'0"E, on the eastern banks of the *Buriganga* River (Ahmed and Ahmed, 2012). The study area of this research is selected as Dhaka Metropolitan Area (Figure 1). This study area covers the whole Dhaka City Corporation (DCC) area, the oldest organic core of Dhaka City (Old Dhaka), the planned areas and the unplanned new generation organic settlements that are called 'Informal Settlements'. DMA almost covers the biggest urban agglomeration and is the central part of Bangladesh in terms of social and economic aspects. The population density of DMA is also one of the highest in the world. Moreover, DMA is currently ranked as the world's worst livable city (Ahmed *et al.*, 2013).

Traffic Accident Scenario of Dhaka Metropolitan Area

The mega-city Dhaka with a population of 14 million (may rise to 22-25 million by 2020) presently cannot cater the demands of the city dwellers in terms of basic transport network (CIA, 2010). DCC, the largest city corporation of the country, is in the verge of challenges like development and maintenance of transport infrastructures, which includes city roads and highways, pedestrian facilities, traffic signals, bus terminals, road surface, on street parking, footpaths, and underpasses/overpasses etc. (Ahmed, 2012).

Figure 2 shows the traffic accident scenario of the four major cities of Bangladesh for the year 2009. This is the latest available data collected from Bangladesh Road Transport Authority (BRTA). It is found that Dhaka is the most vulnerable city both in terms of total number of accidents and accident rates (Figure 2).

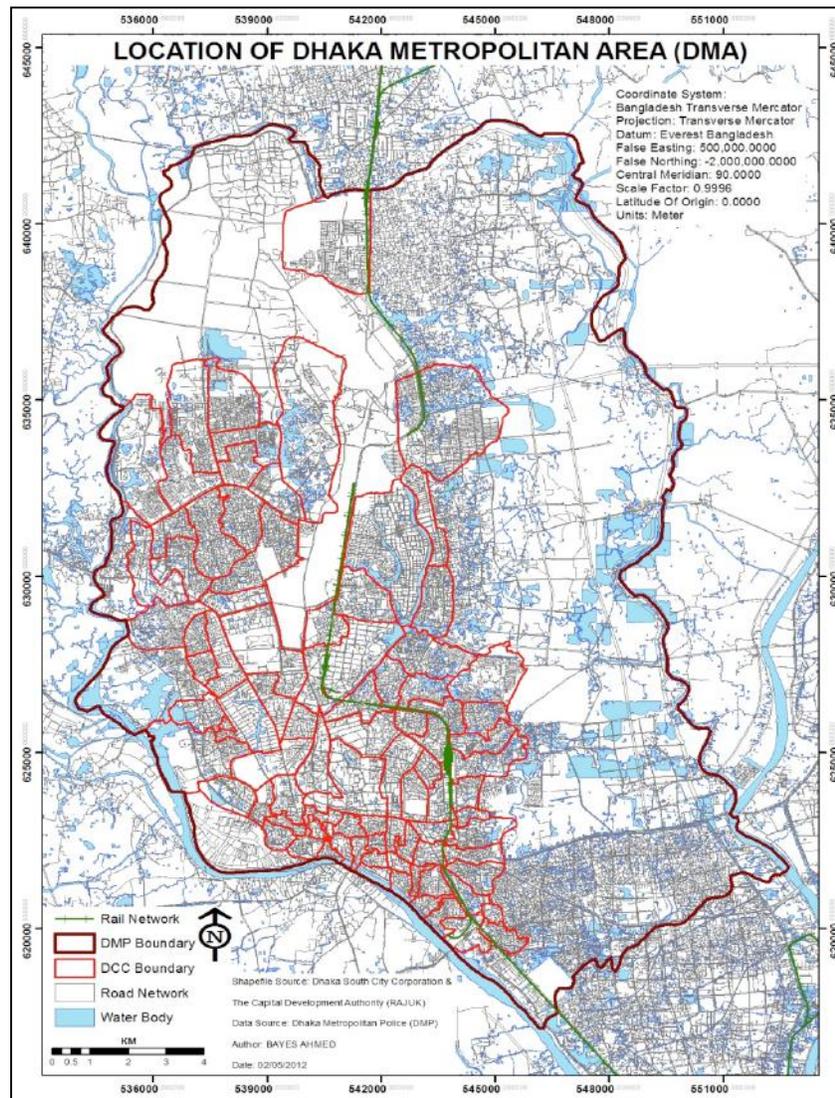


Figure 1: Location of Dhaka Metropolitan Area (DMA); Source: Author.

Figure 2 depicts the casualty accident rates of the four major cities of Bangladesh. It is quite evident from this figure that the accident rate is the highest in Dhaka, while Rajshahi City is in second position. Moreover, it is also evident that the total number of traffic accidents is the highest in Dhaka City, while Chittagong City is in second position. Rajshahi City has the lowest number of traffic accidents (Ahmed, 2012).

