Emerging Road Safety Problems in Urban Areas of Bangladesh

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ABSTRACT: Developing countries like Bangladesh are experiencing very serious road safety problems. Latest studies revealed that there are 10000-12000 deaths from road traffic injuries each year in Bangladesh, nearly 25 percent occurring in the urban areas. Urban road accidents are a very serious and growing problem with vast majority of road accident fatalities comprising vulnerable road users viz. pedestrians, bi-cyclists and motorcyclists. Indeed, in urban areas of Bangladesh pedestrians represent often up to 70 percent of the total road accident fatalities. Their involvement varies between 35 and 62 percent of the road accident fatalities in the medium sized cities. This paper aims to present an overview of the dimensions and characteristics of the road traffic accident problems in Bangladesh, with a special reference to the situation in urban areas, metropolitan cities in particular. The paper also highlights the key safety issues and priority measures for mitigating urban road safety problems in Bangladesh.

INTRODUCTION

The combination of rapid urbanization and motorization has been a key cause of numerous transport problems in developing cities of Asia. Indeed, the rapid urbanization process, high vehicular population growth and that of the mobility, inadequate transportation facilities and policies, varied traffic mix with over concentration of non-motorized vehicles, absence of dependable public transport system and inadequate traffic management practices and parking facilities have created a significant worsening of traffic and safety problems in the major urban centers in Bangladesh.

This paper aims to present an overview of the dimensions and characteristics of the road traffic accident problems in Bangladesh, with a special reference to the situation in urban areas, metropolitan cities in particular. At the very outset, a brief outline of the urbanization trends in Bangladesh is presented which is followed by an overview of the prevailing accident problems, magnitude and characteristics are discussed in the global and the developing countries’ perspective with emphasis on urban accidents. The paper in particular briefly characterizes and discusses the key policy issues and priority needs of urban road safety problems which should be addressed with due urgency in Bangladesh.

THE CONTEXT OF URBANIZATION TRENDS IN BANGLADESH

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Bangladesh is a very densely populated and low-lying country with about 130 million inhabitants living in an area of 144,000 sq.km i.e. some 900 inhabitants per sq.km. By 2024, the population of Bangladesh is expected to touch 168.7 million with very large percentage residing in urban area. Urbanization in Bangladesh has been increasing steadily over the last 10 to 20 years with current urbanization level at around 24 percent. The percentage of people live in urban areas is expected to rise to 30 percent by the year 2010 and to 50 percent by the year 2025. The rate of urbanization is alarmingly high when compared with other developing countries. The current rate of urban population growth in Bangladesh is found to be the highest in Asia. Rural-urban migration is considered to have made the major contribution towards the rapid growth of urban population in Bangladesh. A very high proportion of this urban population is poor. The greater challenge thus for transportation professionals is to develop a system of urban transport that meet the basic mobility needs for all urban dwellers at desirable safety and avoiding the unacceptable level of congestion and its consequent overwhelming adverse environmental effects (Hoque et al, 2005).

A striking feature of urbanization in Bangladesh manifests itself in concentration of urban population in six major metropolitan cities. The six metropolitan cities viz. Dhaka (the capital of Bangladesh), Chittagong, Rajshahi, Khulna, Sylhet and Barishal and accommodate about 54 percent of the total urban population, the share of Dhaka being 35 of the total population of 9.9 million. This is followed by Chittagong (3.2 million), Rajshahi (1.2 million) Khulna (0.6 million), Sylhet (0.28) and Barishal (0.2) (BBS, 2004).

