

## **OVERVIEW OF THE HIGHWAY CRASHES IN BANGLADESH**

**Md. Mazharul Hoque\*<sup>1</sup>, Shahrior Pervaz<sup>2</sup> and Abdullah Al Nur Ashek<sup>3</sup>**

<sup>1</sup>*Professor and Dean, Faculty of Civil Engineering, BUET, Bangladesh email: mazharul@ce.buet.ac.bd*

<sup>2</sup>*Lecturer, Accident Research Institute (ARI), BUET, Bangladesh e-mail: pervazs.ce.buet@gmail.com*

<sup>3</sup>*Lecturer, University of Information Technology and Sciences, UITS, Bangladesh e-mail: ashek.buet@gmail.com*

**\*Corresponding Author**

### **ABSTRACT**

Each year around 3000 police reported road crashes resulting in equivalent number of deaths occur on our roads in Bangladesh. Actual annual road fatalities are estimated to be over 20,000. Around 61% of the road crashes occurred in national and regional highways of Bangladesh which resulted 66% of the total road fatalities. Of those 50% of road traffic fatalities are attributed to Vulnerable Road Users (VRUs) - pedestrians, bicyclists, motor cyclists and users of informal and unsafe motorized and non-motorized transport. Among these VRUs fatalities, pedestrian fatalities emerges as the most common type amounting upto 77%. Heavy vehicles, especially buses and trucks are mostly involved in these crashes. The road environmental factors are particularly prevalent with major roadway defects in design and layout, shoulders, road sides, bridge and its approaches, delineation devices and lack of access controls and others. Unregulated private/business access to national and regional highways leads to endless linear settlements resulting in high risks for pedestrians and other vulnerable road users. Improving safety of these highways and road environment is now a great concern which emphasizes on wider application of proven road engineering measure at the locations identified by systematic crash investigation and research.

This paper presents a brief overview of current road crash and fatality statistics in national and regional highways of Bangladesh for the period from 2006-2015. This study specially assesses the contributory factors and striking characteristics including aspects of road infrastructure safety improvements.

***Keywords:*** *Road safety, national and regional highways, pedestrian, countermeasures.*

## 1. INTRODUCTION

Road transportation is the major mode of transport in Bangladesh and is playing enormous role in enabling economic development, promoting prosperity and poverty reduction. There is no doubt that road transportation is vitally important to our economic and social welfare and must be so maintained and continually improved with due consideration for safety, minimizing crash hazards and risks. However, each year thousands of people are killed and injured on our roads. These terrible losses of lives and injuries affect us personally, socially and economically. Crashes on national and regional highway are taking lion's share of road casualties with frequent occurrence of major fatal crashes. Improving safety of these highways and road environment is now a great concern which emphasizes on wider application of proven road engineering measure at the locations identified by systematic crash investigation and research. This paper present striking characteristics of crashes on the two classes of highways including crash factors and aspects of road infrastructure safety improvements

## 2. TRENDS OF TOTAL ROAD CRASHES AND FATALITIES IN BANGLADESH

The number of police reported crashes and fatalities during the period of 2006 to 2015 are 25,556 and 24,462 respectively (Accident Research Institute [ARI], 2016). Figure 1 shows the trend of crashes and fatalities during this period. It is clearly seen that the number of crashes and fatalities are in decreasing trend. Adoption and improvements of safety measures and increasing awarness among road users played great role behind this decreasing trend. However, the high figures of crashes and fatalities estimated by some national private sources, international agencies and organizations always create debate about the actual figures and reported figures. But it is obvious that, underreporting of crashes and fatalities data mislead researchers and road safety engineers about the actual trend.

