*Proceedings of the 6th International Conference on Civil Engineering for Sustainable Development (ICCESD 2022), 10~12 February 2022, KUET, Khulna, Bangladesh (ISBN-978-984-35-1972-6)*

# PEDESTRIAN SAFETY IN DHAKA MEGA CITY OF BANGLADESH: BEHAVIOR, ATTITUDE AND RISK PERCEPTION

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## ABSTRACT

Pedestrians are always the most vulnerable road victim in terms of crash involvement and injuries. In low motorized developing countries like Bangladesh, this problem is disproportionately higher, particularly in urban setting. Pedestrian itself accounting for nearly 50 percent of road fatalities in Bangladesh. In urban areas, it is varied between 60 and 74 percent. Therefore, there is a need to develop a pragmatic strategy to arrest this problem with proper understanding of their behaviour, attitude, and perception. In this study, an attempt has been made to assess pedestrian safety in problem in Dhaka city. Main objective of this study is to evaluate the risk perception, attitude, and behaviour of the pedestrian. A comprehensive questionnaire survey enabled the collection of pedestrian behavior, attitude, and risk perception data, which included different categories of users.

It is found that most of the responders perceived crossing through running vehicle is unsafe (86.66%) and this perception reflect on their attitudes (crossing unacceptable, 79.33%). But when it comes to the behavior, only 32% reply that they never cross through running vehicle. In case of using mobile phone or taking while crossing, imitate almost same patter between perception, attitude, and behavior. Around 90% feels it is unsafe, same percent disagree to cross the road while using mobile and earphone but only 66% practice this. Regarding the use of footpath or zebra crossing for walking and crossing, majority perceived it is safe (75% and 67.66% respectively). Their attitude is even stronger on this issue. More than 75% disagreed that they can avoid footpath if it is available at least in on side. In case of using designated crossing facilities including foot-over bridge or underpass the percentage goes to 90%. However, only 29.33% responses that they always use footpath for walking. On the other hand, around 48% cross outside crosswalk or avoid foot overbridge or underpass even it is nearby. From this analysis it is evident that perception and attitude is closely related and most of the cases that is very positive. However, there is huge gap between perception, attitude, and behaviour. Many respondents have proven their accurate feelings, right understanding or believe, but their behaviour represents differently. The paper elaborates these two confronting issues with the evidence and conclude with potential implications of these understanding for improving pedestrian safety and future research directions.

***Keywords:*** *Pedestrian, Safety risk, Behaviour, Attitude, Perception*

## 1. INTRODUCTION

No matter whether the primary mode of travel is the automobile including car, auto-rickshaw, non-motorized, or public transit; everyone must walk as a part of the trip, such as from their home to the shop or place of service, and/or to the transit stop. Therefore, walking is one of the main modes of transport in all over the world, particularly in developing cities where motorization rate is low and mixed land use with huge densification. According to different studies, walking is the single largest group of travel mode in Dhaka city catering more than 50 % of all trips [1, 2]. This is mainly attributed with the trip length as 76% of all trips are under 5 km, and 50% under 2 km in Dhaka city [3] which makes walking is a convenient mode of transport.

The risk of pedestrian as an unprotected road user is also very high and comprises more than 50 percent of road traffic fatalities and injuries. According to police reported statistics, a total of 26,464 accidents and 25,879 fatalities reported in Bangladesh from 2010 to 2019. Around half of those road traffic fatalities are pedestrians alone. In case of crash type, 'hit pedestrian' is the dominant crash type both in urban and rural areas, representing 44 percent of total fatal crashes and 48 percent of total crash. In urban area, this share is much higher, varied between 60 and 74 %. In Dhaka city, it accounts for 74% of all traffic fatalities [4].

There are number of studies on the pedestrian safety problem. Those studies mainly focused on the pedestrian crash and injury characteristics [2, 5, 6], existing facilities for pedestrian and their limitations[7, 8] etc. Those studies pointed out that lack walking and crossing facilities and adverse road and roadside environment are the principal reasons behind these deaths [2, 7, 9, 10]. Some studies evaluated the level of satisfaction on the existing facilities and preference [1], self-reported problems. Few studies also investigated and reported crossing and walking behaviour of pedestrian using observational technique including video observation [11]. However, study on pedestrian risk perception, attitude and behavior is very miniscule. In case of developing countries like Bangladesh, this type of inclusive study still yet to be done. Whereas risk perception, attitude and behavior of pedestrian could be highly attributed with the vulnerability and risk of crashes and injuries. Moreover, with the clear understanding on the users' level of satisfaction on providing facilities, reason behind the dissatisfaction, preferences, attitude, and reception, it is important to have deeper knowledge on the action-oriented behaviour to relate the different attributes for selecting specific intervention.

