

Evaluation and development of bus based public transport in Dhaka city

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ABSTRACT: Transportation sector is a massive playground for its user. And Bus is the biggest player in the road based public transportation system. The environment of public transport in Dhaka City is characterized by traffic congestion and delays, inadequate traffic management, unaffordable and inaccessible public transport for majority of the people, high accident rates and increasing air pollution problems. It has seriously been deteriorated and in many respects has already reached in a crisis level. But in the bus based public transport resource is not the main hindrance. The main problem is operational weakness of the present resources. To find the deficiencies first of all it is necessary to evaluate the present operational modes. For this purpose, data have been collected using video camera at mid-block and intersections in the case study corridor. Based on these data, various operational parameters have been observed. The investigations in this paper revealed significant causes of this deficiency in the operation of bus services. This paper investigates the shaping up of different operational sectors of bus based public transport of Dhaka city transport over recent years and some measures to solve the problems with available manpower and resources.

1 INTRODUCTION

The only mass transit mode in Dhaka City is bus and the service provided by bus is insufficient in terms of safety capacity, comfort and convenience. The transportation system of Dhaka City is predominantly road based and NMT (mainly rickshaws) has a substantial share. According to STP, 2004 about 51% of the total trips in Dhaka city are shared by non motorized modes and motorized transport modes contribute to the rest 49% trips in Dhaka City. Proportion of trips that are made by walking is substantial and 22% of all the total trips. Rickshaw is the most dominant among the non motorized modes and represents 29% of all trips but bus is the most dominant among all travel modes and represents 31% of all trips. It is observed from data of BRTA that, within the year of 2003 to 2007, the increase in number of registered bus, minibus and motor car is 135.5%, 8.55% and 31.9% respectively. Among all modes, the percentage increase in the number of bus is the maximum but as all of these buses are not operating in the metropolitan area. So the demand for buses is still higher. On the other hand most of the motor cars are moving through the city streets resulting inefficient use of road streets and congestion.

The average annual growth rate of Dhaka city's population during the last three decades has been over 7 percent doubling its population each decade. The population of Dhaka city was 9 million in 1996 and it is expected to increase to 19.5 million in the year 2015. Now Dhaka is a densely populated metropolitan area of more than 10 million people. As a result of this increasing population, the travel demand is also increasing very rapidly in the city causing enormous pressure on the existing transport supply; and the unavoidable outcome is by any standard Dhaka does not have a reliable transport system

2 OBJECTIVE

The overall objectives of this study are to understand the present operational condition of overall bus industry in Dhaka city. Also feasibility of some effective measures like dedicated lane for bus, reduction of number of car in the peak period which will reduce traffic jam, reduction of travel time and allowing bicycle movement will be discussed in this paper.

3 METHODOLOGY

Data has collected by using video camera and also by manual method. Most of the data are collected by conducting field survey carried out directly by the researcher. Since little information have been available from secondary sources including published and unpublished work about different features of the study area, various field surveys have been performed to realize the existing conditions through the survey corridor. The physical surveys have been conducted at different bus stoppages as well as at other locations along the survey route on demand of various transportation modes, frequency of bus services, passenger carrying capacity etc. To demonstrate different irregularities in mass transit movement photographs have been taken at various locations without hindering the through movement of vehicles and pedestrians. The field surveys also included passenger opinion surveys about the travel time, the existing hazards along the selected corridor. On the other hand questionnaires survey has conducted among women passengers to find out the problems of them. In this study, data were collected from video recording. The advantage of this method is that from the same video footage different parameters can be extracted. Another advantage is that it is possible to run the video footage as many time as desired.

4 DATA COLLECTION AND ANALYSIS

4.1 Study area

The whole study is conducted near the Asad gate bus stand. Here huge number of buses passes every day. Also it is one of the most busy bus stands in the Dhaka city. Various video footages have been taken from the Asad gate over bridge.

4.2 Travel time

Along the case study corridor total travel time at two peak time of the day has been observed for 4 weeks. The two peak times are at morning when all offices and educational institution start and at afternoon when all offices and some educational institutions close their works. After gathering this huge data mean travel time has been observed separately for this two peaks. Also it is observed that travel time at morning peak is smaller than travel time at afternoon peak. The inherent causes behind this also tried to be finding out in this paper. Also the mean travel time is nearly same throughout the seven days except Saturday.

