



EFFECTIVENESS OF CITY BUS STOPS IN DHAKA METROPOLITAN

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Abstract: Effectiveness of the existing local bus stops as transition points in mass transportation system of Dhaka metropolitan city area was investigated through a questionnaire survey among 120 randomly selected passengers at four bus stops namely, Azimpur, Jhigatola, Collegegate and Motijheel, between March and June, 2004. Bus stop was found as one of the major factors of mass transportation system for common people that influence the standard of bus services. Inappropriate location and design made the stoppages inconvenient as a transit. In search of effectiveness, this paper emphasizes on the everyday problems faced by the users of different socio-economic status at bus stops. A guideline has also been suggested to establish effective bus stops for Dhaka metropolitan city in terms of location, design and services.

Key words: Bus stop, mass transportation, Dhaka metropolitan

Introduction

The bus service is currently playing a major role in mass transportation system in Dhaka metropolitan for middle and low income people. Increasing population and urbanization have resulted in additional bus user volume (Ahsan, 1997). According to Dhaka City Corporation (DCC) the total number of the bus stoppages in Dhaka metropolitan is around 120 (personal communication). Existing bus stops are not convenient as a transit route with other transportation systems although bus stops are among the key components of bus services and road transportation system (Ullah, 2004). The mass transit with vehicle is low (27%) in comparison to walking (73%) as the travel mode in Dhaka city (Ullah, 2004). In absence of a reliable public transport system, major share of road space remains occupied by small vehicles. The bus services, as mass transport system, have not been able to provide services against the demand (Ullah, 2004). Therefore, existing deficiencies in mass transport services against increased road traffic have jeopardized the city transport system. In the context of Least Developed Country's (LDC) bus service, emphasize has been given to find out realistic solution of transportation problems in metropolitan Dhaka (Ullah, 2004). A few studies have been reported on mass transportation system of Bangladesh (Ullah, 2004; Kabir, 1997; Ahsan, 1990). Bowman and Turnquist (1981) and Dajni and Gilbert (1978) also worked on this issue.

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The main objective of the present study was to evaluate the effectiveness of present bus stops and to suggest guideline for developing effective bus stops for Dhaka metropolitan. The specific objectives of the study were - (i) to assess the general and physical characteristics of selected bus stops; (ii) to determine the effectiveness of local bus stoppages through the passengers' perception; and (iii) to develop a general guideline for future improvement of the existing condition of the bus stops.

Materials and Methods

The study was conducted through a questionnaire survey at four randomly selected bus stops namely, Azimpur, Jhigatola, College Gate and Motijheel (Fig. 1) in Dhaka metropolitan area. Four bus stops were randomly selected from four different areas—one from a residential area (Azimpur), one from a commercial area (Motijheel) and the rest two from mixed area (Jhigatola and Collegegate). The residential, commercial and institutional characters of Jhigatola and Collegegate were considered as mixed type area. Thirty randomly selected passengers from each bus stop were interviewed between March and June, 2004. The perception of the passengers on the effectiveness of bus stops as transit point in Dhaka metropolitan city were collected on seven different criteria, viz., reasons behind travel by bus, mode used to reach the bus stops, opinion on location suitability of the bus stops, bus stop facilities, aesthetic environment of the bus stops, reasons for dissatisfaction with bus stop facilities and scope for future improvement of the existing condition of the bus stops. Socio-economic profile like age, gender, education and occupation of the passengers were also collected. The physical characteristics of the selected bus stops were also identified.

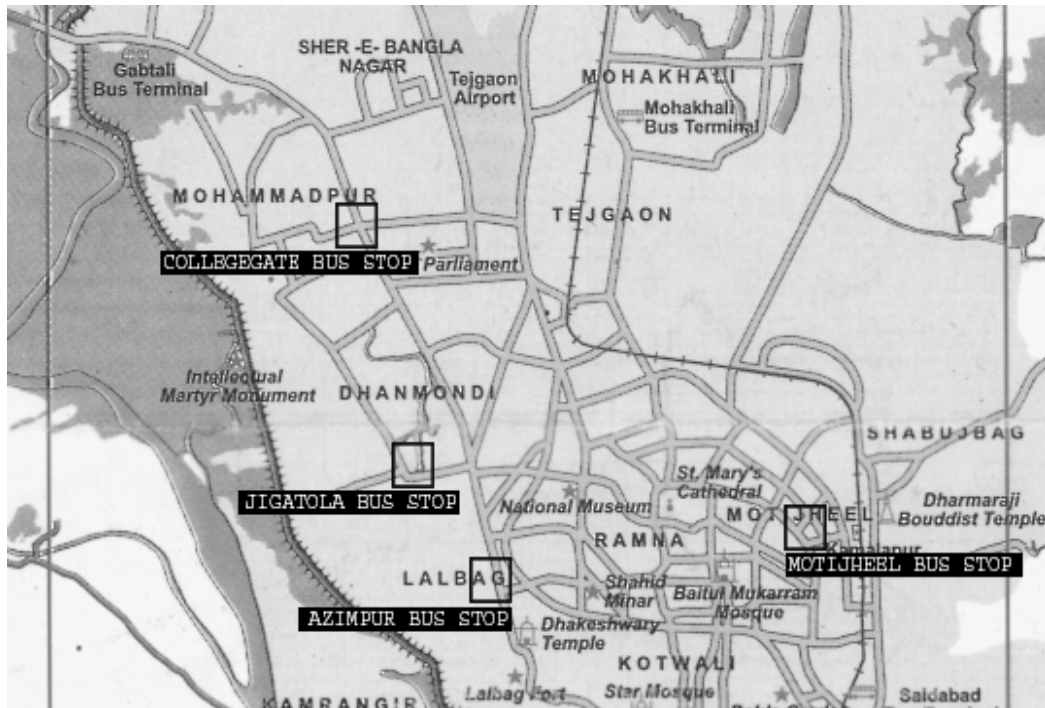


Fig. 1. Map of Dhaka city showing the location of studied bus stops.

