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Present condition and safety issues of non-motorized vehicles in Bangladesh

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Abstract

This study discusses about the present condition of Non-motorized vehicles in traffic stream and their involvement in road traffic accidents with particular context of Bangladesh. With the economical progress and growing motorization level throughout the world the existence of non- motorized vehicles are threatened although they offer a variety of utility. Accidents and road safety related issues are pervasive in Bangladesh due to its vulnerable, heterogeneous and complex transport system along with notable speed differences between motorized vehicles and non motorized vehicles. The accident data used in this study has been collected from ARI, BUET and analyzed using Microcomputer Accident Analysis Package (MAAP) software. Field studies also have been carried out to find the actual NMV scenario in Bangladesh. NMVs are one of the most important para transit in Bangladesh, especially in Dhaka city. According to the Dhaka City Corporation (DCC) 80,000 rickshaws have legal licenses, but different studies indicate that there are more than 5, 00,000 rickshaws plying on the streets of Dhaka. Before year 2002 NMVs have access to all the major corridors and roads of Dhaka city. But after that government of Bangladesh had decided to ban NMVs from some major corridors of Dhaka. That initiative had taken to control the congestion problem of Dhaka city but it brings out a little success. Accident records reveal that in Bangladesh during 1998-2010 nearly 11 percent of the accidents involved non motorized vehicles. Almost 34 percent of these accidents are occurred in the 4 metropolitan cities of Bangladesh. Among these Dhaka is highest with 71 percent of NMV accidents. So it proves that banning of NMVs does not bring any sustainable solution about road traffic accidents. Almost 67 percent of total accidents resulted in fatal. So casualties related to NMV accident are also high (nearly 50 percent of the victims died). Significant speed difference with motorized vehicles is one of the primary reasons of NMV accidents. Study indicates that in 32 percent cases rickshaws have collided with bus and in 25 percent cases heavy trucks hit rickshaws. NMVs should given proper level of accessibility based on its share and need for future years. Physical separation of NMVs can be a very impressive solution. Other possible initiatives to improve the facilities of NMVs and safety countermeasures are also discussed in this study.

Keywords: NMV, Safety, Road traffic accident, MAAP 5 Database, Bangladesh

1. Introduction

Advancement of human civilization has been greatly influenced by transportation system and vehicles are integral part of this system. In broad spectrum vehicles can be divided into two categories – Motorized Vehicles (MVs) and Non-Motorized Vehicles (NMVs). Bangladesh is a developing country with a very dense population of 152.5 million living in an area of 1,47,570 sq. km. Non-motorized vehicles are also known as fuel free transport(FFT). Non-motorized vehicles (e.g. Rickshaw van, Cycle rickshaws, bicycles, Push cart etc.) are one of the main modes of transport in Bangladesh especially in Dhaka city. NMVs are fuel free, eco friendly, and energy efficient, economically viable, requires significantly less road space than their motorized counterparts and provide efficient door to door service for the majority of vehicular short trips in Bangladesh. Traffic congestion, road traffic accident and other safety and pollution related problems are a common feature of the roads and streets of Dhaka city. It is a much debated issue now a day for improvement of traffic system of Dhaka city whether to ban the non motorized vehicles or to give them proper facilities. According to BRTA there are about 17,51,834 motorized vehicles in Bangladesh. While the number of registered rickshaws in urban area is about 7,95,741 and in rural areas the number is estimated about 1,21,297 (BBS, 2010). The number will be far more if the illegal NMVs are count. So it reveals that about 35% of the total vehicles are non-motorized. This huge number of NMVs plays a crucial role in the road traffic characteristics as well as in accidents**.** Road traffic injuries are a major public health problem and a leading cause of death and injury around the world. Each year nearly 1.3 million people die and millions more are injured or disabled as a result of road crashes, mostly in low- and middle-income countries (WHO, 2010). Road traffic accidents, injuries and fatalities are also major concerns for Bangladesh. Bangladesh has a very high road accident fatality rate with official figures indicating more than 60 deaths per 10,000 motor vehicles. Everyday around eight persons die in road accidents. (Maniruzzaman and Mitra, 2005). Among these the pullers and users of NMVs are considered most vulnerable group to road traffic accident due to their light and delicate structure and significant speed difference with their motorized counterparts. About 11 percent of total accidents involved NMVs. This study focuses on NMV scenario in the traffic stream along with the NMV accidents with particular emphasis on accident condition in metropolitan areas and involvement of different type of vehicles in NMV accident. Possible safety countermeasures are also discussed in this study.

