

High-Risk Road Accident Corridors in Dhaka, Bangladesh

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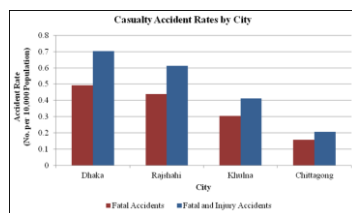
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Graphical abstract



Abstract

Bangladesh has one of the highest fatality rates in road accidents and to address the safety problem is a serious concern. Dhaka is the most vulnerable city of the country. Bangladesh Road Transport Authority maintains a database of accidents using outdated software that lacks in geo-referencing facility. This makes the analysis of accident locations a challenging task. The area for this study was the Dhaka Metropolitan Police area where the concerned forty one police stations are responsible for collecting traffic accident data. The Highway Safety Manual identifies the “Network Screening” as the first step of the Roadway Safety Management Process. This study focuses on locating the accidents on urban roadways in Dhaka and identifies thirty corridors and ranks them using geo-referenced data through developing and using a GIS database. Dhaka-Mymensing Road was found to be the most vulnerable road corridor followed by Airport Road and Mirpur Road respectively. The study recommended special attention and special “Diagnostic” studies as explained in the Highway Safety Manual for the high-risk corridors and to put emphasis on the accident data collection and reporting system. Adoption of modern technologies like GPS and GIS in collecting and reporting of the traffic accident data was emphasized.

Keywords: Road accident locations; High-risk locations; high-risk corridors; urban accident locations; Dhaka road accidents

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1.0 INTRODUCTION

The global forecast has indicated that over the next ten (10) year period developing countries like Bangladesh will experience an alarming increase in road accidents and casualties. Addressing the safety problems thus emerges as a serious challenge in the absence of requisite transport safety professionals and resources¹. The poor countries have about forty percent (40%) of world's motor vehicles but have eighty six percent (86%) fatalities². 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 percent (16%), which is doubling the vehicle fleet in five years². 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 problems are acute in a developing city like Dhaka- the capital city of Bangladesh.

At the current growth rate, the number of vehicles in Bangladesh is expected to double in the next ten (10) years creating an extreme pressure on the capital city transport system. 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 conditions³.

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 families⁴. 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 arterials and the urban intersections particularly the signalized ones, those are 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 makes the intersections of cities of Bangladesh even more complex⁵.

Dhaka City Corporation (currently split in to North and South), the largest city corporation of the country, is in the verge of challenges like development and maintenance of transport

infrastructure which includes city roads and highways, pedestrian facilities, traffic signals, bus terminals, road surface, footpaths, and underpasses/overpasses etc.

Table 1 shows the traffic accident scenario of the four (04) major cities of Bangladesh for the year 2009. This was the latest available data collected from Bangladesh Road Transport Authority (BRTA). It is visible from Figure 1 that Dhaka is the most vulnerable city in terms of accident rates. This indicates the importance of the study on urban accident locations of Dhaka. This is a part of the “Network Screening” process identified as the first step of the Roadway Safety Management Process by the Highway Safety Manual⁶. Bangladesh Road Transport Authority (BRTA) is

the responsible authority in Bangladesh for maintaining the database for the accidents. However, the Microcomputer Accident Analysis Package (MAAP5) software, which is an outdated software (without geo-referencing facility and in DOS mode), is still being used for data recording. This makes the analysis of accident locations a challenging one. This study focuses on the locations of the accidents on urban roadways in Dhaka and the objective of the study is to identify high-risk road corridors of Dhaka city using geo-referenced data and ranking the corridors in terms of accident frequencies.