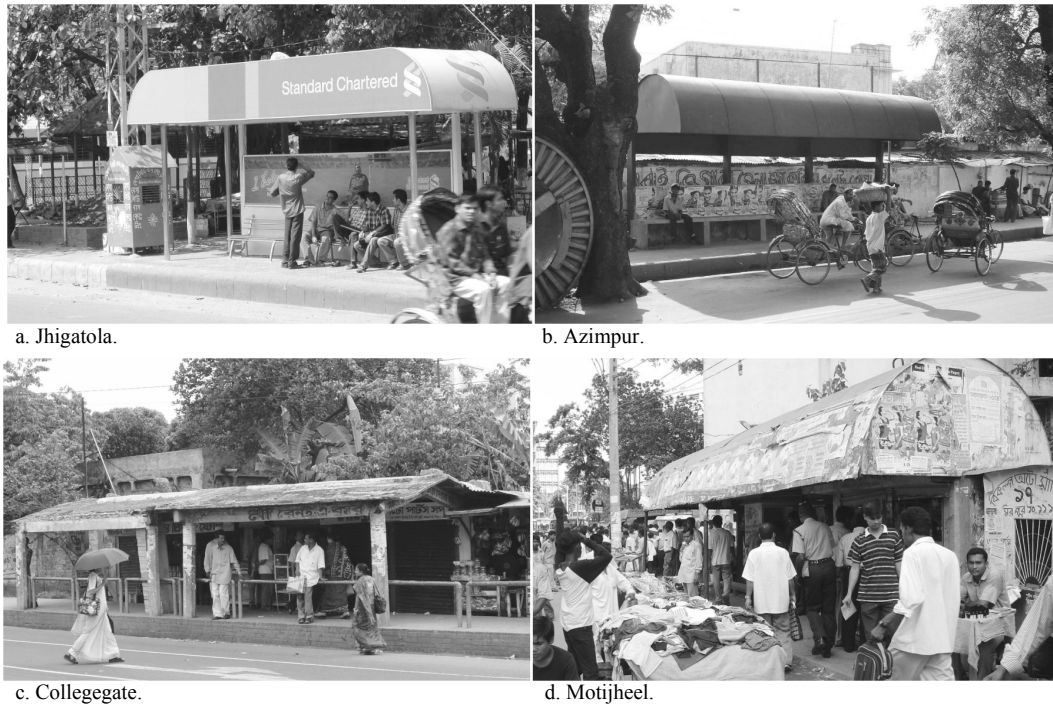


Fig. 2. Selected bus stops of Dhaka metropolitan city, in 2004.

Results

The general characteristics of the selected bus stops are summarized in Table 1.

Table 1. General characteristics of selected bus stops in Dhaka metropolitan city.

	Jhigatola	Azimpur	College Gate	Motijheel
Area type	Mixed	Residential	Mixed	Commercial
Bus route:	Mohammadpur -Jhigatola - Shahbag - Gulisthan - Motijheel	Mirpur - Shyamoli - Azimpur	Shyamoli - Mohammadpur - Jhigatola - Shahbag	Mirpur - Shyamoli - Mohammadpur - Jhigatola - Shahbag - Motijheel
Available bus services:	1.Mega City Bus 2.City Bus	1.Metro link 2.Other local buses	1.Metro link 2.Duldul Paribahan 3.Druti 4.Other local buses	1.Metro link 2.City bus 3.Premium 4.Volvo 5.Other local buses
Existing facilities:				
1. Shed	Yes	Yes	Yes	Yes
2. Sitting	Yes	Yes	No	No
3.Light	Yes	No	No	No
4. Phone	No	No	Yes	No
5. Stationary	No	No	Yes	Yes
Existing major problems:				
1. Placement	On the footpath	On the footpath	On the footpath	On the footpath
2. Bus schedule	Absent	Absent	Absent	Absent
3. Ancillary services	Absent	Absent	Present but illegal	Absent

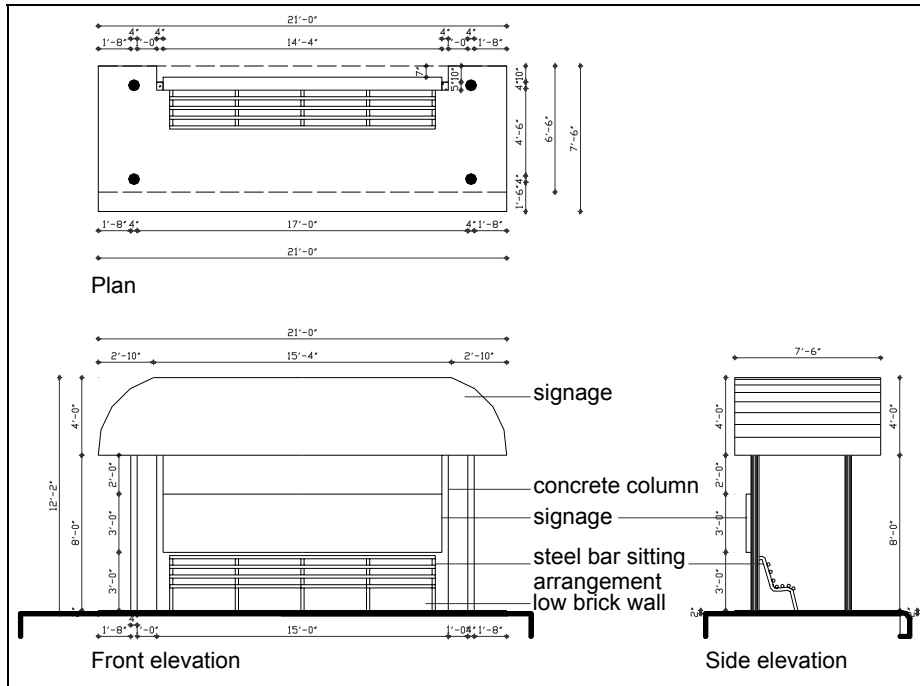


Fig. 3. Architectural drawings of Jhigatola bus stop in Dhaka metropolitan in 2004.