This study attempts to evaluate the risk perception, attitude and walking and crossing behavior of pedestrian to identify the factors significantly affect risk perception and unsafe behaviour of pedestrian. The study uses self-reported data obtained via questionnaire survey. It is expected that the results of this study will lead to better understanding of pedestrian expectation, risk perception, attitude, their behaviour and to support policy makers in their decision making regarding the improvement of pedestrian safety and injuries in urban areas in Bangladesh primarily in Dhaka city.

## 2. METHODOLOGY

### 2.1 Questionnaire Development

After an inclusive literature review on the design and formation of questionnaire, a preliminary questionnaire was drafted. The preliminary questionnaire was tested to see whether the questions are correctly understood, and meaning are properly interpreted by the responders to avoid possible bias due to misinterpretation or misunderstanding. Reliability and level of acceptability of the questions are also assessed to see the whether the questionnaire is adequate enough to evaluate the target objective. Moreover, the questionnaire is shared with several experts to get their opinions and suggestions for further improvement. Finally, after necessary modification with the incorporation of test feedback, experts' comments and suggestions, final questionnaire is fixed for online survey. The questionnaire comprises in total 40 questions. Entire questionnaire has been divided into five

different groups including demography of the participants, pedestrian satisfaction on different existing facilities, pedestrian risk perception, pedestrian attitude, and pedestrian behaviour.

### 2.2 Survey Design

At the beginning, it was planned to organize face to face questionnaire survey. However, due current adverse situation for the fallout of COVID 19 pandemic, the study used online platform for the survey. After completion of the questionnaire, the survey has been designed on the Google form. The questionnaire was discriminated to the respondent through different online platform including email, social media etc. Secondary communication via text, telephone was also made to some target respondents to stimulate the survey as a reminder as well as to get quick response. All the participants of the study are from Dhaka city, the capital of Bangladesh. Figure 1 illustrates the survey area of this study.