2. Data Collection and Research Methodology

This study deals with NMV involvement in road traffic accidents in Bangladesh during the period of 1998-2010 using the Microcomputer Accident Analysis Package Five (MAAP5) software of Accident Research Institute (ARI). Primary data are collected from police. Accident Report Form (ARF) is then collected by ARI from range officers and district officers as hard copy and soft copy. ARI then edits both the hard and soft copies and makes MAAP5 up to date. Field surveys were conducted in Mirpur road near science lab and bonpara-hatikamrul highway, Rajshahi to take photographs and collect data.

3. Water quality of receiving water bodies

There are different modes of NMVs available in Bangladesh. But among these cycle rickshaws are the most popular and one of the main modes of transport in Dhaka. The 1993 Dhaka Integrated Transport Study (DITS) estimated that rickshaws accounted for 19 percent of all person trips in Dhaka city. The 2005 Strategic Transport Plan (STP) estimated 34 percent of all trips and the 2009 JICA study (DHUTP) estimated 39% of all trips. So it can be said that, although the demand of rickshaw as a para transit is increasing day by day, their

role as a public transport mode along the major corridors of Dhaka city has been greatly reduced in recent years due to imposition of restriction in their movement in some main roads of Dhaka city. Currently NMVs are banned in the 11 major links of Dhaka city. The initiative was first implemented in Mirpur road (Gabtoli-Azimpur) and then gradually in the other main roads of Dhaka. The last step of this process was to ban rickshaws from Shantinogor-Malibag-Banglamotor-Mouchak road. Rickshaws was banned in this road because it is believed that they are slow moving vehicle and occupies more road space compared to their passenger carrying capacity that cannot keep pace with the motorized vehicles and thus create congestion. But the banning of rickshaws could not bring any significant success in controlling congestion due to lack of sufficient public transport and increasing private cars in the streets of Dhaka. According to Human Development Resource Centre report (HDRC 2004) the rickshaw ban on Mirpur Road from Gabtoli to Russell Square was a complete failure (Bari et al., 2005). The report also mentions some drawbacks that originate after the banning of rickshaws. They are:

- Caused at least a 50% increase in average journey times.
- Resulted in at an increase of at least 10% in monetary costs per trip.
- About one-third (29%) of former rickshaw passengers continued to use rickshaws via side roads along the corridor, resulting in significant increase of their travel times and costs, as they are forced to take more circuitous and congested side roads.
- Out of the remaining 71% of former rickshaw passengers, One-fourth (25%) switched to walking which resulting in an increase in travel time of about 10 minutes per km. More than one-third (42%) moved to baby taxis and taxicabs, which charge significantly higher fares, are unreliable, are normally reluctant to take short trips, and are not readily available, thus causing higher waiting times. One-third (33%) shifted to buses, but the report conceded waiting times for passengers increased significantly, which obviously almost nullified any gains achieved due to an increase in operating speeds.
- Left virtually no transport for women, children and the elderly, who cannot afford cars, taxicabs or baby taxis.
- Caused 32% to 41% loss of net income for rickshaw and rickshaw van pullers despite their adopting longer working hours.

4. NMV Facilities in Bangladesh

NMV facilities mean some support features to promote the safe and comfortable movement of NMVs in the roads and highways. According to AASHTO guide for development of bicycle facilities there are mainly 4 types of facilities that can be provided to bicycles as well as for NMVs. They are Shared roadways, Signed shared roadways, Exclusive bike or rickshaw lane and shared use paths. In Bangladesh the facilities of NMVs are very little and not well maintained. The scenario of two NMV facilities of Bangladesh is given here. One is situated in the Mirpur road of Dhaka, the place is locally known as science laboratory. Due to high demand of rickshaws in this road an exclusive rickshaw lane about 19 feet wide is provided here. The lane is separated from the main road with the help of concrete blocks. Approximately four rows of rickshaw can move easily in this lane. But due to illegal parking and intrusion of other motorized vehicles limit the spaces available for rickshaws. Another NMV facility is located in Bonpara-Hatikamrul highway, which is a part of Dhaka-Rajshahi highway. It is an outstanding example of a NMV facility in highways. Average width is 10-12 feet throughout the lane. But it is not properly secured with barriers, separated from the main road only with the help of grass turfing which can be very hazardous in safety point of

view. On the other side there is also no fence. This may contribute in falling of NMVs and cause serious accidents.