Table 1. Travel time by bus along case study corridor

Day	Asad Gate to Motijheel			Motijheel- Asad Gate		
	Departure	Arrival	Duration(min)	Departure	Arrival	Duration(min)
Saturday	7:55	8:30	35	5:10	5:55	45
Sunday	7:40	8:55	75	6:30	8:00	90
Monday	7:40	8:50	70	6:50	8:25	95
Tuesday	7:55	9:05	70	6:45	8:15	90
Wednesday	7:37	8:50	73	6:30	7:55	85
Thursday	8:00	9:15	75	6:30	7:55	85
	Mean=66.3333 and Standard deviation=14.16			Mean=70 and Standard deviation=20.41		

(Source: Field Survey)

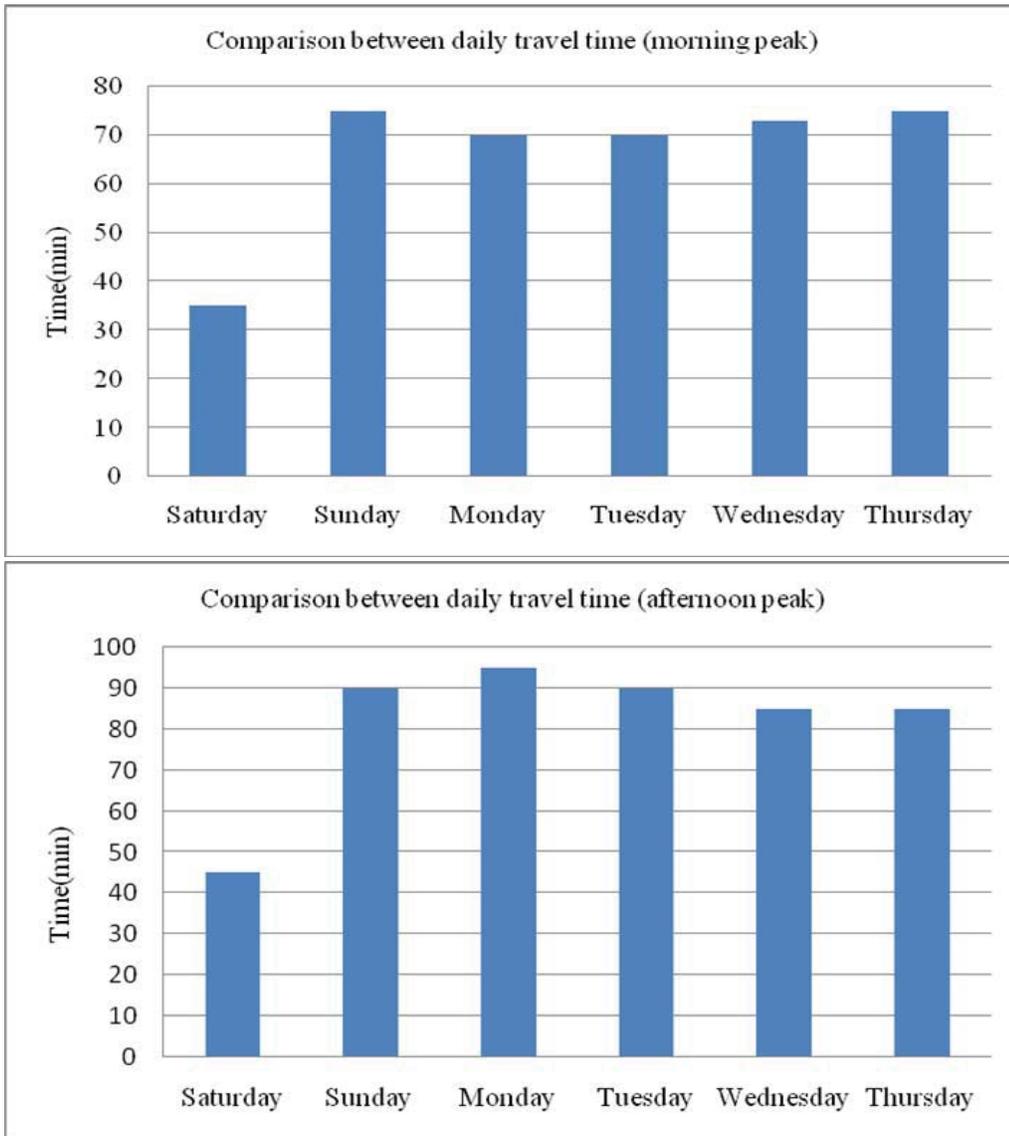


Figure 1. Comparison of travel time at morning peak and afternoon peak in the week.