ROAD SAFETY PROBLEMS: DIMENSIONS AND CHARACTERISTICS

The global situation

According to the World report on road traffic injury prevention (2004), worldwide, an estimated 1.2 million people are killed in road accidents each year and as many as 50 million are injured. In addition to these deaths, between 20 million and 50 million people globally are estimated to be injured or disabled every year. Around 88 percent of those deaths occur in the developing world (Mackay, 2003), even though these countries only account for 32 percent of the total motor vehicle fleet worldwide (Hoque et al, 2001). About 15 percent of global road fatalities were children (0-14) of which 97 percent occurred in low-income and middle-income countries. For every death, there are far greater numbers of injuries- four persons with severe/permanent disabilities, ten persons requiring hospital admission, and thirty persons requiring emergency room treatment. Projections indicate that these figures will increase by about 65 percent over the next 20 years unless there is new commitment to prevention. Road traffic deaths are predicted to increase by 83 percent in low and middle income countries and to decrease by 27 percent in high income countries. It is estimated that road traffic injuries will be the third leading cause of life years lost by 2020 (WHO, 2004). Indeed, they are the second leading cause of death for people aged 5 to 25, with devastating impact on families and communities. For all these reasons, road traffic injuries are an important obstacle to development and place an enormous strain on a country’s health care system, and on the national economy in general (Ban Ki-Moon, 2007). Sustained declining trends of road fatalities in the developed countries have been attributed to concerted efforts in many sectors including effective coordination, community involvement, well researched road safety initiatives, road safety good practices and improved targeting of resources. In developing countries like Bangladesh major considerations of such approaches are required with due urgency and commitment. Essentially, in order to be most successful, road safety policies and
actions should invoke local research based outcomes and for that it is necessary to carry out country specific research to identify effective measures.

**The situation in developing countries**

The safety situation in developing countries is rapidly deteriorating with increasing number of road deaths, largely as a direct consequence of rapid growth in population, motorization and urbanization and lack of investment in road safety. While the road accident situation are slowly improving in the industrialized societies (e.g. Australia, UK, USA), most developing countries are experiencing a worsening situation. According to UNESCAP (United Nations Economic and Social Commission for Asia and the Pacific) in 2006 more than half a million people were killed (50 percent of total global fatalities) and 20-30 million injured in road crashes in Asia and the Pacific region at an economic cost of some US$100 billion. Whereas highly motorized countries’ (North America, Australia, New Zealand, Japan and Western Europe) contributes only 12 percent (GRSP). Accident deaths rates in developing countries are often 10 to 70 times higher than in developed countries. The vast majority of road accident fatalities comprise vulnerable road user viz. pedestrians, bicyclists and motor cyclists, and they are most prevalent in urban areas (Hoque et. al, 1999).

It should be noted that road traffic injuries affect mostly the young and the middle age people in the society. In the low and middle income countries and in the South-East Asian region, road traffic injuries are the 6th leading cause of death for all age group. It is also found that road traffic injuries ranked the 1st and 3rd leading cause of death for age group 15-29 years and 30-44 years respectively (Global Burden of Disease Project for 2000, Version 1). These age groups represent the main working groups for each country.

**The road traffic accident problem in urban areas**

Generally, the road accident problem is disproportionately greater in urban areas than in rural areas (Lundebye 1995). This can be seen with respect to the situation in different cities of developing countries:

- Santiago (Chile): With 35% of Chile's population and 43% of registered vehicles has about 50% of all accidents.
- Sao Paulo (Brazil): With 7% of Brazil's population and 17% of vehicles has about 24% of road traffic injuries.
- Harare (Zimbabwe): Accounted for 43% of road accidents with a population of 12%.
- Metropolitan Dhaka (Bangladesh): Accounted for nearly 23 % of reported road accidents with a population of 7.3% (Hoque et. al, 1999).

Studies revealed that up to 70 percent of urban road accident deaths are often pedestrians alone. For example, according to the latest data, Hong Kong had the highest share of pedestrian fatalities, representing 67 percent. Pedestrians were involved in 62 percent of the total fatal accidents reported in Dhaka, 47 percent in the Republic of Korea, 45 percent in Sri Lanka and 43 percent in Fiji (Ross Silcock and TRL 1996). Pedestrian were high in Middle Eastern countries, around 50 percent. The comparable figure for European countries is around 20 percent. In recent years (1998-2006) pedestrian casualties (fatalities and injuries) have increased markedly, from 36% in 1998 to 53% in 2006, an increase of about 48% percent in the urban areas of Bangladesh. Pedestrians now make up approximately 63 percent of road
accident fatalities and 27 percent of injuries in urban areas of Bangladesh. About 70 percent were pedestrian motorized vehicle collisions. Indeed, in urban areas of Bangladesh pedestrians represent often up to 70 percent of the total road accident fatalities. Their involvement varied between 43 and 73 percent of the road accident fatalities in the medium sized cities.