Fig. 1. NMV Lane in Mirpur road

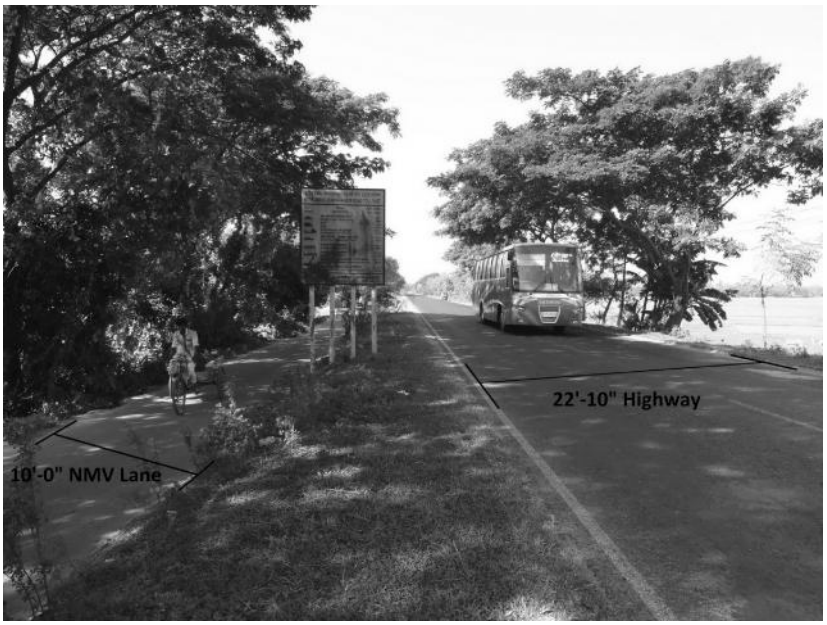

Fig. 2. NMV Lane at Bonpara-Hatikamrul highway, Rajshahi

5. Accident Data Analysis

To understand the inherent reasons behind the NMV accidents and characteristics accident data analysis is important. In this section the proportion of NMV accidents in 4 metropolitan cities of Bangladesh, magnitude of fatality, casualty due to accidents and involvement of different motorized vehicles in NMV accidents are examined.

5.1 NMV Accidents in Bangladesh

Total 45,891 cases of accidents were reported during 1998-2010. Among these each year a significant number of NMV accidents occurred. The comparison can be understood from the figure below.

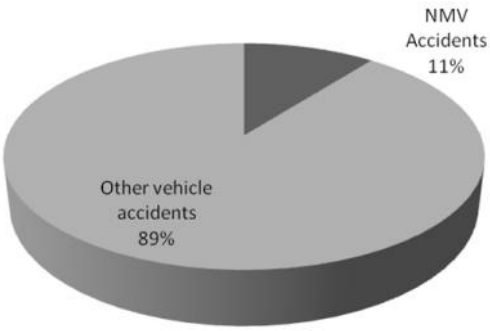

Fig. 3. Proportion of NMV accidents

So, 11 percent of the total accidents involve NMVs. And among these 4,865 accidents 3,288 accidents were fatal, which indicates nearly 67 percent of the accidents were fatal. This is more than the fatality of car accidents (30 percent) and almost equal to the fatality of heavy vehicles (approximately 70 percent for bus and truck). Rest 27 percent are grievous, 5 percent are simple and 1 percent is collision only accident.

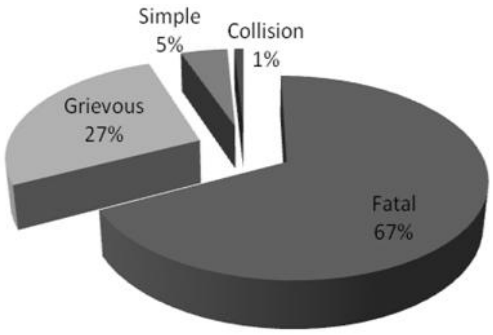

Fig. 4. Fatality of NMV accidents

Casualties of these accidents are also high. Almost 50 percent people died in these accidents. So though the magnitude of NMV accidents is small the impacts of these accidents are heavy.

Table 1
Casualty injury due to NMV accidents

Year	Fatal	Grievous	Simple	Total
1998	208	334	68	610
1999	250	258	107	615
2000	272	265	68	605
2001	215	183	51	449
2002	292	199	70	561
2003	277	256	63	596
2004	234	146	57	437
2005	153	108	24	285
2006	262	168	29	459
2007	259	175	32	466
2008	263	138	40	441
2009	165	80	20	265
2010	164	65	21	250
Total	3014	2375	650	6039

From the table it has been seen that almost 50 percent injuries due to NMV accidents are responsible for the cause of death of victim. On the basis of number of vehicles, during 1998-2010 nearly 8 percent vehicles involved in accidents are non-motorized. Rest 92 percent are motorized vehicles accidents.