Therefore; this study is much important in the context of Dhaka City, in particular DMA, as it is one of the most accident-prone cities in Bangladesh (Figure 2). Moreover, this kind of research will help generating new ideas to find out the parameters for reducing road traffic accidents in developing countries. The decision makers as well the transport planners can initiate appropriate plans based on the outcome of this research study.

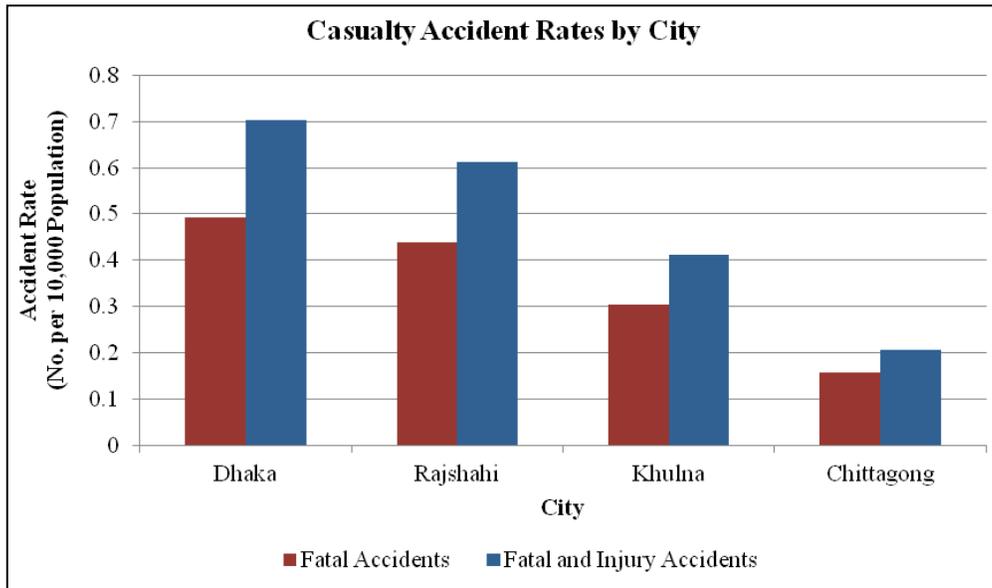


Figure 2: Casualty Accident Rates in the Major Cities of Bangladesh (2009); Source: Author.

Data Collection

After extensive field survey, it is 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. This is the official source of accident information or data. The ARFs for this research were collected from the Dhaka Metropolitan Police Headquarter. A total of 2,720 ARFs were collected for the years of 2007-2011. The GIS (Geographic Information System) shapefiles were collected from the *RAJUK* or *Rajdhani Unnayan Katripakha* (Capital Development Authority).

Analysis and Results

Cause-Effect Analysis

The cause and effect scenario of traffic accidents are depicted in Table 2 and Table 3. A total number of 2,720 accidents occurred within 2007-2011. This caused a total of 1,481 numbers of pedestrian fatal accidents (cause) with 1,562 pedestrian fatal casualties (effect). The scenarios for Non-Motorized Vehicle (NMV) and Motorized Vehicle (MV) are also illustrated in these tables. It is also notable that the total number of traffic accidents is decreasing over the years (Figure 3). From 2007 to 2011, the traffic accidents were decreased by 48%. Moreover, each year the total numbers of traffic accidents were reducing by 11% on an average (Figure 3).

Traffic Accident Severity

Out of 2,720 traffic accidents 1,875 were fatal accidents, 553 were injury accidents and 334 were motor collisions. The effects were 2,057 deaths of passengers/ pedestrians/drivers and 870 other people were injured. A total of 3,751 numbers of vehicles were involved in all those 2,720 accidents from 2007-2011 (Table 2 and Table 3).

Table 2: 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 3: 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; or it can cause more than one casualties.

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

** NMV = Non-Motorized Vehicle

*** MV = Motorized Vehicle

Source: Dhaka Metropolitan Police Headquarter, 2012 and the Author.

