CASE STUDY: ROAD ACCIDENT ON BONPARA-HATIKUMRUL HIGHWAY IN BANGLADESH

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Abstract— **In this study an attempt is made to investigate the characteristics of road traffic accidents on the Bonpara-Hatikumrul Highway in Bangladesh and the effects of road accidents on social life. For details investigation, the highway was divided into three major section as Section-I: Bonpara intersection to Parkol, Section-II: Parkol to Nayabazar and Section-III: Nayabazar to Toll Plaza. Road accident related data on selected highway for different years were collected from Bonpara Highway police station, Jholmoliya Highway Police Station and Fire Service and Civil Defence Station at Natore from year 2008 to 2015. From the investigation it is found that the total numbers of accidents in Bonpara-Hatikumrul highway (Bonpara intersection to Atrai toll plaza) are 210 within year 2008 to year 2015 and the number of fatality, grievous injury and minor injury are 246, 231 & 265 respectively. It is also found that the maximum numbers of accidents (22%) are occurring within 12 AM to 15 PM. Truck is the most involved vehicle in the road accident which is 39% of the total number of vehicle, whereas, bus involved is 21% road accidents. From the year 2014 to 2015 there were 30% head on collisions, 34% rear end collisions, 29% hit pedestrians and 7% overturning occurred. A 3D model of Bonpara-Hatikumrul highway is proposed where the selected highway is developed into four lanes and the movements of fast moving vehicles are kept uninterrupted by providing a grade separated intersections.**

Keywords— **Road accidents, Head on collisions and Rear end collisions.**

I. INTRODUCTION

A road accident refers to any accident involving at least one road vehicle, occurring on a road open to public circulation, and in which at least one person is injured or killed. The increase in road traffic has been followed by a steep increase in the road accidents. Around 88% of the 1.2 million deaths from road traffic injuries occur in the developing world (Makay, 2003 [1]). Accident Research institute (ARI) reported that 12000 people die as a result of road accident every year in Bangladesh. In Bangladesh, Road traffic injury situation is gradually becoming worse the accident fatality rate rose from 126 in 1982 to 170 in 1992 per 10,000 vehicles. This rate was the highest in ASIA, and almost 100 times more than Norway and Sweden (Hoque, 2003 [2]).The estimated total annual cost of road traffic crashes is approximately US$ 230 million (Rahman & Thomas, 2003 [3]).The BHIS estimated over 3,400 children were killed in 2002, most of them as pedestrians and by-cyclist. Due to the high levels of trauma incurred, it was the 4th leading cause of permanent disability from injury, responsible for over 1,360 children being permanently disabled or almost 4 children each day. It was the 8th leading cause of morbidity in children, causing over 110,000 child injuries, or over 300 per day. For all these reasons, road traffic injuries are an important obstacle to development and place and enormous strain on a country's healthcare system, and on the national economy in general (Banki-Moon, 2007 [4]). In Bangladesh the safety situation is very severe by international standards and has been rapidly deteriorating with increasing number of road accidents deaths, largely as direct consequences of rapid growth in population, motorization and urbanization. National Road Traffic Report, 2007 reported that more than 3000 individuals-including from among our peers, our family, our friends and our co-workers loss their lives in road traffic accident in Bangladesh and many more sustain disabling injuries. In economic terms, road accidents in Bangladesh costing, community in the order of tk. 5000 crore (US$ 850 million) which is nearly 2% of GDP (Hoque, 2006 [5]). That figures clearly demonstrate that the road safety is a serious issue as it affects each and every one of us, whether drivers, travelers are consumers and thus demands urgent attention to include road safety in Bangladesh.

Bonpara-Hatikumrul Highway is one of the most costly roads & which plays a very important role in connecting the northern part of Bangladesh with Dhaka. Bonpara-Hatikumrul Highway is directly connecting Pabna and Natore with

Sirajgong. People living in the districts of northern part of Bangladesh such as Natore, Pabna, Chapai-Nobabganj, Naogaon, Rajshahi use this road for office work, for business, for treatment and for other purposes. After completion of Jamuna Bridge, the importance of this highway got a new life. Communication between Rajshahi and Dhaka has become easy and time saving. Due to invention of fast moving vehicles, the problem of accidents is becoming more and more complex on highway (Mackay, 2006 [6]). It is more acute in case of mixed traffic. The spectacular increase in the number of motor vehicles and first moving vehicles on the road of Bonpara-Hatikumrul Highway created a major social problem- the loss of lives through road accidents. The appalling human misery and the serious economic loss caused by road accidents demand the attention of the society and call for the solution of the problem. Total length of roads including National highway, Regional highway & Feeder road is 21,571 km & fatality rate per km is 0.16 in (2003) whereas in Bonpara-Hatikumrul highway the fatality rate is 2.19 (2014) which is almost 14 times of the average rate. These statistics proves the importance of studying the road accident situations in Bonpara-Hatikumrul highway. With the above requirement on view the present study has been taken in order to identify the causes of the road accidents and to establish the possible suggestion for the reduction of accident rate (Kadiyali L.R. (1997) [7]).

