Analysis of Pedestrian Safety on Five Major Arterial Roads in Dhaka, Bangladesh

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Introduction

Bangladesh is a South Asian country with a significant road safety concern. Of all reported traffic collisions between 1998 and 2004, 44% (11,061 cases) involved at least one pedestrian. Among all the pedestrian crashes, 39% occurred in urban areas and about 62% pedestrian crashes in urban areas occurred in Dhaka City. These pedestrian crashes accounted for about 71% of all the fatal crashes occurring Dhaka City. The majority (67%) of the pedestrian crashes and pedestrian casualties (66%) of Dhaka City occurred on road links of Dhaka City.

In an effort to understand the contributing factors to crashes involving pedestrians and reduce casualties, this study will examine these crashes on selected links in five major arterial roads. These roads contributed about 17.3% to the total pedestrian crashes in Dhaka City. It should be noted that crashes at intersections in these roads were excluded because they are very different from those that occurred at mid-blocks or links. Based on the crash statistics and site reviews of the selected links, measures

and strategies will then be suggested to improved pedestrian safety.

Data Collection and Methodology

Traffic crash data were compiled from the First Information Report (FIR) maintained by the police. It included information on collision date, time, location, collision type, number of vehicles involved, and number of deaths in each collision. It should be noted that very few collisions between non-motorized vehicles in Dhaka are reported to police because damages from collisions involving slow-moving vehicles are usually minor and compensation costs are settled immediately and privately.

The compilation and analysis of data were done using polygon analysis in the software Microcomputer Accident Analysis Package (MAAP). Accident frequency method in MAAP was used in ranking locations by the number of accidents. The location with the highest number of accidents is ranked first, followed by the location with the second highest number of accidents, and so on. This method tends to rank high volume locations as high-accident locations, even if those locations have relatively low number of collisions for the traffic or pedestrian volume.

The five major arterial roads selected for this study are described in Table 1. These five arterials are divided into a number of links or mid-blocks. Links of the arterials are defined as the segment of roadway in between two intersections. Since the collision data were collected from the FIR, the links are chosen to be consistent with the definitions used by FIR.

Table 1: Description of Links on Selected Arterial Roads

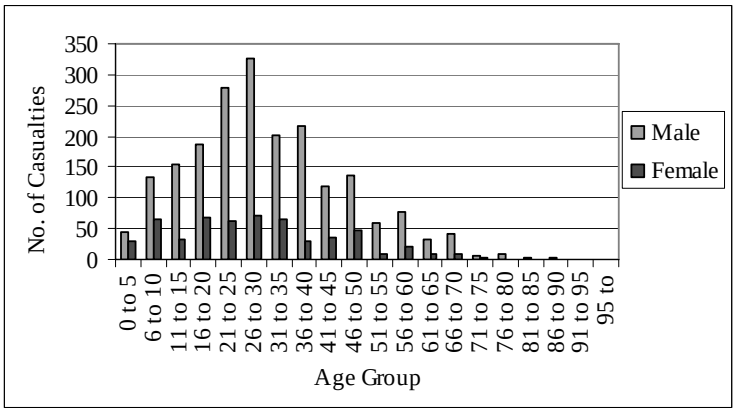
Link	**km**	**Description**
1. Airport Road		
A1	0.86	BAF Officers Mess to 1 km south of Tejgaon P.S.
A2	0.33	Bijoy Sarani crossing to 50 m south of Khamarbari
A3	0.75	Tejgaon Women's College to 60 m north of Sonargaon Crossing
2. Mirpur Road		
M1	1.74	200 m east of Darus Salam junction to Shamoli intersection
M2	0.91	150 m south of Agargaon road to Ganabhaban
M3	0.33	80 m north of Lake Road to Ganabhaban gate no. 1
M4	0.65	Shohbanbag intersection to Kasba Center, Dhanmondi
M5	1.05	Russel square to Science Laboratory intersection
M6	0.57	100 m south of Elephant Road to Balaka Cinema Hall
3. Progati Sarani		
P1	1.80	50 m south of Bashundhara Road to 50m north of Madani Avenue
P2	1.60	U.S. embassy to Badda Post-office
4. D.I.T. Road		
D1	3.00	Badda mosque to Malibagh Super Market

5. Rokaya Sarani		
R1	3.03	Senpara 50 m south of Mirpur 10 to Kafrul
R2	1.00	5 m south of IDB Bhaban to 1 km south of Jahangir-gate

Crash Statistics

The distribution of pedestrian casualties according to their age groups and gender is shown in the Figure 1. As expected, male pedestrians dominated female pedestrians in terms of casualties since male are expected to have a higher exposure and to take more risks (Tay, 2005). This imbalance is exacerbated by the more traditional attitudes towards gender roles in Bangladesh.

