

PERFORMANCE EVALUATION OF DHAKA CHAKA BUS SERVICE

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ABSTRACT

City is just like a living organism and the transportation system is just like the blood circulation system of that living organism. This transportation system consists of mainly roadway, waterway, airway and railway and bus is one of the most important public transport systems particularly for urban areas. Currently, total number of buses including mini-buses in Dhaka city is 10,214 whereas the total number of vehicles is 11,15,654 which means 2.57% of the total vehicle is bus according to Bangladesh Road Transport Authority (BRTA) data (upto April, 2018). Bus trips constitute 27% of total trips by mechanized modes and passenger kilometer traveled by bus is about 40% of passenger kilometer traveled by mechanized modes. Bus plays a vital role in road transportation system as it can carry a large number of passengers of 30-40% using less road space than a car where it can carry only 5-6% passengers occupying almost same space of road. Dhaka's existing bus operation is not organized and due to fragmented ownership of buses and multiple bus companies are operating along the same corridors, they are in fierce completion for passengers. Thereby, existing bus services causing unnecessary congestion and safety problems instead of providing transport solutions. On 10th August 2016, twenty air-conditioned buses were introduced (known as 'Dhaka Chaka') in Gulshan area, Dhaka which is a move taken to increase security measures in the Gulshan area that witnessed Bangladesh's worst terror attack on July 1, 2016. Among the two routes of Dhaka Chaka, one is commuted from Tejgaon-Gulshan Link Road to Banani via Shooting Club, Gulshan-1, Gulshan-2 and the other route is from Banani to US Embassy. This special bus service is introduced by replacing all the previous 15 bus operators those were providing service to that area to improve the level-of-service (LOS) of mass transport system, which is seriously lacking in all the major urban areas of Bangladesh. The introduction of single operator based zonal bus service gave a golden opportunity to evaluate the performance of this service with the multi-operator based services. To measure the performance of 'Dhaka Chaka' bus service as well to compare it's performance with that of other Bus services of Dhaka City, the paper will consider different performance indicators like trip time, travel speed, average distance between stoppages, passenger loading/unloading practice, passengers safety along with users perception of the services etc. In this work, 28 trip time studies of 'Dhaka Chaka' are conducted to determine average travel speed, trip time and to observe passenger loading/unloading practice as well as bus stoppage whereas questionnaire survey of 303 respondents is done to determine the safety perception of 'Dhaka Chaka' users. It is found from the trip study that there is very systematic practice during passenger loading/unloading execution, on the contrary, there exists ill practice in passenger boarding/alighting tradition in Lease type of bus service. From the trip time study, average travel speed is 7.5 km/hr and average trip time is 20 minutes in one direction. Almost all the passengers feel safe using 'Dhaka Chaka' and want this bus service to incorporate in other areas of Dhaka city. This study suggests that driver behaviour should be linked with payment system which discourages them by additional passenger or will care about passenger comfort and safety as well as has made a path to recognize suitable franchising system to improve the quality of the service.

Keywords: *Dhaka Chaka, performance, safety, loading/unloading, level of service.*

1. INTRODUCTION

Transportation plays an important role in the smooth functioning of a city. It is an integral facet of urban life. As the city grows, demand for the vehicles and new roadway facilities and new routes also arise. Different modes of different speed, capacity, hiring system, and fare are seen in the city streets to suit the demand of various classes of passengers. Mass transit is patronized in the city to minimize traffic congestion, increase safety, and reduce the use of cars and parking space. It operates on an established schedule along designated routes with specific stoppages. Examples of mass transit include bus, light rail. Although mass transit is recommended for the smooth and efficient transport system in a city, still Dhaka is not planned enough to flourish bus service or light rail service or a rapid transit system in the city. Bus is the available mass transit in the city. Moreover, the income level of the inhabitants of the city is not high. So, a huge demand for traveling by bus is there. Overcrowded buses, huge waiting times at the stoppages, irregular arrival of buses, and an indefinite period for trip completion deteriorate the bus service in the city. The situation is same in both public and private-owned buses.