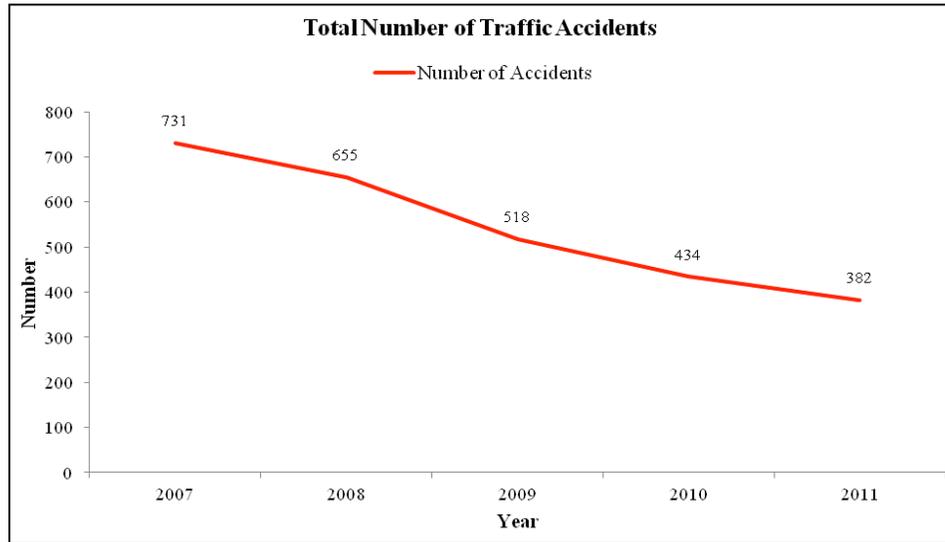


Figure 3: Total Number of Accidents in DMA (2007-2011); Source: Author.

From Figure 4, it is evident that the total number of motor collision accidents was decreasing gradually over the years. Moreover, there was a slight increase in the fatal accidents from 2007-2008. But after then, it started being decreased in a noticeable way. In case of injury accidents, a decreasing trend was found at the beginning; but later from 2009 the trend-line is going upwards (Figure 4).

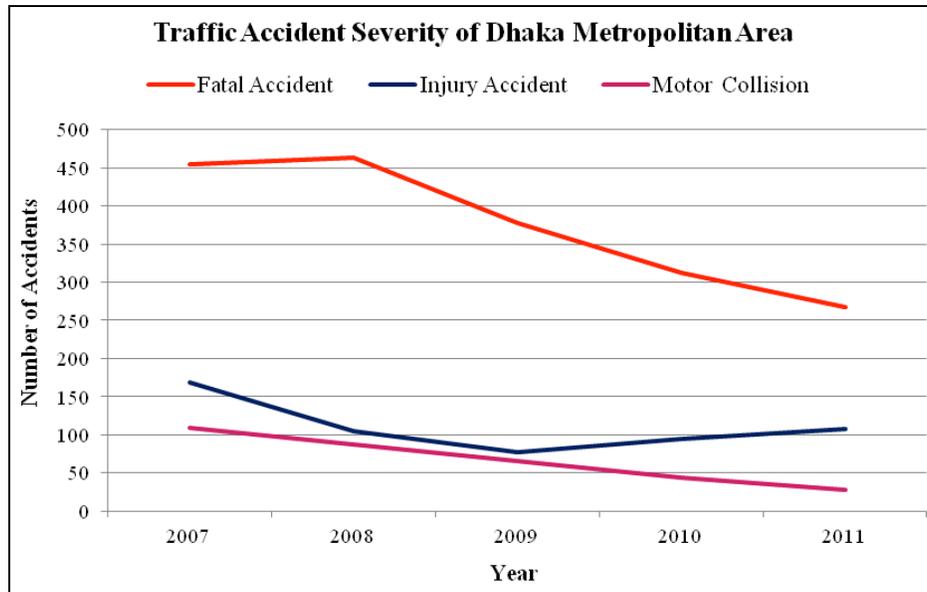


Figure 4: Traffic Accident Severity in DMA (2007-2011); Source: Author.

Figure 5 shows the locations of all the traffic accidents occurred within DMA from 2007-2011. From this kind of map, it is possible to find out the most accident-prone roads. This kind of GIS based map, to locate the accident hot spots, is first ever produced in the context of Dhaka City and can be promoted for further analysis by the concerned stakeholders.

Most Accident Prone Roads in Dhaka Metropolitan Area

After analyzing Figure 5, thirty different accident-prone roads/corridors in DMA were identified. These roads or corridors or avenues cover approximately 95% of the total traffic accidents within DMA from 2007-2011. Remaining 5% accidents occurred in other tertiary roads of Dhaka City. It means special attention should be given in these 30 vulnerable-roads in terms of road safety.