5.2 NMV Accidents in Metropolitan Cities

Since NMVs are a popular transit mode in city areas, the frequency of NMV accidents are also high in this regions. Total 1,576 NMV accidents occurred in the 4 metropolitan cities (Dhaka, Chittagong, Rajshahi and Khulna) which bear the 34 percent of the total share of NMV accidents in whole Bangladesh. The year wise accident scenario in these 4 cities is depicted by the table below.

From the above table it can be demonstrated that though significant number of accidents occurred in the city areas, it has been following a decreasing trend especially after 2003, When NMVs had started to ban from the major roads. The effect can be more easily understood from the scenario of Dhaka metropolitan area, where rickshaws has started to ban from 2002. In 2010 only 39 cases of NMV accidents were recorded which were 203 in 1998. So accidents in DMP have been reduced five times in these thirteen years. Number of accidents has also reduced in the other three metropolitan cities. Other reasons behind decreasing NMV accidents may be their shifting to safer side roads, negligence in reporting NMV accidents and imposing facilities in streets and highways. It can be also showed from the table that the region under DMP has the highest share of NMV accidents (71%) than other three cities.

Table 2
NMV accidents in metropolitan cities of Bangladesh

Year	Metropolitan Cities				Total
	RMP	KMP	DMP	CMP	
1998	11	7	203	36	257
1999	15	10	146	16	187
2000	13	9	114	24	160
2001	17	7	79	9	112
2002	18	13	93	14	138
2003	19	5	85	16	125
2004	18	3	62	12	95
2005	14	2	51	9	76
2006	9	6	59	12	86
2007	6	10	59	21	96
2008	13	3	73	11	100
2009	11	9	54	8	82
2010	3	4	39	16	62
Total	167	88	1117	204	1576

5.3 Involvement of Other Vehicles in NMV Accidents

Very low level of safety features in NMV structures and significant speed difference with motorized vehicles are the main reasons NMV accidents on both streets and highways. Due to its delicate structure and size it easily becomes victim to accidents when it collides with other motorized and heavy vehicles. In fact collision with other vehicles is the primary reason behind

NMV accidents. Because data shows only about 10 percent NMV accidents were liable to own vehicle defects. And the rest portion of NMV accidents is believed to occur due to collision with other motorized and heavy vehicles. To analyze this all ARF forms from 2006 to 2010 has been scrutinized from MAAP database and involvement of different vehicles in rickshaw accident has been listed. This data can be presented by the help of a pie chart.

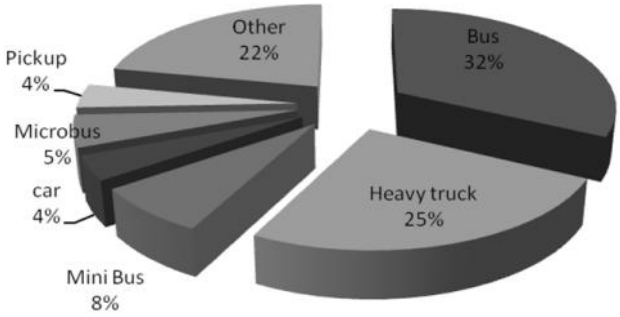

Fig. 5. Involvement of Motorized vehicles in rickshaw accident

From the above figure it can be inferred that,

- More than 50 percent cases Heavy vehicles hit rickshaws.
- Bus is the vehicle that rickshaws are most frequently collide in the road traffic accidents (32%)
- In 25 percent accident cases heavy trucks hit rickshaws.
- Then come Minibus (8%), microbus (5%) and private cars (4%).
- Rest of the motorized vehicles involved in 22 percent NMV accidents.

5.4 Contributing Factors in NMV accidents

Table 3
Contributing factors of rickshaw accidents

Factors	1st Contributing Factor	No. of Accidents 2nd Contributing Factor	3rd Contributing Factor	Total
Careless driving	177	368	18	563
Over speed	348	130	11	489
other	-	13	139	152
Overtaking	13	13	19	45
Close to another vehicle	9	14	21	44
Signal	4	15	17	36
Faulty road geomet	4	7	23	34
Faulty turning	16	3	4	23
Pedestrian	5	4	11	20
Road condition	2	7	9	18
Vehicle defect	5	3	8	16
Driver fatigue	1	3	10	14
Overload	2	4	4	10
Alcohol	1	1	5	7
Weather	2	-	3	5
Passenger	-	2	1	3

