

Pedestrian's Behaviour on Road Crossing Facilities

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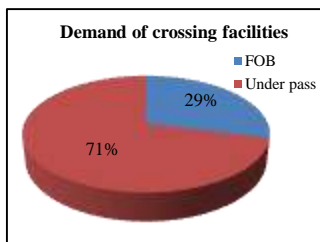
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Abstract

Walking is a major mode of transportation in developing countries where most road users are pedestrians who spend significant time on roads and using the road system. Walking almost inevitably involves crossing a road, where the chances of conflict between pedestrian and motor vehicle is much higher. In Dhaka, the capital of a developing country Bangladesh, pedestrians increase their accident risk when they decide to cross the road way without using the road crossing facilities. When a relatively unsafe choice is made, the pedestrian increases his accident risk and faces casualties. However, in Dhaka, it was not explored in the past about what percentage of people cross the road by pedestrian foot over bridge/ underpass or by jaywalking. Therefore, It is found that 40.2% of the pedestrians do not use road crossing facilities and 71% pedestrians prefer underpass rather than using foot over bridge. The reasons pedestrians are not using road crossing facilities are insufficient security, time consuming, poor entrance, hawker's problem, discomfort, takes a long walk etc. To improve this situation several steps should be taken, such as: Enhance lighting facilities, prohibit commercial activities, adequate usage of roadside and median barrier, construct more underpass rather than foot over bridge etc.

Keywords: Walking; pedestrian; risk; safety; jaywalking.

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1.0 BACKGROUND OF THE STUDY

Walking, the simplest form of transportation has many benefits for pedestrians and the society. Yet, pedestrians are a vulnerable group of people and safety concerns are a significant barrier in one's decision to walk [1]. With over 500 million cars and trucks in use, the World Health Organization WHO reported that the world loses over 1.2 million people annually and 50 million are injured because of motor vehicle crashes. The estimated economic loss is more than US\$ 500 billion [2]. If explored in depth these statistics surely reveal that a significant portion of economic loss and life loss are associated with pedestrian involvement in crashes.

Bangladesh is one of the densely populated countries in the world. It has a land size of 147,570 square km with a population density of 1015 peoples per square km and population growth is 1.37 per annum. On the other hand Dhaka, the capital city of Bangladesh has the population density approximately 10 times higher than the overall population density of the country which is 8229 peoples per square km [3]. According to Dhaka Transport Co-ordination Authority (DTCA) (2013) at present in Dhaka city more than 15 million people are living and everyday this huge number of peoples causes around 25 million daily trips by using several modes of transport.

Among the various modes seen in Dhaka, walking is one of the main modes of transport, with 60% of trips made by foot and only 4% by car [4]. It is because 76% of all trips are under 5 km, and 50% under 2 km [5], which makes walking is a convenient mode of transport. As large numbers of people are pedestrian and they are exposed to traffic, pedestrian risks are increasing day by day.

If we look into statistics, the risk for the pedestrian can be understood. According to Bangladesh Road Transport Authority

from 1999 to 2008, a total of 35,105 accidents occurred in Bangladesh. In these 10 years, 13,516 pedestrians were killed in traffic crashes in Bangladesh, representing 53% of all the people that died in traffic crashes. Among 13,516 pedestrian fatalities, 3156 i.e. 24% happened in 4 metropolitan cities. In a particular year, for example in 2008 in Dhaka city, 281 pedestrians died from injuries suffered in collisions with motor vehicles which accounts for 72% of all road users' fatalities there. Also in 2008, 20% pedestrian fatalities of the country occurred only in Dhaka city [6]. Another statistics showed that 80% pedestrian fatalities of the 4 major cities occurred only in Dhaka City [7].

Bangladesh Police HQ conducted some road accident survey from 1993 to 2000 in Bangladesh. They reported 45,616 casualties during these 8 years. They showed that pedestrians are involved in about 70% of road accidents [8].

