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Analysis of Pedestrian Facilities in CBD Area of Pabna Municipality, Bangladesh

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Abstract: Pabna is one the most densely populated town with poor transport infrastructure in Bangladesh. Here huge pedestrian gathers in roads and intersections in CBD (Central Business District) area mainly for commercial and business purposes. At present, pedestrian facilities are one of the greatest challenges in terms of traffic and safety for the urban dwellers. The footpath, zebra rossing, road intersection, walkways, parking and other facilities are the major part of road transportation system as well as pedestrian facilities and people have to pass walking distance to reach their destinations, before and after use of transport mode. For instance, this paper tries to emphasize the problems of pedestrian facilities and to explore the qualitative level of comfort for the pedestrians of three selected intersections namely Traffic More, Indra More and Nimtola More in CBD area of Pabna Municipality through primary and secondary data. However, about 60% trips are making on foot every day, but the pedestrians are facing many problems while using the walkways. Pedestrian crossing behaviors were also observed by using pedestrian volume survey and the survey explores that pedestrian crossing rate at these intersections is about 5,000 to 7,000 per hour at a peak period and average 15% to 25% illegal crossing occurs at those intersections. The physical observation and data from the questionnaire survey also indicate that informal business on the footpath, illegal parking, illegal vendor on walkways, physical obstacle, poor lighting facilities and geometric problem of the road intersection makes uncomfortable situations for the pedestrian day by day.

Key words: Pedestrian facilities, traffic congestion, pedestrian crossing, CBD area, traffic volumes.

1. Introduction

The transport sector in Bangladesh is characterized by the weak public and private institutions and low level of investment. It operates in a physical environment of high levels of risk, and socio-political context of extreme poverty and frequent man-made disruptions. The general quality of services at all levels and by all modes has been poor. The overcrowded buses, trains and water transports, with poor safety and security records, and unreliable service options are quite common in Bangladesh. In freight transport, excessive cost, time, pilferage, etc., are some of the common problems. These problems are further complicated by vesting from both within and outside the transport sectors itself and the socio-political environment of the country. Some of the major problems in urban transportation also include fragmentation of organizational responsibilities, inefficient use and overcrowding of major roads by law capacity vehicles, inadequate road space, poor traffic control and management, and absence of adequate pedestrian facilities [1].

In Bangladesh, pedestrian forms 52% of the road facility user group [2]. But pedestrian facilities are most often neglected in transport planning of large cities in Bangladesh including the capital [3]. A lot of research works are going on for assessing the pedestrian's level of services in the developed nations but in developing countries like Bangladesh, it is not a significant one for the transport planners. Provision of more and more footpaths, cycle tracks, guardrails, pedestrian overpasses, zebra crossing, relocation of hawkers from footpath and removal of illegal storage of building materials and garbage from the major roads and intersections are mandatory for safety, comfort and convenience of the pedestrians. To find

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possible ways, the study goes through the reasons behind pedestrian facilities problems with analytical thoughts and also critically evaluates the system of authority to solve the problems of the pedestrian.

Pedestrian poses a significant position in traffic generation and is increasing day by day in Pabna Municipality. Most of the trips are started and ended as the means of a pedestrian. Pabna is one of the fastest growing cities of Bangladesh with economic development which is linked with the communication network of a region. Pabna has glorious industrial and commercial background. To support those sectors, sound transportation system is extremely essential with some distinctive features. Transportation routes and networks mostly end to or start from the CBD within the Municipality. People from surrounding areas and also from nearby rural areas make trips to the CBD to perform their economic, social and official activities. The high volume of pedestrian movement is also likely to take place in the CBD area because of most trip makers there, meets to their purposes, whatever it be social, economic or administrative, being on foot. Along with the view to facilitate the pedestrians with adequate services and smooth flow, the good pedestrian transportation system is also necessary to ensure sound shopping and marketing activities to the economic activist. The proportion of trips made by walking is increasing day by day but the existing pedestrian infrastructure and pedestrian facilities are not satisfactory. This research is designed to estimate the existing and future pedestrian demand, to assess the present supply of pedestrian way of that area and focuses on the role of pedestrianization as well as the problem of the pedestrian to mitigate the transport problem in Pabna CBD area.

2. Methodology

Central Business District (CBD) of Pabna Municipality is selected as a study area which is one of the major towns in Rajshahi Division of Bangladesh. Fig. 1 shows the selected roads in CBD (Central Business District) area of Pabna Municipality namely Abdul Hamid Road, Boro-Bridge Road, Awrangozeb Road and Ataikula Road. It plays a major role in connecting the northern and southern parts of the country, with the capital Dhaka city. The area of Pabna Municipality is 15.66 km^2 and the population density is 8,130/km^2. It was upgraded to "A" Category Municipality and consists 15 wards, 46 mahallas and 29,928 holding members [4]. The CBD area of Pabna Municipality covered most of the part of ward No. 02 and 03 as administrative and commercial zone and it covered 341.473 acres of land [5].

Various retail shops, banks, roadside activities, traffic gathering, restaurants and hotels and cinema hall are found in the area that is indicated in Fig. 2. CBD includes various activities, among them 21 banks, 3 cinema halls, 12 big and small shopping centers, 11 hotels and restaurants, offices and a huge number of scattered shops, both formal and informal.

The physical condition of the road with respect to geometric feature is not standard in the study area. The carriageway width (Table 1) of Abdul Hamid Road is acceptable but the others are very narrow compared to the surrounding land use.

Both primary and secondary data are collected to find out the expected outcomes. Primary data collection process is mainly survey oriented. A number of surveys were conducted to gather primary data and relevant information. Primary data have been collected through: (1) observation survey; (2) geometric survey; (3) questionnaire survey; (4) pedestrian volume survey. Secondary data have been collected from various statistical reports, books, journals, BBS (Bangladesh Bureau of Statistics), World Bank and Pabna Municipality office.