THE PROBLEM OF ROAD TRAFFIC ACCIDENTS IN BANGLADESH

The dimension of the problem

According to police reported statistics around 4000 people die through Road Traffic Accidents (RTA) in Bangladesh each year. It is estimated that the actual fatalities could well be 10000-12000 each year taking consideration of underreporting and definitional inconsistencies. A recent household survey also revealed the actual spectrum of accidents and casualties.

![Figure 1: Pyramid of road accident casualties in Bangladesh](Bangladesh Health and Injury Survey, 2005)

In economic terms, road accidents in Bangladesh are costing the community in the order of Tk. 5000 crore (US $ 850 million) which is nearly 2 percent of GDP. This is, of course, a huge sum that the nation can ill afford to lose (Hoque et al, 2007a).

Some striking accident characteristics

A comprehensive analysis was undertaken of all reported accidents in Bangladesh in the period 1998-2005. Most striking characteristics of accidents are:

- The statistics revealed that Bangladesh has one of the highest fatality rates internationally in road accidents, over 100 deaths per 10,000 motor vehicles.
- About 70 percent of road accident fatalities occurred in rural areas including rural sections of national highways.
- Of the total reported accidents nearly 37 percent occurred on national highways.
- Accident type analysis showed ‘hit pedestrian’ as the dominant accident type both in urban and rural areas, 45 percent involvement in fatal accidents. Other common
accident types are: rear end collision (16.5%), head on collision (13.2%) and overturning (9.3%).

- Heavy vehicles such as trucks and buses including minibuses are major contributors to road accidents (bus/minibus 33%, trucks 27%) and in fatal accidents their shares are 35 percent and 29 percent respectively.
- The incidence of overall child involvement in road accident fatalities in Bangladesh is found to be also very high, accounting for about 21 percent.
- Up to 61 percent of urban road accident deaths are pedestrians alone. Pedestrians accounted for 49 percent of all reported fatalities in the accident database.
- Accidents occur more frequently at day time (6 AM to 6 PM):
  - Accidents in rural areas: day time 75 percent, night time 25 percent
  - Accidents in urban areas: day time 65 percent, night time 35 percent
- Nearly 22 percent of all reported accidents in Bangladesh occurred in Dhaka Metropolitan City. Nearly 52 percent of all accidents occurred at only 9 percent (18 intersections) of the total 200 intersections where at least one accident occurred during 2001-2003
- Accidents tended to occur more on Thursdays with fairly equal distribution among the week and weekend days.
- Accidents peaked in the months of January and March, accounting for 9.5 and 9.5 percent respectively
- About 2.5 percent of reported accidents occurred on bridges and culverts
- The principal contributing factors to 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
- The widespread underreporting and incomplete collection of specific details of accident data are a major problem. This limits proper accident analysis to be carried out towards improving and monitoring road safety. (Hoque et al 2007b).

Poverty impact of RTA

The poverty incidence in road traffic accidents has been examined by Quazi (2006). Some of the sticking findings are briefly summarized below:

- Road accidents disproportionately affect the poor and their consequences plunge household into acute poverty.
- Poor people are forced to use non-standard and unsafe vehicles.
- NMV operators particularly rickshaw pullers are being unaware of traffic safety are putting lives at rest.
- Of the children being killed and permanently disabled in RTA, the majority are from the poor families.
- Many families are driven deeply into poverty by the loss of a breadwinner and the added burden of the disable members.
- According to TRL over 70% of poor household reported their household income and food consumption decrease after a road death (for non-poor it is 57%)
- Some 61% poor families are forced to arrange loan after road death ( 34% for non-poor)
- Among the poor, 32% road deaths occur to head of households (compare to 21% non-poor)
Socio-economic Burden of Accidents

Together with the social impact in terms of pain, grief and suffering, there is a serious economic burden. Overseas research has shown that countries lose the most economically active years from road accident victims, and approximately 70 percent of the ‘years of life’ lost due to accidents are ‘working years’. People of 15–45 years old account for almost 63% of road traffic deaths. People of that age are in their most productive earning years, so their families suffer financially when they are killed or disabled (Hoque, 2007b).