All the statistics clearly demonstrate that pedestrians are the most vulnerable road users in Bangladesh. One of the reasons is that most of the pedestrians are not well educated and also unaware of traffic rules. Sometimes the pedestrian do not use the facilities provided for them to cross the road (i.e., overpass or underpass) due to several reasons such as, height of the structures, installed on improper locations, vendor problem, time consuming etc. Some of the facilities are not well designed so that pedestrians are discouraged to use it. Perhaps because of these reasons, a significant number of pedestrians are often observed in jay walking to cross the road. In a survey interviewing pedestrians, it has been found that the majority of the pedestrians prefer to cross on level ground and medians, with females and younger pedestrians willing to use non-level crossings [9]. For this reason pedestrians become more vulnerable and do faults when crossing the roads. In an investigation results show that pedestrians are found at fault in 59% of the crashes, drivers in 32%, and both are found at fault in 9%

[10]. Also when crossing the level ground the waiting time may increase and this affects the crossing behavior of the pedestrians. Hamed (2010) studied the factors that influence a pedestrian's waiting time and frequency of attempts to cross streets. He found that pedestrians' expected waiting time has profound influence on the number of attempts needed to successfully cross the street. Hamed (2010) established that pedestrians who spend more time waiting to cross from one side of the street to the median are likely to have a higher risk of ending the waiting time than when they cross from central refuge to the other side of the street [11]. In another study, it was found that as signal waiting time increases, pedestrians get impatient and violate traffic signal indications which increases the risk of being struck by a motor vehicle [12]. Studies generally point out male pedestrians as those most frequently involved in pedestrian crashes and elderly and children as the most vulnerable pedestrians [13].

Location of pedestrian crossing facilities also plays an important role of crash occurrences and crash related injuries. The severity of the crashes increases in non-junction crosswalks because the pedestrians always do hurry to cross the roads to save time. So, they always cross the road in level ground instead of using underpass and foot over bridge. In Israel a detailed analysis of pedestrian accidents in 2006–2007, with an emphasis on the infrastructure characteristics involved, was performed; it was found that 75% of the fatalities and 95% of the injuries occurred in urban areas, the majority of cases occurring on road sections (not at junctions). About 80% of the accidents took place when a pedestrian crossed the road, the majority of them at non-crosswalk locations or at non-signalized crosswalks [14]. In another study it has been found approximately 38.2% of the crashes occur at crosswalk locations, while proportionately more (61.8%) of the pedestrian accidents occur at non-crosswalk locations [15].

However, it is hypothesized that if enough road crossing facilities are provided, the interaction between pedestrian and vehicle would be less and pedestrian risk of involving in crashes may be minimized. All the reasons discussed above of not using pedestrian crossing facilities and the effect of pedestrian crossing locations have been extracted from different studies which were performed in different contexts. In Bangladesh, very few researches have been conducted on pedestrians' behavior, more specifically, if there any on the usage of road crossing facilities. For this reason, it has not been sorted out yet why the significant numbers of pedestrians do jaywalking while crossing the roads.

The aim of this paper is to find out the pedestrians' perception on using road crossing facilities in Dhaka. This might be helpful to develop a safe pedestrian environment and will reduce casualties. For this purpose, the study is divided into two parts. In first part, the present scenario of the utilization of road crossing facilities is explored by taking real time data on several locations in Dhaka. In the second part of the study, a questionnaire survey has been prepared to examine the pedestrian perception on this issue. Particularly, the analysis from the survey data will reveal the measures needed to be taken to increase the usage of road crossing

facilities. It is expected that the results of this study could lead to better understanding of pedestrian crossing behavior in Dhaka and support policy makers in their decision making regarding the improvement of road crossing facilities in Dhaka city.

■2.0 PRESENT SCENARIO OF ROAD CROSSING FACILITIES IN DHAKA CITY

According to Dhaka North City Corporation (DNCC) (2013) at present in Dhaka city there are total 34 foot over bridges (FOBs) and 4 under passes. Among them 19 are steel made and another 15 are Reinforced Cement Concrete (RCC) Structures. The four under passes are also RCC structures.

To observe the present situation 17 road crossing facilities in different location were visited. The conditions of the facilities were not good. In most of the places the entrance to the facilities were blocked by vendors, so that it was very tough for the pedestrians to use the facilities. Some of the foot over bridges were occupied by hawkers, so that not enough space is available for the pedestrians to walk safe and conveniently. Almost all foot over bridges (FOBs) and underpasses were very dirty and some people throw waste on them.

At night time the road crossing facilities become unusable because of insufficient lighting facilities. Sometimes unwanted incident occurs (such as, hijacking) due to the lack of security personnel. Also at night time the number of traffic reduces, for this reason pedestrians are more encouraged to cross the road without using the road crossing facilities.

An investigation was done to observe the percentage of pedestrians who use the road crossing facilities and those who do not. This investigation was limited to only 7 road crossing facilities due to time and manpower constraints. They are situated at different locations of Dhaka city so they are representative of crossing facilities in Dhaka City.