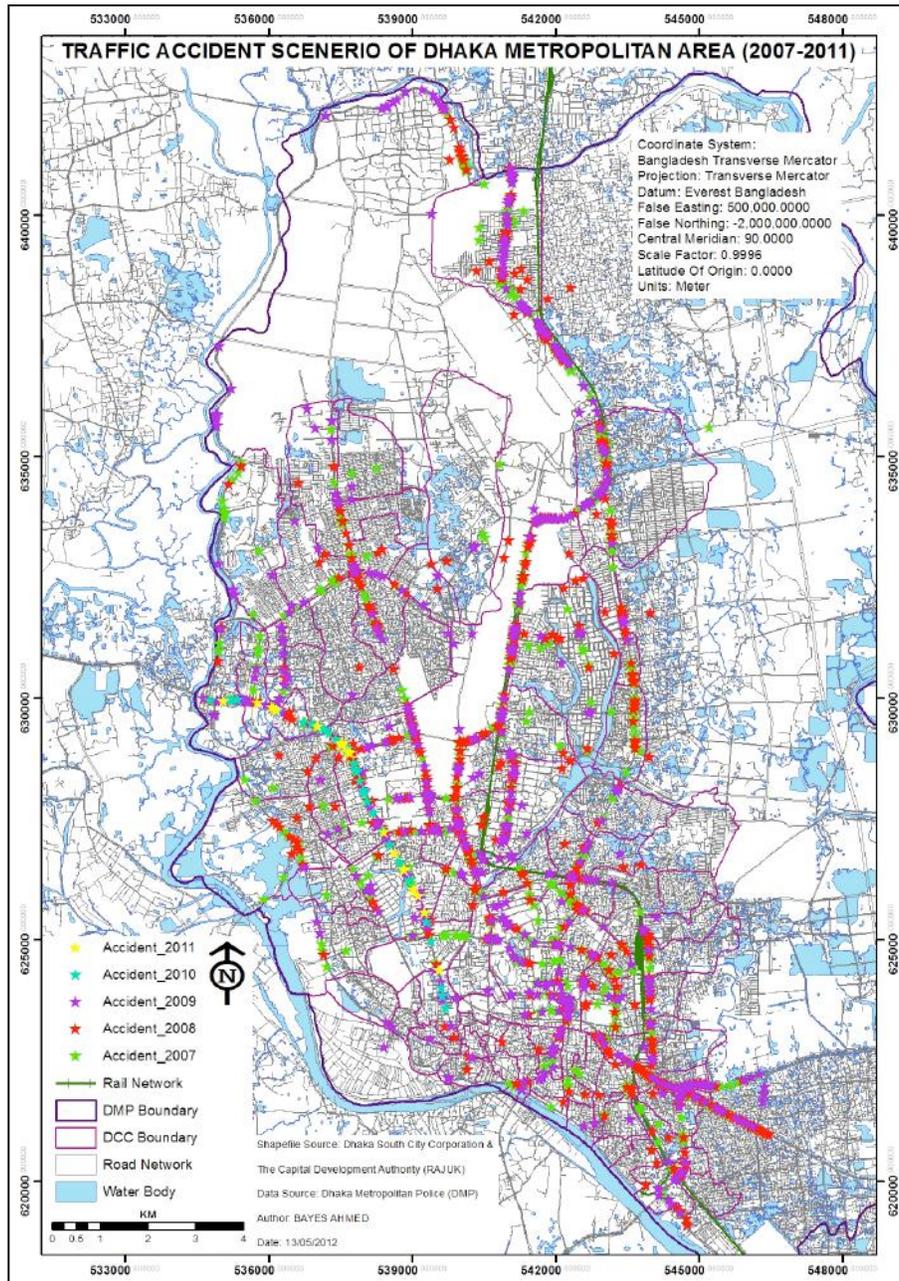


Figure 5: Traffic Accident Scenario in Dhaka Metropolitan Area (2007-2011); Source: Author.

Figure 6 depicts the number of fatality and injury accidents occurred in each year in the selected most 30 accident-prone roads. It is found that Dhaka-Mymensing Road is the most accident-prone road, while Airport Road is in second position. Johnson and Finix Roads are the least accident-prone.

Traffic Accidents by Severity

From Figure 7, it is found that the fatal accidents were dominant in DMA area. About 69% accidents caused fatality, while 19% accidents caused injury. Motor collision accidents occurred in least numbers (12%) in DMA (Figure 7).

Traffic Accidents in Junctions

The interesting fact was that most of the accidents took place at ‘no junction areas’. Figure 8 illustrates that approximately 71% accidents (1925 out of 2720) occurred where there was no junctions. Then the ‘Tee-Junction’ was in second position (16%) in terms of the number of traffic accidents. Another vulnerable junction type was the ‘Cross-Junction’ (12%). Accidents in ‘Staggered-Junctions’ and ‘Railway Crossings’ were the least (Figure 8).