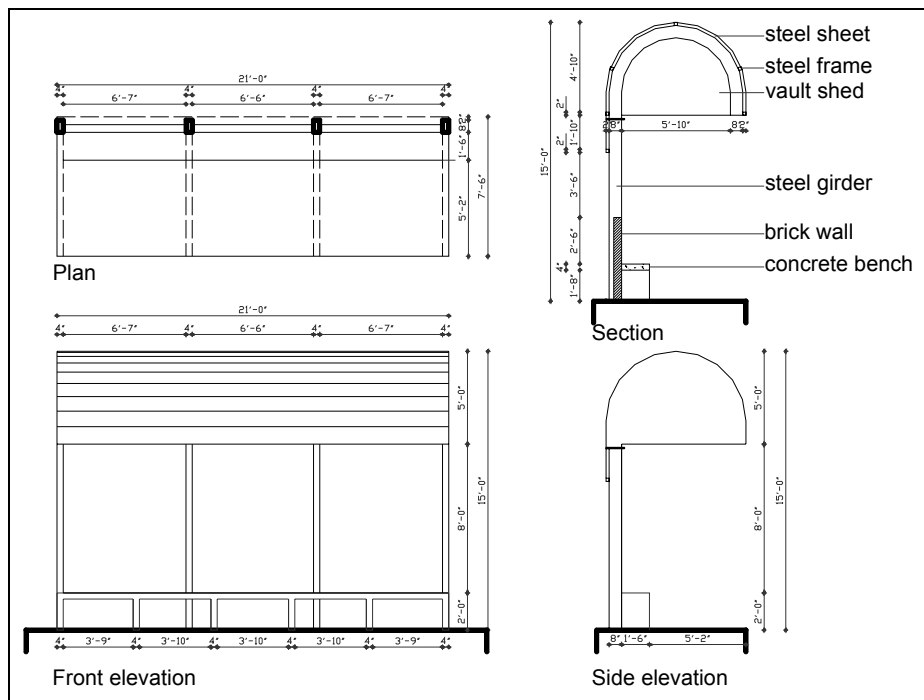


Fig. 4. Architectural drawings of Azimpur and Motijheel bus stops (prototype design was used in both the bus stops) in Dhaka metropolitan in 2004.

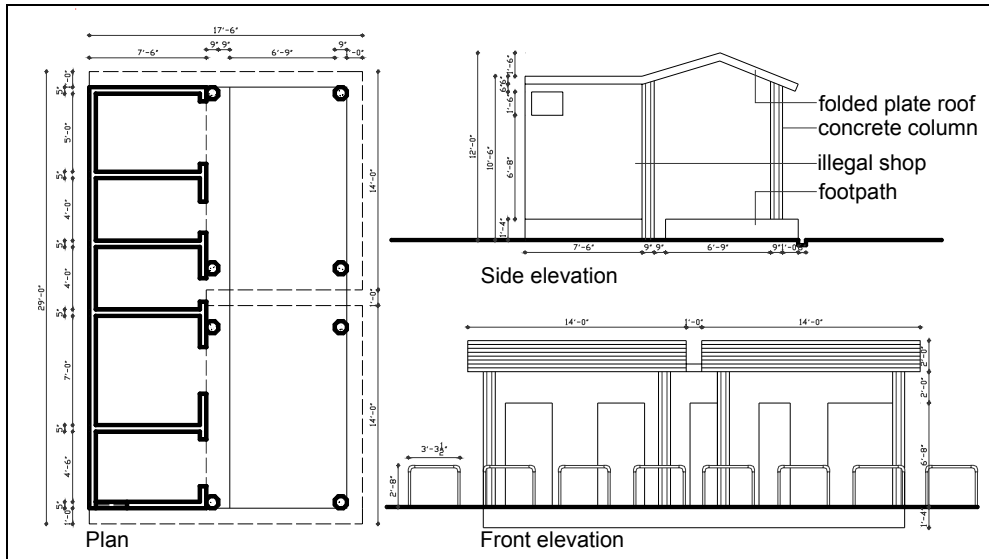


Fig. 5. Architectural drawings of Collegegate bus stop in Dhaka metropolitan in 2004.

Scio-economic profile of the passengers: The demographic characteristics of the passengers are shown in Fig. 6 and 7. Among different age groups, the maximum number of the passenger (30%) belonged to age group 30-44 years, which was followed by 20-29 (28.34%), 14-19 (23.33%), 45-59 (11.67%), 59+ (4.99%) and 0-14 years (1.67%) age groups (Fig. 6).

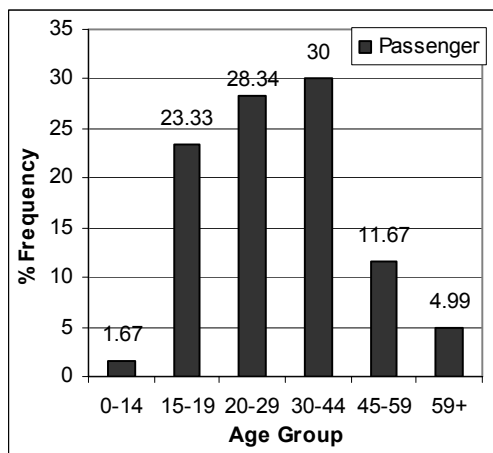


Fig. 6. Age distribution of the bus passengers in Dhaka metropolitan in 2004.

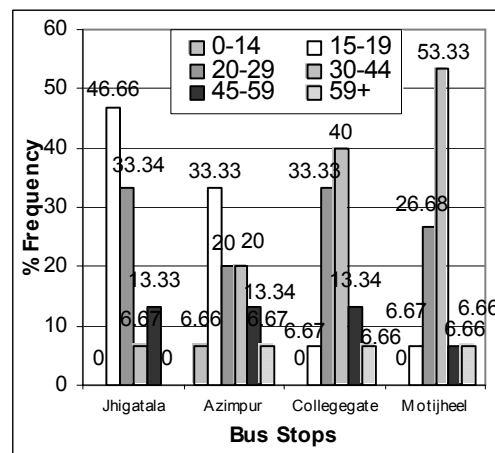


Fig. 7. Age distribution of the passengers at 4 selected bus stops in Dhaka metropolitan in 2004.