For example, Farmgate area is a commercial zone with activities such as cinema hall, bus terminals and students tutoring centers. It is one of the busiest places in Dhaka city. New market and Science lab are recognized as shopping zones. Karwan Bazaar is an institutional zone where governmental and non-governmental offices are located. Notun Bazar is an area beside the diplomatic zone where several universities and colleges are situated. Uttara is mostly residential area, because commercial activities in this area are very less. Abdullahpur is one of the entry points to Dhaka city.

Figure 1 and Figure 2 shows the seven locations from where data was collected. In each of the seven locations, data has been taken for one hour duration. However, the time of data capture was different for different locations due to shortage of manpower.

Though the crossing behavior of the pedestrians may vary with the time of day, however, this issue might not play a vital role in our study as our goal was limited to finding out the percentage of pedestrians not using the road crossing facilities.

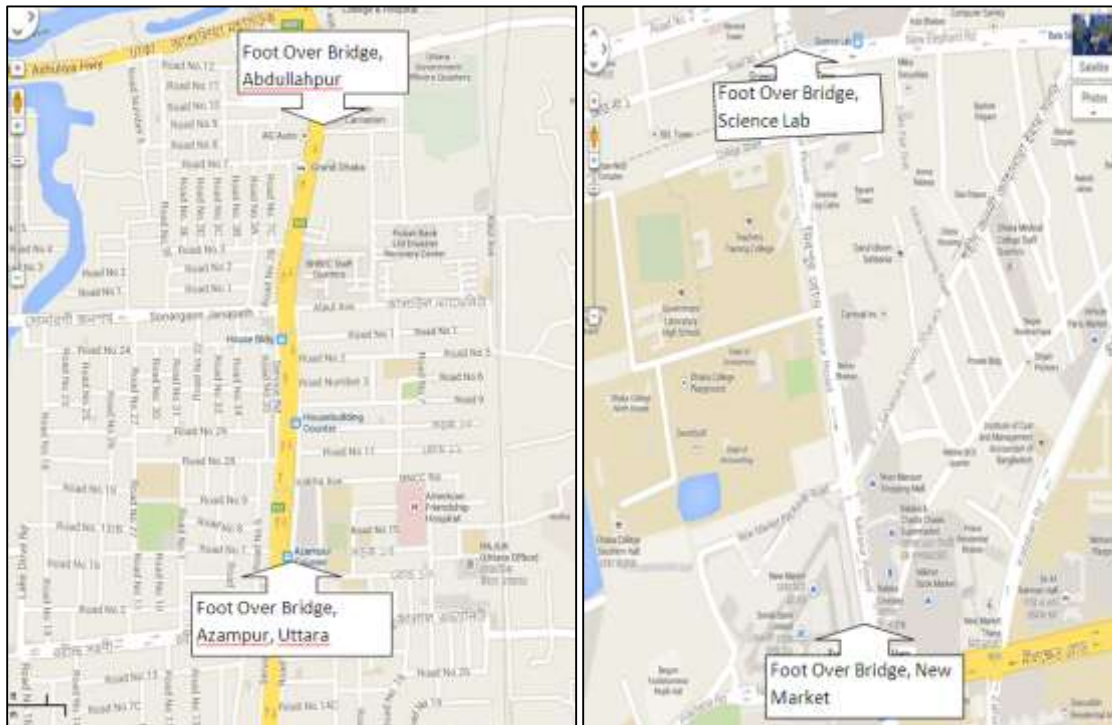


Figure 1 The locations of the 4 road crossing facilities.