ACCIDENT CHARACTERISTICS IN URBAN AREAS OF BANGLADESH

Urban Accidents Statistics

The distribution of reported road traffic accidents and fatalities in urban and rural areas for the period of 1998-2006 is shown Table 1 and 2. In the nine year period, at least 11472 accidents occurred in urban areas accounting for 35 percent of total accidents in the country. These accidents resulted in 6519 fatalities and 8471 injuries. Around, 25 percent of the total fatalities occurred in urban areas. The data presented in the table shows some possible reporting inconsistencies in the distribution of urban-rural accidents which require further investigation. Aspects of urban accidents are examined in the following sections.

<table>
<thead>
<tr>
<th>Table 1: Trends of Accidents in Urban and Rural Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reported Accidents</td>
</tr>
<tr>
<td><strong>YEAR</strong></td>
</tr>
<tr>
<td>1998</td>
</tr>
<tr>
<td>1999</td>
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<td>2000</td>
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<td>2001</td>
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<td>2003</td>
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<td>2004</td>
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<tr>
<td>2005</td>
</tr>
<tr>
<td>2006</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 2: Trends of Fatalities in Urban and Rural Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reported Fatalities</td>
</tr>
<tr>
<td><strong>YEAR</strong></td>
</tr>
<tr>
<td>1998</td>
</tr>
<tr>
<td>1999</td>
</tr>
<tr>
<td>2000</td>
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<td>2004</td>
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<tr>
<td>2005</td>
</tr>
<tr>
<td>2006</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
</tr>
</tbody>
</table>

Accidents in Metropolitan and Non-Metropolitan areas

A distribution of urban accidents and fatalities by metropolitan and non-metropolitan areas is presented in Table 3. The data shows that urban accidents are concentrated in metropolitan areas. Of the total urban accidents of Bangladesh, 82 percent are metropolitan related accidents which contribute to nearly 75 percent of urban fatalities. It may be mentioned that nearly 30 percent of total accidents and 20 percent of total fatalities are metropolitan related, with 12 percent of the total population of Bangladesh in metropolitan areas.
Table 3: Distribution of Urban Accidents and Fatalities (1998-2006)

<table>
<thead>
<tr>
<th>Locations</th>
<th>Accidents</th>
<th>Percent</th>
<th>Fatalities</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metropolitan</td>
<td>9399</td>
<td>82</td>
<td>4880</td>
<td>75</td>
</tr>
<tr>
<td>Non-Metropolitan (urban)</td>
<td>2073</td>
<td>18</td>
<td>1639</td>
<td>25</td>
</tr>
<tr>
<td>All Urban</td>
<td>11472</td>
<td>100</td>
<td>6519</td>
<td>100</td>
</tr>
</tbody>
</table>

The break-down of metropolitan accidents by metropolitan cities over the period of 1998 to 2006 is presented in Table 4. There are six declared metropolitan areas in Bangladesh. These are Dhaka, Chittagong, Rajshahi, Khulna, Sylhet and Barishal. It may be seen that, by far the greatest proportions of road traffic accidents and fatalities are in Dhaka, 74 percent and 65 percent respectively (Table 4).