4.3 Capacity of Buses

In the study corridor various bus owner companies give there service. At the morning peak time (8:30am to 9:30am) the number of vehicle passing in the case study corridor was observed. It was seen that some buses carry passengers only from the staring point. On the other hand though some buses take passenger from other places it is very much insufficient. The whole scenario is carrying no qualities of public transport. Table 2 shows the passenger carrying scenario of various bus service provider.

Table 2. Passenger carrying capacity of bus

Bus company name	Origin-Destination	Total seat number	Average number of passenger at peak hour	Highest number of passenger at peak hour	Number of bus counted in 1 hour	Total number of passenger in 1 hour
New Vision	Mirpur-Motijeel	40	40	40	10	400
Trans Silva BD.	Mirpur-Motijeel	50	59	60	5	295
Dishari	Mirpur-Motijeel	35	35	35	14	490
ATCL	Md.pur-Motijeel	50	55	67	16	880
BRTC	Mirpur-Motijeel	60	68	80	2	136
BRTC	Md.pur-Motijeel	60	77	85	3	231
Rajdhani	Shamoly-Motijeel	60	76	85	10	760
Tanjil	Mirpur-Motijeel	40	40	40	5	200
Bahon	Mirpur-Motijeel	60	80	85	4	320
Chiriakhana	Mirpur-Motijeel	35	47	50	4	188
Chiriakhana (Direct)	Mirpur-Motijeel	35	35	35	7	245
Super Bus	Mirpur-Motijeel	50	56	60	3	168
Office Bus	Mirpur-Motijeel	25(approx)	20	20	19	380
					Total	4693

(Source: Field survey)

4.4 Mode of service

Along the case study corridor various bus companies give various mode of service. As a whole public transport system must have equal accessibility to any passenger from the bus lay-by. But the scenario in Dhaka does not match with the definition of public transport. Table 3 describes the classification of bus services and their comparison in various parameter.

Table 3. Various types of bus service

Type of service	Definition	Accessibility from bus stop-page location	Fare	Women accessibility
Gate Lock	Starts at origin and ends a destination .No accessibility of passenger from other locations.	No	Very High	Yes
Seating Service	Starts at origin and ends a destination. Having Provision of accessibility of passenger from other locations if seat is available.	No	High	Yes
Ticket Service	Ticket system available. Having Provision of accessibility of passenger from other locations if standing space is available in bus.	Yes	Medium	Suitable at only origin
Local Service	No ticket system available. Having Provision of accessibility of passenger from other locations if standing space is available in bus.	Yes	Comparatively Low	Very poor accessibility

(Source: Field survey)

4.5 Frequency of bus and occupancy

Along the case study corridor the frequency of bus usually increases as starting of office hour come closer. But it is a very positive sign of public transport that lot of double decked bus are in operation for office going purposes. The main advantage of office going bus is that it carries a lot of officials in a very cheap cost in comparison other mode choices. Table 4 shows the frequency of 60 seat passenger bus, 40 seat passenger bus, 40 seat office buses and 80 seat double deck in the case study corridor.

Table 4. Frequency of bus

Time	Bus (60 seat)	Bus (40 seat)	Office Bus 40 seat	Office Bus2 Double Decker	Total No. of Bus
8:45-8:50	1	4	4	1	11
8:50-8:55	9	6	3	1	20
8:55-9:00	10	15	5	1	32
9:00-9:05	7	3	4	2	18
9:05-9:10	9	6	4	1	21
9:10-9:15	9	31	4	1	46
9:15-9:20	4	8	0	0	12
9:20-9:25	13	22	2	2	41
9:25-9:30	8	5	0	0	13
9:30-9:35	1	4	0	2	9
9:35-9:40	10	22	0	2	36
9:40-9:45	6	10	0	1	18

(Source: Field survey)