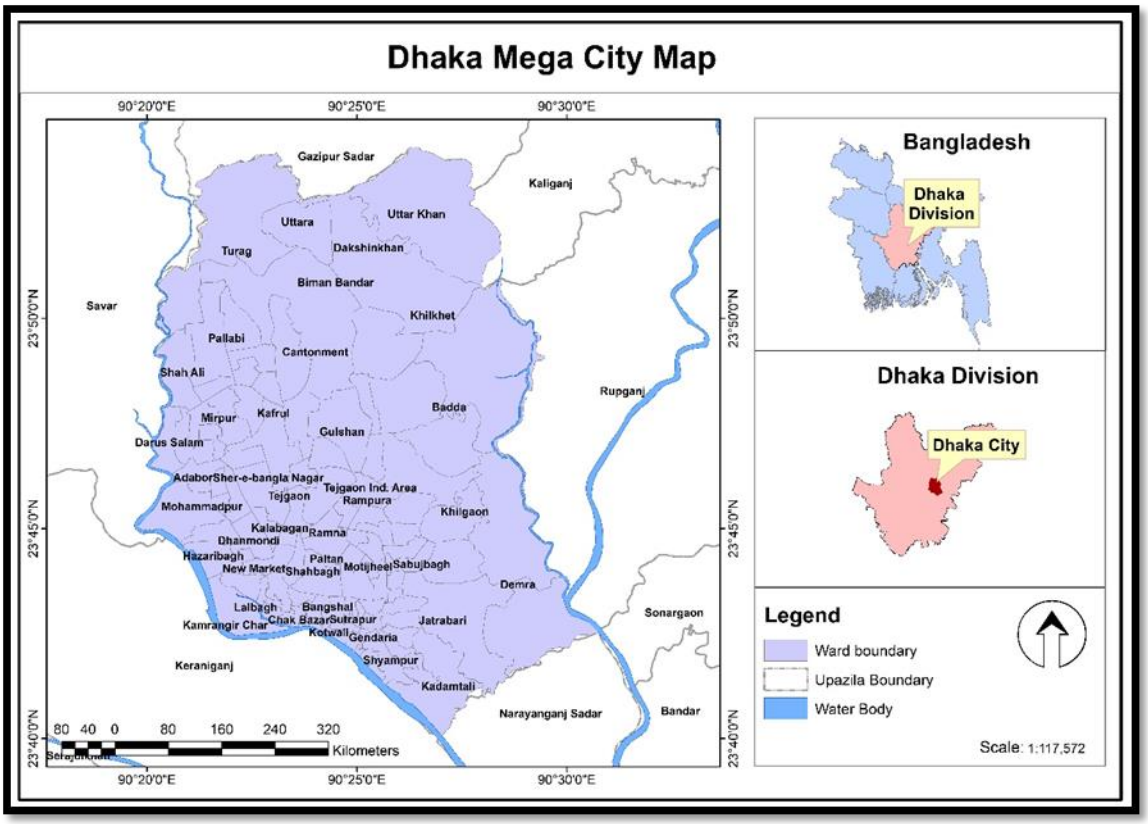


Figure 1: Study Area Map of Dhaka Mega City

## 3. ANALYSIS AND RESULTS

### 3.1 Responded profile

A total of 300 responders completed the online survey. Regarding the demographical characteristics, of the total 300 respondents, 168 men accounted for 56% of the test population, while 130 women accounted for 43.33% and the remaining 2 persons (0.66%) prefers not to comment on this gender issue. From those 67% respondents are inside of Dhaka city and else 33% respondent are outside of Dhaka city. In age analysis, below 18 years is 4.66%, from 18 to 24 years are 53.66%, from 24 to 30 years are 19.66%, from 30 to 36 years are 4.66%, from 36-42 years are 5%, from 42 to 48 years are 3.66%, from 48 to 54 years are 4.33%, and above 54 years are 4.33%. In terms of education status, we can see which have no formal education are 0.66 percentage. Up to primary 1%, up to secondary school 4.66% and up to higher secondary school 12.66% and graduate respondents are 61%. 20% have the degree of post-graduations. 78% of respondents have monthly income less than 20

thousands, 11.33% have twenty to forty thousand monthly income, 7% have forty to sixty thousands monthly income, 1.66% have sixty to eighty thousands monthly income, none have eighty thousands to one lakh monthly income and 2% have more than one lakh monthly income in BDT. In analysis of current profession of respondents Govt. employee 7.66%, Private employee 10.66%, Self-employed (Business) 4.66%, Student 63%, Unemployed 6.33%, Other 7.66%. When evaluating the major purpose of walking, 14.33% respondents walk for job, 4.33% walk for shopping, 46% walk for education, 1% walk for drop-off and pickup, 16.66% walk for Recreation/exercise/prayer and 17.66% walk for others purpose respectively. In case of average walking time per day, 5% of pedestrians spent less than 15 minutes, 24.33% pedestrians spent 15-30 minutes, 28.66% pedestrians spent 30-45 minutes, 16% pedestrians spent 45-60 minutes, 17.33% pedestrians spent 1-1.5 hours and remaining 8.66% pedestrians spent more than 1.5 hours in walking. Over the past one year, 110 (36.66%) respondents have experienced traffic injury one to two times while walking, 25 respondents have faced three to five injury crashes and 10 respondents have face more than five injury crashes.

### 3.2 Pedestrian Satisfaction on Different Existing Facilities

Table 1 presents the overview of level of satisfaction of the respondents on the walking and crossing facilities in Dhaka city.

In regard to the walking facilities, around 49.33 percent expressed they are not satisfied with the existing walking facilities (31.33% not much satisfied or fairly dissatisfied and 54 (18%) not at all satisfied or very dissatisfied). In case of crossing facilities this figure is more than that of the walking facilities. Around 52.33% respondents are dissatisfied with the crossing facilities (35% not much satisfied or fairly dissatisfied and 17.33% are not at all satisfied or very dissatisfied). Only 6.66% users among the respondents are very satisfied and 35.33% respondents are fairly satisfied with the existing walking facilities. In case of crossing facilities, these values are that 5.33% and 31.66% respectively. In both cases, average level of satisfaction goes to the below the neutral/median level i.e. fall under the dissatisfactory level, 2.813 for walking facilities and 2.726 for crossing facilities.

In walkway/footpath physical condition i.e. width, height shows that 6% respondents are very satisfied, 31.66% respondents are fairly satisfied, 10% respondents are neither satisfied nor dissatisfied, 26.66% respondents are not much satisfied or fairly dissatisfied and 25.66% are not at all satisfied or very dissatisfied.

In case of aesthetic condition of walkway/footpath i.e., texture of surface shows that 4.33% respondents are very satisfied, 31.33% respondents are fairly satisfied, 10.66% respondents are neither satisfied nor dissatisfied, 27% respondents are not much satisfied or fairly dissatisfied and 26.66% are not at all satisfied or very dissatisfied.