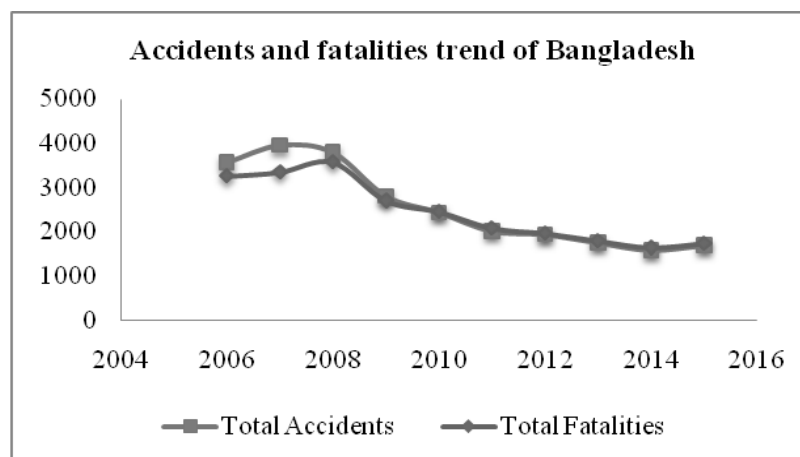


Figure 1: Trend of crashes and fatalities in Bangladesh

## 3. CRASHES AND FATALITIES BY LOCATION TYPE

Percentage of crashes and fatalities by location type in Bangladesh confirms significant fluctuations in between 2006 to 2015. Figure 2 shows that urban crashes and fatalities increased significantly upto the year 2011 (upto 47% and 41% respectively) and decreased during 2013 (36% and 31% respectively) and then again increasing very recently in 2015 (46% and 38%). Trend of rural crashes and fatalities shows opposite scenary. This may be the result of the intervention of some speed enforcing measures in rural highways. Study also shows that, percentage of urban fatalities are less with respect to urban crashes. This is the effect of lower speed of the vehicles in urban areas. High speed rural areas shows reverse result.

#### 4. CRASHES AND FATALITIES BY ROAD CLASS

The distributions of total crashes and fatalities according to road class are national highways 47% and 51%, city roads 18% and 14%, regional roads 14% and 15%, feeder roads 12% and 11% and rural roads 9% and 9% respectively. Table 1 presents the comparative distribution of crashes, fatalities by road class.

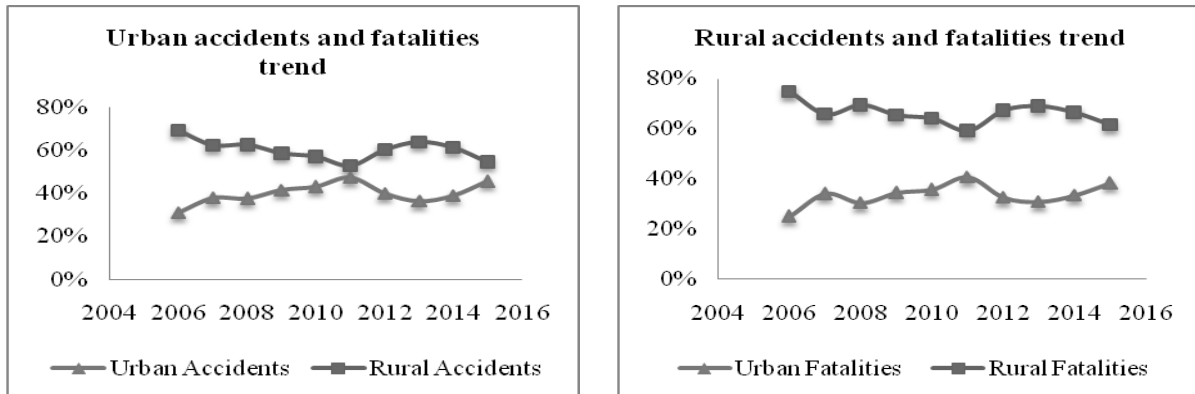


Figure 2: Crashes and fatalities by location type in Bangladesh

Table 1: Road crashes and fatalities by road class

Road Class	Crash	fatality
National Highways (NHs)	47%	51%
Regional Highways (RHs)	14%	15%
Feeder Roads (FRs)	12%	11%
Rural Roads (RRs)	9%	9%
City Roads (CRs)	18%	14%

Furthermore, crashes and fatalities in national and regional highways have shown upward trend recently (as shown in Figure 3). Thus, it is clear that crashes on the national and regional highways are of primary concern to improve the road safety situation in Bangladesh. The incidence of aggressive speeding is also evident on these highways.