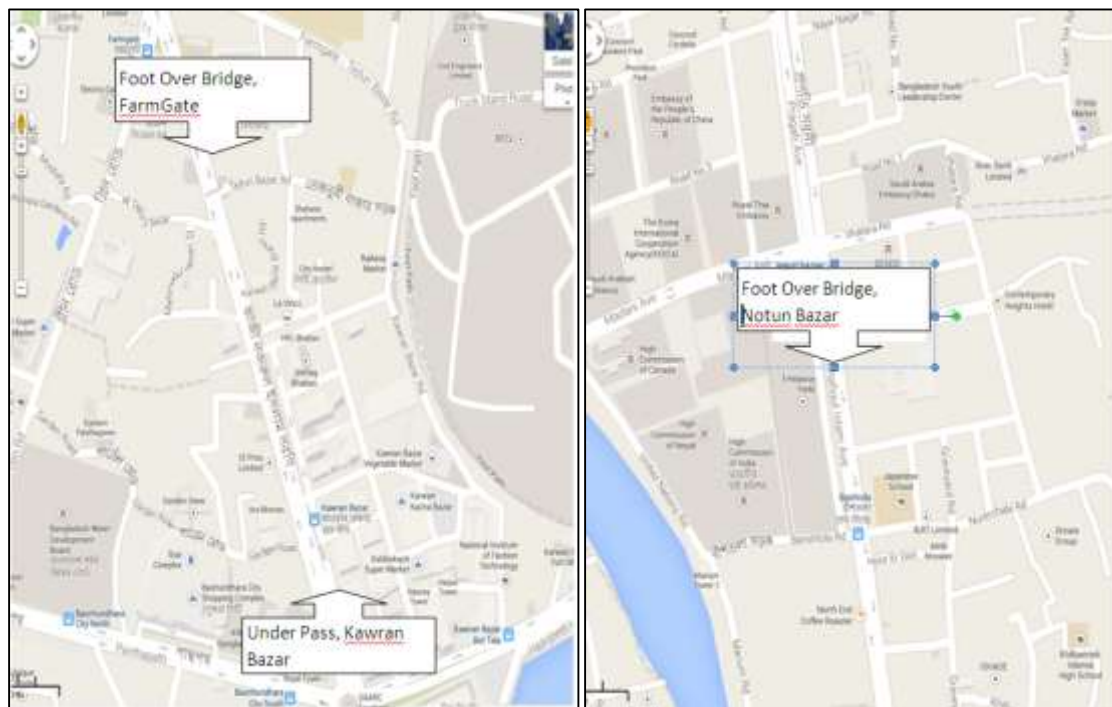


Figure 2 The locations of the 3 road crossing facilities.



Figure 3 Pedestrians are crossing the busy roads without using the crossing facilities.

The numbers of pedestrians counted at the 7 road crossing facilities are 22628. Overall 59.8% of the pedestrians were found to be using facilities, while the remaining 40.2% of the people did not use the pedestrian FOB/underpass. A pedestrian is considered as a sample if the target person is within 15.24m distance in either direction from the crossing facilities. It means if a pedestrian does not use the crossing facilities it is considered that the pedestrians

outside the 15.24m distance, we excluded him from the investigation.

It has been observed that in most of the locations pedestrians are crossing the busy roads without using the crossing facilities (Figure 3). Table 1 shows the number of pedestrians using road crossing facilities.

Table 1 Percentage of pedestrian using crossing facilities

Location	Date	Time	Crossing facility type	Number of pedestrian		% of pedestrians not using facilities
				Using facilities	Not using facilities	
Farmgate	22.03.13	2.00-3.00 pm	Foot Over Bridge	1588	760	32.4%
Science Lab	23.03.13	4.00-5.00 pm	Foot Over Bridge	1640	820	33.3%
New market	24.03.13	5.00-6.00 pm	Foot Over Bridge	1508	2040	57.5%
Karwan Bazar	25.03.13	6.00-7.00 pm	Underpass	1644	488	22.9%
Uttara	15.05.13	5.00-6.00 pm	Foot Over Bridge	2280	2080	47.7%
Abdullahpur	17.05.13	2.00-3.00 pm	Foot Over Bridge	2452	1612	39.7%
Notun Bazar	18.05.13	7.00-8.00 pm	Foot Over Bridge	2420	1296	34.9%
Total				13532	9096	40.2%

At Farmgate and Science Lab area the pedestrians not using FOBs are 32.4% and 33.3% respectively. These two locations show the lower percentage of jaywalking since median barrier is placed at the middle of the road. Moreover, pedestrians are also confined within the pedestrian path by road side barriers offering less chance to cross the road illegally. It is also observed that the number of vendors is less and space for entry is enough wide.

On the contrary, at New Market area, 57.5% pedestrians are not using the pedestrian over bridge. In this area, though both roadside barrier and median barrier are observed, however, these measures are unsuccessful to resist pedestrian from jaywalking because these structures are not working properly due to the lack of periodic maintenance. It is also noticeable that the entrance to the foot over

bridge (FOB) is occupied by many vendors and hawkers who are selling different goods and obstruct the access of pedestrians to use the overpass. The scenario is same at Uttara FOB where near half of pedestrians are not using pedestrian overpass.