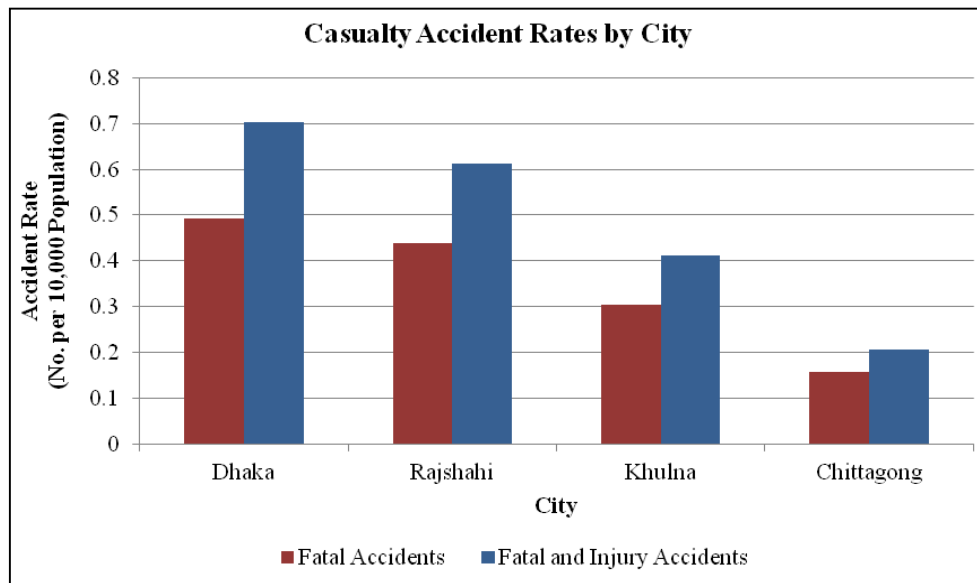


Figure 1 Casualty accident rates of the major cities of Bangladesh (2009)

2.0 DATA AND METHODOLOGY

Road traffic accidents with casualties are causing great concern in the transport sector of Bangladesh. It has long been recognized that the most effective means towards accident reduction lies in a systematic and scientific approach based on the use of accurate and reliable traffic accident data. Much of the accident information available in police files is too often incomplete and therefore has not been reliable to the fullest extent⁷. After extensive field surveys, 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 Forms (ARFs)” for accidents. This is the only official source of accident information or primary data. The ARFs were collected from the Dhaka Metropolitan Police (DMP) Headquarter, Dhaka. A total of 2,720 ARFs were collected for the period 2007-2011.

2.1 Database Creation

At the initial stage of the study, a database was developed using the “Microsoft Access” software. Later, this database was exported to ArcGIS software for mapping and projecting the accident locations incorporating all the necessary information.

2.2 Plotting the Accident Locations in a GIS Platform

One major problem while plotting the accident locations in GIS platform was to match the unknown coordinate system of DMP maps. The DMP Headquarter uses quite old maps of Dhaka city

with no geographic and projected coordinate system. To resolve this problem, the unknown coordinate system was transformed into Bangladesh Transverse Mercator (BTM) projection system. This transformation facilitated to identify the accident locations more accurately. The base maps (shape files) including the Dhaka City Corporation (DCC) boundary (currently comprises of both Dhaka North and Dhaka South City Corporations) and road networks were collected from Rajdhani Unnayan Kartripakkha (RAJUK)- the capital development authority. These maps were produced in 2010. The GPS and other surveying activities were conducted during 2005-2008. Those were the latest available and the most up-to-date maps of Dhaka City.

2.2.1 Problems Related to Base Map Preparation

There are currently forty one (41) police stations in DMP area. But the DMP Headquarter uses the old version maps of seventeen (17) police stations for positioning the accident locations. The old police station maps were collected from DMP Headquarter in Dhaka. But these maps are out-of-date as the road network has changed over time or many new roads have been constructed. Moreover, the base year of these maps and the geographic or projected coordinate systems are unknown.

2.2.2 Problems Related to Boundary Demarcation

Another problem faced was demarcating the boundary for the study. The DCC and DMP area boundaries are different. DMP area covers a much greater area than DCC boundary. The boundary

areas of the forty one (41) police stations were not available in the GIS format. Moreover, the only source of traffic accident data is the Police Stations of Dhaka city, covering only the accidents occurred within the jurisdiction area of DMP. No accident data is available for only DCC area.

Therefore, for this study purpose, the DMP area was selected as the study area.

2.2.3 Problems Encountered During the Accident Location Plotting

In many cases, the accident data could not be plotted accurately due to inaccurate recording. There were also errors in filling out of the forms those were found during the review process. During the analyses, it was found that twenty percent (20%) of the ARFs did not contain any information about the coordinate (X,Y) values. This happened because the outdated maps are still being used by DMP. Because of this problem, some of the accidents occurred in new roads even could not be located. The study was conducted based on the available data and incorporating correction of locations to the extent possible.