After collection of the data, data accumulation, processing was accomplished in a systematic way. Raw data were processed for further analysis. For processing and analytical purpose, GIS (Geographical Information System) software, Arc View and Arc GIS

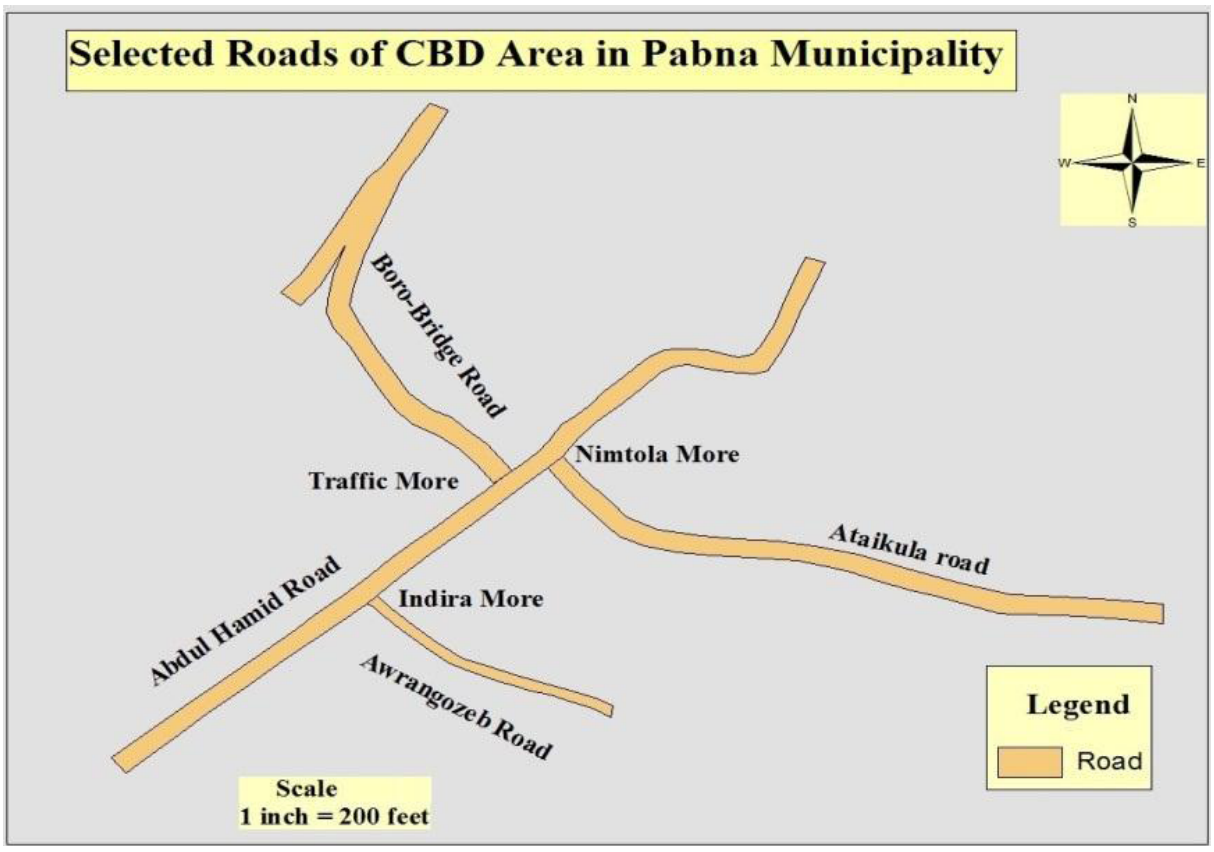

Fig. 1 Study area.

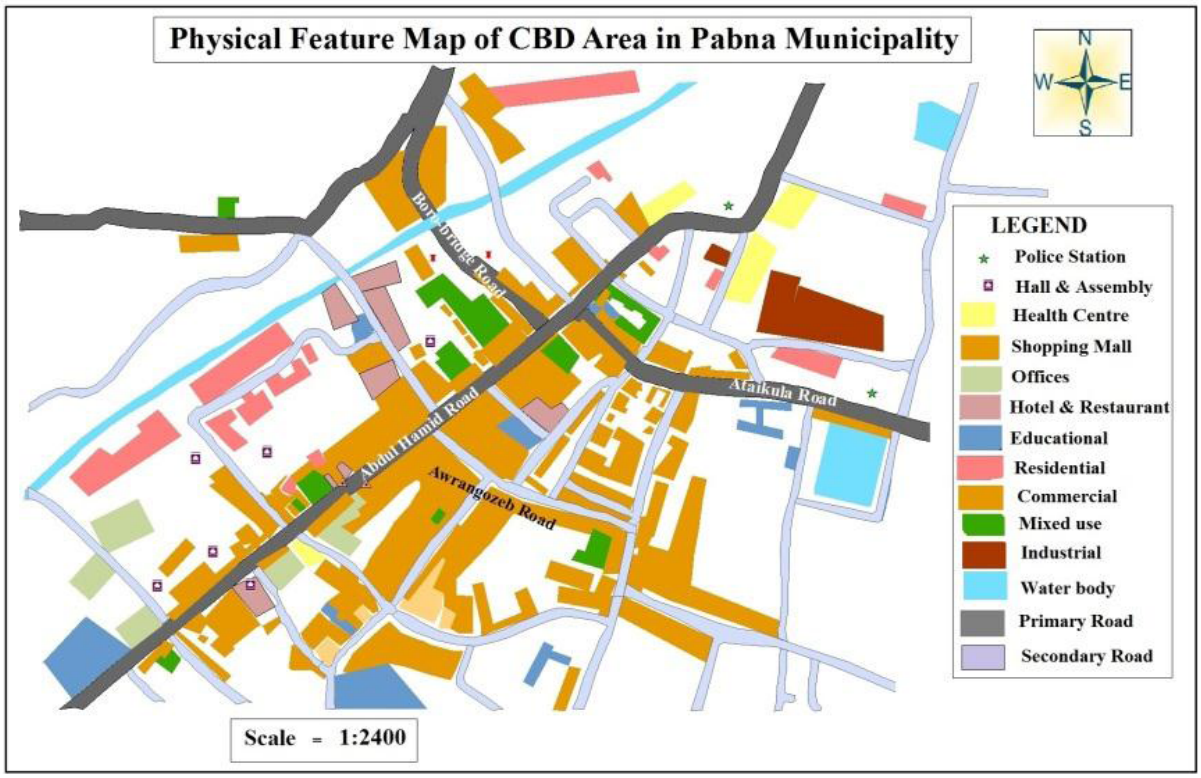

Fig. 2 Physical feature map of CBD area.

Table 1 Geometric elements of road and intersection.