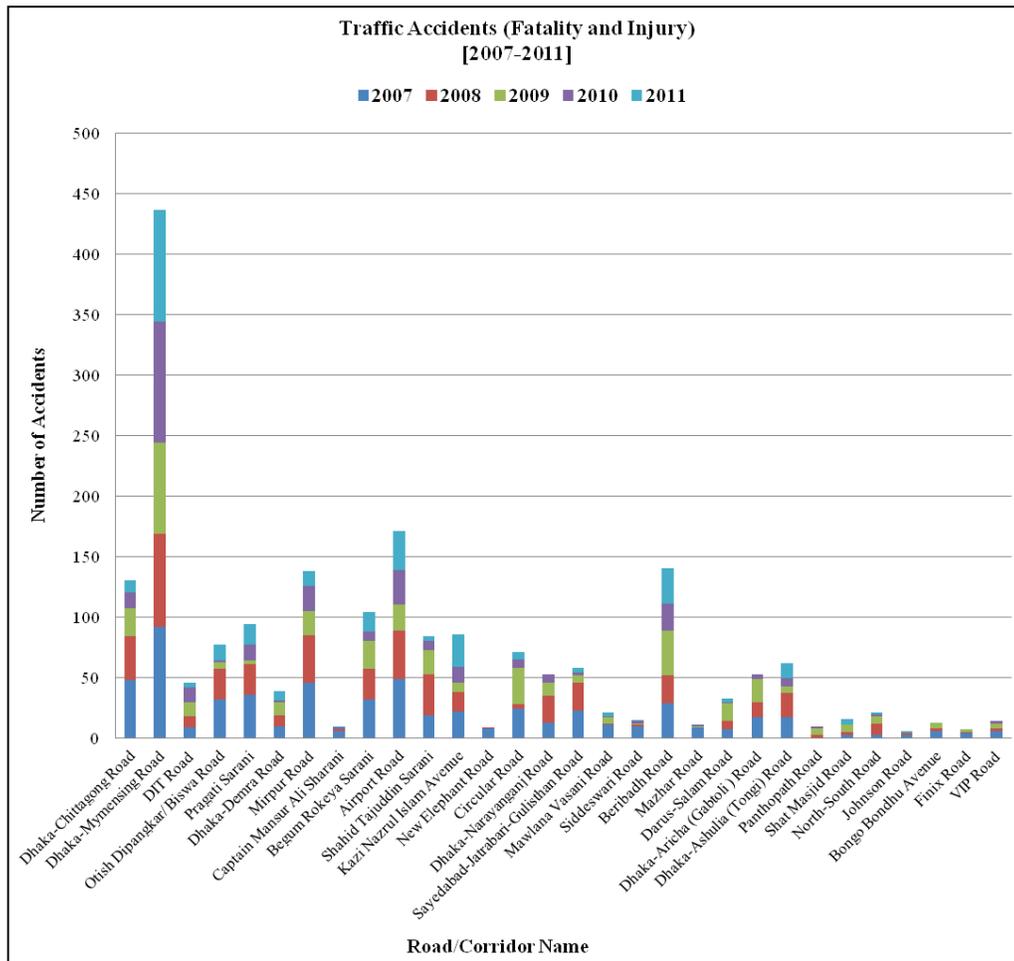


Figure 6: Year-wise Traffic Accident Scenario in Different Roads of DMA; Source: Author.

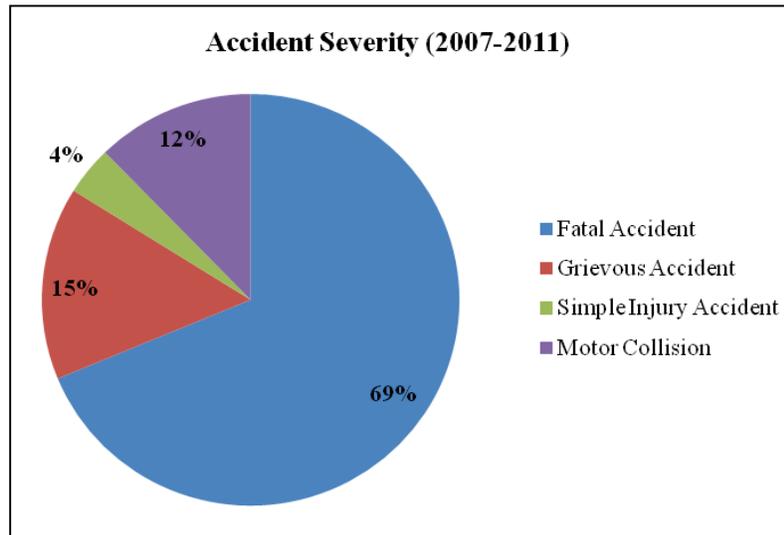


Figure 7: Traffic Accidents by Severity; Source: Author.