With regards to the walkway/footpath environmental condition i.e., cleanliness and free from obstacle shows that 2% respondents are very satisfied, 23% respondents are fairly satisfied, 7.66% respondents are neither satisfied nor dissatisfied, 27.66% respondents are not much satisfied or fairly dissatisfied and 40% are not at all satisfied or very dissatisfied.

Proper location of foot overbridge is one of the important factors which encourage pedestrians to use this facility. However, in case of Dhaka city, only 40.33% are satisfied with the location of foot overbridge (9% respondents are very satisfied, 31.33% respondents are fairly satisfied), whereas 41.66% are not satisfied with the present location of foot overbridge (28.66% fairly dissatisfied and 13% very dissatisfied). In case of number and placement of on-road crossing facilities like zebra crossing, 7% respondents are very satisfied, 31% respondents are fairly satisfied, 16.33% respondents are neither satisfied nor dissatisfied, 26.33% respondents are not much satisfied or fairly dissatisfied and 19.33% are not at all satisfied or very dissatisfied. The mean value of satisfaction number and placement of on-road crossing facilities is 2.8.

Table 1: Pedestrian Satisfaction on different existing facilities

| How satisfied are you with the following? | Very Satisfied | Fairly Satisfied | Neither satisfied nor dissatisfied | Fairly dissatisfied | Very dissatisfied | Mean Satisfactory level (Std. dev) |
|---|---|---|---|---|---|---|
| **Walking facilities** | 20, 6.66% | 106, 35.33% | 26, 8.66% | 94, 31.33% | 54, 18% | 2.813 (2.6) |
| **Crossing facilities** | 16, 5.33% | 95, 31.66% | 32, 10.66% | 105, 35% | 52, 17.33% | 2.726 (2.5) |
| **Walkway/footpath physical condition i.e., width, height** | 18, 6% | 95, 31.66% | 30, 10% | 80, 26.66% | 77, 25.66% | 2.656 (2.4) |
| **Walkway/footpath aesthetic condition i.e., texture of surface** | 13, 4.33% | 94, 31.33% | 32, 10.66% | 81, 27% | 80, 26.66% | 2.596 (2.41) |
| **Walkway/footpath environmental condition i.e. cleanliness and free from obstacle** | 6, 2% | 69, 23% | 23, 7.66% | 82, 27.33% | 120, 40% | 2.196 (2.0) |
| **Location of foot-over bridge** | 27, 9% | 94, 31.33% | 54, 18% | 86, 28.66% | 39, 13% | 2.946 (2.7) |
| **Number and placement on road crossing facilities like zebra crossing** | 21, 7% | 93, 31% | 49, 16.33% | 79, 26.33% | 58, 19.33% | 2.80 (2.6) |
| **Visibility of zebra crossing** | 28, 9.33% | 88, 29.33% | 47, 15.66% | 75, 25% | 62, 20.66% | 2.816 (2.6) |
| **Mid-road pedestrian refuge** | 12, 4% | 70, 23.33% | 38, 12.66% | 72, 24% | 108, 36% | 2.353 (2.2) |
| **Street lighting** | 44, 14.66% | 103, 34.33% | 43, 14.33% | 64, 21.33% | 46, 15.33% | 3.116 (2.9) |
| **Overall pedestrian safety facilities** | 18, 6% | 84, 28% | 29, 9.66% | 80, 26.66% | 89, 29.66% | 2.54 (2.4) |

Note: Mean calculated considering Very Satisfied=5, Fairly Satisfied=4, Neither/nor=3, Fairly Dissatisfied =2, Very Dissatisfied=1

Visibility of zebra crossing is also an import issue for its functionality. Study shows that 9.33% respondents are very satisfied, 29.33% respondents are fairly satisfied, 15.66% respondents are neither satisfied nor dissatisfied, 25% respondents are not much satisfied or fairly dissatisfied and 20.66% are not at all satisfied or very dissatisfied with this issue. In case of mid-road pedestrian refuge, it shows that 4% respondents are very satisfied, 23.33% respondents are fairly satisfied, 12.66% respondents are neither satisfied nor dissatisfied, 24% respondents are not much satisfied or fairly dissatisfied and 36% are not at all satisfied or very dissatisfied.