Among the seven locations, we found the least percentage of pedestrians not using the road crossing facilities in Karwan bazar area to be 22.9%. It is noted that this is the only underpass considered in this study. Near this location, road side barrier was provided beside pedestrian path so that people cannot enter to the mid-block section. However, still some pedestrians are coming out from footpath and cross the road by the damaged portion of the barrier. Also there was not any median barrier provided at the middle of the road. The reasons behind the lowest percentage of

people are not using pedestrian underpass is because there are no hawkers; entrance is quite wide, lighting facilities are very good and presence of beggars is less. In another survey, we have found that 71% people prefer underpass to over FOBs. Pedestrians think it's less time consuming, safe, enough lighting; entrance is not narrow and congested, less beggar and hawker problem while comparing with those of the FOBs.

In Abdullahpur and Notun Bazaar areas percentage of people not using the road crossing facilities were 39.7% and 34.9% respectively. In these locations, roadside barrier was not provided

which encourages pedestrians to come out of the road very easily and cross the road at midblock. However, comparing with New Market and Uttara areas the percentages of not using the overpass are still less at these two areas, perhaps, because of different road environment condition. Continuous flow of traffic is observed near the FOB at Abdullahpur and Notun Bazaar. On the contrary, the scenario is reversed in Newmarket and Uttara areas, where buses and cars are at low speeds due to adverse road conditions; this encourages pedestrians to stop vehicles which enhance jaywalking.

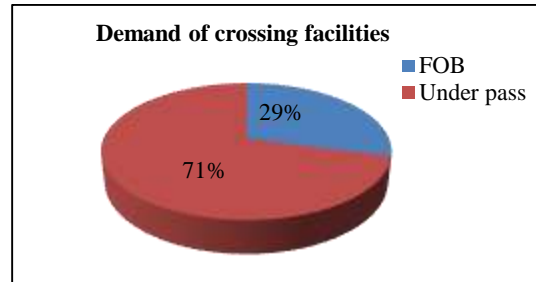


Figure 4 Comparisons between Underpass and FOBs



Figure 5 Entrance of the foot over bridge and FOB's are occupied with hawkers and beggars.

3.0 METHODOLOGY

3.1 Data Collection and Pedestrian Profile

To analyze the situation why a significant percentage of pedestrians are not using the road crossing facilities, a questionnaire survey was conducted among the pedestrians. A total of 300 pedestrians were random sampled to get representative sample from the population. The socio-economic and demographic profile of the pedestrian sample is shown in Table 2.

Table 2 Profile of respondents (%)

Gender	Male:	72
	Female:	28
Age	Below 25:	34.72
	25-35:	24.44
	35-45:	20.03
	45-55:	18.4
	Over 55:	4.4
Literacy	Illiterate:	11.8
	Primary:	19.4
	Secondary:	47.2
	Post-Secondary:	21.52
Income	Below 12,000:	31.94
	Below 25,000:	38.8
	Below 35,000:	18.05
	Below 50,000:	4.86
	Over 50,000:	3.47
Dwelling condition	Personal:	9.72
	Rental:	58.33
	Slum:	20.1
	Office quarter:	11.1
	Others:	1.38

3.2 Questionnaire

A questionnaire was designed to find out the reasons for not using the pedestrian overpass and underpass. For this purpose, 12 possible causes were identified from field investigation which discourages pedestrians to use these facilities and promote jay walking. The possible reasons are shown in Table 3. The perception of using road crossing facilities was assessed by a 5 point Likert scale ranging from “Strongly Agree” to “Strongly Disagree”.

For analyses, numerical scores 1 to 5 were assigned to indicate the reason for not using road crossing facilities. For an example, if a pedestrian answers “Strongly Agree” to the question 1 to question 12, then the minimum value will be 12 and if he answers “Strongly Disagree”, then the maximum value will be 60. Based on the mean value for each statement, the results are ranked to show which factors are the prime reasons for not using pedestrian foot over bridge or under pass.

4.0 RESULTS AND DISCUSSION

As earlier stated most of the pedestrians prefer underpass rather than FOBs and the objective is to find out why 40.2% of pedestrians are not using the road crossing facilities.

The mean responses of all the questions vary from 1.71 to 2.76 which lie in between ‘neutral’ and ‘strongly agree’. In general, this result implies that the respondents agree with the possible reasons of not using the pedestrian facilities identified from field investigation.

Based on the questionnaire survey it has been found that insufficient security (mean=1.71) has been identified as the top reason (R=1) of not using pedestrian foot over bridge or underpass. The reason is true particularly during night time as no lighting facilities are observed on any pedestrian overpass which increases the chance of mugging. Also most of the times, railings of the foot over bridges are covered by commercial advertisements which restrict the vision of the security personnel to vigil the FOB.