Table 1 Most accident prone roads/corridors of DMP (2007-2011)

Name of Road/Corridor/Avenue	Name of Road/Corridor/Avenue
1. Johnson Road	2. Finix Road
3. Panthopath Road	4. Captain Mansur Ali Sharani
5. Shat Masjid Road	6. New Elephant Road
7. Majhar Road	8. Bongo Bondhu (BB) Avenue
9. VIP Road	10. Siddeshwari Road
11. Mawlana Vasani Road	12. North-South Road
13. Darus-Salam Road	14. Dhaka-Demra Road
15. DIT Road	16. Dhaka-Aricha (Gabtol) Road
17. Dhaka-Ashulia (Tongi) Road	18. Dhaka-Narayanganj Road
19. Circular Road	20. Kazi Nazrul Islam Avenue
21. Sayedabad-Jatrabari-Gulistan Road	22. Otish Dipangkar/ Biswa Road
23. Shahid Tajuddin Sarani	24. Pragati Sarani
25. Begum Rokeya Sarani	26. Beribadh Road
27. Dhaka-Chittagong Road	28. Mirpur Road
29. Airport Road	30. Dhaka-Mymensing Road

* The roads of Table 1 are in descending order. It means traffic accidents occur in least number in Johnson Road while Dhaka-Mymensing Road is the most accident prone corridor of the DMP area.

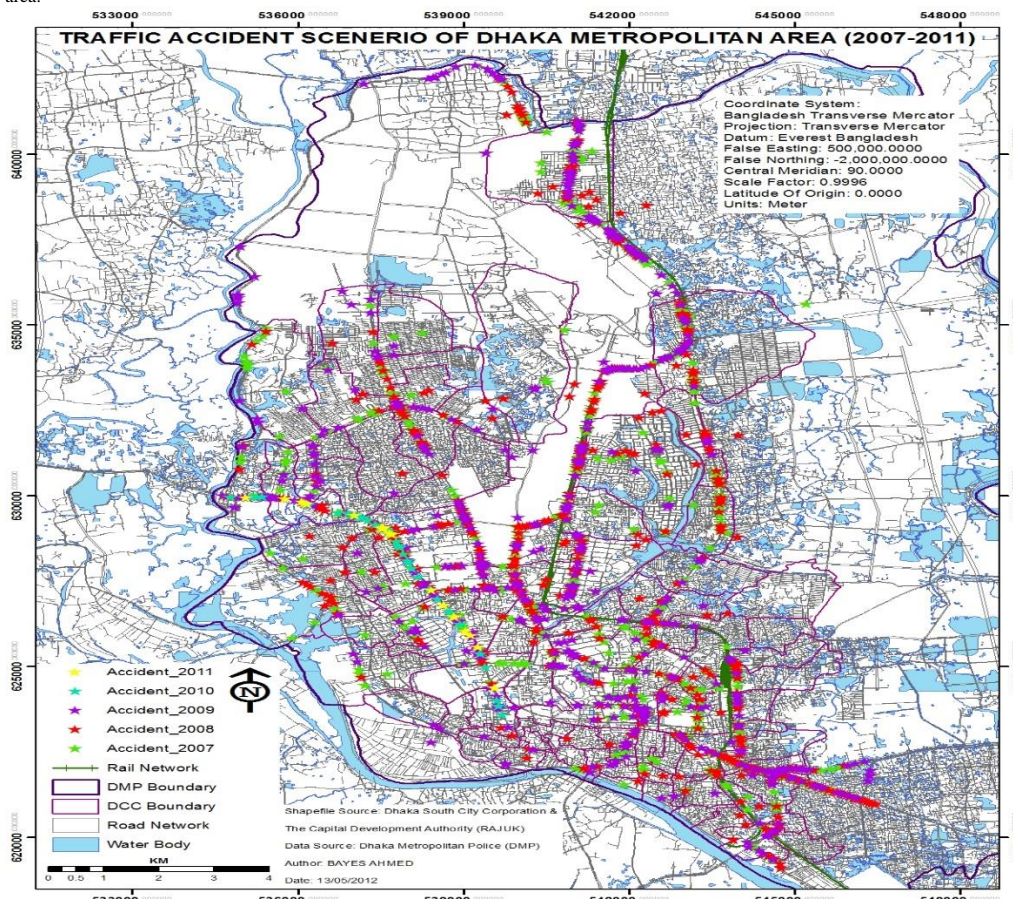


Figure 2 Road accident locations on the DMP map (2007-2011)