Street lighting is the only facilities which represents mean satisfaction value is above average (mean=3.116). As implied by the respondents, 14.66% respondents are very satisfied, 34.33% respondents are fairly satisfied with the existing street lighting condition. In contrary, 21.33% respondents are not much satisfied or fairly dissatisfied and 15.33% are not at all satisfied or very dissatisfied. Around 56.66% of respondents opined that they are not satisfied with the overall pedestrian safety facilities (26.66% respondents are not much satisfied or fairly dissatisfied and 29.66% are not at all satisfied or very dissatisfied). In contrast, 34% are satisfied with the present pedestrian safety facilities. Around 9.66% respondents are neither satisfied nor dissatisfied. The overall satisfaction level is significantly low, 2.54.

From this chart we find that majority of the responders are not much satisfied on different existing walking and crossing facilities in Dhaka city. The mean responses of all the questions related to satisfactory level vary from 2.196 to 2.946 except street lighting which lie in between ‘neutral’ and ‘Fairly Dissatisfied.

### 3.3 Pedestrian Risk Perception

In pedestrian risk perception, total four parameters are analyzed with Likert scale. Among them two are related to positive behavior and two are related to negative behavior.

The respondents were asked "How much safe do they feel as pedestrian when they cross road through running vehicle". Around 56.66% of the people consider crossing road through running vehicle is "Not at all safe or very unsafe". Only 6.33% respondents feel that it is safe. In case of mobile while crossing, almost 75.33% considered crossing road using mobile phone are not at all safe or very unsafe. Only 2.33% considered it is safe. The mean responses related negative behaviour questions are 1.636 and 1.386 which lie in between 'fairly unsafe' and 'very unsafe'. This implies that the respondent is very much concern about their risk.

Cross road on Zebra crossing, almost 67.66% considered it is safe (23% very safe and 44.66% safe), which mean value is 3.703 falls in between neutral and safe. However, around 32.32% including users 15.66% neutral has negative perception regarding this. Almost 75% respondents opined that walking on footpath is safe (34.66% very safe and 40.33% safe). The mean value risk perception level regarding this is 3.94, lies in between neutral and safe (Table 2).

Table 2: Pedestrian Risk Perception

| How much safe do you feel as pedestrian when you are | Very safe | Fairly safe | Neither safe nor unsafe | Not much safe or fairly unsafe | Not at all safe or very unsafe | Mean Satisfactory level (Std. dev) |
|---|---|---|---|---|---|---|
| **Cross road through running vehicle** | 3, 1% | 16, 5.33% | 20, 6.66% | 91, 30.33% | 170, 56.66% | 1.636 (1.32) |
| **Cross road using mobile phone or taking with someone** | 3, 1% | 4, 1.33% | 25, 8.33% | 42, 14% | 226, 75.33% | 1.386 (1.02) |
| **Cross road on Zebra crossing** | 69, 23% | 134, 44.66% | 47, 15.66% | 39, 13% | 11, 3.66% | 3.703 (2.98) |
| **Walk on footpath** | 104, 34.66% | 121, 40.33% | 36, 12% | 31, 10.33% | 8, 2.66% | 3.94 (3.04) |

Note: Mean calculated considering Very safe=5, Fairly safe=4, Neither safe nor unsafe=3, Not much or fairly unsafe =2, and Not at all safe or very unsafe=1.

## 4. PEDESTRIAN ATTITUDE

### 4.1 Crossing the Road

In pedestrian attitude i.e., their thinking/believe to cross the road related section total seven parameters are analysed with Likert scale. Table 3 presents overview of response on attitude related to cross the road with mean and standard deviation of Likert scale value.

The mean Likert Scale value of responses of all the questions vary from 1.456 to 4.52 which lies in between 'neither/nor' and 'strongly disagree'. Respondents were asked about their thinking on 'road crossing through running vehicle is normal and acceptable' and around 79.33% respondents replied as negative. On the other hand, when they were asked 'driver should always yield to pedestrian', around 72.32% were positive