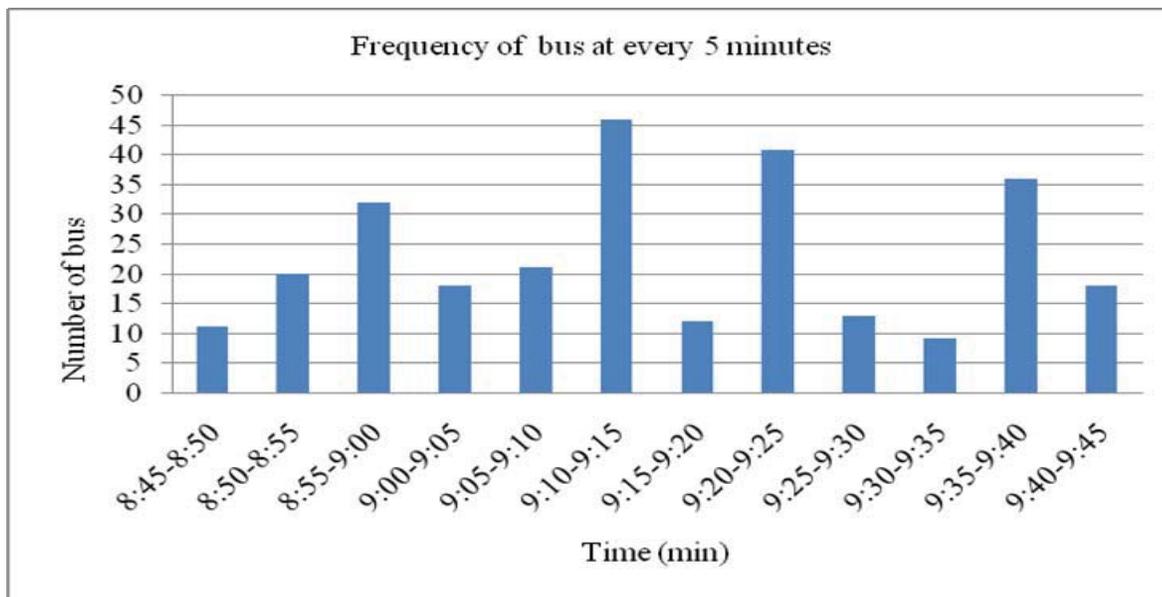


Figure 2: Bar Chart for representing relation between number of bus and time in every 5 min

4.6 Boarding and alighting time

In Dhaka city for maximum buses only one door exists. So that the boarding and alighting time is very slow. On the other hand driver of bus want to stay a long time in the origin and destination point and they usually does not want to stop at the intermediate bus stoppage.

Table 5 .Boarding and alighting time at bus.

Motijheel to	Asad Gate	Azimpur to	Chowdhury Para
Bus stoppage	Boarding alighting time	Bus stoppage	Boarding alighting time
Motijheel	10 min	Azimpur	5 min
Stadium	3 min	Eden College	7 sec
Press Club	30 sec	Nilkhet	11 sec
Shahbug	15 sec	Dhaka College	27 sec
Science Lab	4 sec	Science Lab	30 sec
Kalabagan	30 sec	Kataban	5 sec
Dhanmondi 32	30 sec	Sisu Park	32 sec
Asad Gate	15 sec	Kakrail	1 sec
		Malibug	1 min 25 sec
		Mouchak	44 sec
		Malibug Railgate	15 sec
		Chowdhury Para	10 sec

(Source: Field survey)