SL	Intersection name	Route name	Width of carriageway (m)
01	Traffic More	Abdul Hamid Road (towards Hospital)	11
		Abdul Hamid Road (towards Townhall)	11
		Boro-Bridge Road	15
02	Nimtola More	Abdul Hamid Road(towards Hospital)	11
		Abdul Hamid Road (towards Townhall)	11
		Ataikula Road	5.5
		Khoaghatpara Road	4.0
03	Indira More	Abdul Hamid Road (towards Hospital)	11
		Abdul Hamid Road (towards Townhall)	11
		Awrangozeb Road	6.5
		Rupkatha Road	4.0

were also used. After proper use of the tools, all the processed information and were analyzed with respect to objectives of the study. Then the data and information were presented in the form of tables, graphs, and maps for presentation.

3. Data Analysis

3.1 Pedestrian Characteristics of the Study Area

It has been stated that to calculate the pedestrian demand, pedestrian observation survey and a questionnaire survey of a number of 120 pedestrians have been conducted to reveal their socio-economic status, in short, to explore their travel pattern including place of origin, the purpose of trips to CBD. An important outcome of this survey was the problems and perceptions of pedestrians regarding the present facilities, management system and some other related issues which will obviously come to meet the other objectives of the study.

3.1.1 Road User According to Occupation

There are various types of road user such as student, service holder, business man, rickshaw/van puller, daily labor, etc., used the selected roads in the study area. Fig. 3 shows that the highest road user is business man which is 49% and the lowest users of these roads are agricultural labor. This road is also used by hawker, shopkeeper, retired person, housewives and others.

3.1.2 Purpose of Pedestrian Walking

In the study area, mainly pedestrians are walking for different purposes. Afterwards, people prefer to walk for saving time and money due to heavy congestion in the central part of the city on going to educational institute, shopping or other places. Fig. 4 represents that 50% of the road users make trips by walk for business purposes only. Some pedestrians are used to walk for official purpose, another pedestrian is used for educational, and the other pedestrian is used for shopping and recreational purposes.

3.1.3 Walking Duration of Pedestrians

As this study seeks to know the travel pattern of pedestrians in the study area, it shows interest for the walking duration of pedestrians in the area. Walking duration is the time that pedestrians walk to meet their needs. Walking duration is important in exploring pedestrians walking behavior. It also has implications for assessing the needs of the pedestrians and in designing facilities for the improvement of the pedestrian environment. The walking duration of pedestrians in the study area varies from less than ten minutes to more than two hours and Fig. 5 indicates that 55% of the users have walking duration between 15 to 34 minutes.

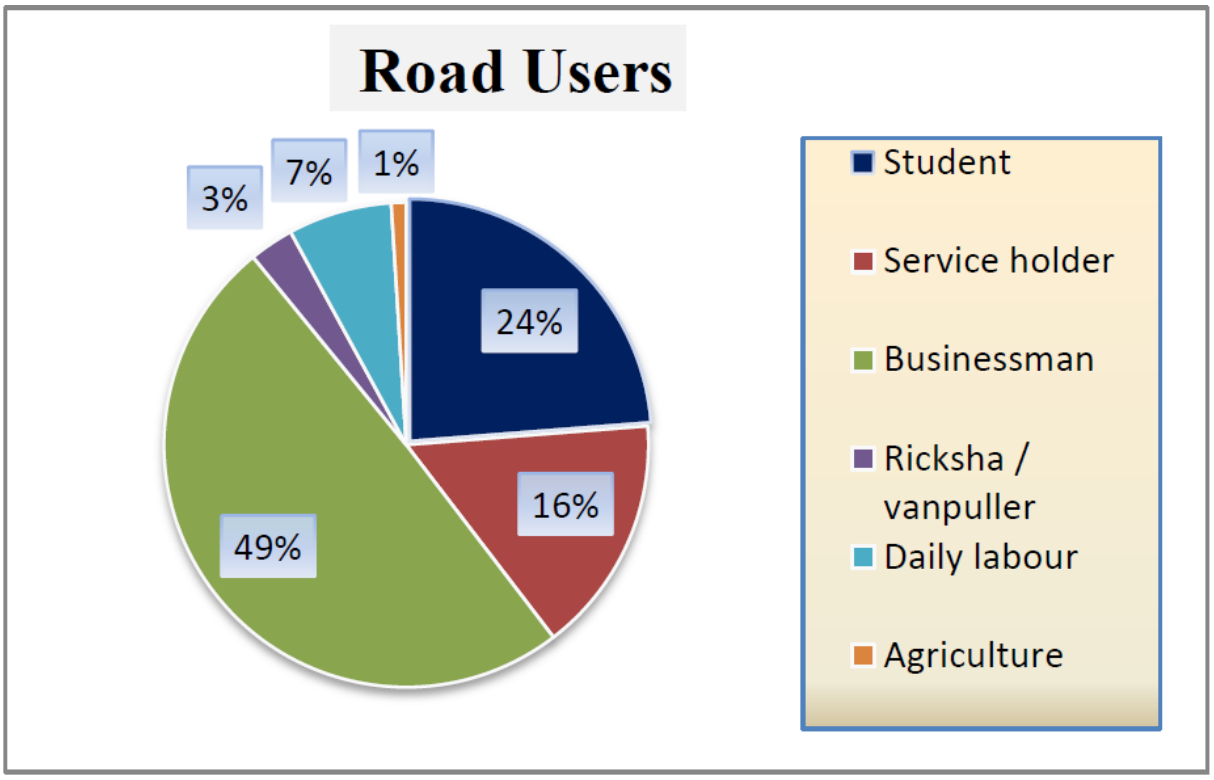

Fig. 3 Purpose of pedestrian walking.