The age distribution of the passengers was found to vary according to types of the area. Passengers between age 0 -14 were only found at Azimpur bus stop (6.66%). The highest number of the passengers at age group 20-29 was found at Jhigatala (33.34%) and Collegegate (33.33%) and the lowest (20%) at Azimpur. Passengers of age group 30-44 were dominant at Motijheel (53.33%) and Collegegate (40%) while passengers of age group 15-19 were highest at Jhigatala (46.66%) and Collegegate (33.33%). The percentage of the passengers of age group 59+ was similar at

Azimpur, Collegegate and Motijheel (6.66%). No passenger of this age group was found at Jhigatola bus stop (Fig. 7).

In terms of gender distribution of the passengers overwhelming dominance of men was observed at all bus stops –it was 93.33%, 80%, 73.33% and 66.67% at Jhigatola, Motijheel, Azimpur and Collegegate respectively. While the maximum (33.33%) female passengers was present at Collegegate following 26.67% at Azimpur, 20% at Motijheel and 6.67 % at Jhigatola. The male female ratio of the passenger at Collegegate bus stop was nearly equal than that of other three bus stops (Fig. 8).

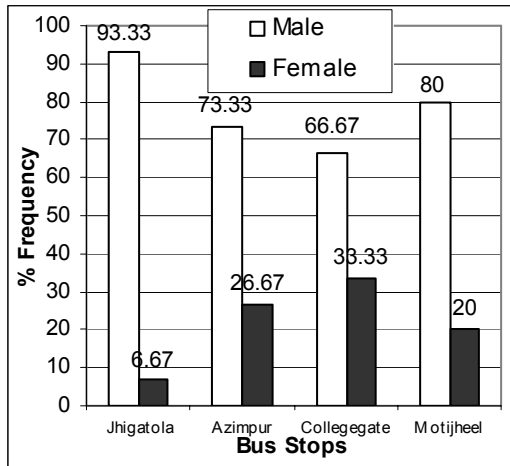


Fig. 8. Gender distribution of the passengers at 4 selected bus stops in Dhaka metropolitan in 2004.

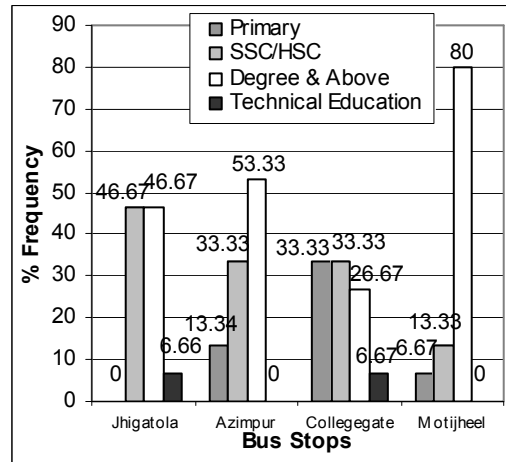


Fig. 9. Educational qualification of the passengers at 4 selected bus stops in Dhaka metropolitan in 2004.

The educational qualification of the passengers is shown in Fig. 9. Passengers having primary education were maximum at Collegegate (33.33%), following by Azimpur (13.34%) and Motijheel (6.67%). However this type of passengers were absent in Jhigatola bus stop. The highest number (46.67%) of the passengers with educational qualification at SSC/HSC level was recorded at Jhigatola, followed by 33.33% at Azimpur and Collegegate and 13.33% at Motijheel. Passengers with graduate and above education were highest (80%) at Motijheel, followed by 53.33% at Azimpur, 46.67% at Jhigatola and 26.67% at Collegegate. Passengers with technical education were only found at Jhigatola (6.66%) and Collegegate (6.67 %) (Fig. 9).

At Motijheel bus stop the passengers with government service was the maximum (53.33%) followed by business (33.34%). The lowest number of passengers having occupation of government service was at Jhigatola and Collegegate (6.67%). Passengers having private services were the highest at Jhigatola (33.33%) and the lowest at Motijheel (13.33%). The passenger engaged in business was maximum (33.34%) at Motijheel and lowest (13.33%) at Collegegate. At Jhigatola, Azimpur and Collegegate the maximum number of passengers (40%, 26.67% and 26.67% respectively) was student. Passengers with occupation of labor were only found at Collegegate bus stop (13.33%). Passengers engaged in housewifery was maximum (13.33%) at Azimpur followed by 6.67% at Collegegate. No passenger of this category was found at two other bus stops. Except the passengers with the occupations mentioned (govt. service, private service, business, student, labour and housewife) and unemployed passengers, 13.33% passengers had other type of occupation at Collegegate bus stop (Fig. 10).

The passenger with occupation of labour, housewife and other except the mentioned was absent at Jhigatola and Motijheel bus stop. On the other hand, passengers with each type of occupation mentioned (govt. service, private service, business, student, labour and housewife) were present at Azimpur bus stop (Fig. 10).

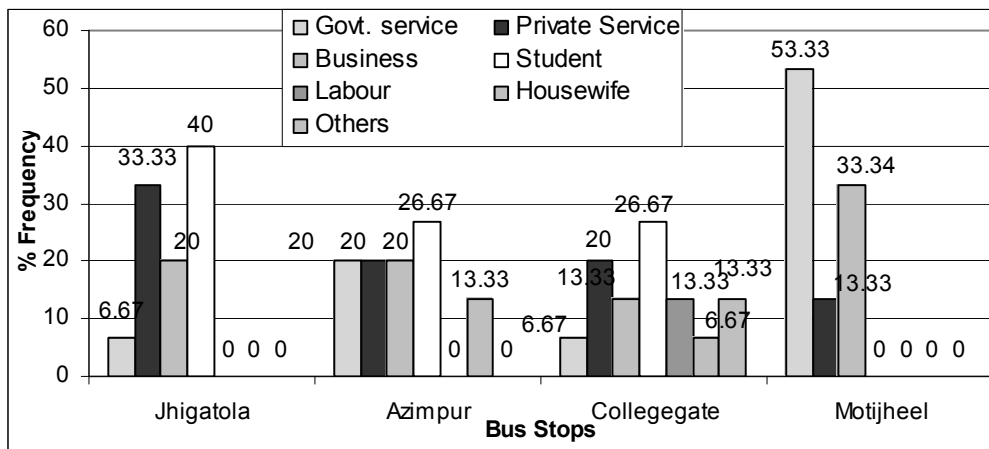


Fig. 10. Occupation pattern of the passengers at 4 selected bus stops in Dhaka metropolitan in 2004.