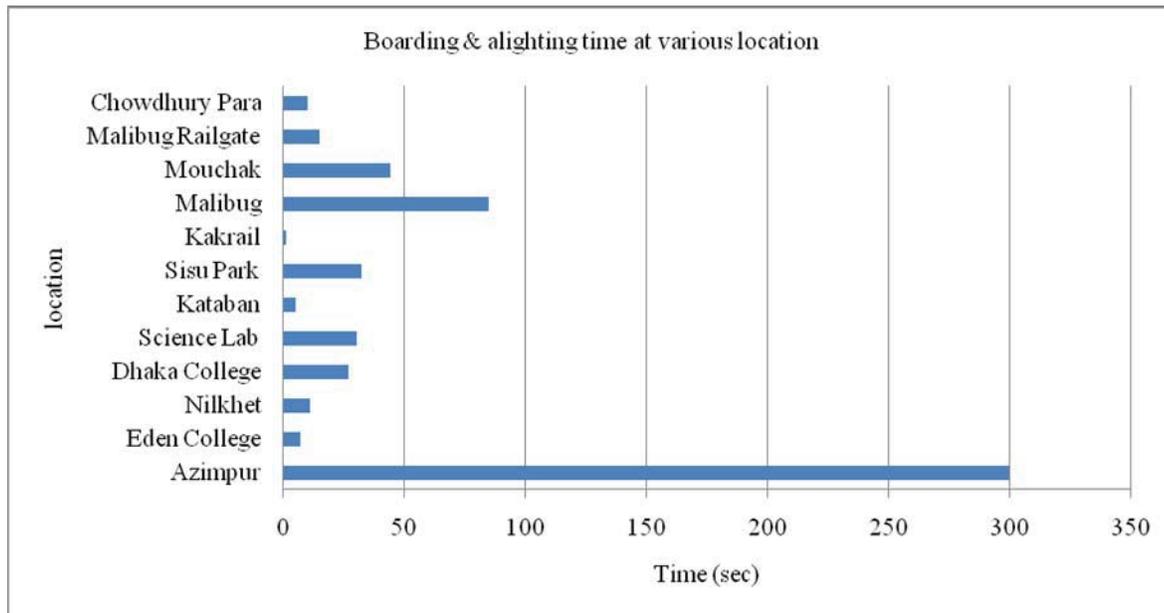


Figure 3: Bar Chart for representing relation between number of bus and time in every 5 min

4.7 Modal share

The main advantage of bus is that it can carry huge passenger in a short time. Also if number of car is huge in the roadway it creates traffic congestion. In table 6 it is clear that number of car passing in the corridor is around 2.14 times higher than the number of bus. But the number of passenger carrying by bus is about 15 times higher than the car. So the traffic jam will drastically reduce if number of car can be reduced in from the road.

Table 6. Modal share at study corridor

Vehicle Type	Approximated passenger boarded at peak hours	Number of vehicle observed	Number of passenger during an hour
Bus	60	360	21600
Car	2	770	1540
Micro Bus	8	270	2160
Motor Cycle	1	564	564
3 Wheeler	2	180	360
Rickshaw	0	0	0
		Total	26224

(Source: Field survey)

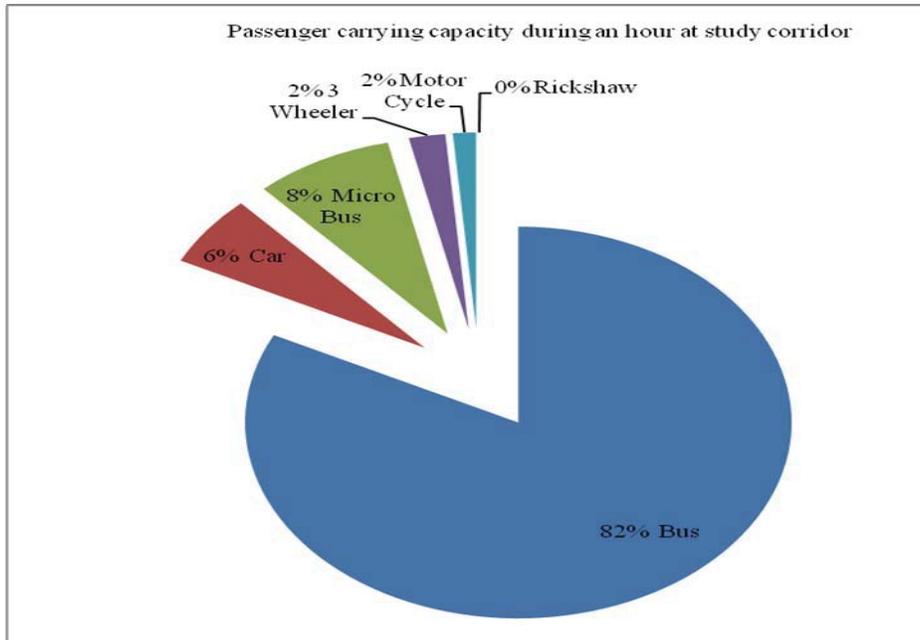


Figure 4: Passenger carrying capacity during an hour at study corridor

4.8 Condition in bus industry

According to BRTA, up to March, 2008 there is 6488 number of authorized buses in Dhaka City and many of these buses are operated by individual owners. Drivers and crews in most cases rent the buses on a daily or monthly basis. They then operate the buses on their own revenue risk, requiring enough passengers per day to repay the bus rental fees cover fuel cost, basic maintenance cost and make a profit. As a result the present bus industry of Dhaka city has not been developed as a healthy one. Due to the poor condition of bus industry, there is lack of coordinated control of these buses and no route commitment resulting in time wasting, aggressive competition on roads and waste of resources. Rough behavior of bus crews, unsafe driving practice, dangerous boarding and alighting by passengers in the middle of roads, nosing of buses are the results of fragmentation in bus ownership.