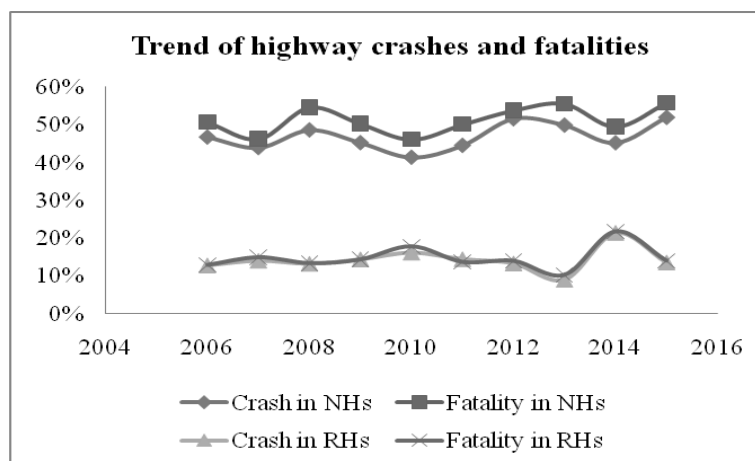


Figure 3: Road crash and fatality trend in national and regional highways

## 5. CRASHES AND FATALITIES IN HIGHWAYS BY COLLISION TYPES

More frequent collision types have been identified in this study. Of the total reported crashes and fatalities hit pedestrian emerges as the most common type of collisions in national and regional highways amounting upto 43% and 38% respectively (Figure 4). This is followed by the head on (21% and 28%), rear end (13% and 12%) and overturn (7% and 9% respectively). This four types of collision comprises upto 84% and 87% of crashes and fatalities in these highways respectively. The figure also indicates that pedestrian safety issues must be considered as an urgent basis. Again the greater incidence of head-on type collision highly justifies the necessity of separating opposing traffic stream.

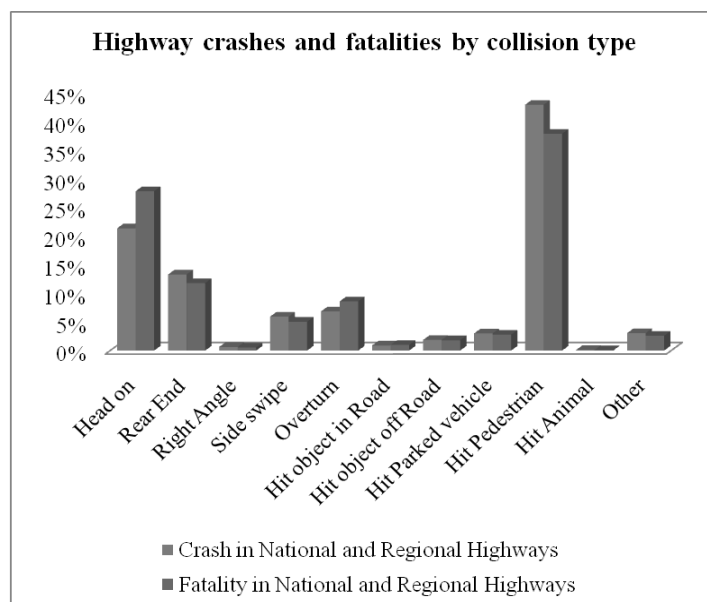


Figure 4: Highway crashes and fatalities by collision type

## 6. CRASHES AND FATALITIES IN HIGHWAYS BY ROAD GEOMETRY

It is found that, nearly 91% of crashes and 90% of the fatalities in national and regional highways occur at straight section of the highways. This result also substantiates the over speeding of these highways.

Table 2: Highway crashes and fatalities by road geometry

Road geometry	Crash in highways	Fatality in highways
Straight	92%	91%
Curve	6%	7%
Slope	1%	1%
Others	1%	1%
Total	100%	100%

## 7. CRASHES AND FATALITIES IN HIGHWAYS TIME OF THE DAY

The frequency distribution of crashes and fatalities of highways for the various times of the day depict that the peak time of crash occurrence for major crashes and fatalities is 12:00 pm-2:00 pm (13% crashes and 13% fatalities) as shown in Figure 5.