Reason behind traveling by bus: Low cost has been the reason to most of the passengers at Azimpur (46.67%), Motijheel (40%) and Jhigatola (33.34%) for traveling by bus. The maximum (46.66%) passengers at Collegegate mentioned their opinion behind the use of bus as travel mode due to the absence of better alternative than bus, followed by Azimpur (33.33%), Motijheel (26.67%) and Jhigatola (13.33%). Twenty and 6.67% passengers of Jhigatola and Collegegate respectively identified the less travel time as the factor to use bus service than other mode of transport. Safety was identified as the main factor in selecting bus service by 13.33% passengers of Jhigatola and 6.67% of Azimpur and Collegegate bus stops. However safety was not considered as a factor by the passengers of Motijheel bus stop. About 13.33% and 6.67% passengers at Motijheel and Jhigatola bus stops considered bus service as comfortable. The highest number of the passengers having the opinion for proximity (close to origin) was at Jhigatola (13.33%) and no passengers at Azimpur gave their opinion for this reason (Fig. 11).

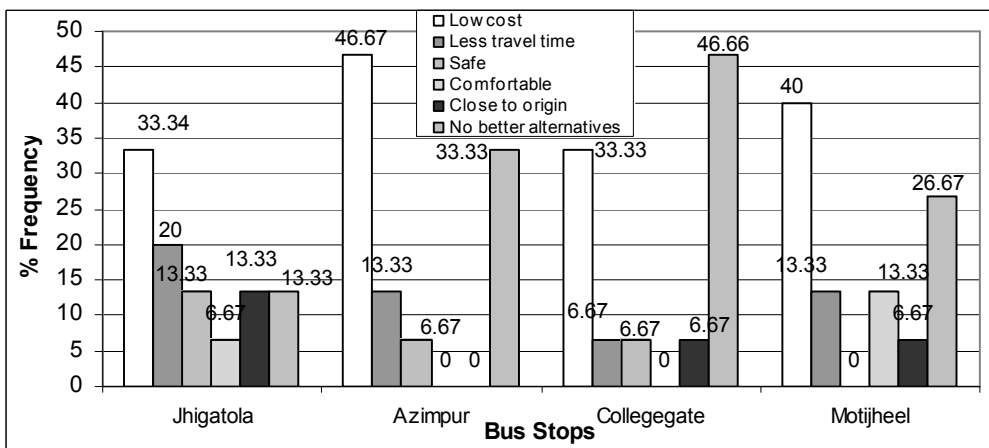


Fig. 11. Reason behind traveling by bus of the passengers at 4 selected bus stops in Dhaka metropolitan in 2004.

Mode used to reach bus stops: The highest number of the passengers reached at the bus stop from their origin by walking was at Motijheel (80%), followed by Jhogatola (66.67%), Collegegate (60%) and Azimpur (40%). While the maximum (60%) passengers reached bus stops from their origin by rickshaw was at Azimpur, following 40% at Collegegate, 33.33% at Jhigatola and 20% at Motijheel (Fig. 12).

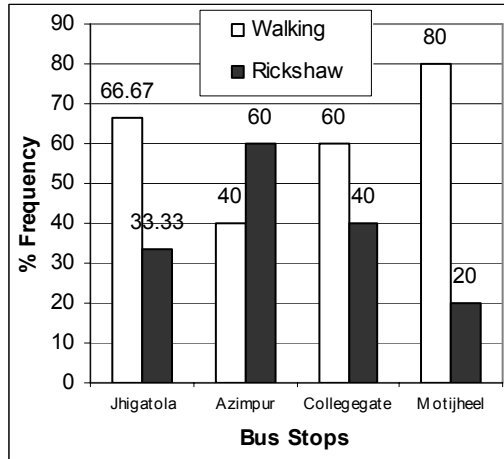


Fig. 12. Mode used to reach the selected bus stops in Dhaka metropolitan in 2004.

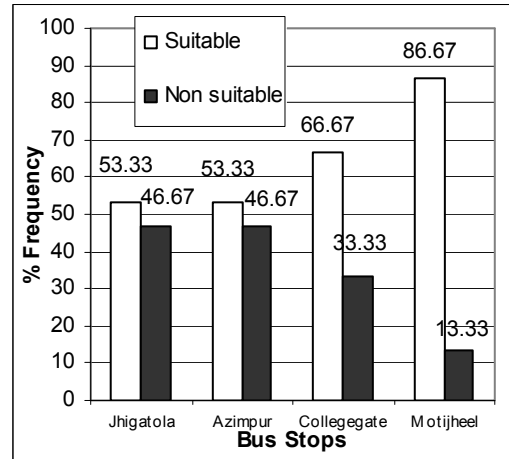


Fig. 13. Passenger's opinion on placement suitability of 4 selected bus stops with footpath in Dhaka metropolitan in 2004.

Passenger's opinion on placement suitability of bus stops with footpath: The maximum passenger of all the four selected bus stops mentioned that the bus stop location was suitable. About 86.67% passengers of Motijheel, 66.67% of Collegegate and 53.33% of Azimpur and Jhigatola bus stops agreed as suitable. The highest number of the passengers mentioned the bus stop location as unsuitable at 46.67%, 33.33% and 13.33% at Jhigatola and Azimpur, Collegegate and Motijheel respectively (Fig. 13).