On the night of 1 July 2016, at 21:20 local time, five militants took hostages and opened fire on the Holey Artisan Bakery in Gulshan Thana. 29 people were killed, including 20 hostages (18 foreigners and 2 locals), 2 police officers, 5 gunmen, and 2 bakery staff. The incident was the worst terrorist attack in Bangladesh's history. After that event DNCC (Dhaka North City Corporation) launched the program of the special transport service named “Dhaka Chaka”. On August 10, 2016, almost 40 air-conditioned buses and 500 rickshaws have been introduced in Gulshan-Banani area; Dhaka's diplomatic zone, a move taken to increase security measures in the area that witnessed Bangladesh's worst terror attack on July 1. The surveillance system in the diplomatic zone has been changed and the special transport service is a part of it. The rickshaw-pullers have been trained in security, hospitality and emergency measures. Passengers in the new buses enjoy several facilities including WiFi and television. Moreover, even if the engine of the bus is turned off while sitting in a traffic jam, the air-conditioner stays on. Rajib Hossain, the 22-year-old college student who lost one of his arms in a bus accident in Dhaka on April 3, 2018, and after two weeks in coma, Rajib Hossain drifted off to death on April 17, 2018. A student of Government Titumir College in Dhaka, Rajib lost his right arm when a bus of Sajan Paribahan hit a BRTC double-decker bus parked at SAARC circle on April 3, 2018, and was a stupid race of two irresponsible drivers. So there is a crying need to systemize the public transport sector for public life and safety. Single operator based public transit can play an important role in this regard.

Barua, U., & Tay, R. (2010) studied safety issues of transit services in Dhaka city. There has been a general increase in the severity of transit bus crashes for 1998-2005. They utilized the transit crash data to understand the factors behind the collisions. They recommended a driver training and education program, traffic enforcement and more police control to be introduced to improve road safety in Dhaka city. Punctuality, or time performance, and regularity are two different aspects of the performance of transit service. It can be found in the literature that the importance of service measures varies between long headway routes and short headway routes. For headway routes, the most common measure of reliability is punctuality (Furth, P. G., & Muller, T. H. (2007)). However, for high-frequency routes, it is important to monitor headway regularity (Transportation Research Board. 2002; Van Oort, N., & van Nes, R. (2009); Trompet, M., Liu, X., & Graham, D. J. (2011)). “On-time performance is often measured only on routes with longer headways (e.g., longer than 10 minutes, while headway regularity is often measured for routes with shorter headway.” (Transportation Research Board, 2002, p. 207). On short headway routes, customers should not have to rely on the schedule. (Research Board, 2002).

In this paper, we evaluate the performance of Dhaka Chaka bus service in comparison with the “Lease-type” bus service currently running in the city. Lease type bus services are accident-prone; reckless driving, overtaking tendency are also common. This study is interested in finding whether

these drawbacks are found in this bus service or not. The specific objectives of the paper are as follows:

- To study the performance of newly introduced Bus Route franchise-based bus service in Gulshan area.
- To identify the problems and bottlenecks of the existing service.
- To recommend some guidelines for the improvement of the bus service of Dhaka.

The main objective of this research is to investigate the performance of bus service Dhaka Chaka in Dhaka city. Public safety and user experience study were taken into account to compare the service with Lease type bus service. Public satisfaction is an important parameter for any performance evaluation. In this study, this parameter was evaluated by doing a questionnaire survey. User opinion survey, trip study, passenger volume survey data are represented as tabular and graphical form and analyzed. The bus service was launched to make a sustainable solution for congestion and transportation in these areas. This study also desirous to evaluate if this service is up to the mark to meet its initial purposes.

2. METHODOLOGY

Methodology is the guidelines and logical framework for the researcher for conducting the research. To fulfill the objectives effectively and to carry out the entire study, some procedures and initiatives have been taken. The working process used in this project involved the following main steps; literature search, literature review, route selection, data collection such as route survey, passenger survey, interviews and data analysis, sorting of data, minimization or elimination of data errors. All these processes are compiled to achieve the objectives.

2.1 Surveys

As Dhaka Chaka buses are conducted on 2 routes, surveys were done mainly on these two routes. Traffic surveys were conducted on all 2 routes to find out route characteristics, bus-stops, passenger loading and unloading practice, travel pattern and performance of the bus service in the routes. To evaluate the performance parameters of the buses on these routes, field surveys would depict the existing situations. Mainly two types of surveys were introduced in these routes, namely

1. Travel Time survey of Buses

2. Sample Questionnaire Survey of Passengers

Interview of officers in Dhaka Chaka office was also conducted to get the trip information and other details of this bus services. Field and visual observation was done to ensure a first-hand experience. Sufficient photos were taken for further attachment.