Figure 1: Age and Gender of Pedestrian casualties

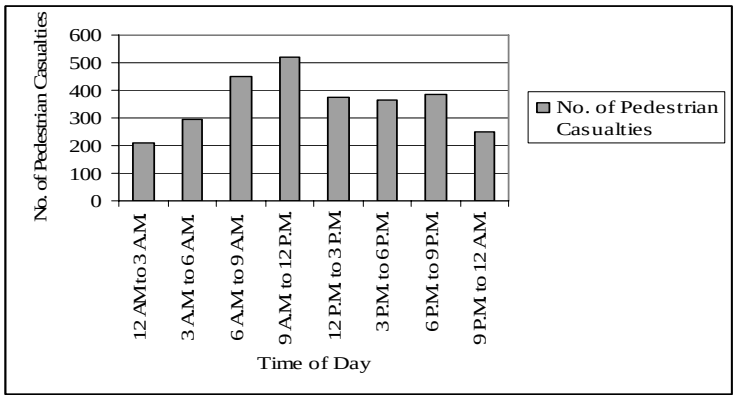


Also, it is evident from Figure 1 that pedestrian casualties are concentrated in the 21-40 of age groups and are the

highest in the 26-30 age group. Since most of the working people in Bangladesh fall into this group, it may simply reflect the relative exposure to work related and other travel demands.

The above inference is also supported by the fact that most of the pedestrian casualties occurred between 6.00am and 9.00 pm (see Figure 2), with the peak occurring between around 9am. These times coincide with the peak travel times, especially the morning peak for commuting.

Figure 2: Time Variation of Pedestrian Casualties



The spatial distribution of pedestrian collisions and casualties in the five major arterial roads is shown in Figure 3. About 17.3% of the total pedestrian crashes in Dhaka City occurred on these selected arterials. The highest number, 88 crashes (4.6%) occurred on Progati Sarani, followed by Rokaya Sarani which accounted for 4.3% or 82 crashes.

Figure 3: Crashes and Casualties on the Selected Arterials

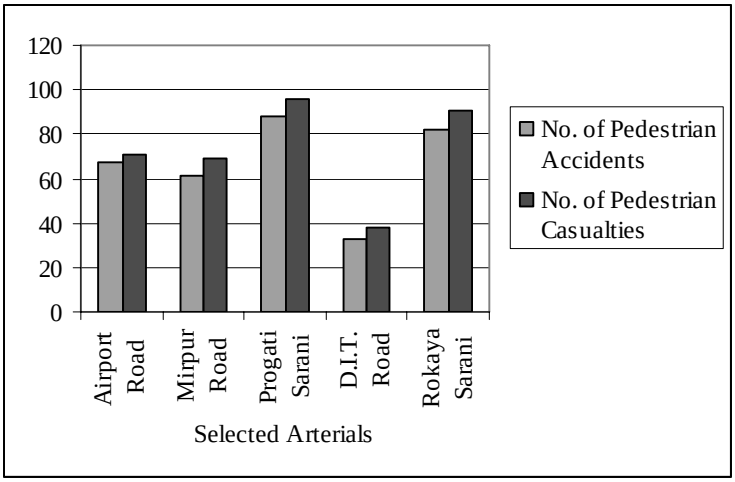
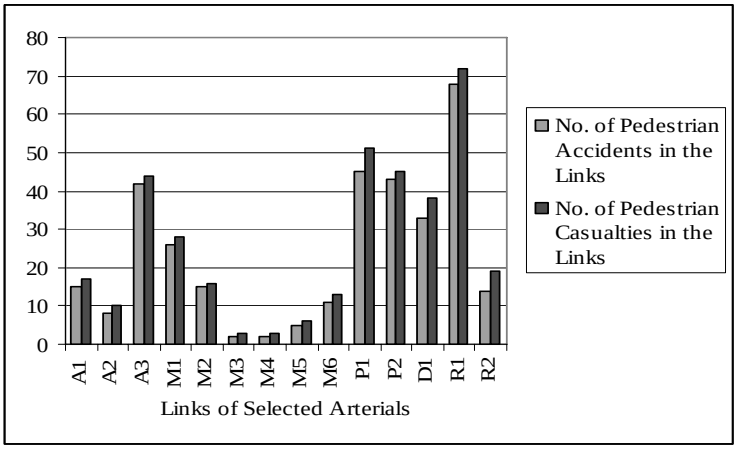