Table 3: Attitude Related to cross the road

| Your thinking/believe to cross the road (Please rate your scale) | Strongly agree | Agree | Neither | Disagree | Strongly Disagree | Mean (Std. Dev.) |
|---|---|---|---|---|---|---|
| **Road crossing through running vehicle is normal and acceptable** | 14, 4.66% | 23, 7.66% | 25, 8.33% | 79, 26.33% | 159, 53% | 4.153 (3.80) |
| **Driver should always yield to pedestrian** | 70, 23.33% | 83, 27.66% | 64, 21.33% | 54, 18% | 29, 9.66% | 2.63 (2.43) |
| **It is acceptable to violate the rules while walking or crossing when I am in a hurry** | 10, 3.33% | 25, 8.33% | 23, 7.66% | 71, 23.66% | 171, 57% | 4.226 (3.86) |
| **If there is foot-over bridge or underpass nearby, we can generally avoid that** | 7, 2.33% | 1, 0.33% | 7, 2.33% | 92, 30.66% | 193, 64.33% | 1.456 (1.12) |
| **It is ok to group cross even through running traffic** | 20, 6.66% | 42, 14% | 46, 15.33% | 73, 24.33% | 119, 39.66% | 3.763 (3.47) |
| **It is acceptable to cross the road while using mobile and earphone** | 8, 2.66% | 6, 2% | 19, 6.33% | 56, 18.66% | 211, 70.33% | 4.52 (4.09) |
| **There should be punishment for pedestrians who cross through running vehicle or do not use footbridge for crossing despite having good foot-over bridge/underpass** | 149, 49.66% | 68, 22.66% | 23, 7.66% | 26, 8.66% | 34, 11.33% | 2.093 (2.05) |

Note: Mean calculated considering Strongly Agree=1, Agree=2, Neither=3, Disagree=4, and Strongly Disagree=5.

Around 80.66% believe that violation of rules during walking or crossing is unacceptable in any circumstances. When it has asked that if there is foot-over bridge or underpass nearby, we can generally avoid almost 95% did not agree with that (64.33% strongly disagree and 30.66 disagree). Nearly 64% believe crossing through running traffic is not ok though they are in group. Regarding crossing while using mobile phone or earphone, almost 90% stated that that are not acceptable. Regarding punishment 72.32% attitude is positive. They believe the responsible should be punished who are violating crossing rules or not using existing facilities. However, around 20% is not in favour of punishment. Average Likert scale attitudes value goes in between agree and neutral level, mean-=1.456.

### 4.2 Walking along the Road

The responses related to attitude on walking along the road presented in Table 4. Around 87% responders believe that using footpath is not a matter of choice, but it must. Moreover, 76% opined that they should use foot though there is footpath on only one side. When they were asked one might walk together with a group without considering footpath, 80% disagreed. Mean Likert scale values regarding the no use of footpath in any circumstances varied between 4.013 to 4.16, lies under strongly disagree. Attitude also judged regarding the importance of visibility at night-time as a pedestrian. Around 75 believe they should be visible wearing visible clothing at night. In contrary, 29.33% did not agree with that excluding 19.33% in between. The mean is 2.686 lies in neutral position.

Table 4: Attitude Related to Walking along the Road

| Your thinking/believe to walk along the road (Please rate your scale) | Strongly agree | Agree | Neither | Disagree | Strongly Disagree | Mean |
|---|---|---|---|---|---|---|
| **Even though there is a footpath, it is my choice to use while walking** | 9, 3% | 18, 6% | 31, 10.33% | 106, 35.33% | 136, 45.33% | 4.14 (3.75) |
| **Even though there is footpath on one side of road, I can walk along any side** | 10, 3.33% | 19, 6.33% | 43, 14.33% | 113, 37.66% | 115, 38.33% | 4.013 (3.63) |
| **Without considering footpath, one might walk together with a group** | 10, 3.33% | 18, 6% | 33, 11% | 92, 30.66% | 147, 49% | 4.16 (3.78) |
| **It is safe to walk wearing visible clothing at night** | 76, 25.33% | 78, 26% | 58, 19.33% | 40, 13.33% | 48, 16% | 2.686 (2.55) |

Note: Mean calculated considering Strongly Agree=1, Agree=2, Neither=3, Disagree=4, and Strongly Disagree=5

## 5. PEDESTRIAN BEHAVIOUR

### 5.1 Crossing the Road

Table 5 presents responses on the behavioural i.e. what are they doing/practicing attributes related to crossing the roads. There are eight attributes presented with Likert scale. The mean value of responses of all the questions vary from 1.55 to 2.863 which lie in between 'rarely' and 'often'.

Only 32% responders stated that they never cross the road through running vehicles. Other 68% have the tendency to cross the road through running vehicle. When they are asked regarding the crossing places, 80% mentioned they have practiced crossing road other than the pedestrian crossing at different level. On the other hand, 66% stated that they never cross the road outside the pedestrian crossing if there is a crosswalk or zebra crossing nearby. Moreover, 47.33% stated that they never avoid using pedestrian bridges or underpasses due to inconvenience. In contrary, around 28% Avoid using pedestrian bridges or underpasses due to inconvenience, even if that is located nearby.