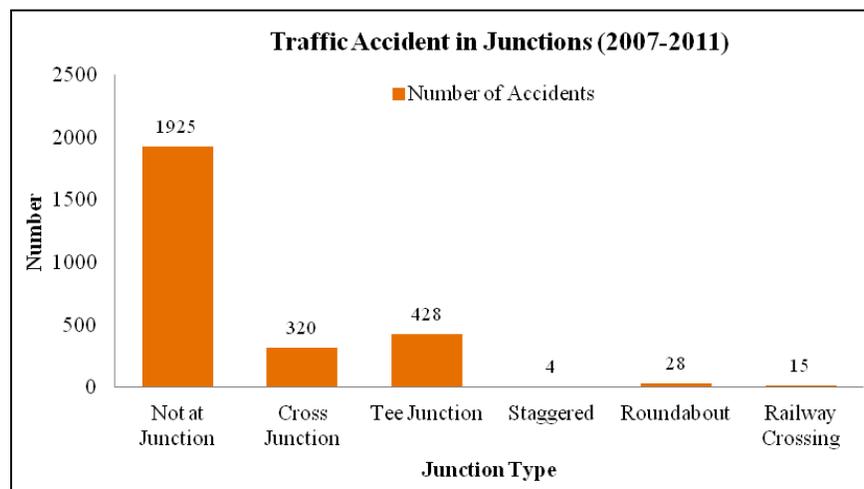


Figure 8: Traffic Accidents in Junctions; Source: Author.

Traffic Control

In DMA, over the years (2007-2011), most accidents occurred where there was no traffic control. This was nearly 63%, which means 1711 accidents out of 2720. Moreover, accidents in the presence of 'Police Control' were also evident (33%), which was in the second position (Figure 9). Most distinctive part is that accidents both in the existence of traffic lights and police control were also high. Another aspect should be taken into consideration is that about 1% accidents took place in zebra crossings or due to pedestrian crossing. Though this number is low (26 out of 2720); but it is a matter of real concern (Figure 9).

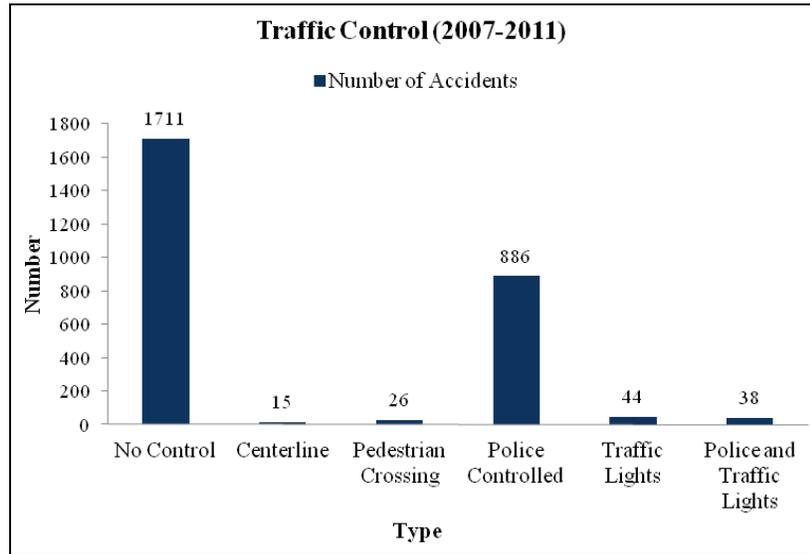


Figure 9: Traffic Control; Source: Author.

Collision Type

In terms of collision type, an accident due to hitting a pedestrian was found dominant (60%). Rear end accident type was in second position (25%). Head on (4%) collision was the third highest cause for road traffic accidents in DMA (Figure 10).

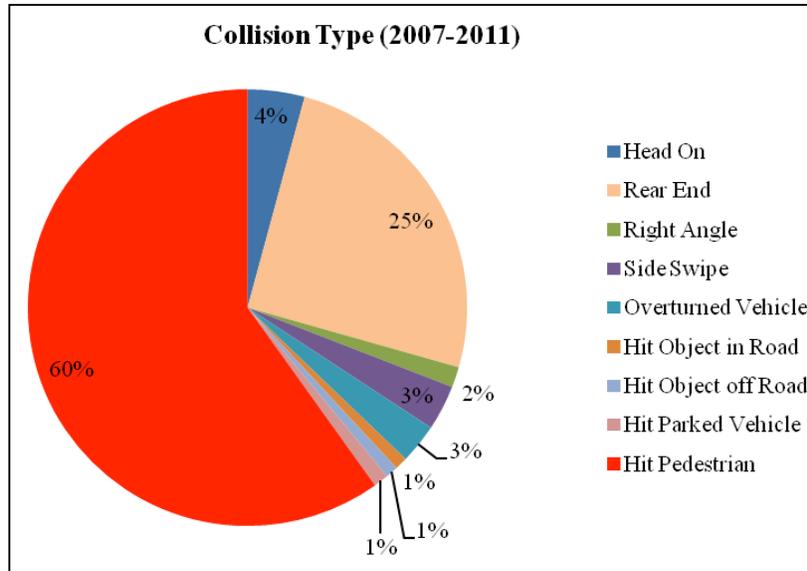


Figure 10: Collision Types; Source: Author.