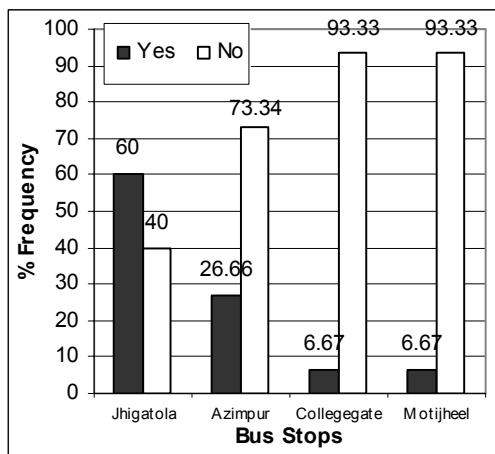


Fig. 14. Level of satisfaction on the selected 4 bus stops facilities in Dhaka metropolitan in 2004.

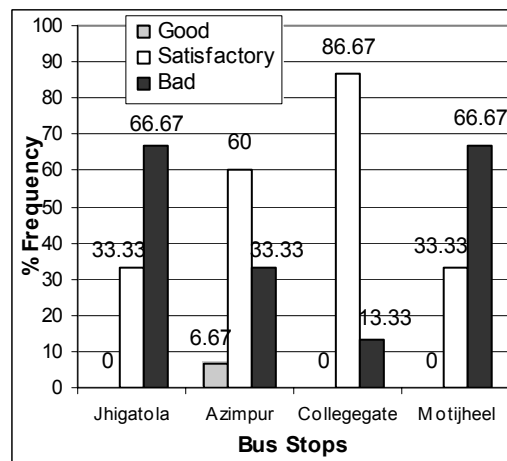


Fig. 15. Aesthetic environment of 4 selected bus stops in Dhaka metropolitan in 2004.

Level of satisfaction on bus stop facilities: Passengers at Motijheel and Collegegate bus stops (93.33%) followed by Azimpur (73.34%) were not satisfied with the stop facilities. The highest number of passengers who were satisfied about their stop facilities at Jhigatola (60%), followed by Azimpur (26.66%), Collegegate (6.67%) and Motijheel (6.67%) (Fig. 14).

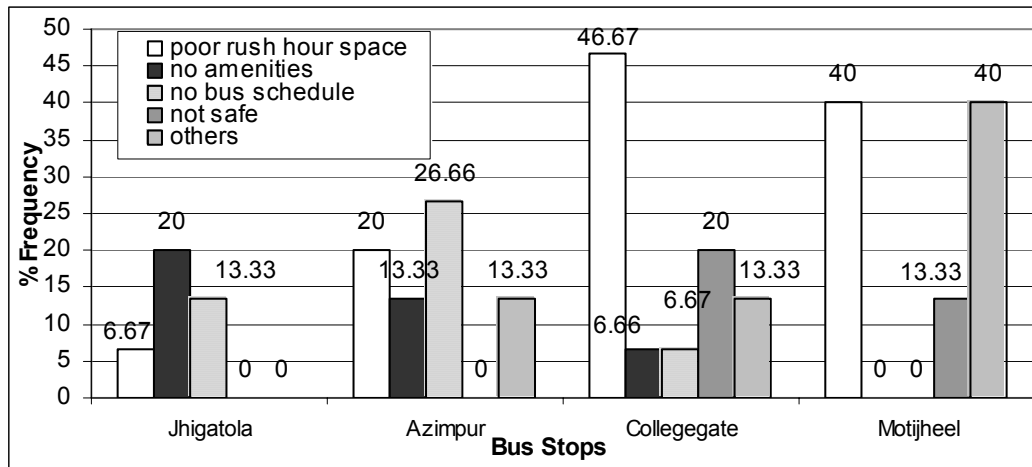


Fig. 16. Reasons for dissatisfaction with stop facilities at 4 selected bus stops in Dhaka metropolitan in 2004.

Aesthetic environment of the bus stops: The aesthetic environment of the selected four bus stops through passengers' view is shown in Fig.18. Among the four bus stops, only 6.67% of the passengers at Azimpur bus stop mentioned the aesthetic environment of the bus stop was good. Satisfactory aesthetic environment was mentioned by the passengers at Collegegate (86.67%), Azimpur (66.67%), and Jhigatola and Motijheel (33.33%). About 66.67%, 33.33% and 13.33% passengers at Jhigatola and Motijheel, Azimpur and Collegegate bus stops respectively mentioned the aesthetic environment of the bus stop was bad (Fig. 15).

Reasons for dissatisfaction with bus stop facilities: Various reasons for dissatisfaction on bus stop facilities are shown in Fig. 16. The maximum passengers were dissatisfied for poor rush hour space at Collegegate (46.67%) and Motijheel (40%) and the lowest at Jhigatola (6.67%). The maximum passengers (20%) at Jhigatola and lowest (6.67%) at Collegegate were dissatisfied for no amenities available at bus stops. No passenger of this category was found at Motijheel bus stop. Passenger expressed dissatisfaction for the absence of bus schedule was also absent at Motijheel bus stop but this group was varied from 26.66% to 6.67% at Azimpur and Collegegate bus stop respectively. A considerable proportion of the passengers (40%) was dissatisfied for other reasons like the crowding by the vendors, poor physical condition etc (Fig. 16).

Passenger's opinion on future improvement of the existing condition: The maximum (26.67%) passengers of Azimpur and Collegegate and the minimum (13.33%) passengers of Jhigatola bus stops mentioned the need for future increase of sitting facility at bus stop. Passenger's opinion on developing quality of shed was varied between 46.67% and 13.33% at Jhigatola and Collegegate bus stop respectively. Passengers gave their opinion for providing amenities 46.67% at Motijheel, 40% at Collegegate. No passenger of this group was found at Jhigatola and Azimpur bus stop. Passengers given other opinion except the mentioned one were the highest at Jhigatola (20%) and lowest at Collegegate (6.67%). No passenger of this group was found at Jhigatola and Motijheel bus stop (Fig. 17).