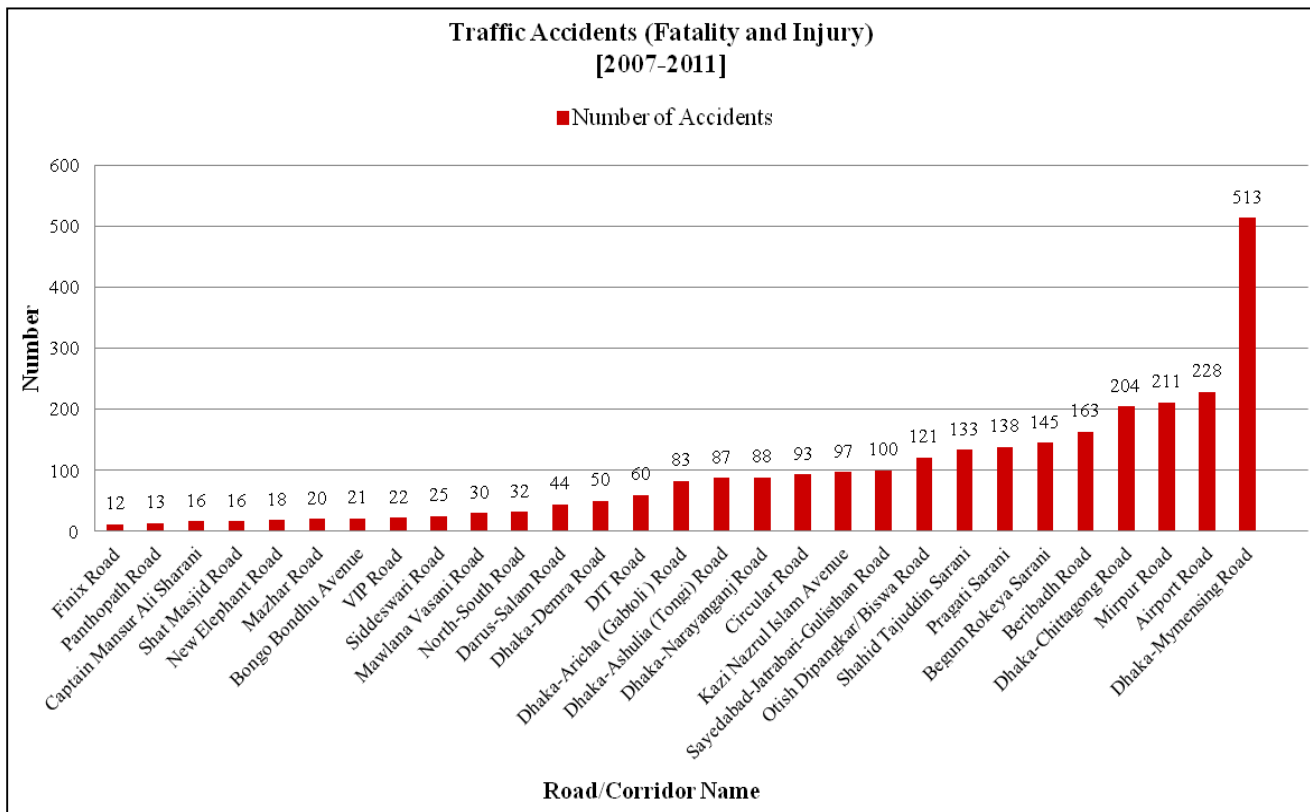


Figure 3 Year-wise traffic accident scenario in different roads of DMP area

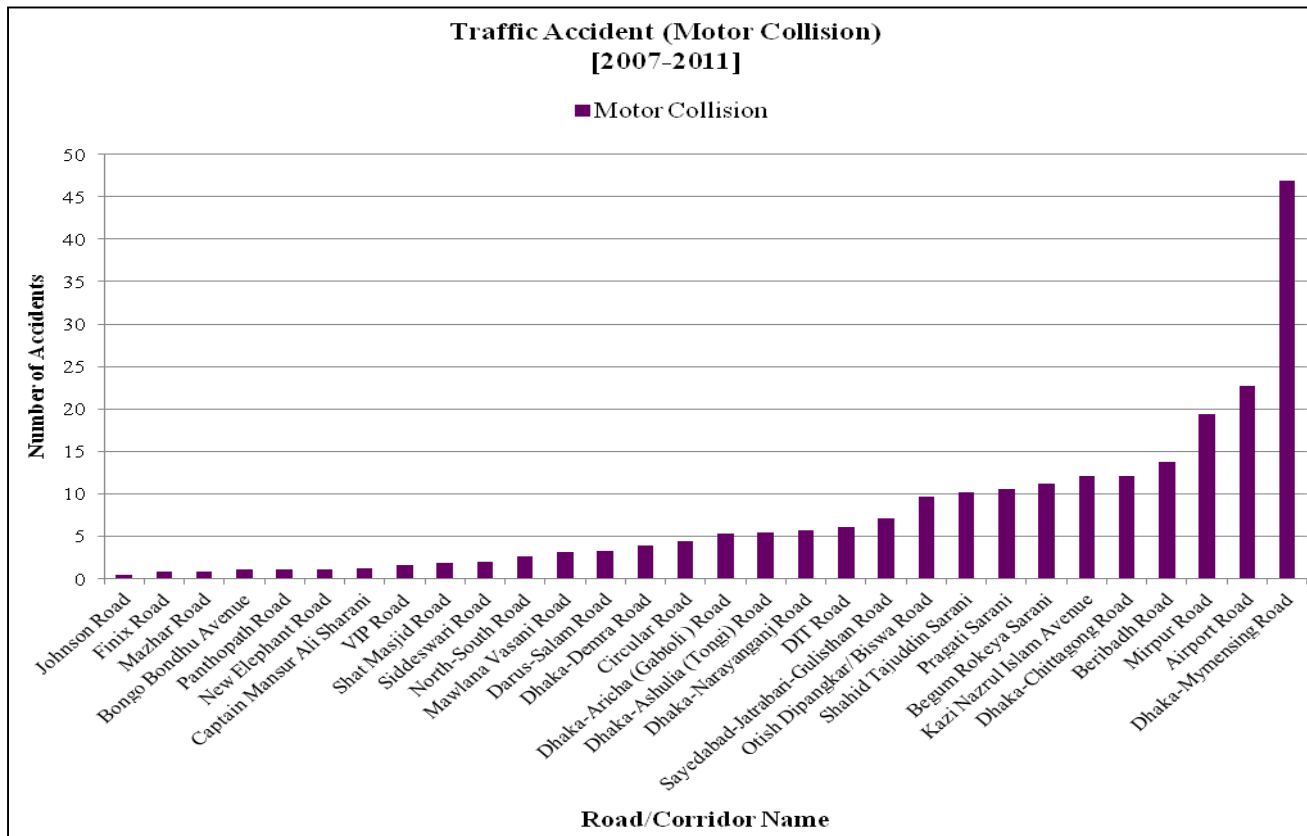


Figure 4 Year-wise motor collision scenario in different roads of DMP area

■3.0 RESULTS AND DISCUSSIONS

The detailed analyses of the GIS based traffic accident maps included analyses of all the accident locations from year 2007-2011 of Dhaka city, which required plotting of geo-referenced data on the DMP map as shown in Figure 2. This was conducted as the “Network Screening” process- the first step of the Roadway Safety Management Process as explained in the Highway Safety Manual⁶. Through the analyses using a GIS software, thirty (30) different most accident prone roads/corridors of DMP area have been identified in terms of accident frequency rankings as shown in Table 1 and the locations of the accidents are shown in Figure 2. The identified thirty (30) roads or corridors cover approximately ninety five percent (95%) of total traffic accidents within the DMP area during 2007-2011. Rest of the five percent (5%) accidents occurred in other roads of Dhaka city. Figure 3 and Figure 4 show i) all fatal and injury accidents and ii) motor vehicle collision related accidents on different roads of Dhaka. It was found that Dhaka-Mymensing Road was the most accident prone road in Dhaka followed by Airport Road and Mirpur Road respectively. The numbers of motor collisions are very small in comparison to the total numbers of fatal and injury accidents. This is caused due to a greater number of pedestrians being involved in the accidents and less number of vehicle to vehicle accidents being occurred.

■4.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the finding of the study the following conclusions are drawn and recommendations are made:

- a) The identified thirty (30) corridors account for ninety five percent (95%) of all the accidents of the DMP area. The first three (03) identified roads Dhaka-Mymensing Road, Airport

Road and Mirpur Road are the most accident prone corridors in terms of i) all fatal and injury accidents and ii) motor vehicle collisions. However, Dhaka-Mymensing Road has comparatively high speed of vehicular traffic but the other roads are different in nature. These corridors need special attention and need special “Diagnostic” studies as explained in the Highway Safety Manual⁶.

- b) In the data analysis process, significant challenges were faced during the base map preparation, boundary of the city demarcation and the plotting of accident locations with accurate geo-referencing. It is concluded that adoption of modern technologies (e.g. use of GPS and GIS techniques) in collection and reporting of traffic accident data has become a bare necessity for a mega city like Dhaka.

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