Usually there are many factors behind a road traffic accident like vehicular factors, road user factors, traffic factors, geometric factors, environmental factors etc. Often a road traffic accident cannot be attributed to a single cause but a combination of several contributing factors. In the ARF forms of Bangladesh usually three contributing factors are tried to identify for a road traffic accident. Since rickshaws are the most popular and widely used form of NMV in Bangladesh, in this study the contributing factors behind rickshaw accidents is analyzed. To analyze this all ARF forms from 2006 to 2010 has been scrutinized from MAAP database and different contributing factors behind rickshaw accident have been listed. This data can be presented by the help of the table below.

From the above table the things that can be inferred,

- Over speed of vehicles is the 1st or primary contributing factor for almost 60 percent rickshaw accidents.
- But careless driving is the contributing factor which is most frequently associated with rickshaw accidents.
- In 48 percent cases "other" has been selected as the third contributing factor of rickshaw accidents. It may be due to failure in identification or absence of proper contributing factor in the ARF form.
- Other significant contributing factors are overtaking, close maneuver between vehicles, signal problems, faulty road geometry etc.

6. Result and Discussions

Though NMVs has been banned from the major arterials of Dhaka city, it has not been quite beneficial according to mobility and serviceability purpose. On the other hand banning has reduced the amount of NMV accidents, especially in city areas. Off all the road traffic accidents occurred during 1998-2010, 11 percent of them are NMV accidents. 67 percent of those NMV accidents are fatal, casualty rate is 50 percent. 34 percent of the total accidents have occurred in city areas and the trend is decreasing. Dhaka city posses the highest share in NMV accident with 71 percent incidents. Collision with heavy vehicles is one of the main reasons of NMV accidents. In 36 percent accident cases rickshaws have collided with bus and in 24 percent cases they are collided with heavy trucks. Over speed and careless driving are two most primary contributing factors of rickshaw accidents.

7. Some Safety Counter Measures to Prevent NMV Accidents

To prevent NMV accidents some counter measures are prescribed below:

- *Provision of separate and exclusive NMV lane*: Since the most common reason of collision of non-motorized vehicles with motorized vehicles is the significant speed difference between two vehicles, it will be wise to physically separate these two vehicles. And this can be done by keeping provision of parallel service roads or exclusive lane only for NMVs on both sides of highway and busy streets.
- *Modernizing the NMV design*: The delicate and vulnerable structure of NMVs is a major factor to make the vehicle accident prone. So it is very important to improve the design of NMVs, especially the ancient design of rickshaws. Some potential improvements may be (i) reducing the overall weight of NMVs (ii) Providing gears to NMV (modern world pedicabs is a successful example of this) (iii) Adding reflectors for night time use.
- *Training of the rickshaw pullers and modernizing the licensing process*: Most of the NMV pullers in our country are illiterate. They have little or no knowledge about road

traffic system. So they often create congestion and accidents in the road. To check this proper training should be given to each rickshaw puller prior to give them any sort of permission to ply on roads.

- *Separate bicycle provisions*: Though bicycle is very few in number, but it is still a very reliable mode of transportation, especially in rural areas. At present there are no cycling strategy and separate regulations for bicycles in Bangladesh. These provisions should be made to check the bicycle accidents.
- *Discourage overloading*: Push carts and rickshaw vans are widely used for carrying goods in Bangladesh. But sometimes they carry goods and materials more than their capacity. This can be very detrimental for other road users and cause serious accidents. So strict regulations must be imposed to prevent this type of overloading.

8. Conclusions

This study has mainly highlighted the general characteristics of NMV in the present traffic stream of Bangladesh and accidents of NMVs with particular emphasis on involvement with heavy vehicles and contributing factors of accidents. With the growing population and urbanization, a sustainable transportation system is needed for Bangladesh which will meet both the present and future demand. Public transport must be given the maximum preference instead of private cars. Banning NMV in some special roads has not solved the problems and accidents related to NMV just shifted from one place to another. With the huge numbers of NMVs plying in the streets every day, increasing accidents and safety problems make the condition even worse. The countermeasures stated in this study might be helpful in minimizing the fatality rate of NMV accidents. It is to be ensured that NMVs get their proper places to move freely and safely in the road. A reasonable balance between NMV and MV should be maintained. Most urban trips in cities around the world are fairly short distance. Therefore as Dhaka grows, the proportion of short distance trips will remain high and the rickshaw as well as other NMVs will continue to have a potential role.

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