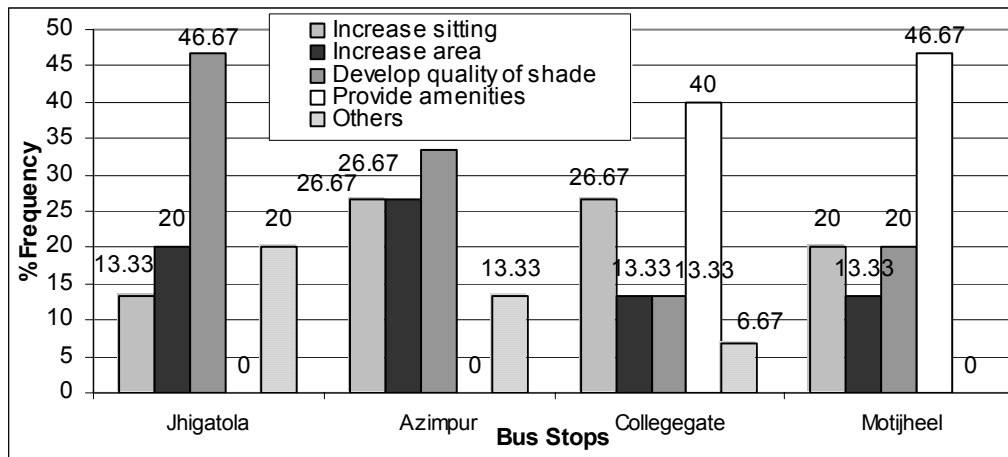


Fig. 17. Passenger’s opinion on future improvement of the existing condition at 4 selected bus stops in Dhaka metropolitan in 2004.

Discussion

Scio-economic profile of the passengers: The age group 30-44 is the active working group in our country playing vital role to the country’s economy. As the passengers of this group uses bus stops more frequently than the other age groups (Fig. 6), their mobility to work places is directly influenced by the bus services.

The maximum bus users at Collegegate and Motijheel were at age group 30-44 because the presence of surrounding commercial activities. While the highest number of passengers at Jhigatola and Azimpur bus stops was within the age group 15-19 and most of them are student (Fig. 7). The reason behind this was that there is a concentration of educational institutions in this area.

The lower number of female passengers in comparison to male passengers in all the four bus stops in Dhaka metropolitan would be due to existing poor social security for female (Fig. 8).

Age distribution and economic status of respondents would have great influence on the educational qualification of the passengers. Therefore passengers with primary education were the maximum at Collegegate bus stop as because most of them may come from lower middle class family. Being a posh area with middle and higher middle class passengers Jhigatola bus stop has no passengers with education level lower than SSC/HSC grade. Maximum passengers at Jhigatola bus stop had the education level of SSC/HSC as because most were from the age group 15-19 and would have come from higher middle class family. Maximum passengers with education level of degree and above was at Motijheel bus stop as they were mostly employee of different organizations (Fig. 9).

Age distribution, educational qualification and area type had influence on occupation pattern of the passengers. Being an office area the percentage of the passengers engaged in government service and business were maximum at Motijheel bus stop. Again, as the passengers of Jhigatola and Azimpur bus stops were mostly within the age group 0-15 with education level of SSC/HSC and degree, the maximum passengers of these two bus stops were student. Among the passenger student, labour, housewife and others were absent at Motijheel bus stop. This reflects the characteristics of Motijheel as the big commercial and business area. As the Jhigatola bus stop is

located in the posh area, no respondent was found from the occupation categories of labour, housewife and other profession. Interestingly, representatives of all the seven occupation type among the passengers were found at Collegegate, because this is familiar with diversified settlement of different professionals including medical, educational, governmental, residential and institutional (Fig. 10).

Reasons behind traveling by bus: Among six factors most of the respondents gave opinion to low cost and absence of better alternative transport service behind the reason for selecting bus as transport mode (Fig. 11).

Mode used to reach bus stops: Most of the respondents walked to reach bus stop and a few used *rickshaws*. Therefore it may conclude that bus stops are within easy reach for the bus users in Dhaka city (Fig. 12).

Passenger's opinion on placement suitability of bus stops with footpath: Most of the passengers agreed that bus stops were conveniently located though the placement was not convenient. This result would be due to their general lack of real experience with a good placement of a bus stop (Fig. 13).

Level of satisfaction on bus stop facilities: Most of the passengers of Motijheel, Collegegate and Azimpur bus stops were unhappy with the bus stop facilities because of poor appearance and services. In contrast, most of the passengers of Jhigatola bus stop were satisfied only because of its good appearance than the rest three bus stops. Most of the bus stops in Dhaka metropolitan city represent the bus stops studied here cannot satisfy passengers mainly due to lack of proper placement and shed. Many other problems like improper placement of ticket counters, poor accommodation in rush hours and illegal shops at stops are responsible for the existing poor condition of the bus stops in Dhaka city (Fig. 14).

Aesthetic environment of the bus stops: The opinion on aesthetic environment of the bus stops depends on socio-economic background of the respondents. As Jhigatola is a posh area, its passengers are mainly from good economic background. So, their satisfaction level is obviously higher than that of others. They are also more optimistic for better service of bus stops. It could be a reason for the opinion to bad aesthetic environment of the bus stop by majority of the passengers at Jhigatola bus stop although aesthetically it stands in a better position than the rest three other stops. On the contrary, having a poor aesthetic environment of the bus stop, the passengers of Azimpur and Collegegate bus stop were satisfied as they are as much pessimistic as not to demand for better. Their socio economic background may be attributed to make their satisfaction level lower. They are so much accustomed with poor environment that they cannot imagine that they have right to get better service than that. Most of the passengers of Motijheel bus stop gave their opinion as bad because they are experienced with bad aesthetical condition of the bus stop (Fig. 15).