During the survey process, some problems were prominent. Some people were not co-operative at all. Even the authority was not supportive in that case at first.

2.1.1 Bus Performance Parameters Evaluation Procedures

The indicators of bus service which are considered are travel time, travel speed, average distance between stoppages, passenger loading/unloading practice and safety against user perception. Following methodological study have been taken to evaluate the performance parameters:

To get the basic understanding on the topic, literature survey was undertaken and information was collected from published and unpublished sources.

Basically, these buses are serviced in two routes in Gulshan and Banani area. So, the study routes were selected from google map. The locations of the starting bus-stops were also collected via google. According to recent study by the consultant under Bus Network Study at DTCA, lengths of the bus routes vary from 0.5 to 66 km, although 26.3% have lengths between 10 and 15 km, 24.3% between 15 and 20 km and 17.8% between 20 and 25 km. As mention earlier, there are about 289 permitted bus routes in the City. The number is very high as because there are many overlapping routes. Among these routes, one route is selected for analysing non-franchise system in Dhaka. This is Azimpur to

Mohammadpur bus stand. The route length is 4.9km and there exists four legal stoppage at Azimpur, Zigatola, Sankar and Mohammadpur. Fare was TK.12 and it was fix for any distance.

Route surveys were done to collect information on origin and destination of bus service, travel time components, travel speed, frequency of service, number of buses in the route, number of passengers carried per trip, number of trips per day, stoppage, congestion, passenger loading-unloading practice, passengers' safety. Sample questionnaire surveys were conducted among the user of the buses. The survey aimed to determine passenger safety and comfort along the ride. It also aimed at study the problems they face in and their opinion and recommendations for the improvement of the system.

Interview of authority in the office was held to get some information regarding this system. The information consists of number of trips per day, operation time, driver and helper's salary, accurate locations of bus-stops in both routes, average trip time, average travel speed.

Field observations of this bus system was done by visual and photographic observations. Photos has been taken to differentiate between the Dhaka Chaka bus service and Lease type.

In this study, for speed measurement, time mean speed followed. For measuring time to complete a trip, direct riding on bus was done. Travel time between two bus stops was taken at the start and the end as well as to complete a trip. Bus dwell time in any stop was also counted. Dwell time is the time interval between opening and closing its doors to serve passengers at the bus stop. To find the average distance between two stops google map application was used.

3. PERFORMANCE STUDY OF DHAKA CHAKA BUS SERVICE

The bus service usually operates at 8:00 AM to 10 PM. The surveys were conducted at different periods of the day to see and analyze the performance throughout the day. The author decided to carry out the survey at three different periods of the day to get a better idea. Four selected periods were

1. Morning (between 9:00 AM and 11:00 AM)
2. Noon (between 11:30 AM and 3:00 PM)
3. Afternoon (between 3:30 PM and 6:30 PM)

The respondents of the questionnaire survey in Dhaka Chaka bus service were 303. Among them 222 were male and 81 were female. There were 253 respondents in Lease type of bus service. The graphical representation of age and sex structure of the respondents of Dhaka Chaka Bus Service and Lease Type Bus Service are given in Figure 1.

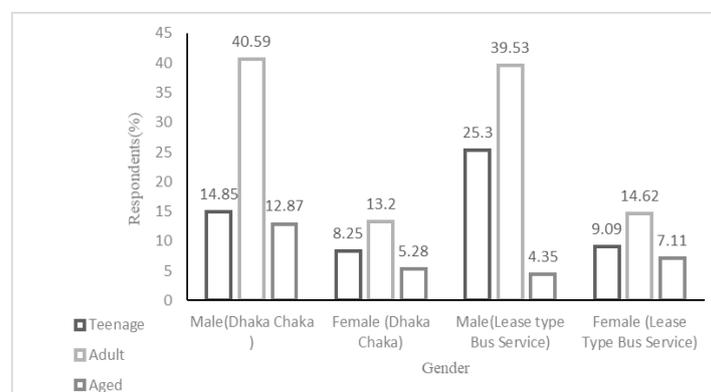


Figure 1: Percentage of respondent's age and sex

Figure 1 reveals that the adult respondents were in higher proportion both in Route 1 and Route 2 of Dhaka Chaka Bus Service and Lease Type Bus Service. However, in this broad category, the teenagers were larger than the age group in both cases. In both services, adult respondents are highest among the teenage and aged. The young passengers were using the Dhaka Chaka Bus Service in