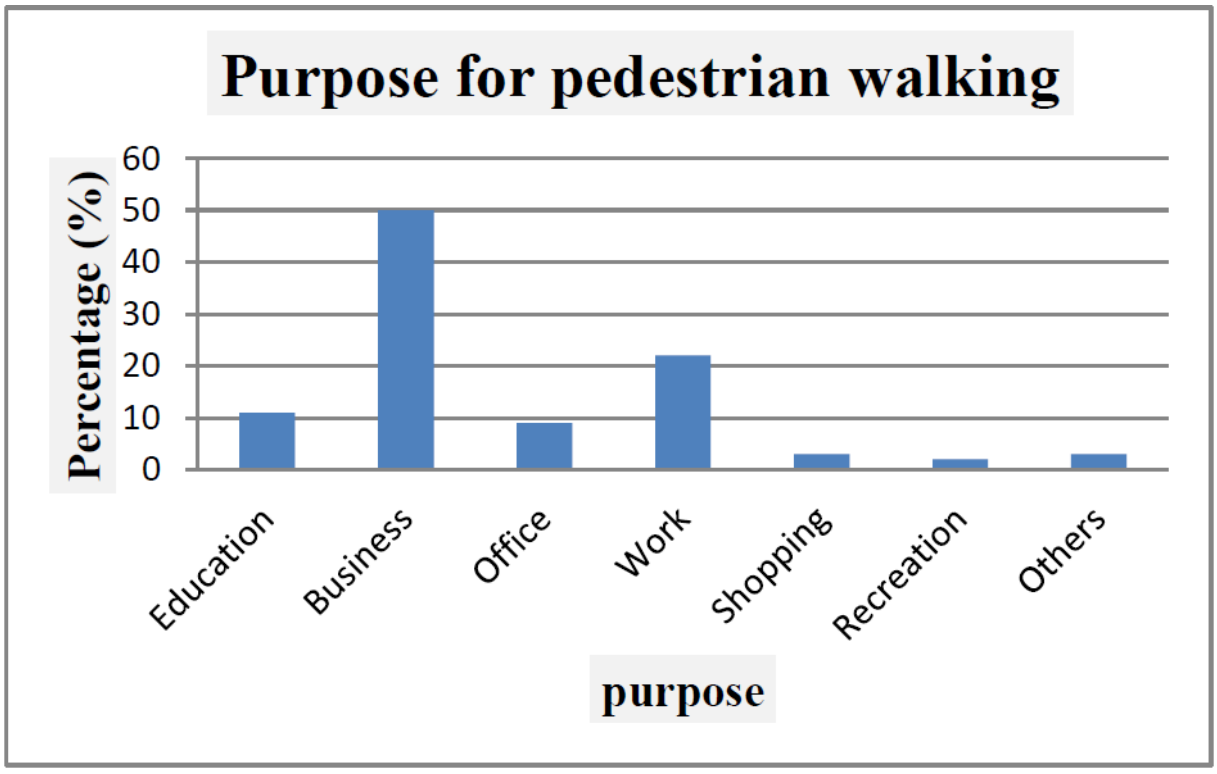

Fig. 4 Trip purpose.

3.1.4 Condition of Footpath

Pedestrian is the most vulnerable situation in their journey. Fig. 6 reveals that 55 percent pedestrian is commented that footpaths physical condition is bad, 27 percent moderate, and 13 percent most horrible and only 5 percent is good. While using the footway, they face a different experience and vulnerable situation.

3.1.5 Pedestrian Problem

There are a lot of problems that have been found in the study area regarding the pedestrians convenience is shown in Fig. 7. They are a haphazard footpath, lack security for pedestrian, uncontrolled vehicles, open manhole, street lighting, traffic signal, zebra crossing, foot over bridge, etc. The people's perceptions are shown in the graph. Among the various problem uncontrolled vehicles, haphazard footpath, lack of security of pedestrians are the main problem that most pedestrians faced.

3.1.6 Types of Accident

The most accident occurs at the intersection point of the study area. This accident is mainly pedestrian vs. vehicle collision is presented in Fig. 8. Besides this type of accident collision between vehicles and vehicle also occurred. And this accident causes injury to a pedestrian, damage of property and sometimes causes death.

3.2 Pedestrian Flow in the CBD Area of Pabna Municipality

Pedestrian flow is defined in this study as the number of pedestrians passing a particular point in a specified period of time. For collecting flow data, specific points along the sidewalk are selected. The survey has been conducted for selected survey hours throughout the day. At least, one point is taken from every road section for collecting flow data. The following tables represent the pedestrian flow data for specific survey hours and for specific survey points of selected roads in the study area.

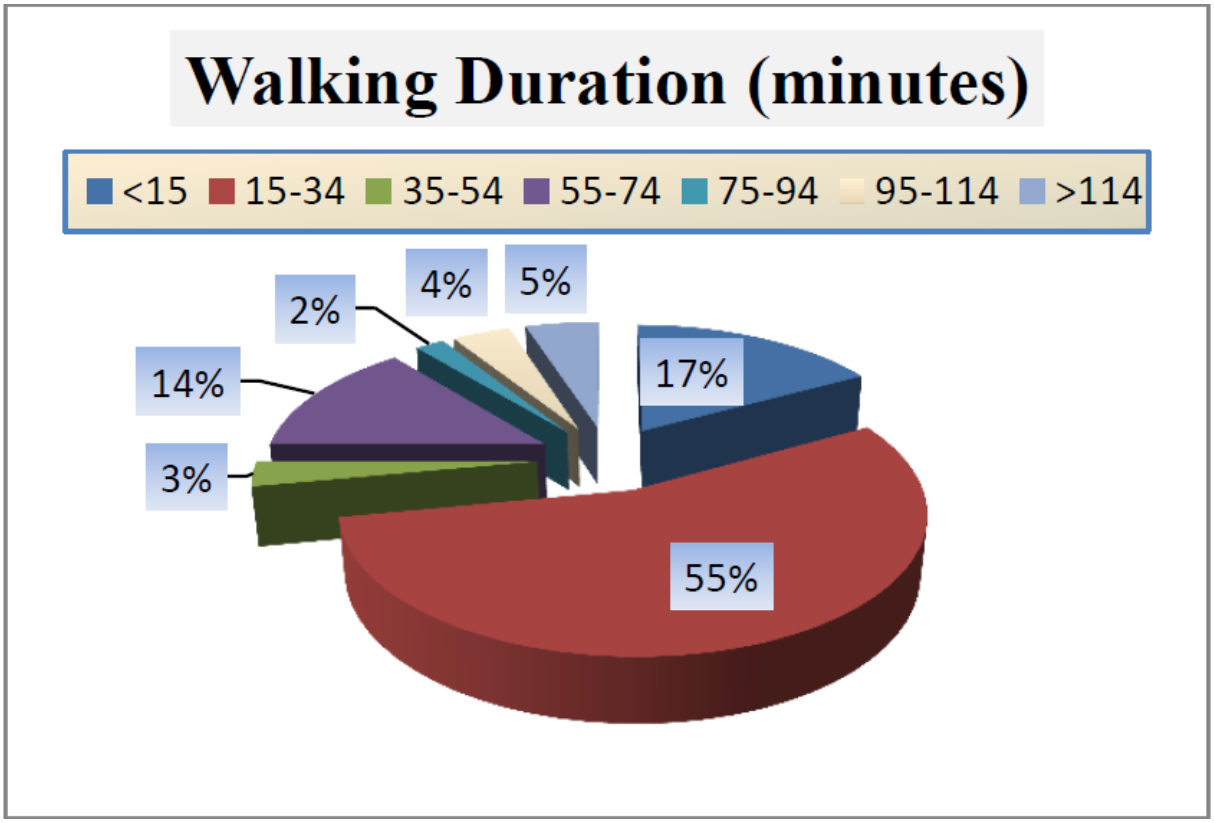

Fig. 5 Walking duration of pedestrians.