Reasons for dissatisfaction with bus stop facilities: Accommodation in the rush hours is the reason for the high dissatisfaction of most of the passengers at Collegegate and Motijheel in particular. Because the space of these two stops always occupied by the illegal shops and vendors. In addition, lack of amenities, absence of bus schedule and insecurity are common in all bus stops surveyed. However, these lacking are not given equal importance by the passengers at all bus stops as because the existing facilities of the bus stops in Dhaka city are not similar everywhere (Fig. 16).

Passenger's opinion on future improvement of the existing condition: As the bus stops in Dhaka metropolitan city lack in the basic requirements of a standard bus stop like proper shed, sitting,

space and amenities, passengers at the four selected bus stops demanded facilities which varied as the standard of the service and facilities varied among bus stops (Fig. 17).

Common characteristics and problems of the existing bus stops in Dhaka metropolitan area:

Location: The primary problem of existing bus stops is incorrect placement. They are placed on the pedestrian walkway and do not provide any stop spacing. Therefore, both pedestrian flow and waiting passengers face difficulties.

Structure: Several types of structure in sheds are seen viz., vault (concrete/steel); folded plates (concrete); truss (steel) etc.

Ticket counter: These are placed outside the shed. Sometimes, the concerned bus service authorities build their own tiny shed on the footpath in a series which largely limit normal movement of both passengers and pedestrian. As a result there create a disorganized condition.

Accommodation: Passengers' queue is often too long. Often it goes beyond the bus stop shed through the pedestrian walkway, roads and other properties. In addition the bus stop size is not adequate to meet the length of passengers queue.

Stop facilities: Most of the bus stops in Metropolitan Dhaka are not marked with appropriate traffic symbols. Therefore, both passengers and bus drivers become confused. Furthermore, majority of the stoppages lack in facilities, such as information board, sheds for protection against extreme weather.

Shops at bus stops: Some of the bus stops are partially occupied by illegal shops like photocopy, flower, magazine, video, grocery etc. They reduce the space for passengers as they are not constructed under a prescribed design.

However, in recent days stoppages with improved facilities (e.g., shed and sitting arrangements) are being constructed sponsored by organizations which are designed but due to lack of space, policy and bus stop standards they are not as effective as the requirement.

Bus stop standards: Bus stops are the static points that serve the passengers as a key component of the transportation system in a city. Bus stops that are designed with paved waiting pads, shelters, benches, windbreaks and lighting can furnish comfortable, safe waiting areas as transit point to the users. Services of bus stops can be improved by providing a public phone and book and newspaper stall. The size and design of a bus stop will vary depending on space availability and expected number of users. The location of a stop may vary depending on space availability, utility placement, passenger counts and drivers' visibility. Bus stops would have a minimum setback from the street. The key elements of an effective and organized bus stop are – lobby, route information, bench, lighting, landscape architecture and amenities for the passengers. The lobby can be designed as interior waiting area for the users. It is very important because absence of it will expose the travelers to bad weather. For passenger comfort, seating should be provided in the lobby. Transit route information can be displayed to provide accurate route and schedule to the passengers. The benches would be constructed with vandal resistant materials and should be placed under shed. A well lit waiting area will not only increase a pedestrian's feelings of security but also will allow a transit vehicle driver to see clearly the bus stop. Landscape architecture can be used at transit waiting areas to increase passenger comfort and an attractive transit waiting area. Convenient amenities like ATMs, newspaper, vending boxes etc. would be integrated in a bus stop.

Guidelines for future development

Considering finding of this study a guideline has been proposed for developing effective bus stops in Dhaka metropolitan city:

1. Bus stop cannot be built on footpath as it reduces safety of both passengers and pedestrian flow. Therefore the bus stops to be built should follow the standard for bus stops and location regulation;
2. Although necessary it is not possible to demolish all bus stops for relocation, but few bus stops still would have possibility to relocate or rearrange with footpath;
3. To avoid different private bus service ticket counters along the footpath, they can be arranged within a bus stop shed with broader area;
4. Unused bus stops should be demolished which are not now using as a bus stop rather than illegal stationeries, flower shops etc.;
5. Illegal shops and vendors under bus stop shed should be eradicated; and,
6. Bus stop facilities like drinking fountains, sitting arrangement, space for rush hour, amenities like newspaper stall, telephone booth, restroom, etc. should be provided.

Conclusion

This paper gives us a scenario of the present condition of local bus stops of Dhaka metropolitan city based on user's opinion through field survey at four selected bus stops. In addition, a guideline to improve the present condition of the bus stops has been suggested. The demographic, educational and occupational characteristics of bus stop users were studied and their opinions on various aspects of effective bus stops have been presented. Bus users in Dhaka city are suffering a lot of problems everyday due to unorganized bus stops. Though the problems identified are common but study showed that in respect to different location types and economic status passengers of the selected bus stops were reacted differently in their opinion. However, most of them are not aware about their right to get organized and well facilitated bus stops. This paper reports the effectiveness of the local bus stops of Dhaka city in respect to passengers' opinion collected from a limited number of bus stops. Extensive study with physical survey of road layout would be necessary to find the technical effectiveness of the bus stops as a transportation element in the total transportation network.

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References

- Ahsan, H.M. 1990. A study of mass transit in metropolitan Dhaka. M.Sc. Thesis, Department of Civil Engineering, Bangladesh University of Engineering and Technology (BUET), Dhaka, pp. 40-45.
- Bowman, L.A. and Turnquist, M.A. 1981. Service frequency, schedule reliability and passenger wait times at transit stops. *Transportation Research*, 15(a): 465-471.
- Dajni, J.S. and Gilbert, G. 1978. Measuring the performance of transport systems. *Transportation Planning and Technology*, 4: 97-103.
- Kabir, S.A. 1997. Dhaka Nogorir Janbahan Samasya. The Daily Sangbad, 4th Octber, 1997.
- Ullah, M.S. 2004. Study on bus service characteristics in Dhaka city. Undergraduate thesis, Department of Civil Engineering, Bangladesh University of Engineering and Technology (BUET), Dhaka, 53 pp.