Traffic Movement and Road Divider

It is evitable from Figure 11 that most accidents (73%) took place in one-way streets. It means streets with road divider is more accident prone than streets without dividers. About 80% accidents occurred where road dividers exist (Figure 12).

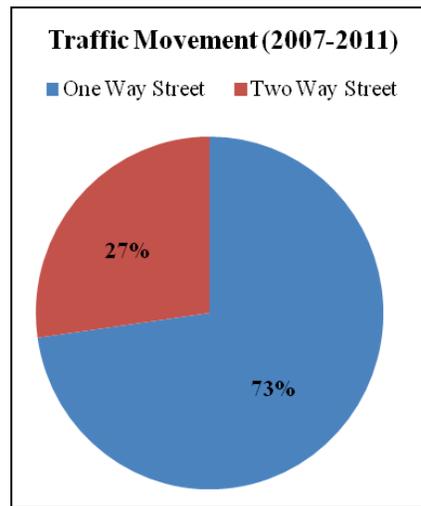


Figure 11: Traffic Movement; Source: Author.

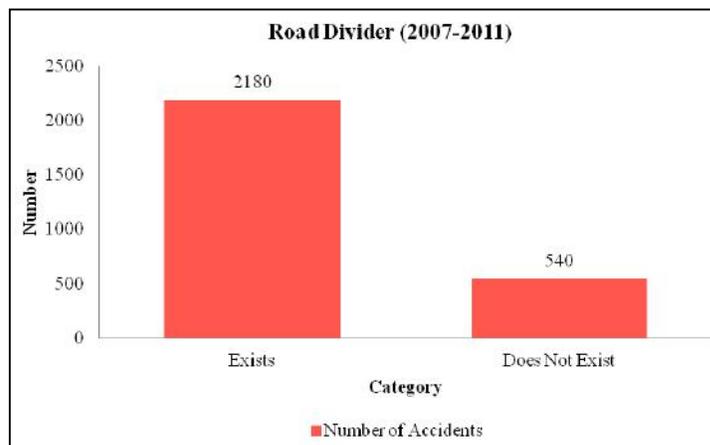


Figure 12: Road Divider; Source: Author.

In general, most road accidents take place in roads without dividers. This is a common scenario for national highways in the case of head-on collisions. But in DMA, the percentage of head-on collision was low (4%); but pedestrian collision was found evident (60%). Therefore, road dividers play almost no role in traffic accidents in Dhaka City. This is one of the reasons for most accidents occurring in the streets without road dividers.

Findings and Recommendations

Safety and efficiency are the two primary objectives of transportation engineering, planning and management. Traffic accidents cause a huge tangible as well as intangible burden on the society. Significant progress in crash reduction can be achieved through a comprehensive information system of traffic accident database and analyzing it properly. In this research, the road safety situation and trends of DMA are discussed.

Findings of the Research

The findings of this research are as follows:

a. Bangladesh Perspective

1. Bangladesh has one of the highest fatality rate in road accidents in the World.
2. The number of registered vehicles in Bangladesh is increasing gradually.

b. Scenario of Dhaka Metropolitan Area

1. Among all the major cities of Bangladesh, Dhaka is the most vulnerable both in terms of total number of accidents and accident rates.
2. Most accidents are occurring in the major arterial roads of DMA, not in the tertiary access roads.
3. Indiscriminate use of footpath, uncontrolled pedestrian crossing, unskilled drivers and lack of adequate penalty are the major reasons for traffic accidents.
4. Dhaka Metropolitan Police is the only Government authorized legal source for collecting accident information.
5. Under-reporting, under-recording and improper transcription of accident reporting forms are some of the major drawbacks of accident data collection.
6. On an average, the total number of traffic accidents is reducing by 11% each year.
7. Fatal accidents and motor collisions are decreasing while injury accidents are increasing.
8. Approximately 95% of the total accidents take place in the selected 30 roads.
9. The following roads are most accident prone:
 - i. Dhaka-Mymensing Road
 - ii. Airport Road
 - iii. Mirpur Road
 - iv. Dhaka-Chittagong Highway
 - v. Beribadh Road
10. No profound effect of weather/season on road accidents is found.
11. Most traffic accidents:
 - i. Cause fatality (69%)
 - ii. Hit a pedestrian (60%)
 - iii. Dominant in straight and flat roads (97%)
12. Most traffic accidents occur:
 - ⇒ where there is 'No Junction' (71%); and 'No Traffic Control' (63%)
 - ⇒ in 'One-Way Streets' (73%); and where 'Road Dividers' exist (80%)
 - ⇒ in 'Daylight' (54%); and in 'City Roads' (67%)

Recommendations

Key factors affecting the urban transport sector of Dhaka City are characterized by (MOEF, 2009):

- a) Rapid growth in urban population
- b) Generally poor infrastructure or lack of infrastructure with low level of maintenance
- c) Weak local government institutions with inadequate capacity for planning and implementing projects
- d) Overlapping and poor coordination among different ministries, departments and municipal agencies entrusted with managing urban transport and
- e) Inadequate public transport regulation.