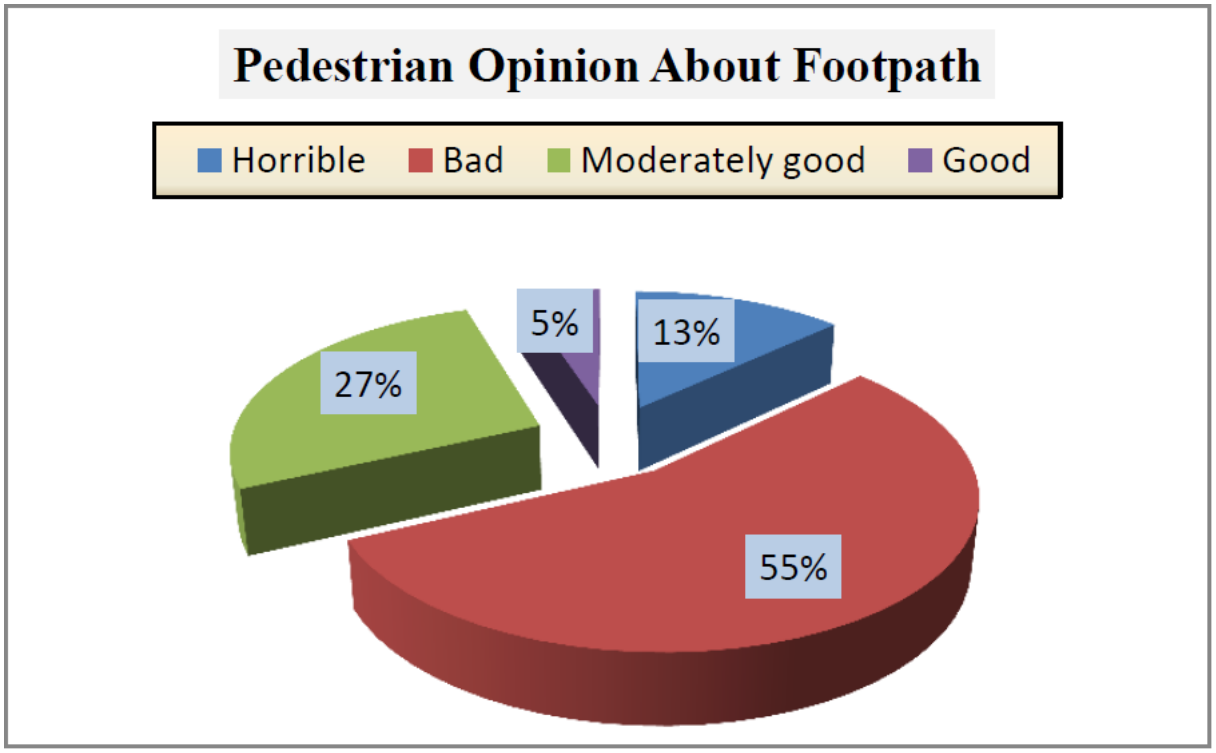

Fig. 6 Condition of footpath.

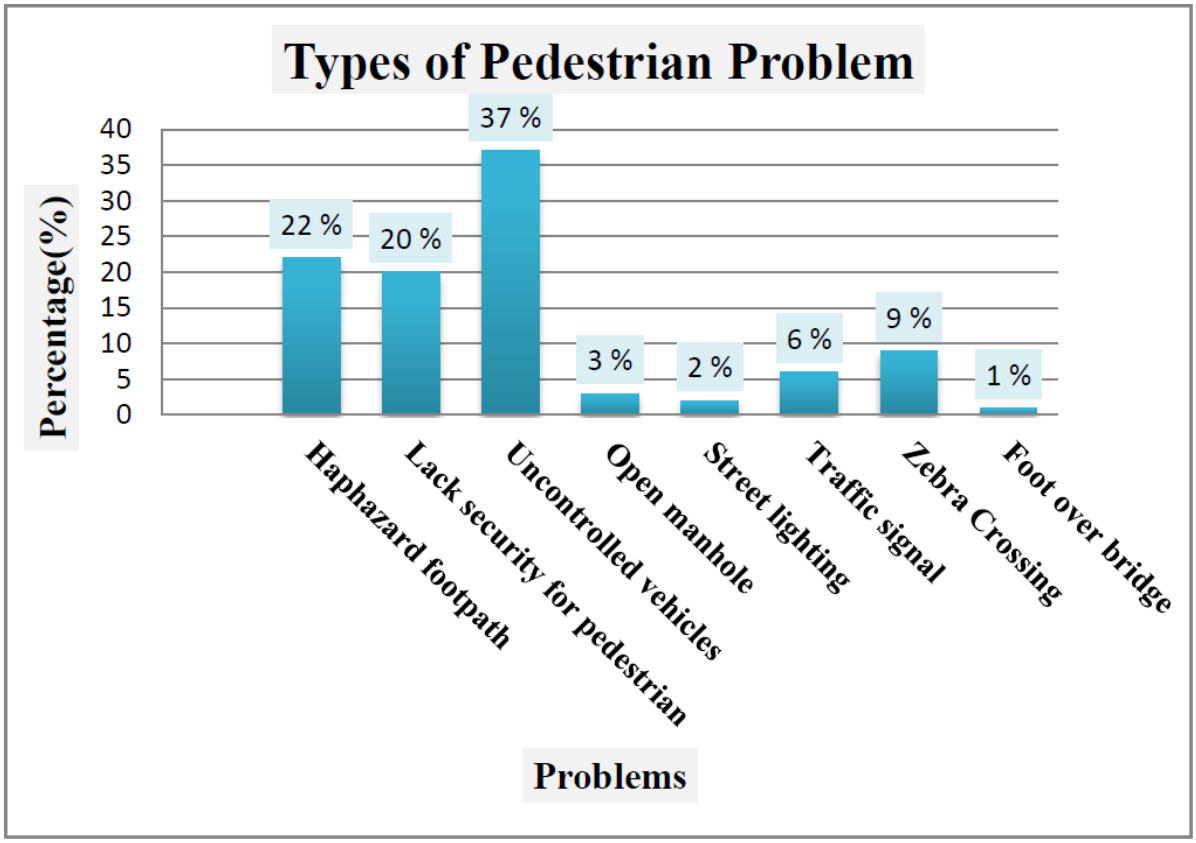

Fig. 7 Pedestrian problems.