greater proportions probably because Gulshan-Banani-Baridhara are commercial areas, so most of them come there for their office.

Figure 1 shows the sex structure of the respondents. Naturally, male passengers were much higher in proportion compared to female passengers in both the passenger group. Notably, female passengers were found to be in higher proportion in the case of Lease Type of Bus Service. There were 26.73% female passengers among the Dhaka Chaka Bus Service users against 30.82% among the Lease Type of Bus Service users. From the figure, it is also revealed that women were less responsive as mentioned before in 2.1 Survey.

Among 303 respondents of Dhaka Chaka bus service, 233 respondents were regular users of this bus service. From Figure 2, it is seen that most of the respondents were regular users. Among all the respondents, Dhaka Chaka passengers are more regular.

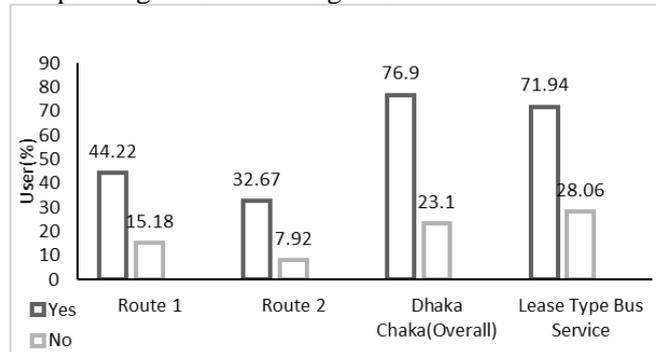


Figure 2: Respondent's using Type as Regular or Irregular

Dhaka Chaka Bus Service serves two routes in Gulshan-Banani-Baridhara area. The fare is fixed which is Tk.15 and it fixed for all distances. Basically, it has access driven fare system. No passenger is allowed to get on the bus without a ticket. Performance parameters such as travel speed, trip time, average distance between stoppages, passenger loading unloading practice, passenger safety along with user perception of the service are evaluated in this section.

3.1 Average Travel Speed

Travel speed is measured by counting trip time in one direction. 16 trips were made in Route 1 and 12 trips were done in Route 2. Travel speed of this service is given in Table 1

Table 1: Average Travel Speed

Route Name	Average Speed(km/hr)	Maximum Speed(km/hr)	Minimum Speed(km/hr)
Route 1	7.39	11.08	2.40
Route 2	7.60	11.08	3.27

Source: Trip Time Study, 2018

From Table 1, it is defining that average speed was 7.5 km/hr. It is also seen that the average speed of Route 2 is slightly greater than Route 1 as Route 1 was more congested with traffic due to signal and route length is slightly larger than Route 1. Consequently, the maximum speed of both route is the same. On average, Route 1 travel speed was less than Route 2 as minimum speed also smaller than Route 2.

3.2 Trip Time

The study was conducted at different periods of the day to find out the condition at different situation of the day. It was conducted in both directions. Trip times were taken by 16 trips in Route 1 and 12 trips in Route 2. For the convenience of the author, the direction in Route 1 from Natun Bazar to Banani was considered DOWN and Kakoli to Natun Bazar was considered UP. The direction in Route

2 from Gulshan DCC Market to Police Plaza was considered DOWN and Police Plaza to Gulshan DCC Market was considered UP.