4.9 Overall road condition

In Dhaka City, roads after construction has no regular improvement measures to counteract the road delays due to the poor road surface condition. Moreover, most of the roads do not fulfill the geometrical criteria, proper right of way and proper use of different elements regarding road grades and sub grades. Effective road width is reduced by presence of dustbin and hawkers. In some places construction materials for building purposes are placed on the roads. Due to the above reasons natural movement of buses are interrupted. In addition to that haphazard parking of vehicles due to the deficiency of parking places, inefficient width and use of footpaths restrict the free movement of buses along the roads.

4.10 *Mixed flow operation*

There is complex mixture of motorized and non-motorized traffic in the same lane along the roads in Dhaka city except some non motorized traffic restricted roads. The roads are occupied by inefficient modes of transport like private cars, rickshaws etc. According to BRTA, most number of private cars had been registered in Dhaka up to 2007. The number of 115880 rickshaws is already over 5 lacks. As slow and fast moving vehicles are plying in same lane, the speed of fast moving mass transit buses are decreasing significantly.

4.11 *Problematic boarding and alighting facilities*

Delay occurs at bus stoppages due to boarding and alighting of passengers. It is due to higher vertical steps of the buses, higher deck to pavement height, inefficient width of doors of buses etc. Here a good number of buses have only one door and those which have two doors. In most cases the second one is not used for the boarding and alighting of passengers due to presence of one conductor to check the ticket in the front door. Moreover, the doors are narrow compared with the width of doors of standard buses used in developed countries. As simultaneous boarding and alighting is not possible through single narrow door, the delay at bus stoppages increases.

4.12 *Lack of safety*

In Dhaka City, travelling in buses is not safe at all. Most of the time the buses remain overloaded. It is a common scene in Dhaka City that people are hanging with the handles of the buses resulting in increase in tile risk of accident. Also hijacking and pick pocketing is a common scenario of public busses.

4.13 *Unorganized ticket collection systems*

Dhaka City several buses run along the same route and the passengers are not provided with any kind of advanced information about the arrival of buses as congestion along the road is predictable. Since several buses of different bus companies operate buses through the same route at the same time, there is tendency among the passengers to wait for the first arrival bus and not buying the ticket until the bus arrives. Generally the passengers stand around the bus counter and when a bus arrives at particular bus stoppage then the people try to buy the ticket all together. Moreover, those who already have bought tickets of buses of other companies, they start changing their tickets after arrival of bus of different company. Due to this faulty ticket purchasing and ticket changing criteria, the stopping time at bus stoppages as well as the total travel time of buses increases significantly.

4.14 *Poor integration with supporting modes*

No single mode is likely to succeed by itself in providing transport service to the whole city. So integration with supporting modes is required for its efficient functioning. In Dhaka City there is lacking in the integration of mass transit system with other modes of transit like cycling, walking etc. A few authorized bus stops are available in Dhaka City. There are neither definite lands for rickshaws or neither auto-rickshaws nor bus stops are well organized with footpaths. Only a few modes are available among which few are accessible by all strata of people.

4.15 *Shortage of law enforcing agencies*

Police-population ratio in Dhaka City is so misappropriate as to leave a void in controlling buses for various purposes. Moreover, the law enforcing agencies are not concerned about their duties in most cases. As a result, traffic rules are frequently violated by bus drivers engaging themselves in wasteful and dangerous practices like stopping at or near to junctions, overloading and allowing passengers at the bus exterior etc. A significant portion of the roads are occupied by passengers near the bus stoppages and the violations of route permission of buses authorized by BRTA are also occurring due to lack of enforcement.

4.16 *Environmental pollution*

One major source of air pollution in Dhaka City is the smoke emitted from mass transit oriented buses. Emission from buses is injurious to people's health, increasing the problem of respiratory diseases, infections, heart strain and higher blood pressure, lower I.Q. levels in young children and increasing the risk of cancer. Emis-

sions of buses are also a major contributor to global warming. The black smoke emitted by buses in Dhaka City contains nuclear hydrocarbon, lead, carbon mono-oxide, sulfur-di-oxide, nitrogen etc each of which is seriously detrimental to health.

4.17 *Irregularity in service*

Although there are a huge number of public buses, their frequency is not high enough to carry the people in a regular manner. There is no specific interval between two consecutive buses of same company. The bus companies either do not maintain or cannot maintain strict scheduling of buses due to existing severe road congestion. As a result passengers have to wait for a long time which makes the bus stoppage a congested location.