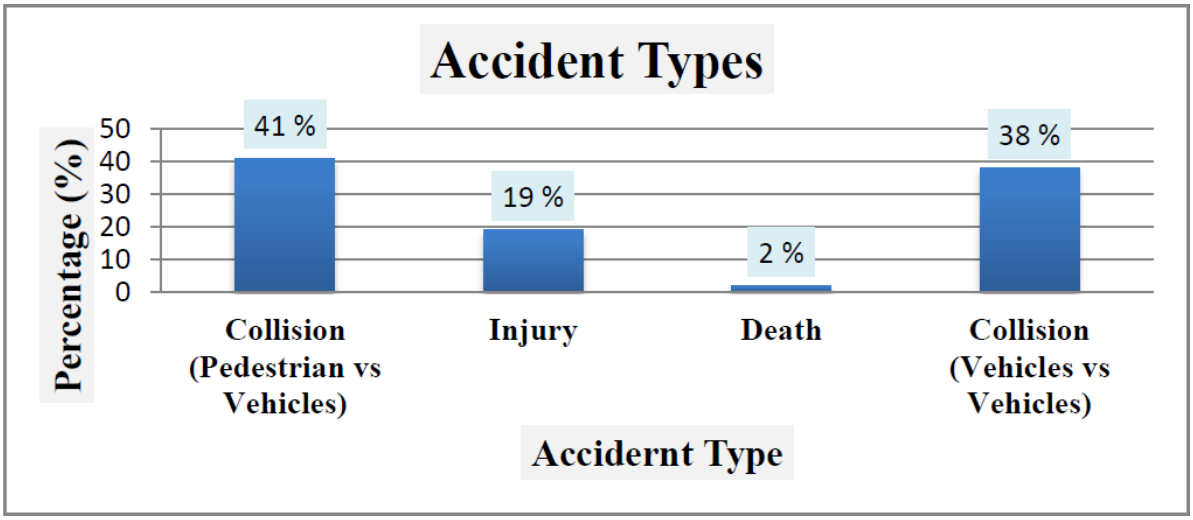

Fig. 8 Types of accident.

Table 2 Pedestrian traffic flow of Abdul Hamid Road.

Time of survey	Traffic More to Townhall			Town Hall to Traffic More			Total
	Male	Female	Sub total	Male	Female	Sub total	
9:00-10:00 a.m.	900	146	1,046	729	291	1,020	2,066
10:00-11:00 a.m.	734	240	974	863	312	1,175	2,149
12:00 am-1:00 p.m.	762	110	872	822	175	997	1,869
4:00-5:00 p.m.	838	204	1,042	960	140	1,100	2,142
5:00-6:00 p.m.	725	130	855	771	141	912	1,767
Total	3,959	830	4,789	4,145	1,059	5,204	9,993

Table 3 Pedestrian traffic flow of Awrangozeb Road.

Time of survey	Indra More to Doibazar More			Doibazar More to Indira More			Total
	Male	Female	Sub total	Male	Female	Sub total	
9:00-10:00 a.m.	730	370	1,100	359	161	1,040	2,140
10:00-11:00 a.m.	650	440	1,090	642	244	886	1,976
12:00 am-1:00 p.m.	715	245	960	615	175	790	1,750
4:00-5:00 p.m.	930	510	1,440	580	280	860	2,300
5:00-6:00 p.m.	550	270	820	545	242	787	1,607
Total	3,575	1,835	5,410	2,741	1,102	4,363	9,773

3.2.1 Abdul Hamid Road

Pedestrians are broadly classified as male and female and they are counted according to their place of walking. Pedestrians those are walking along the footpath at the time of the survey are counted under on footpath category and those who are walking along carriageway or other than footpath are counted under the on-road category. Table 2 represents the pedestrian traffic flow data of Abdul Hamid road. Data are collected from the point located in front of A. R. Plaza market.

The above table presents that there are variations of pedestrian flow among the survey hours. This sidewalk has an average pedestrian flow of about 1998 pedestrians per hour. Findings also show that this road section is mostly used by pedestrians who are entering to the CBD. The percentage of pedestrians using this road for entering to the Traffic More intersection varies with survey period, that is, the pattern of use of this section of road by pedestrians' changes with time.

3.2.2 Awrangozeb Road

Table 3 represents the pedestrian traffic flow data of Awrangozeb road. Data are collected from the point

located in front of Government Bulbul College.

In the above table, pedestrians are classified as those who are walking along the footpath and the others who are walking along carriageway to have estimation about the proportion of pedestrians walking along carriageway or other than a footpath. Although pedestrians are expected to walk along the pedestrian way, the scenario in the study area is somewhat different. In most of the road section, a significant portion of pedestrians is found to walking along roadway or carriageway. The proportion varies for different road section but for all the road sections, the pedestrians who are walking along carriageway constitute a larger part of the total pedestrians.

3.2.3 Boro-Bridge Road

The pedestrian volume survey data of the Boro-Bridge road are also collected for the five hours of a day that shows in Table 4. The number of a pedestrian in the Boro-Bridge road is different for different hours of the day. This difference depends on type and purpose of trips. The surrounding land uses of the Boro-Bridge road are characterized mostly by commercial and retail business activities and hence there may be more diversity in the trip's purpose of the visitors.

3.2.4 Ataikula Road

The pedestrian volume survey data of the Ataikula road are also collected for the five hours of a day and the findings are presented in Table 5. The table also illustrates that among the total 6,460 pedestrians traffic flow in the Ataikula road during the five survey hours, about 21 percent pedestrian's traffic flow occurs in an hour.