Table 2: Time to Complete a Trip

Route Name	Origin-Destination	Average Time(hr:min)	Maximum Time(hr:min)	Minimum time(hr:min)
Route 1	Natun Bazar-Banani(Down)	00:21	00:30	00:17
Route 1	Banani-Natun Bazar(Up)	00:22	1:00	00:13
Route 2	Gulshan DCC Market-Police Plaza(Down)	00:19	00:30	00:10
Route 2	Police Plaza-Gulshan DCC Market(Up)	00:24.33	00:44	00:15

Source: Trip Time Study, 2018

While going from Police Plaza to Gulshan DCC Market, the required time to complete a trip varied widely like as Route 1. From the study it was found that the maximum time required to complete a single trip was 1 hour and the minimum time required to complete the trip was 13 minutes, both in UP direction (Table 2) while in opposite direction (DOWN journey), travel time was fairly same. In the case of UP journey, the lowest time was found in afternoon as that period is working time and maximum time was found in the evening because of office closure time. For the same reason, DOWN time was found lowest in the afternoon and the highest time was found in the evening (Trip Time Study). The total average trip time (average for UP-DOWN journey) was found to be 22 minutes.

3.3 Average distance Between Stoppages

In Route 1, there were 6 stoppages and in Route 2, there were also 6 stoppages. The average distance of the stoppage is given in Table 3.

Table 3: Average Distance between Stoppages

Route 1 (Stoppage)	Average distance between stoppage(km)	Route 2 (Stoppage)	Minimum Speed(km/hr)
Natun Bazar	-	Gulshan DCC Market	-
Gulshan- 2	1.20	Agora	0.60
Kakoli	1.20	Jabbar Tower	1.00
Banani	0.45	Police Plaza	0.70
Gulshan- 2	0.90	Gulshan 1(Navana Tower)	0.80
Natun Bazar	0.85	Gulshan DCC Market	1.50

Source: Google Map

In Route 1, the route length is 2.4 km and in Route 2 the length is 2.3 km in one direction. Shortage distance between stoppages is 0.45 km in Route 1 which is between Kakoli to Banani. In Route 2 shortage distance is between Gulshan DCC Market and Agora which is 0.60 km. The longest route length is observed in Route 1 that is 1.20 km from Natun Bazar, Gulshan-2 and kakoli direction. As stoppages are situated in short range, it is convenient for the passengers to get the bus to board. People use this service instead of walking

3.4 Passenger Loading/Unloading Practice

In this bus service, passengers were boarded on bus only at stoppages but unloaded both in stoppage and without stoppage. Passenger got down from bus if his destination was before the stoppage or he had to change the route. It is seen in Table 4 that no passenger was loaded in middle of the road as illegal stoppage among 16 trips in Route 1 and 12 trips in Route 2. Table 5 shows among the observed passengers in 28 trips, 55.23% of the passengers getting down from bus at legal stoppage. Though in Route 2, passengers unloaded at illegal stoppage was greater than unloaded at legal stoppage

Table 4: Passenger Loading/Unloading Practice

Route Name	Number Of Passenger			
	Legal Stoppage (up)	Legal Stoppage (down)	Illegal Stoppage (up)	Illegal Stoppage (down)
Route 1	563	345	0.00	218
Route 2	451	215	0.00	236

Source: Trip time Study, 2018

Table 5: Percentage of Passenger Loading and Unloading from Bus

Legal Stoppage(up)	Legal Stoppage(down)	Illegal Stoppage(up)	Illegal Stoppage(down)
100%	55.23%	0.00%	44.77%



Figure 3: Passenger loading and unloading practice on bus (Dhaka Chaka)



Figure 4: Passengers are in queue to get on the bus (Dhaka Chaka) and bus at stoppage



Figure 5: Passenger loading and unloading practice on bus (LBS)

3.5 Passenger Safety

In the questionnaire survey, respondents were asked about their safety when traveling through the bus and loading-unloading practice. Almost all the passengers in both Route answered the same that their answer was *Yes*. Table 6 shows the survey result.