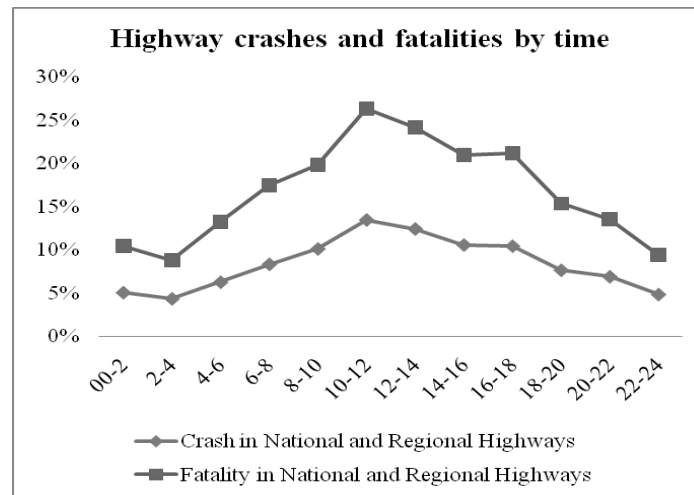


Figure 5: Highway crashes and fatalities by time of the day

Nearly 57% crashes and 55% fatalities occur between 8:00 am- 6.00 pm. Other time periods in which relatively high numbers of crashes and fatalities occur are 6:00-8.00 am (8% and 9% respectively) and 6:00 pm-8:00 pm (8% and 8% respectively).

### 8. CRASHES AND FATALITIES IN HIGHWAYS FATALITY BY AGE

The age distributions of fatalities among various road user groups are shown in Figure 6. The study observes that most economically active and productive people (26-45 years age groups) are the main victims of road fatalities which are 46% of all road deaths in the highways. The other significant road death groups are 21-25 years group (12%) and 16-20 years group (7%). Children who are aged under 15 represent a significant proportion (14%) of road highway fatalities.

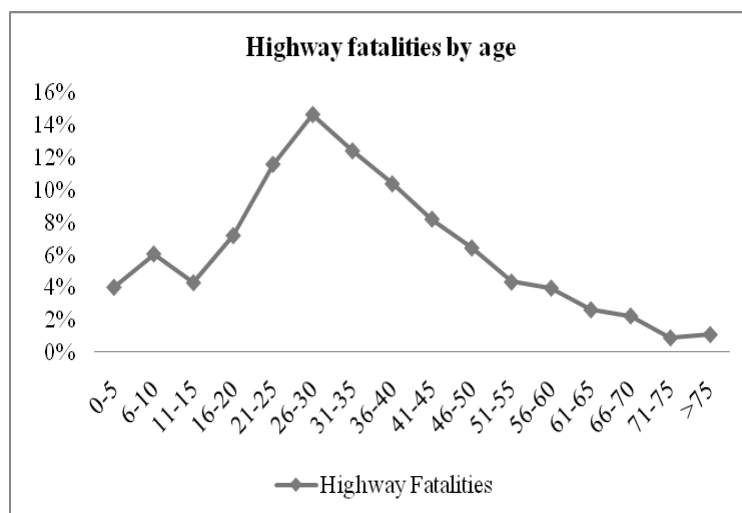


Figure 6: Highway crashes and fatalities by age group

### 9. VRUS CRASHES AND FATALITIES IN HIGHWAYS

In highways, nearly 50% of the road traffic fatalities are attributed to VRUs (viz. pedestrian, bicycles, cycle rickshaws and motor cycles). Of these VRUs, 77% fatalities are attributed to pedestrian fatalities followed by motorcyclists 13%, rickshaws 5% and bicyclists 5%. These VRUs are in general slow-moving and exposed and at higher risk of injury when their travel path conflicts with those for

the high speed motorized vehicles (Hoque, Mahmud & Qazi, 2008). The lack of external protection is the most fundamental features of VRUs which cause them to be fatally injured even when the collision speed is not that high. The irony is that most of the VRUs of the highways have little choice but to travel along roads in close proximity to fast vehicles. As a consequence, they found themselves in a high risk situation, which inevitably leads to large numbers of crashes. Due to absence of proper regulation and dedicated facilities for this vast group of road users they consequently become the worst sufferer of road crashes in this country. Therefore, it is crucially important to realize that facilitating VRUs and ensuring their safety is the key to ensure a sustainable transportation system under mixed traffic condition in the foreseeable future.