3.3 Parking Facilities

On-street parking is one of the major problems in the study area and all the roads are used as a place of parking or on street parking. Among the roads, the Boro-Bridge road (Traffic More-Government Edward College) has larger on street parker. On-street parking may lead to traffic congestion and may also be a cause of the accident. Curb or on-street parking should be allowed in such a way that road capacity is not affected very much. In the study area, both parallel (parallel to the road direction) and angular (30, 45, 60 and 90 degrees with the curb) on-street parking is done. But such parking is not approved for those areas. Parallel parking consumes the maximum parking length, while 90-degree parking, the least. On the Abdul Hamid road and Boro-Bridge road, parked

Table 4 Pedestrian traffic flow of Boro-Bridge Road.

Time of survey	Traffic More to Government Edward College			Government Edward College to Traffic More			Total
	Male	Female	Sub total	Male	Female	Sub total	
9:00-10:00 a.m .	326	184	510	824	402	1,226	1,736
10:00-11:00 a.m.	314	178	492	446	270	716	1,208
12:00 am-1:00 p.m.	308	191	568	499	180	679	1,247
4:00-5:00 p.m.	408	120	528	815	345	1,160	1,688
5:00-6:00 p.m.	397	115	512	775	270	1,045	1,557
Total	1,753	788	2,610	3,359	1,467	4,826	7,436

Table 5 Pedestrian traffic flow of Ataikula Road.

Time of survey	Traffic More to Government Edward College			Government Edward College to Traffic More			Total
	Male	Female	Sub total	Male	Female	Sub total	
9:00-10:00 am	570	174	744	528	136	664	1,408
10:00-11:00 am	540	130	670	548	92	640	1,310
12:00 am-1:00 pm	463	127	590	440	115	555	1,145
4:00-5:00 pm	632	201	833	416	96	512	1,345
5:00-6:00 pm	460	190	650	497	105	602	1,252
Total	2,665	822	3,487	2,429	544	2,973	6,460

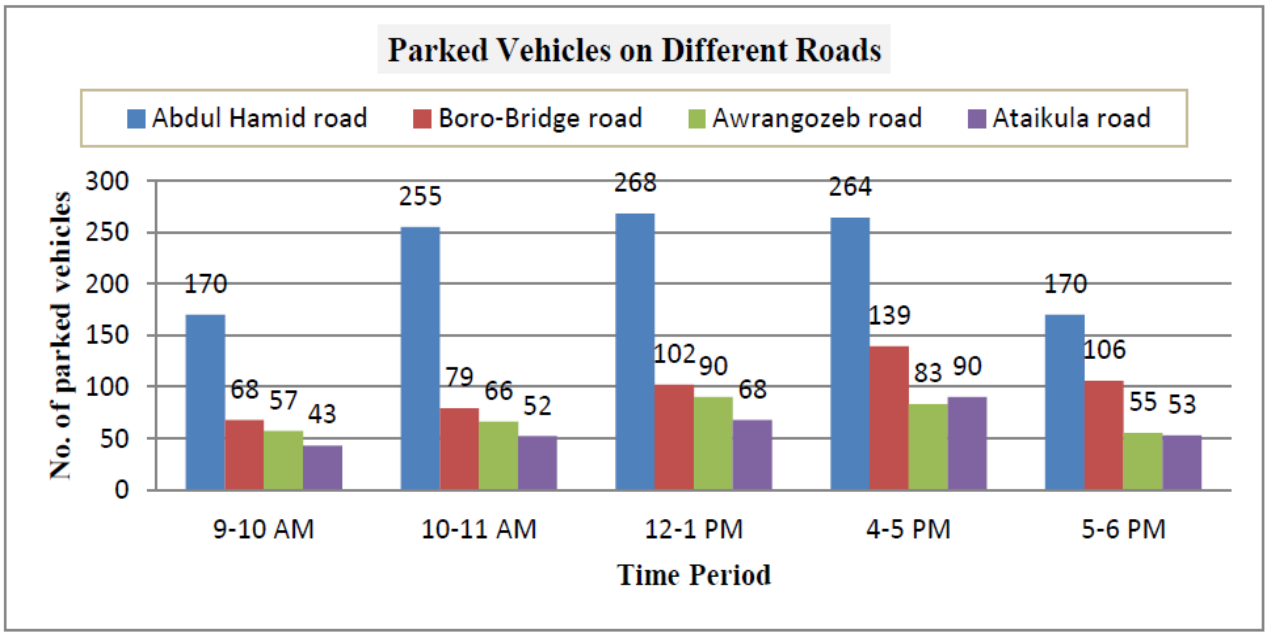

Fig. 9 Parked vehicles on different roads.

vehicles are higher at different hours compared to other roads in the study area (Fig. 9). At 4:00-5:00 p.m. and 5:00-6:00 p.m., parked vehicles are always higher. Parked vehicles are relatively lower on the roads at 10:00-11:00 a.m. and 12:00-1:00 p.m. At the effect of parked vehicles, carriageway width is reduced. Pedestrian is likely to walk on the road because of inadequate pedestrian facilities but carriageway width is reduced by the effect of parked vehicles.

4. Findings and Discussion

There are a lot of problems relating to the use of footpaths by the pedestrians. The most serious problem is the retailer traders and hawker on the footpaths, who eventually reduce the effective width of the footpath. There are a lot of big size dustbins on the streets close to the footpath causing inconvenience to the passersby.

4.1 Informal Business Occupancy on Footpath

There are a lot of informal business shops occupying on the road as well as on the footpath. Different types of shops are concentrated and these are cloth, food, ornaments, fruit, blacksmith and etc. These business shops created different problems for vehicular as well as pedestrian movement. Fig. 10 shows the physical scenario of the roads and reveals pedestrian movement is interrupted due to footpath that is almost blocked. The footpath is also blocked by the shopkeepers and market owners. They often keep their instruments in the footpath.

4.2 Illegal and Poor Parking Facilities

Illegal motorized and non-motorized vehicle parking over footpath creates a lot of problems for the pedestrians movement. This type of vehicle parking also reduced the area and width of the footpath which is unexpected and so much problematic. Several CNG (compressed natural gas) stand exists on the footpath and created problems for the pedestrians. So it is a great problem for the pedestrians.