Based on the findings of this research the following recommendations are made (Hoque, 2006):

a. Engineering Aspects

1. Small changes/improvements in road geometric layout and use of roundabouts where necessary.
2. Provision for and augmenting of adequate pedestrian facilities like safe crossing, treatments or construction of sidewalks/footpaths and foot-over bridges, safer zones, grade separation, time separation, raised medians etc.
3. Provision of special facilities (e.g. separate lanes) for non-motorized vehicles and designated bus lanes.
4. Intersections design improvements like channelization, traffic islands etc.
5. Improvements of narrow and deteriorated lanes, bridges and culverts.
6. Improved access controls, road surface, roadway shoulder, cross-sections, sight distances, alignments, traffic signs, traffic signals, road markings, traffic calming devices and lighting.
7. Speed control in specific vulnerable areas.
8. Treatment of known hazardous roads or corridors or black spots.
9. Pedestrian count and travel speed survey of the most vulnerable roads should be performed on regular basis.

b. Enforcement Aspects

10. Forcing the pedestrians to use the foot-over bridges or over-passes or under-passes through proper channelization.
11. Ensure safer vehicle standard for road-worthiness as well as for crash worthiness.
12. Effective enforcement of laws and provision for adequate penalty for violating the rules.
13. Strict driving licensing is critically important.
14. Improvement of the existing 'Motor Vehicle Ordinance'.
15. Ensure vehicle standard and fitness requirements by strengthening technical inspection system for checking and testing of vehicles.
16. Periodic safety audits in existing roads.
17. Controlling dangerous and undesirable over takings using appropriate traffic calming measures.
18. Haphazard parking on road-side and illegal use of footpath should be eradicated.
19. Detail land use master plan must be developed and proper implementation should be ensured.

c. Educational Aspects

20. Training of the police officers and concerned staffs regarding traffic management, accident data collection and filling the ARFs properly.
21. Incorporating modern technologies (e.g. using GIS techniques instead of MAAP5 software) in analyzing and upgrading traffic accidents related issues.
22. Intensifying road safety awareness and publicity campaigns including pragmatic measures to improve and rectify road user behaviors through public motivational programs.
23. Developing and implementing community based road safety programs frequently.

24. Develop appropriate road safety resource materials and promote road safety education in schools.
25. Strengthening institutional and professional capacity of all the concerned agencies, stakeholders, NGOs, private companies and organizations for the successful implementation of road safety measures.
26. Introduction to road safety audit process into road planning, design and construction process.
27. Intensified and effective high profile police enforcement should be promoted to deter unsafe behaviors and violations using both actual and perceived enforcement strategies.
28. Promote strategies to counteract the effect of drivers fatigue in driving for long periods.
29. Secure legitimate and adequate funding to support road safety initiatives including research, training and road safety promotional activities.
30. To strengthen and co-ordinate accident and casualty data collection system involving different agencies and research organizations.
31. Rehabilitation of street hawkers, mobile vendors and slum dwellers from carriageways and footpaths would be ensured.
32. Alternative income sources for drivers to reduce over-duty.
33. Electronic and print media should publish articles and news on traffic safety rules and accident incidents on regularly.

d. Emergency Response Aspects

34. Prompt emergency assistance and efficient trauma care management are clearly important in minimizing the road accident deaths and therefore should be introduced.
35. Trauma care specialists to be trained and employed in all general hospitals.
36. Specialized rehabilitation centers should be established in different zones.

Conclusions

The global forecast has indicated that over the next 10 years developing countries like Bangladesh will experience an alarming increase in road accidents and casualties. Addressing the safety problems thus emerges a serious challenge in the absence of requisite transport safety professionals and resources (Hoque, 2004).

Critical measures are needed to reduce the national burden of deaths and injuries include adequate management and co-ordination of the problem, sustainable funding, development of a strategic plan, an adequate database and a well trained dedicated group of experts working on the problems.

Analysis of traffic accident is a complex task, as many factors can play important role in the occurrence of the event. An integrated approach using scientific and technological advances should be adopted to mitigate and manage the traffic accidents, which will be a pioneer research work in the context of Dhaka City or especially for Bangladesh.

There is urgent need and scope for improving the road safety situation by implementing an effective and coordinated safety policy and actions that require significant improvements in the relevant sectors.

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