Table 4: Accidents and Casualties in Metropolitan Areas of Bangladesh (1998-2006)

<table>
<thead>
<tr>
<th>Metropolitan City</th>
<th>Population</th>
<th>Accidents</th>
<th>Casualties</th>
<th>Fatalities</th>
<th>Casualties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dhaka</td>
<td>9912908</td>
<td>64.0</td>
<td>3047</td>
<td>67.0</td>
<td>6935</td>
</tr>
<tr>
<td>Chittagong</td>
<td>3202710</td>
<td>20.7</td>
<td>653</td>
<td>14.3</td>
<td>1089</td>
</tr>
<tr>
<td>Rajshahi</td>
<td>1227239</td>
<td>7.9</td>
<td>260</td>
<td>5.7</td>
<td>421</td>
</tr>
<tr>
<td>Khulna</td>
<td>646716</td>
<td>4.2</td>
<td>176</td>
<td>3.9</td>
<td>303</td>
</tr>
<tr>
<td>Sylhet</td>
<td>285308</td>
<td>1.8</td>
<td>369</td>
<td>8.1</td>
<td>588</td>
</tr>
<tr>
<td>Barishal</td>
<td>202242</td>
<td>1.3</td>
<td>46</td>
<td>1.0</td>
<td>63</td>
</tr>
<tr>
<td>Total</td>
<td>15477123</td>
<td>100</td>
<td>4551</td>
<td>100</td>
<td>9399</td>
</tr>
</tbody>
</table>

Striking Accident Characteristics in Urban Areas

Pedestrians - The Most Vulnerable Road User Group: In Bangladesh, with a low level of motorization, the role of walk mode is quite significant and is highly vulnerable as well. In Table 5, the distribution of road traffic fatalities by user groups in different metropolitan and non-metropolitan urban areas are presented. Pedestrians are by far the biggest user group in road traffic fatalities and their involvement varied between 37 and 73 percent of the road accident fatalities in the metropolitan areas with an average of 65 percent. It should be noted that, the percentage of pedestrian fatalities has significantly increased from 57 percent in 1998 to 66 percent in 2006 in urban areas. Pedestrian also accounted for nearly 56 percent in non metropolitan urban areas. Further analysis revealed that most of the pedestrians fatalities occur while crossing the road (41%) and is closely followed by walking on the road (39%). The next highest user group is bicyclists, accounting for nearly 11 percent. Their shares are particularly high in Rajshahi, Khulna and Barishal metropolitan areas. The high involvement of vulnerable road users’ viz. pedestrians and bicyclists in accidents demand special attention particularly in urban planning and design to cater for their safety.

Table 5: Fatalities by User Groups in Metropolitan Areas of Bangladesh

<table>
<thead>
<tr>
<th>User Groups</th>
<th>Dhaka</th>
<th>Chittagong</th>
<th>Rajshahi</th>
<th>Khulna</th>
<th>Sylhet</th>
<th>Barishal</th>
<th>All Metro</th>
<th>Non-Metro</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pedestrian</td>
<td>2304</td>
<td>431</td>
<td>115</td>
<td>102</td>
<td>204</td>
<td>22</td>
<td>3178</td>
<td>905</td>
</tr>
<tr>
<td>Bicyclist and bike</td>
<td>308</td>
<td>79</td>
<td>91</td>
<td>37</td>
<td>24</td>
<td>9</td>
<td>548</td>
<td>234</td>
</tr>
<tr>
<td>occupants</td>
<td>(10)</td>
<td>(11)</td>
<td>(29)</td>
<td>(20)</td>
<td>(6)</td>
<td>(18)</td>
<td>(11)</td>
<td>(14.3)</td>
</tr>
<tr>
<td>Motorcyclist and motor</td>
<td>52</td>
<td>24</td>
<td>20</td>
<td>17</td>
<td>29</td>
<td>0</td>
<td>142</td>
<td>65</td>
</tr>
<tr>
<td>occupants</td>
<td>(2)</td>
<td>(3)</td>
<td>(6)</td>
<td>(9)</td>
<td>(7)</td>
<td>(0)</td>
<td>(3)</td>
<td>(4.0)</td>
</tr>
<tr>
<td>Baby Taxi/Tempo/Microbus</td>
<td>141</td>
<td>76</td>
<td>24</td>
<td>8</td>
<td>97</td>
<td>12</td>
<td>358</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td>(4)</td>
<td>(10)</td>
<td>(8)</td>
<td>(4)</td>
<td>(23)</td>
<td>(24)</td>
<td>(7)</td>
<td>(2.2)</td>
</tr>
</tbody>
</table>
Involvement of Children in Road Accidents: The national road accidents statistics in Bangladesh revealed a serious threat to the children. The incidence of overall child involvement in road accident fatalities in Bangladesh is found to be very high, about 19% of all fatalities are children below the age of 16 years. The average child fatality involvement in metropolitan area is nearly 18 percent with the highest concentration in the Rajshahi Metropolitan Area of 21.6 percent followed by Sylhet Metropolitan Areas, 21.5 percent (Figure 2). Of these total child fatalities, around 82 percent occur as pedestrians (Figure 3). Children as bicyclist are also quite marked in Rajshahi and Barishal. The involvement of children in different road user groups in different metropolitan areas is shown in Figure 3. It is of interest to note that children are over represented as pedestrians in Rajshahi (38%), Sylhet (34%) and Barishal(33%) metropolitan areas as compared to an average of 22 percent in all metropolitan areas. This perhaps reflects the greater exposure of children as pedestrian in Rajshahi, Sylhet and Barishal. As vehicle occupants children involvement is particularly high in Khulna metropolitan cities (20%) (Figure 4). However, the aspects of children involvement in metropolitan road accidents need further examination.