4.18 *Unhealthy and unorganized bus stoppages and counters*

In Dhaka City quite a smaller number of passenger sheds are available. In some places the shed are so small that these cannot provide shelter to the passengers who wait for buses. The bus stoppages are not designed with actual specification. As a result passengers suffer a lot during, hot sunny day or in rainy season. For scheduled buses and minibus operators, fare collection conducted outside the bus at small ticket counter or a chair under an umbrella or just on standing located at bus stops. In some cases, there is also no shelter for the counter men of buses respite them sweltering heat and summer.

4.19 *Fitness of buses*

Most of the buses operating in Dhaka City are not fit enough to carry people. From a survey conducted by BRTA it was found that about 20% of the buses do not have fitness for operation (BRTA, 2004). Weak physical structures, old engines, narrow sitting arrangement are the most common features of the public buses. In most cases, the owners of the buses do not take any initiative to solve those problems. Very dirty and unhygienic condition of public buses also keep women passenger away from buses.

5 CONCLUSION AND RECOMMENDATION

Travel time at morning peak is lower than afternoon peak. Because from 7:30am school & colleges start. At 9:00am maximum office starts and at 10am bank working hour starts. So that at morning total time is distributed among three hours. So that road congestion is much lower. Though office hours end at 5pm and bank close at 6pm, most of the officers stars from 5:30pm to 6:30pm. Also day shift school, college and university end at 5pm. So that road congestion occurs due to heavy load of passengers. So that at afternoon the office closing hours should be distributed among 3 hours. Likely from 4pm to 7 pm is a very suitable time range. As a result the home going people can easily reach their destination in a very short time.

In Dhaka for a single route 5 to 6 companies have been given route permit. So the real problem is in the root. In a single route only one company should be given route permit. With the existing structure bus owner should create co-operative society. As a result the unhealthy competition among bus owners will stop.

The drivers and helpers are paid by daily basis. As a result they always try to make more profit by unhealthy competition. So that they should be paid monthly at a fixed rate, so that their risk to lose their job will be reduced and they will surely provide better service.

As a whole public transport system must have equal accessibility to any passenger from the bus lay-by. But from the analysis it is clearly seen only origin point gets enough accessibility. This is not a quality of public transport. So at every station bus should stop for a fixed time. 30 sec to 1 min is a very convenient time which is followed for metro rails.

Also multistep boarding is another cause for increasing the travel time. If the door of bus is at equal level of bus lay-by the boarding time will be reduced nearly 2 times.

Also gate lock, seating service, ticket service and local service is a huge dilemma for the passengers. So that ticket based and single company based service will be established as soon as possible.

Frequency of bus is also a very important factor. At peak hours frequency must be higher. But at late night bus service should be available, though frequency may be lower. All of these are the qualities of ideal public transport.

From the modal share Data it is seen that number of car is around 2.14 times higher than the number of bus. But the number of passenger carrying by bus is about 15 times higher than the car. Also this huge number of car keeps a bad impact in the overall transport sector. So that bus based public transport should be popular-

ized by doing extra taxation to the car owners. Also subsidy should be provided at public transport to make the fare cheaper.

Also a schedule of bus timing should be hanged on bus stoppage in every day. As a result any passenger can estimate his time of travel in a very organized way. Even though at late night a passenger can travel if he can surely know the bus arrival time.

Women are the less user of public transport in Dhaka city. They have no security, no sufficient seat, no accessibility, and no honor in the public transport in Dhaka. They are always called slow passenger by bus helpers. So that number of women seat should be 40% in every bus. Also there boarding should be safe.

An authorized institutional management body manned by educated traffic and transport engineer can provide that sort of governance, without which growing metropolis of developing cities would perhaps continue to suffer with an inefficient transport system as the case of Dhaka.

Toll free bicycle should be brought into operation to enhance the accessibility at bus based public transport. Also Nice and secure walkway should be made in connection with bus stoppage.

Dedicated lane for bus is a common scenario in developed countries. In Dhaka around 2 lanes is always occupied by buses. So that for a 4 lane road 2 lane should be dedicated for buses.

Restricted car parking is another way to popularize the public transport. So that where traffic congestion is high, car parking should be restricted. Also charge of parking should be make very high, which will increase the popularity of public transport.

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