## 10. PEDESTRIAN CRASHES AND FATALITIES IN HIGHWAYS

Pedestrian-vehicle conflicts are clearly the greatest safety problem and show almost steady trends in Bangladesh. In recent years, pedestrian crashes and fatalities showed increasing trend. In 2012, nearly 33% crashes were hit pedestrian type which were responsible for almost 29% of total fatalities in highways (Figure 7).

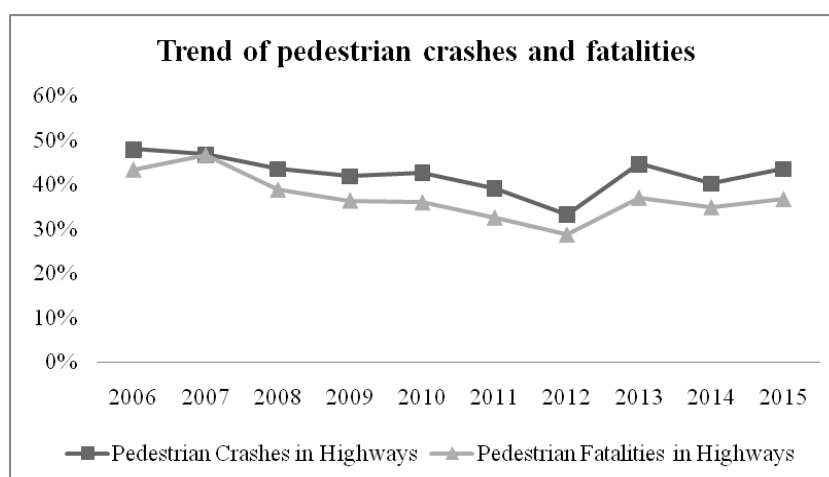


Figure 7: Pedestrian crashes and fatalities trend

In 2015, the percentage of pedestrian crashes increase to 44% and fatalities to 37%. It clearly indicates that these type of crashes should be mitigate urgently. In highways, 37% crashes and 40% fatalities occur while crossing the roads followed by 28% crashes and 29% fatalities during walking through edge of the road or shoulder (Table 3).

Table 3: Pedestrian fatalities by pedestrian actions

Pedestrian Actions	Crash in National and Regional Highways	Fatality in National and Regional Highways
None	20%	21%
Crossing	37%	40%
Walking on the Road	7%	8%
Walking through Edge of the Road	28%	29%
Working/Playing on the Road	7%	2%

## 11. VEHICLE INVOLVEMENT IN HIGHWAY CRASHES AND FATALITIES

Studies of road crashes revealed that heavy vehicles such as buses and minibuses (32%) and trucks (24%) are major contributors to road crashes in highways. This group of vehicles is particularly over involved in pedestrian. Informal vehicles like Nosimon, Korimon, etc. contribute 9% of the vehicles

involved in highway crashes. Besides, motorcycle (8%) plays a great role in road crashes in Bangladesh. Low level of awareness of the safety problems, inadequate and unsatisfactory education, safety rules and regulations and traffic law enforcement and sanctions of the drivers play significant role behind this crashes.

Yearly trend analysis of the involved vehicles in highway crashes shows that trucks and informal vehicles involvements are increasing alarmingly. In 2006 the involvement of informal vehicles was 4% which has increased up to 15% in 2015. Often these low speed informal vehicles involve in collisions with heavy and higher speed vehicles and results greater death rates.

## **12. MAJOR ROAD CRASH CAUSATIONS IN HIGHWAYS**

The principle contributory factors behind road traffic crashes and fatalities in highways of Bangladesh have been identified in this study. The analysis shows that overspeeding and careless driving contributed almost 85% and 85% of crashes and fatalities in highways respectively. Besides this, pedestrian action also mentionably contributed to 8% and 7% crashes and fatalities in highways of Bangladesh.

## **13. ROLE OF ENGINEERS IN ROAD SAFETY**

Road crashes are considered a "public health" problem, which confronts society generally. Engineers must, therefore, work closely with experts in other scientific disciplines such as educators, health and enforcement agencies to effectively tackle the problem. Engineering improvements to road safety can be conveniently subdivided into three categories: road and roadway environment improvement; vehicles improvement; and improvements aimed at assisting other scientific disciplines. Road and vehicle engineering measures have been well proven effective in reducing crashes. Road safety is more appreciated in developed countries and their crash rates are decreasing. In comparison, the problem may appear of little concern in developing countries and their crash and casualty rates are higher than developed countries. It is unlikely that much progress can be made in substantially reducing crash cost unless a comprehensive strategy is adopted with due regard to the latest advances, principles and measures. A multi-directional approach should be considered along with collaboration between, traffic police, health, law, and transport authorities in developing countries.