Table 6: Passengers Perception about Safety

Route Name	Safety Along With User Perception(Total 303)	
	Yes	No
Route 1	179	1
Route 2	122	1

Source: Questionnaire Survey

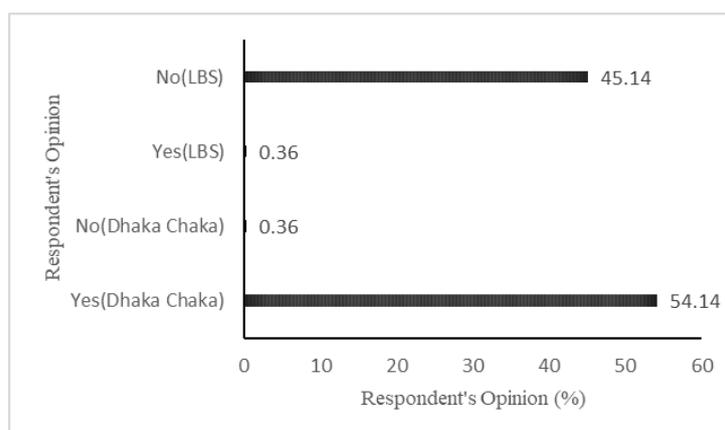


Figure 6: Passengers Feeling about Safety

In Table 6, only 2 respondents out of 303 respondents in both Route didn't feel safe from this service. But other than all the passengers felt safe as indicated in Figure 6 were 54.14% passenger of Dhaka Chaka gave their consent. It implies that the bus serviced safely to the passengers through their loading-unloading practice. On the other hand, 45.14% of respondents didn't feel safe using the Lease type of bus services. This is because of the unhealthy practice of boarding and alighting of passengers from the bus.

3.6 Driver's Remuneration

Table 7: Driver's Remuneration

Dhaka Chaka Bus Service (Bus Route franchise)	TK.1300/day
Lease Type Bus Service (Non-Franchise)	TK.200/trip

Remuneration of driver is different in two different bus services. Remuneration plays an important role in driver behaviour in the road along with driving. From Table 7, it can be seen that Dhaka Chaka bus driver usually gets TK.1300 per day for 14 hours duty. This remuneration is fixed which is independent of the number of trips and passenger served. On the other hand, drivers in Lease Type Bus Service get only TK.200 per trip. This is solely dependent on the number of trips a driver can complete per day. The higher the trip number, the more one can earn. This practice makes the unhealthy competition among drivers to reckless driving and to board on more passengers. Hence safety issue hampers of the passengers. This is one of the reasons for accidents in Dhaka city which causes serious injury such as separation of hand from the body even death. As Dhaka Chaka bus operates under franchise system, there is no unhealthy competition among drivers to complete as many as trips they can to earn more. How many trips they complete, they get a fixed amount. This practice brings mental calmness of a driver. So, he doesn't engage himself in competition and drives safely. This reduces accident rate and increases passenger safety. Passenger can safely get on the bus where driver does no harsh driving and safely alighting passenger to the desired stoppage. So, a

franchise system can bring discipline among the drivers for safely driving in the road. It derives the driver from competing with each other. Drivers have no hurry to complete many trips as they get a fixed amount. But in a non-franchise system, drivers want to complete many trips that lead completion and create passenger as well as road safety concerns.



Figure 7: No scratch on bus body (Dhaka Chaka) and scratches on bus body (LBS)

4. CONCLUSIONS

There is a little variation in average speed between two routes because of longer signal time and congestion. The maximum trip time is generally observed during peak hours. As stoppages are situated in the short-range, people use DCBS instead of walking. Passenger loading-unloading practice in Dhaka Chaka is very well organized compared to the Lease Type Bus service. Because passengers of the non-franchise bus service usually board/alight on/from the bus in the middle of the road, even when the bus is in motion. Most of the passengers consider DCBS as safe due to the disciplined loading-unloading practice. As a result, all the participants of the survey want this service (DCBS) on the other routes of the Dhaka City.

The process of forming a new company comprising of the existing operator is not an easy task. The formation of one or two operators from the existing company is a complex task and needs careful study and consultation. The behaviour of the local drivers needs to be studied as payment based KM operation. The driver behaviour should be linked with the payment system and a careful investigation is required for linking driver behaviour with the payment. Otherwise, they will not be inspired by additional passengers or will not care about passenger's comfort and safety. The cause and effect of the penalty system need to be carefully studied as penalty and rewards work only where adequate capacity is in place by the authority.

Creating omnibus operating companies should be done under the regulations of independent, strong, skilled and very capable regulatory body. If the regulator is weak, it will not be a feasible option to improve the quality of service. This study has made a path to recognize suitable franchising systems to improve the quality of the service and another study could be done on strategies to improve the applicability of selected franchising systems.

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