Figure 4: Collisions and Casualties on Selected Links



If separate links are considered, the R1 link of Rokaya Sarani (Senpara, 50 meter south of Mirpur-10 to Kafrul)

accounts for the highest number of pedestrian collisions (67) and casualties (72) among the selected links, followed by the links on Progati Sarani, with over 40 crashes each (see Figure 4). Another link with over 40 crashes is link A3 on Airport Road.

Examples of Major Safety Issues

Inadequate Footpaths and Sidewalks

One of the problems for pedestrian safety in Dhaka City in general and along the five arterials in particular is the lack of adequate provision of proper footpaths and pedestrian walkways in many locations. The lack of an adequate side walks often forces pedestrians to walk along the arterial roads themselves making the pedestrians vulnerable to vehicular traffic (see Figure 5).

Figure 5: Lack of Adequate Pedestrian Sidewalks

This problem is compounded by the frequent and uncoordinated cutting and filling of roads and footpaths by

the various government departments, utilities companies and contractors. Unlike most western developed countries, there is often no provision of a safe alternate route for the pedestrians who are then forced to walk on the roads with the protection of barriers.

Encroachment of Footpaths and Sidewalks

Another serious safety problem is encroachment of hawkers on the footpaths in the commercial areas. Vendors spread their wares on the footpath and eventually reduce the effective width of footpath. In many links, especially at M6 link, almost all the footpath width is encroached by them. Hence, pedestrians are forced to walk along the road rather than the footpath creating serious safety hazard (see top of Figure 6).

Figure 6: Hazardous Pedestrian Crossing

Besides encroaching on the footpaths and side walks, having vendors along the roads also increases pedestrian traffic. Moreover, vendors and shoppers are often distracted and not fully aware of the vehicular traffic. In addition, they also pose as distraction for some drivers. Finally, these road side markets also encourage pedestrians to cross illegally and dangerously to get to the vendors (see Figure 6).

An additional problem exists in the D1 link for the people seeking a living on the footpath. This number is increasing rapidly everyday and little attention has been paid to regulating this road side hazard, source of driver distraction and contributor to hazardous pedestrian walking and crossing behaviors.

Another cause of the reduction in the effective width of footpath is the presence on road and footpath of many other obstacles like rickshaw stands, rent-a-car service parking, garages and other encroachments. Encroachment of footpath by building materials is a common occurrence in many parts of the city. There are a lot of large waste bins on the streets close to the footpath in most of the links selected in our study. These waste bins cause addition problem to pedestrians because the garbage stored in them often overflow onto the streets and footpaths thereby creating more safety hazards.

Inadequate Road Maintenance and Safety Reviews

Besides the existence of hazardous 'road-side furniture' and vendors, many parts of the major arterials also have other 'traps of death'. For example, on the DIT Road, there are many open manholes on the roadways as well as on

the footways. These and other holes on the roadway and side walks pose a serious threat to the safety of the pedestrians directly and serve as a potential source of driver distraction and loss of vehicle control.

In addition to problems associated with the poor maintenance of the road, there are also serious problems related with the maintenance of pedestrian facilities. Many of the pedestrian or zebra crossings on these arterials and other roadways were found to be in poor physical conditions which greatly reduced their visibility and thus may not be visible enough to make the motor drivers pay sufficient attention for safe pedestrian crossing.

Inadequate Traffic Control and Enforcement

In order to minimize delay, drivers and pedestrians have a tendency to cross junctions quickly. Many of the late arriving vehicles often violate the stop signal and the red light at signalized intersections. Red light running behavior was observed at almost all of the link roads. This illegal behavior is a serious safety hazard for the pedestrians attempting to cross the road in a hurry when the pedestrian signal turns green.