## **14. THE SAFE SYSTEM APPROACH AND ROAD INFRASTRUCTURE SAFETY IMPROVEMENTS**

One of the most recent advances in tackling road safety is the concept of safe system approach (Hoque and Salehin, 2013). It deals with more forgiving approach (Figure 8) and considers that public make mistakes and they are vulnerable. This approach puts particular emphasis on safe roads along with the mutual importance of safe road users, vehicles and speeds. The approach is very effective in preventing road deaths and serious injuries on large scale and its potential in less motorized countries like Bangladesh is enormous. Given the road environmental situation and hazards associated with VRUs, as discussed in the preceding sections, the systematic implementation of safe system approach can significantly enhance the safety of the VRUs in Bangladesh.

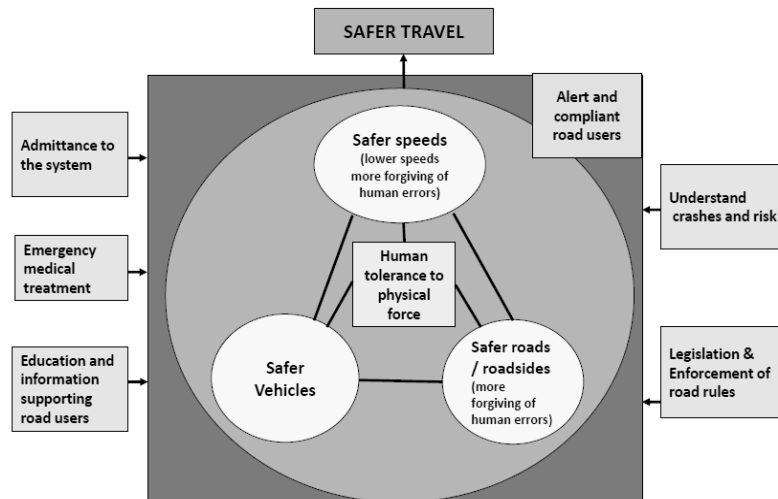


Figure 8: Safe system (Source: Australian Transport Council, 2004)

## 15. HIGHWAY INFRASTRUCTURE SAFETY IMPROVEMENTS IN BANGLADESH

In Bangladesh, extensive studies of police reported crash data as well as on-scene in-depth investigation of selected crashes have been conducted for understanding of the characteristics and identifying effective safety improvement options with particular regard to road infrastructure improvements. The following promising actions of road infrastructure safety are of prime importance for road safety in Bangladesh. The treatments and approaches would help road infrastructure required to deliver safe system outcomes (Hoque, Salehin & Smith, 2012).

### 15.1 Hazardous Road Location Treatments

Spot safety programs which seek to identify, prioritize and treat crash locations have been very successful. There is urgent need and scope for road environmental improvements aimed at correcting the most common deficiencies in hazardous road locations in Bangladesh. Hazardous road location treatments have shown high economic benefits and demand priority consideration in Bangladesh. Desirably, emphasis should be placed initially on introducing low cost improvement schemes which proved to be highly effective. Typical safety measures are incorporation and treatments of road shoulders, pedestrian facilities (segregated footways, crossings), junction improvements, treatment of hazards, speed control devices, median barriers, access control, channelization, traffic islands, skid resistance treatment, improved delineation devices, safety zones etc. including provision of divided roads.

### 15.2 Road Safety Audits

Alongside crash reduction work, crash and injury prevention work must also be pursued through road safety audit as an important process in road safety engineering. An effective road safety audit process has great potential for improving road safety. Road safety audit being a systematic examination of roadway elements for safety would focus on explicit safety implications and recommend desirable changes or modifications in highway design and operational aspects appropriate to the local safety needs. Road safety auditing or checking is a very essential and systematic step that needs to be introduced to document such widespread safety deficiencies for appropriate corrections. Proactive identification and treatment of hazardous road locations through road safety audit is considered to be highly beneficial to Bangladesh context.