Figure 2: Child Fatalities in Metropolitan areas

Figure 3: Child Fatalities among different user groups
Figure 4: Involvement of Children in Different Road User Groups

- **Temporal Characteristics:** The occurrence of the accidents and fatalities was examined by the time of day. The distribution of accidents was 64 percent day (6 am to 6 pm) and 36 percent night (6 pm to 6 am) in urban areas of Bangladesh. It is found that accident and fatalities remained fairly evenly distributed in day times with the peak occurrence during 10 am to 12 noon (13%).

- **Locations of Accidents:** A large proportion of the road accidents in urban areas are distributed on the main street network (64%) while 30 percent of the accidents occur at intersections including railway level crossings which very often become accident black spot. Nearly 22 percent of all reported accidents in Bangladesh occurred in Metropolitan Dhaka. Nearly 52 percent of all accidents occurred at only 9 percent (18 intersections) of the total 200 intersections where at least one accident occurred during 2001-2003.

- **Predominant Accident Types:** Accident type analysis showed ‘hit pedestrian’ as the dominant accident type in urban areas, 62 percent in fatal accidents. Other common accident types are: rear end collision (15%), head on collision (8%) and side swipe (3.5%). These four accident types account for nearly 90 percent of the fatal accidents in urban areas.

- **Over Involvement of Trucks and Buses:** Studies of road accidents revealed that heavy vehicles such as trucks and buses including minibuses are major contributors to road accidents and are responsible for 56 percent of urban accidents. This group of vehicles is particularly over involved in pedestrian accidents accounting for about 73 percent or urban pedestrian fatalities.

- **Major issues of concern and factors:** The major issues of concern for urban accidents in Bangladesh are defective and road unworthy motor vehicles, drivers incompetence, underreporting of accidents, inadequacy in police inspection and safety education, education and awareness etc. The principal contributing factors of accidents are adverse road and roadside environment, poor 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. Others include a low level of awareness of the safety problems, inadequate and unsatisfactory education, safety rules and regulations and traffic law enforcement and sanctions.