Lack of Bus Bay and Dangerous Passengers Behaviors

There are very few designated places for buses to stop along these major arterials. Most of the buses stop at the road side haphazardly and causes a serious safety problem for both vehicular and pedestrian traffic. This unregulated stoppage also induces passengers to alight and board the bus under dangerously traffic conditions. Moreover, such

behavior often results in road sides and side walks being crowded with passengers, thereby influencing pedestrians to move onto the road.

Figure 6: Bus Passengers and Pedestrian Behaviors

As shown in Figure 6, the buses often stop in the middle of the street near the flaring to serve as many passengers as possible. This unusual stopping and the suddenly rush of passengers toward it may cause collisions associated with the passengers running for the bus and those getting down from bus in a hurry.

Problems in Underpass and Overpass

The underpasses and overpasses in these links are not heavily used because of a few real and perceived problems (see Figure 7). For example, accesses to overpasses along

Mirpur Road are often hindered by the encroachment of hawkers. Also, the aesthetic and perceived physical conditions of the overpasses are also not as good as can be at DIT Road and Pragati Sarani.

Figure 7: Under Utilization of Overpass

The underpass at the A3 link of the Airport Road possesses serious safety hazards especially at night time. Various unsocial and criminal activities take place in the underpass at night despite the sufficient lighting available. This highly risky activities force pedestrians to cross the road even though it is unsafe instead of using the underpass.

Lack of Adequate Median Barrier

Due to absence of adequate median barriers allowed pedestrians to cross the road haphazardly instead of using

the designated crossing facilities (see Figure 8). Although low fencing are installed in some places, they are insufficient to deter pedestrians (see Figure 5). Moreover, the existing black fence barriers are sometimes not very visible at night time.

Figure 8: Inadequate Median Barriers

Suggestions for Improving Pedestrian Safety

1. Provision of user friendly footpath: Safe and user friendly footpaths must be provided. It is also important to ensure that encroachment by hawkers is properly managed.

2. Control of haphazard parking: Haphazard parking on road side and illegal use of footpath including storage or dumping of building materials should be controlled.

3. Installation and enhancement of pedestrian crossings: Install pedestrian fencing or other barrier types on the approaches and departures from signalized and other

pedestrian facilities to encourage pedestrians to use them. *4. Installation of pedestrian refuges:* In multilane streets, raise medians and other pedestrian refuges should be used. In addition, 'yield to pedestrians' signs should be installed at all approaches to designated crossings.

5. Provision of designated bus stops: Designated bus stops with properly designed bus bays and passenger waiting areas should be provided at appropriate places and behavior of passengers should be modified.

6. Separate signal phase: Traffic control devices such as traffic signals should be designed with greater emphasis on pedestrian safety. An example is the provision of an all red time for pedestrian crossing at all major signalized intersections. The provision high visible zebra crossing and diagonal crossing pavement marking for the pedestrians can also significantly improve the safety of pedestrians.

7. Provision of user friend signal: As many motorists and pedestrians are not always clear about the meaning of pedestrian signals, more education on their proper use are needed, especially for children. Pedestrian flags should also be installed at crossing regularly used by school children.

8. Separation of vehicular and pedestrian traffic: Space separation with self-enforced restrictive engineering measures New Jersey type concrete barriers should be given more consideration to improve pedestrian safety.

9. Provision of delineation: Providing additional delineation as well as advance warning signs and lower speed limits through areas with heavy pedestrian traffic.

10. Access Control: The accesses to all school sites,

hospital entrances and other major employment centers be upgraded by adding proper fencing and signage, using appropriate traffic calming devices like road humps, and providing suitable pedestrian crossing. Access to all petrol stations should be limited to two points only.

Conclusions

The high rate of fatal crashes in Bangladesh is a cause for alarm in road safety. This paper examined the characteristics of pedestrian crashes in five major arterial roads in Dhaka city. These roads were selected using the Accident Frequency Method in MAAP. A review of the road links along these roads found several serious safety problems with the engineering design as well as inappropriate driver and pedestrian behaviors. A number of strategies to address pedestrian safety problems were suggested based on the observational studies. More research on the factors contributing to pedestrian collisions and the effectiveness of initiatives are needed to tackle the pedestrian safety problems and improve road safety.