### 15.3 Road Inspection and Assessment

This approach has now emerged as a new tool for systematic analysis of road infrastructure deficiencies and provides targeted countermeasures programs to improve road safety across an entire



road network. The International Road Assessment Programme (iRAP) tools particularly address the safety of vulnerable road users and assess each stretch of roads for its safety for pedestrians, bicyclists, motor cyclists and car occupants separately (International Road Assessment Programme [iRAP], 2008). The iRAP methodology offers 'vaccines for roads' and therefore demands priority consideration for application in Bangladesh with support from the international road safety community. The iRAP targets high-risk roads where affordable programs of safety engineering can reduce large number of deaths and serious injuries on the basis of strong partnership for key local stakeholders.

## **16.FURTHER HIGHWAY SAFETY MEASURES FOR BANGLADESH**

Other promising road infrastructure safety measures that demand increased attention includes the following.

### **16.1 Walking Facilities**

Nearly 28% of highway pedestrian crashes and 29% of fatalities occur while walking along the edge of the highways. Adequate shoulder and separate walking facilities are importance to separate the pedestrians away from the main traffic stream which will ultimately reduce the this type of crash in the highways (Mahmud, Hossain, Hoque, & Hoque, 2006).

### **16.2 Crossing Facilities**

About 37% pedestrian crashes and 40% pedestrian fatalities occur while crossing the highways in Bangladesh. So it is very important to provide crossing facilities, such as, overpass and underpass at right place to separate the pedestrian and main traffic. In addition, for school-goers of young ages pedestrian flag facilities can be applied.

### **16.3 Service Roads**

Bicyclists, motor cyclists and pedal rickshaws are legal road users and have the right to use the roadway. Service roads are wished to be used to decrease fatalities of such road users in highways.

### **16.4 Treatment of Roadway Shoulder**

It is well established that the safety benefits of shoulders improvement are evident with benefit-cost ratio of 29:1 (Hoque et al., 2006). Major two type of collision such as run-off and head on collision can be significantly reduced by shoulder widening. Moreover, wide paved shoulder provides shelter for slow moving vehicles.

### **16.5 High Roadside Slope Protection and Treatments**

Exposed roadside steep-slope, particularly at bends is a potential hazard. Installation of roadside safety barriers is the best option to encounter this hazard. When such places are not properly delineated or guided, there is always chance of crash at night time. Installing guide post or even placing wire-rope barrier can increase safety tremendously. Setting of guide post with reflector or reflective paint can be very useful at night.

### **16.6 Enforcement Measures**

Advanced warning which could be as VMS (Variable Message Sign), traffic signs, and advanced road markings can be efficient for speedy road users like motorcyclist. Here new Intelligent Transportation System (ITS) can be major tools for enforcing safety of the road which are proven to be effective in developed countries..

### **16.7 Policy Measures**

Land use policy need to be applied for regulating to construct new infrastructure in city areas. Additionally, all safe infrastructures should follow manual of roads and highway department and related departments

## 17. CONCLUSIONS

This paper has mainly highlighted the characteristics of highway crashes and fatalities in Bangladesh by identifying most common types of crashes and the causal factors. It is found that VRUs are the main victim of these fatalities, accounted for over 50% of the total highway fatalities. Hit pedestrians represented by far the largest share of the highway fatalities with nearly 77% of the total VRUs fatalities. Thus, the pedestrian safety should be considered as a priority group in taking any roadway safety improvement schemes and measures. Infrastructural safety improvement of roads, roadside hazards treatment, roadway environmental safety, standard design principles and frequent safety inspections are highly needed to address other types of crashes in highways of Bangladesh. Detailed analysis of the most recent crash statistics revealed that effective road safety countermeasures in accordance with crash patterns are necessary and have been identified in this paper. The role of road safety engineers are particularly significant in this context with a view to apply effective countermeasures within the context of safe system principles.

## ACKNOWLEDGEMENTS

Authors acknowledged the support and assistance of Accident Research Institute (ARI) of Bangladesh University of Engineering and Technology (BUET). The opinion and views expressed in this paper are those of the authors.

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