II. INVESTIGATION

The usefulness of an accurate and comprehensive system of collection and recording accident data cannot be over-emphasized. Such data serve to identify the basic causes of accidents and to suggest means for overcoming the deficiencies that lead to such accidents.

Actual alignment of highway selected for study was collected from Google and shown below:

Figure 1: Alignment of Bonpara-Hatikumrul highway.

The cross section of selected highway viewed from East to West is shown in Fig. 2.
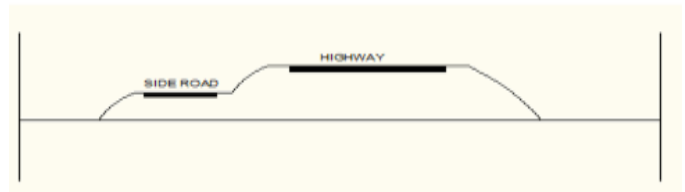

Figure 2: Cross section of selected highway (Hatikumrul to Bonpara).

III. SPEED STUDY

The results of speed and delay studies are useful in detecting the spots of congestion, the causes and in arriving at a suitable remedial measure.

The maximum speeds on some spots are collected from the interviews of the drivers of different vehicles and results are given in Table 1.

Serial No.	Vehicles type	Maximum speed (Km/hr)
1	Car	125
2	Microbus/ Jeep	115
3	Bus	110
4	Truck	90

IV. CAUSES OF ACCIDENT IN BONPARA-HATIKUMRUL HIGHWAY

Road surface condition: Investigated results indicate that there are various defects on road surface within study zone. Sometimes road accident occurs due to this defective surface. Two defective road surface are shown in Fig. 3 (a and b).

(a) Potholes

(b) Slippage.

FEATURES OF ROAD SIDE

Road side conditions are the cause of accident due to:
(1) Road side trees, advertisement board and attractive building at the road side.
(2) Unauthorized parking at the road side.
(3) Staking of materials at the road side.
(4) Stray animals at the road side.

(a) Attractive bill board.

(b) Unauthorized parking.

(c) Stack of construction materials.

(d) Stray animals.

ROAD GEOMETRIES

Derailments of vehicles at sharp horizontal curve during rainy season are the cause of accident within the study zone. Sharp horizontal curve and derailed bus are shown in figure 4 (a and b).

(a) Derailed bus.

(b) Sharp horizontal curve

V. Traffic control

Features of traffic control for study zone are shown in Figure 5 (a & b).

(a) No lane separated marking.

(b) Lack of street light.

THE VEHICLE

It is being increasingly realized-thanks to consumer protection pioneers like Ralph Nadar- that vehicles play a dominant role in road safety. One estimate puts that mechanical deficiencies cause about 5% of all traffic accidents (Kadiyali, 1997 [7]). Bus, truck and micro hamper the normal movement due to:
(1) Over dimensions, over weight and over speed

(2) Defective brake, headlight, steering, tire condition, horn, rear view mirrors.

Over loaded truck

Defective vehicles

The driver

From investigation it is found that motorcycle & scooter drivers are frequently violating traffic rules and using the highway instead of using the side road in Fig.6.1 (b) and riding 3 or 4 passengers in Fig.6.2 (a).

(a) Riding more passengers.

(b) Violation of traffic rules.

Pedestrian

From investigation careless movement, road crossing of pedestrians are found which is shown in Fig. 7.

Figure 7: Pedestrian running on the road carelessly

Environmental factors

Mist, fog (thick mist), dust, smoke, heavy rainfall restricts normal visibility.

Figure 8: Foggy weather restricts normal visibility.

VI. ANALYSIS AND RESULT

From investigation it is seen that, the total number of accidents in Bonpara-hatikumrul highway is 19 in the year 2008, while it is 41 in the year of 2014. The rate of accidents is increasing indifferent section of the highway.

	2008	2009	2010	2011	2012	2013	2014	2015
■ SECTION-I	5	7	7	7	9	12	12	8
■ SECTION-II	9	7	6	10	12	15	20	12
■ SECTION-III	5	6	5	6	7	7	9	7

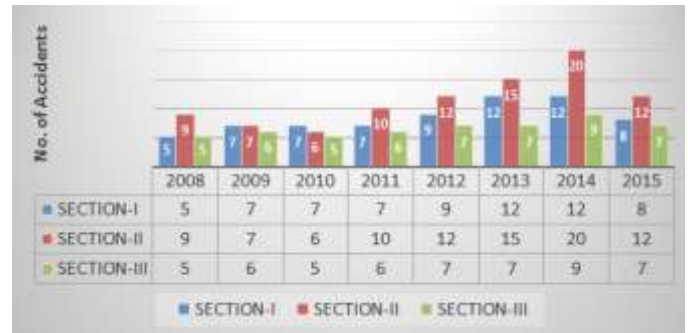■ SECTION-I   ■ SECTION-II   ■ SECTION-III

Figure 9: Histogram showing No. of accidents in different sections from year 2008 to 2015.