Table 5: Behaviour Related to Crossing the Road

| Please mark how often you do the following things as a pedestrian | Never | Rarely | Often | Very often | Always | Mean (Std. dev) |
|---|---|---|---|---|---|---|
| **Cross the road through running vehicle** | 96, 32% | 107, 35.66% | 75, 25% | 19, 6.33% | 3, 1% | 2.086 (1.75) |
| **Cross streets at places other than the pedestrian crossing** | 81, 27% | 124, 41.33% | 60, 22% | 26, 8.66% | 3, 1% | 2.153 (1.81) |
| **Use mobile/earphone during road crossing** | 198, 66% | 60, 20% | 28, 9.33% | 7, 2.33% | 7, 2.33% | 1.55 (1.21) |
| **By showing signal to drivers by hands I cross the road** | 42, 14% | 86, 28.66% | 88, 29.33% | 39, 13% | 45, 15% | 2.863 (2.32) |
| **Cross outside the pedestrian crossing even if there is a crosswalk or zebra crossing nearby** | 149, 49.66% | 75, 25% | 45, 15% | 20, 6.66% | 11, 3.66% | 1.896 (1.60) |
| **Avoid using pedestrian bridges or underpasses due to inconvenience, even if that is located nearby** | 142, 47.33% | 75, 25% | 45, 15% | 23, 7.66% | 15, 5% | 1.98 (1.68) |
| **Run across the street without looking because I am in a hurry** | 208, 69.33% | 37, 12.33% | 28, 9.33% | 16, 5.33% | 11, 3.66% | 1.616 (1.35) |
| **Follow group pedestrians who cross through running vehicle** | 119, 39.66% | 92, 30.66% | 57, 19% | 20, 6.66% | 12, 4% | 2.046 (1.72) |

Note: Mean calculated considering Never=1, Rarely=2, Often=3, Very often=4, and Always=5.

In case of use of mobile/earphone during road crossing, 66% behaviour is positive, they never used during crossing. However, about 85% admitted that they tried to stop driver forcefully showing hands to cross the road. Mean value of practice is 2.863. In contrary, 69.33% stated that they never run across the street without looking though they are in a hurry. In regard to group crossing, 60.32% acknowledged that they followed group pedestrians though they cross through running vehicle (30.66% rarely, 19% often, 6.66% very often and 4% always).

### 5.2 Walking along the Road

To evaluate the behaviour related to walking along the road, responders were asked three questions related to walking behaviour. They are questioned how often they are practicing/following those behavior and the answer was taken with Likert scale.

Regarding the use of footpath, 62.66% stated the use footpath always or very often if there is footpath at least in one side (29.33% always and 33.33% very often). The Likert scale value is 3.716 falls between often and very often. Regarding walking on the right side if there is no footpath, around 30% behaviour is negative i.e. never or rarely practice that. Around 27% responders often do that. Moreover, 58.66% claimed that they consider using footpath importantly though they walk in a group (Table 6).

Table 6: Behaviour Related to Walking along the Road

| Please mark how often you do the following things as a pedestrian | Never | Rarely | Often | Very often | Always | Mean (Std. dev.) |
|---|---|---|---|---|---|---|
| **Use footpath if there is one in one side** | 15, 5% | 33, 11% | 63, 21% | 100, 33.33% | 89, 29.33% | 3.716 (2.91) |
| **Walk on the right side of road if there is no footpath** | 47, 15.66% | 43, 14.33% | 80, 26.66% | 78, 26% | 52, 17.33% | 3.15 (2.60) |
| **Don't use footpath while walking in a group** | 175, 58.66% | 40, 13.33% | 39, 13% | 16, 5.33% | 30, 10% | 1.953 (1.64) |

Note: Mean calculated considering Never=1, Rarely=2, Often=3, Very often=4, and Always=5.

## 6. CONCLUSIONS

This study attempted to evaluate stated pedestrian behaviour, attitude and perception in urban areas of Bangladesh using questionnaire survey. Altogether 40 questions were asked including demography of the participants, pedestrian satisfaction on different existing facilities, reasons and stated preference for crossing, risk perception, attitude, and behaviour for both walking along and crossing the road. Level of satisfaction, attitude, perception, and behaviour are measured using five scale points Likert scale. Due to current COVID 19 pandemic, online survey was made.