4.3 Poor Lighting Facility

Most of the traffic lights are out of work and also the facility is not adequate. All the posts have the opportunities to provide lighting facilities to the pedestrians as well as the drivers to locate the places

in the surrounding vicinity. Unfortunately, 3% of the lights work rarely or not at all in most of the cases under bad weather condition and often some not working properly due to lack of proper maintenance at a regular interval. In the study area, there are well-lighting opportunities in the main roads (primary roads) on both sides. But the access roads or the connecting secondary roads do not have well-lighting facilities. The presence of the illegal drug sellers and the hijackers were observed in the places where the lighting facilities were not well on the secondary roads. However, this situation encourages people not to use the roadside walkway during the night time. Besides, a number of hijacking and bag-snatching events of walkers on the walkway is very common in the night where lighting facilities are not sufficient or inactive.

4.4 Solid Waste Mismanagement and Obstacles on the Footpath

There are a lot of big size dustbins on the streets close to the footpath in the study area (Fig. 10). These dustbins cause problems to pedestrians when the garbage stored inside these overflow on the streets and

Fig. 10 Physical condition of pedestrian facilities.

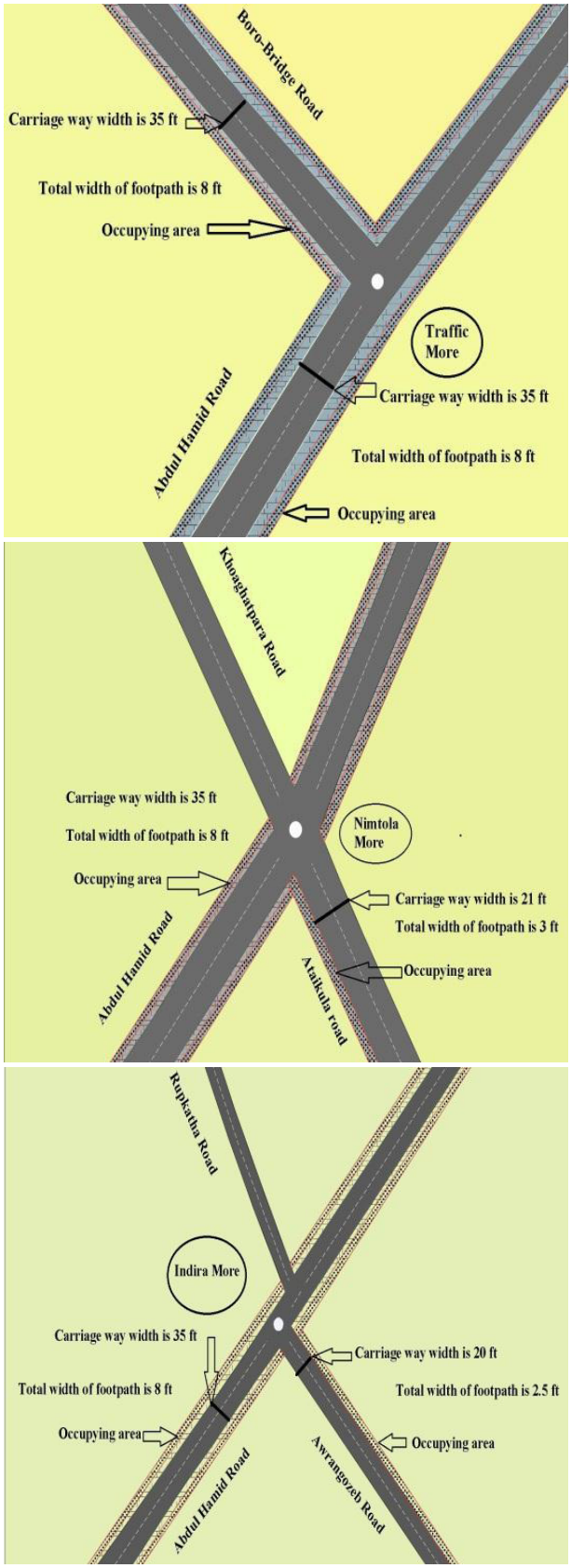

Fig. 11 Geometric feature of road intersection.

footpaths. Establishment of the dustbins on footpath creates problems with spreading bad odor and germs. There are various types of obstacles such as Gas line, electric pole, rod, tin, and iron sheet standing on the footpath are the prime cause of disturbance of the pedestrian movement.

4.5 Illegal Vendors on Walkways

The walkway is almost blocked due to illegal vendors that operate informal business. This situation deteriorates the safety and convenience of the walkers on the walkway surface, too.

4.6 Geometric Feature

There are mainly three intersections in the study area which is highly congested (Fig. 11). Hawker creates a huge problem for the pedestrians. They blocked the footpath and used it as a marketplace. Though it is illegal, hawkers always captured the area of footpath in the footpath. As a result, pedestrians face many problems in their everyday life. For changing of this type of condition, the government has to take several steps. Hawkers should be removed by elite force strictly. Authority keeps more intention to remove the hawker. Approximately half part of the footpath is occupying the area. For example, at Abdul Hamid Road, the total width of the footpath is 8 ft., but approximately 4 ft. is the occupied area and also the same condition exists on the Boro-Bridge road.

5. Conclusion

Walkway or pedestrian way is one of the most important issues in the transport planning because pedestrian forms the largest single road user group. As pedestrian encompass all age groups, every nationality and every socio-economic group, so it is very important to design sustainable walkways for the pedestrian. Nowadays, a lot of advancement can be seen with many models and techniques for designing pedestrian way or sidewalk around the world. But in Pabna Municipality, the transport authorities or the researchers are still thinking with managing only the motorized vehicles. For this, the most vulnerable road users in the transportation planning and the pedestrians are neglected for their safety as well as convenience. However, illegal vendor's occupancy on the walkway is also one of the major responses from the pedestrians at Pabna Municipality. It has also been experienced that the problems are not similar in each studied areas. From the walker's point of view, the CBD areas are the most vulnerable with illegal vendors.

Provision of walking and improvements of road design helps to create more balanced transportation systems that reduce automobile dependency, increase accessibility and can reduce the negative impact of pollution. It also helps the national transportation policy as well as non-motorized transportation policy. Proper planning, implementation, and maintenance can bring a fruitful result of the walkway, which is the most comfortable, fast, time-saving and economic way of sustainable transportation system.

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