The yearly traffic volume is also increasing every year. Annual Average Daily Traffic (AADT) on Bonpara to Hatikumrul highway for 9 years were collected from Roads and Highways Department, Natore&Atrai Toll Plaza on selected highways and presented in Fig. 10.
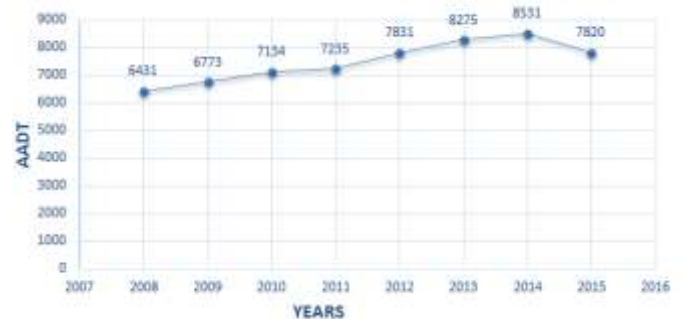

Figure 10: Yearly variation of AADT on Bonpara-Hatikumrul Highway.

The overall number of vehicles in Bangladesh is increasing day by day which is the main cause of traffic volume increase in this road section. Political crisis were very severe in the year 2015. About three months of this year were under continuous strike. Due to this political unrest the natural flow of traffic was hampered in this road section, so, the traffic volume was decreased in 2015.

In the year 2015 in Bonpara-Hatikumrul highway16 persons were killed, grievously injured 28 and minor injured persons were 38. We can represent it with the help of pie chart.
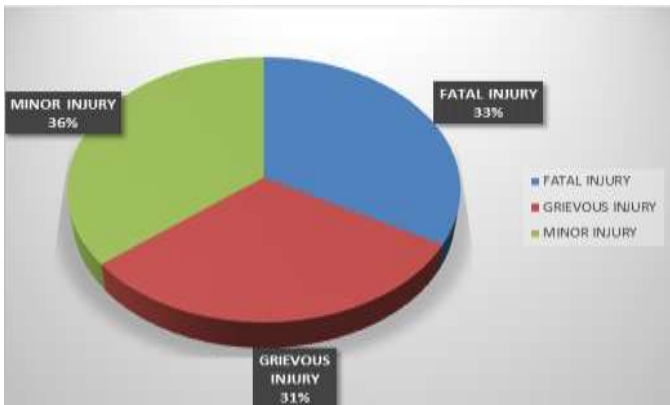
Figure 11: Pie chart showing different types of life losses in Bonpara-Hatikurul highway from (Jan 2008 to Dec 2015).

From the year 2014 to 2015 there were 30% head on collisions, 34% rear end collisions, 29% hit pedestrians and 7% overturning occurred. The reason of the higher percentage of head on collision is the mixed traffic and the absence of elevated lane separator. By providing elevated road lane separator and developing the highway into four lanes these problems can be eradicated.
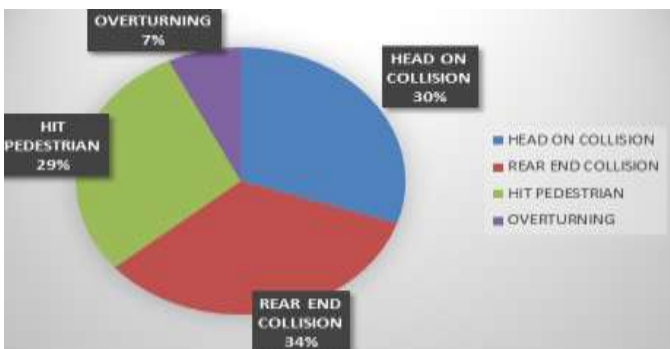

Figure 12: Pie chart showing different types of accidents in Bonpara-Hatikurul highway from (Jan 2014 to Dec 2015).