A total of 300 responses were analysed age ranged from 18 to 54+. Among them 56% are male and remaining are female under different level of education, income, and profession. The major trip purpose of the responders is education, accounting for 46% followed by other 17.66%, Recreation/ exercise/ prayer, 16.66%; Job, 14.33%. Average walking time of majority of responders varies from 15 to 60 minutes. Regarding safety experience, 48.32% responders injured at least 1 time while walking within the last 1 year, 11.66% 3 and above times. From safety point of view, it is very alarming rate and concerning as well.

Majority of the pedestrians are dissatisfied with the existing walking and crossing facilities and the mean satisfactory level varies between neutral and fairly dissatisfied, except street lighting. People are worst satisfied with the walkway/footpath environmental condition i.e., cleanliness and free from obstacle (mean=2.196), this is followed by mid road pedestrian refuge (mean 2.353), Walkway/footpath aesthetic condition i.e., texture of surface (mean=2.596), walkway/footpath

physical condition i.e. width, height (mean=2.656). Reason for not using footpath or overbridges also demonstrate that the leading cause for not using these facilities is illegal occupancy. This is followed by aesthetic e.g., dirty, congested and geometric e.g., narrow, high and planning problem e.g., foot overbridge is not in proper place.

Therefore, priority initiative should be taken to improve the environmental condition of footpath/walkway of the city area e.g., getting rid of illegal activities like vendors, hawker, dumping on the footpath. Also, initiative should be taken to make the waking facilities safe, comfortable, environmentally friendly through improving physical and aesthetic condition. For crossing, at grate signalized crossing (pedestrian green phase with push button) is the main choice. This is followed by foot overbridge/underpass and zebra crossing with traffic clamed measure. As at great crossing facility is convenient for all type of pedestrian including people with disability or elderly people, augmentation of this type of facilities with proper design is very important.

Main objective of this study is to evaluate the risk perception, attitude, and behaviour of the pedestrian. Most of the responders perceived crossing through running vehicle is unsafe (87%) and this perception reflect on their attitudes (crossing unacceptable, 79.33%). But when it comes to the behaviour, only 32% reply that they never cross through running vehicle. In case of using mobile phone or taking while crossing, imitate almost same patter between perception, attitude and behaviour. Around 89.33% feels it is unsafe, same percent disagree to cross the road while using mobile and earphone but only 66% practice this. Regarding the use of footpath or zebra crossing for walking and crossing, majority perceived it is safe (75% and 67.66% respectively). Their attitude is even stronger on this issue. More than 75% disagreed that they can avoid footpath if it is available at least in on side. In case of using designated crossing facilities including foot-over bridge or underpass, the percentage goes to 90%. However, only 29.33% responses that they always use footpath for walking. On the other hand, around 48% cross outside crosswalk or avoid foot overbridge or underpass even it is nearby.

From this analysis it is evident that perception and attitude is closely related and most of the cases that is very positive. But there is huge gap between perception, attitude, and behaviour. Most of the people have right feelings, right understanding or believe, but they are practicing differently. There are two issues, one is behavioural problem and other is problem with the infrastructure, but platform might be different. So, target oriented engineering and behavioural i.e., education and enforcement measures need to be taken. In case of use of crossing and walking facilities, obviously there is problem with the engineering or infrastructure. That is also evident from the first part of the analysis. Therefore, need proper engineering intervention to ensure adequate well-designed crossing and walking facilities. Enforcement is also needed to a certain extent to ensure proper use. In case of using mobile phone or group cross or walking or running, problem is mainly related to the revealed behaviour. For this target-oriented education and enforcement program need to be taken.

This study mainly provides preliminary analysis of pedestrian behaviour and attitude survey to understand pedestrians' attitudes towards crossing, walking, and using different pedestrian facilities along with their usual walking and crossing behaviour. Like many other studies, this study has many limitations. Due to current COVID pandemic situation and limited resources and time limitations, only a limited number of samples has been used for this study. Improved sample size may provide better understanding and would be useful to confirm the results presented here. The analysis could be extended through using different statistical tests to see the influence of different attributes on perception, attitude, and behaviour of users. In addition, application of advance modelling technique e.g., Structural Equation Model (SEM) to identify the factors significantly affect risk perception and unsafe behaviour of pedestrian as well as to explore the intrinsic causal relationships among the variables that affect walking and crossing behaviour could be a highly potential future research avenue.

## ACKNOWLEDGEMENTS

The authors would like to thank MD. Shifun Newaz, Assistant professor, Accident Research Institute (ARI), BUET and Shahnewaz Hasanat-E-Rabbi valued contribution to prepare and finalize the questionnaire.

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