Time is another important factor which discourages pedestrians to use the road crossing facilities. Mean value is 1.81 for “using road crossing facilities is time consuming” and 61% pedestrians strongly agree with this statement. Perhaps the pedestrian are always in hurry which may discourage them to climb the foot over bridge.

The mean value of the “entry access is poor” is 1.83. Often the surrounding environment of the entrance of FOB or underpass is not good. Waste is often dumped near the entrances and bad odor comes from the waste. Some people simply feel uneasy or discomfort of not using the pedestrian foot over bridge perhaps because of not feeling physically comfortable (mean=1.91). Presence of beggars and hawkers are also a reason of less usage of pedestrian overpass and underpass.

Interestingly “the climbing height of the facilities” is not a major cause for the less use of pedestrian foot over bridge or underpass as implied by the respondents (mean=2.76). Similarly, the absence of median barrier or roadside barrier has been less emphasised for not using the road crossing facilities (mean=2.56). Narrow and congested condition are not prime reasons of not using road crossing facilities (mean= 2.31).

Table 3 Views of respondent

Possible causes of not using road crossing facilities	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)	Mean
1. I feel uneasy or discomfort to use road crossing facilities.	55	8	28	9	-	1.91 (R=4)
2. It is more time consuming.	61	9	19	10	1	1.81 (R=2)
3. The road crossing facilities are very dirty.	42	21	31	5	1	2.02 (R=5)
4. The climbing height of using the facilities is a problem.	21	10	44	22	3	2.76 (R=11)
5. Hawkers’ problem.	63	1	12	19	5	2.02 (R=5)
6. Insufficient security.	71	2	17	10	1	1.71 (R=1)
7. Takes a long walk	62	4	8	21	5	2.03 (R=6)
8. Entry access is very poor.	69	1	11	16	3	1.83 (R=3)
9. Too much narrow and congested	36	16	33	11	4	2.31 (R=9)
10. Can cross the road easily because no guard rail or restriction is provided.	28	11	39	21	1	2.56 (R=10)
11. Numbers of beggar is too high	33	23	35	9	-	2.20 (R=8)
12. Unsocial or illegal activities	31	25	39	5	-	2.18 (R=7)

Note: Mean calculated considering Strongly Disagree=5, Disagree=4, Neutral=3, Agree=2, Strongly Agree=1., “R” means “Rank”

5.0 CONCLUSION

This study reveals the perception of pedestrians on the use of pedestrian crossing facilities. Based on the study it is identified that insufficient security is the prime concern of pedestrians to use pedestrian foot over bridge or underpass. Security should be increased so that pedestrians do not fear for the hijacking and mugging problem.

Field observation suggests that the maintenance of roadside barrier and median barrier should be improved to separate pedestrian movements from vehicular traffic and to encourage pedestrians to use road crossing facilities. Also there are other sectors which should be improved such as: pedestrian awareness, social awareness, design improvement etc.

Type of road crossing facilities plays an important role to increase the efficiency of it. According to our study 71% pedestrians want underpass rather than FOBs. Thus, we propose, if possible, to build more underpass rather than overpass. Nonetheless, several steps have to be taken to improve the surrounding environment of the FOBs which ultimately increase their usage. The steps are as follows:

Foot over bridge should be accessible very easily. It means the entrance should be wide enough and convenient approach to facilities so that pedestrians can use it without discomfort and hindrance.

Foot over bridge should be free from all kinds of commercial and illegal activities. Such as: it should be free from hawkers, beggars, prostitutes etc. Billboard and advertisement should be banned in foot over bridge.

Foot over bridge should have appropriate roofing facilities so that pedestrians can use it during the rainy season as well as in the hot summer.

Lighting facilities should be increased so that pedestrians can use the facilities at night without hesitation and discomfort. Foot over bridge should be aesthetically beautiful.

Public awareness campaign should be organized by the government and different road authorities. Variable message sign can be used to warn the pedestrians about the bad impact of not using road crossing facilities.

Based on the situation observed and survey the most important sector should be improved is law enforcement.

Government should take proper steps so that if any pedestrians do not use road crossing facilities or cross the road illegally he or she should be fined. Unfortunately, till now no fines are imposed to pedestrians in Bangladesh due to jaywalking, perhaps, the government is afraid of becoming unpopular to citizens from political perspective.

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