From this it is seen that highest 22% accidents are occurred within 12 to 15 hour (24 hour format) of a day. From the investigation it is found that in 12 to 15 hour the traffic volume increases in a significant amount as well as the number of crossing of highway of light vehicles and pedestrians coming from the village roads are increased.
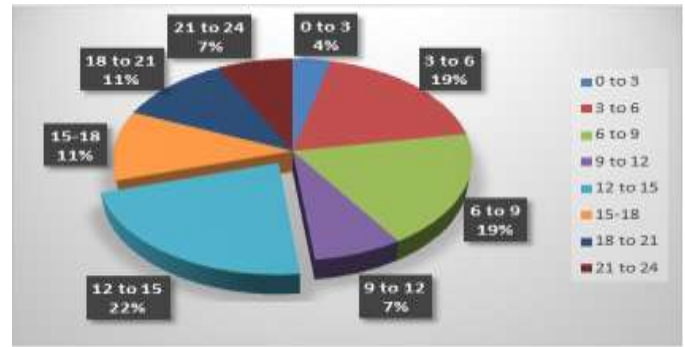

Figure 13: Pie chart showing percentage of accidents in different time of a day in Bonpara-Hatikumrul highway from (Jan 2014 to Dec 2015).

To get rid of this problem grade separated intersections and foot over bridges for pedestrians are to be provided in the busiest intersections. Details of this grade separated intersections is given at the end of this chapter.

It is notable that the percentage of truck, heavy truck & mini truck are collectively 50% which is half of the total vehicle. In Fig. 13 it is seen that truck is the vehicle which is involved in road accidents in most of the cases. To solve this problem, developing the highway into four lanes with an elevated road separator will be very useful. These may decrease head on collision. In some cases it is seen that truck is slower than other vehicle types in case of average speed. So, over taking zones should be provided for smooth overtaking operation.
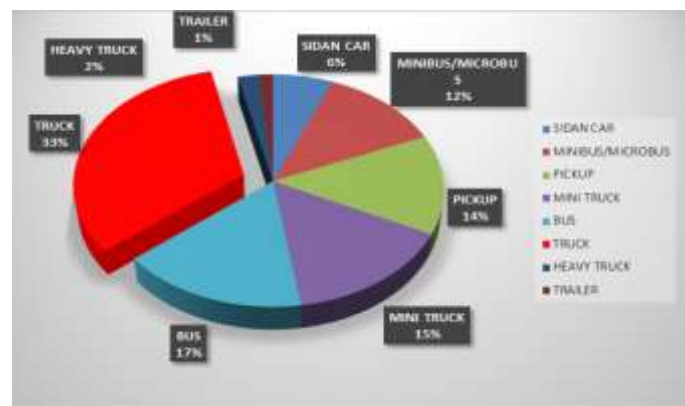

Figure 14: Pie chart showing percentage of types and number of vehicle in Bonpara-Hatikumrul highway from (Jan 2014 to Dec 2015).

Key Proposals for Bonpara-Hatikumrul Highway

From the investigation and analysis of all the traffic accident data of the selected highway it can be concluded that, by

implementing following proposals traffic accident and corresponding losses can be reduced significantly.

• Conversion of the highway to four lanes with elevated lane separator.

• Grade separated intersections for crossing of vehicle from uncontrolled access and foot over bridge for pedestrian crossing.

• Widening of pavement width at sharp curves with elevated separators.

• Providing side road in the both side of the highway.

• Strict application of traffic rules and regulations.

Enlightening these proposals few pictures of the 3D model are given below. This Figure 14 (a), (b), (c) and (d) are proposed model is also uploaded in you tube. To view this model log into: [8] (Proposed 3D model of Bonpara-Hatikumrul (Rajshahi-Sirajgonj) by Farhan khan chowdhury).

https://www.youtube.com/watch?v=bX9KyazR4tE

(a)

(b)

(c)

(d)

VII. CONCLUSIONS

It is clear that in Bonpara-Hatikumrul highway the trend of accident is an uncertain motion. So after analyzing the data it can be said that the accidents rate in Bonpara-Hatikumrul highway is worsening day by day. It is observed that the principal contributing factors of road accidents are adverse roadway roadside environment, poor detailed design of junctions and road sections, excessive speeding, overloading, dangerous overtaking, reckless driving, carelessness of road users, failure to obey mandatory traffic regulations, variety of vehicle characteristics and defects in vehicles and conflicting use of roads. For safe crossing of the slow moving vehicle from the side road an over pass bridge can be constructed for heavy vehicles to avoid conflict. Such a solution is provided in the proposed 3D model.

VIII. RECOMMENDATIONS FOR FUTURE STUDY

From the investigated result, it is observed that there are a lot of problems. For better investigation the following topics in this field can be studied:

(1) Identification of road accident with details throughout the year.

(2) Development of responsibility to every person for road safety.

(3) Study of the role of highway traffic to control the road accident in this region.

(4) To find out the new technology that can implement in this highway to overcome the existing problems.

IX.   REFERENCES

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[8]   https://www.youtube.com/watch?v=bX9KyazR4tE (Proposed 3D model of Bonpara-Hatikumrul (Rajshahi-Sirajgonj) by Farhan khan chowdhury).