**SOME ROAD SAFETY IMPROVEMENT OPTIONS IN URBAN AREAS**

With particular regard to road safety in urban areas, pedestrian-vehicle conflicts are clearly the greatest problem with significant involvement of trucks and buses. It is indeed possible to significantly reduce the number of such road accidents and casualties by implementing an effective and coordinated safety policy and actions which require significant improvements in the relevant sectors viz. better enforcement, better roads, enhanced vehicle safety standards and improved public education programs. A fairly more common and perhaps the most important characteristic in developing countries is that there has been very little systematic safety consideration given in the planning, design and operation of roadways. TRL Guide (1991) noted that "highway design standards in many developing countries tend to be either outdated and no longer relevant or else simply too direct a translation from overseas without
appropriate modification for the particular needs of the developing country. These standards usually ignore pedestrians, other non-motorized traffic and motor cycles”. There is a severe lack of priority and attention given to vulnerable road user movements despite this group of road users dominating travel patterns as well casualty types (Silcock and TRL 1997). The safety of the vulnerable road users must be sufficiently catered for in the urban planning, road safety engineering strategies and principles.

Indeed the following problem characteristics are evident in many developing countries particularly less motorized countries like Bangladesh which should be given increased consideration in safety strategies (Mohan 1993):

- mixed traffic conditions with predominance of non-motorized transport (walk, bicycle, cycle rickshaws etc).
- the vast majority of road accident fatalities comprise vulnerable road users (VRU) viz. pedestrians, bicyclists and motorized two-wheeler riders.
- trucks and buses are involved in a majority of fatal accidents.

Other important characteristics which are major constraints inhibiting safety improvements include (Rolt 1997):

- a low level of awareness of the problem by senior officials and policy makers,
- inadequate or non-existent road accident data,
- very different conditions from those in developed countries e.g. poor road user behaviour and knowledge, wider traffic mix and a relatively unsafe environment.

In view of the above facts, there is specific need and much scope for road environment improvements aimed at correcting the most common deficiencies through wider application of traffic engineering approaches. It is argued that priorities be placed on the principles like traffic segregation to provide facilities and road space for the most vulnerable users particularly pedestrians and non-motorized vehicles, force correct road user behaviour (self enforcing measures) via channelisation, speed reduction measures etc. With resource constraints greater emphasis should be placed on low cost improvement schemes. Implementation of such measures should take place at hazardous road locations (accident blackspots) identified by systematic accident investigation (rather than in an ad-hoc manner). To promote enhanced road safety, developing countries should have programs to implement well-known engineering measures, leading to larger and longer lasting effects at less expense, widely and systematically. Immediate measures to achieve greater road safety (likely to also improve traffic flow) and which would also offer cost-effective results include:

- Small changes/improvements in road layout and use of roundabouts
- Treatments of roadway shoulders (provide wide and strong shoulders)
- Provision of adequate pedestrian facilities (crossings, urban and rural footways)
- Facilities for non-motorized vehicles (e.g. bike paths) and designated truck lanes
- Intersection design improvements (flaring, channelization, traffic islands, etc.)
- Installation and upgradation of median barriers and refuge islands
- Treatments of roadside hazards (trees, ditches, other objects)
- Improvements to narrow and deteriorated bridges, culverts and lanes
- Control speeding and dangerous overtaking including traffic calming measures
- Installation and regular maintenance of delineation devices (e.g. lane markings, guide posts, chevrons)
- Better access controls, cross-sections, sight distances, alignments
• Introduction of effective rescue of accident victims using ITS
• Improvement of pre and post hospital care for accident victims
• Road safety audit – systematic examination of roadway elements for safety

CONCLUDING COMMENTS

The urban road safety problem has now emerged as a serious issue in many developing countries like Bangladesh. The road accident problem is disproportionately greater in urban areas than in rural areas. Pedestrian -vehicle conflicts are clearly the greatest road safety problem with significant involvement of trucks and buses in urban areas of Bangladesh. Bicyclists in road fatalities are also prevalent in some metropolitan areas. This paper has highlighted the scale and characteristics of the road safety problem in urban areas in Bangladesh. There is urgent need and scope for improving the road safety situation by implementing an effective and coordinated safety policy and actions which require significant improvements in the relevant sectors. The opportunities and need for road environmental and engineering improvements by incorporation of new approaches and methods are particularly emphasized in the paper. Intensified efforts are also needed to bring about changes in the attitudes of road users including drivers towards achieving greater road safety in urban areas of Bangladesh.

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