

EVALUATING THE USER'S PERCEPTION REGARDING THE ROLE AND PERFORMANCE OF PUBLIC TRANSPORT IN KHULNA-JESSORE HIGHWAY: A CASE STUDY ON AFILGATE TO FULBARIGATE MIDBLOCK

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ABSTRACT

The sustainable growth of a city can greatly be influenced by public transport in developing countries. It can be a prerequisite from social and economic aspects. The study has been conducted to evaluate the user's perception about the role and performance of public transport (i.e. the existing condition of the fixed facilities and control system) of Khulna-Jessore Highway (Afilgate to Fulbarigate) in Khulna. To achieve the objective a user opinion survey has been conducted among the public transport users including drivers and traffic polices. The overall traffic condition of the study area has been evaluated and the satisfaction level of the users has been measured. Moreover, speed and volume survey have been conducted to get an overview of the vehicular flow and the fluctuation of speed on the midblock. Overall satisfaction level of public transport has been obtained through Customer Satisfaction Index (CSI) considering some service performance indicators including availability, reliability, safety and comfort. Users of bus (CSI score = 4.80) are less satisfied blaming availability and reliability of this transportation mode where Mahindra/ Atul (CSI score = 5.84) has got less satisfaction because of the discomfort and high fare cost. Again, analyzing data, this study has found that about 46% respondents have indicated Fulbarigate as the busiest node at peak hours because of high road side commercial activities. However, the people are satisfied with accessibility and availability of the vehicles all over the midblock. During questionnaire survey about 35% of the respondents have suggested to ban road side commercial activities and around 25% has focused on lane separation for abating traffic congestion and irregular flow.

Keywords: Evaluation, User's Perception, Satisfaction, Performance, Transportation.

1. INTRODUCTION

Transport is an important component of economic activity in all over the world especially in developing counties (Mahmud, Rahman, & Rabbi, 2006). According to (Shamsher & Abdullah, 2012) the annual country wise wastage due to traffic jam was USD 79 million for the year in 1997. The Asian developing cities are facing the serious traffic congestion, deteriorating public transport service, lack of investment funds and other traffic problems.

Bangladesh is among the top 12 developing countries with a population of over 20 million and 7.1% annual GDP growth (World Bank, 2016). One of the most challenging and complicated issues in city management in the present decade for Bangladesh is the traffic problem as well as the improvement of transportation system (Shamsher & Abdullah, 2012). The safety situation of road transport in Bangladesh is very severe by international standard and traffic accidents are costing the community in the order of US\$ 800 million (nearly 2% of GDP) each year (Mahmud et. al, 2006).

In this situation, improvement of traffic and transportation system is one of the main challenge. As becoming industrialized city and divisional town with a port at Mongla, Khulna is the

country's third largest city in Bangladesh having a higher transportation demand (Asian City Development Strategies, 2000). Again, the establishment of Padma Bridge will stimulate the economy of entire south-western region through the well connectivity with rest regions of the country. Thus, the pressure on the transportation system of the city will be much higher than now within 2018 and will play a significant role in national economy. The identification of the existing problems of the highway will help to provide some propositions for the embodiment of transport facilities where it is needed.

Continuous urban growth, environmental issues, competition for limited space, longer commuting distances as well as the need to promote equity and equality in society are the primary reasons that make the use of Public Transport a priority in today's world (Abenzoza, Cats, & Susilo, 2016). Developing public transport facilities is one of the main ways to reduce congestion (Lia, et. al, 2013).

Performance of public transport can be measured by service utilization (ridership), service quality, and accessibility to the service (Hawas, Khan, & Basu, 2012). Customer retention and the attraction of new users can be accomplished by increasing customer satisfaction with Public Transport services and improving their public image, which are widely believed to play decisive roles in rising ridership (Abenzoza et. al, 2016). Optimum efficiency can be achieved by the creation of balance in supply cost (disutility) and level of service improving the operational features (Daganzo, 2010). The objective of this study is to evaluate the user's perception regarding the role and performance of public transport of a midblock (Afilgate to Fulbarigate) of Khulna-Jessore Highway.

2. METHODOLOGY

2.1 Review of Previous Study

The evaluation index system of public transportation was established based on six aspects like safety, speediness, punctuality, comfort, economy and convenience from the operators and users in China. (Lia, et. Al,2013).

(Abenzoza et. al, 2016) Identifies and characterizes current and potential users of public transport in Sweden and identifies the most important determinants of travel satisfaction with Public Transport services for each segment of travelers. It investigates the changes over time of attribute importance among the different segments and the inter-segment geographical variation of overall satisfaction. The cluster analysis results with five segments of Swedish travelers include: (i) inactive travelers; (ii) long distance commuters; (iii) urban motorist commuters; (iv) rural motorist commuters and; (v) students. By contrasting satisfaction with the importance of each quality of service attribute, three key attributes that should be prioritized by stakeholders are identified: customer interface, operation, network and length of trip time.

(Nesheli, Ceder, & Estines, 2015), Study was undertaken in two-parts: (a) assessment of the effects of delay on PT user's perception and decision to change route or mode; (b) evaluation of user's decision based on various real-time operational tactics. To investigate users' perception and decisions related to various operational tactics, a user-preference survey was conducted at a major terminal in Auckland, New Zealand, and Lyon, France. The survey data was modeled a Multinomial Logistic Regression and a decision-tree-based method.

From the study of different research and secondary sources, User perception regarding the role and performance of public transportation system can be found through the evaluation of operational features based on a user opinion survey. In this paper, the road users are passengers, drivers and traffic staffs. In this study area, maximum trips are commercial based as almost half of the land use is commercial along the highway. The satisfaction level of the

road users can perceive the congestion rate and level of service of that midblock.

Traffic volume should be in an optimum number and composition so that the highway can serve the passengers without hazard. Speed is an important transportation consideration because it relates to safety, time, comfort, convenience, and economics determining general speed trends, reasonable speed limits. The actual speed of traffic flow over a given route may fluctuated widely, as because at each time the volume of traffic varies. Accordingly, speeds are generally classified into three main categories; spot speed, journey speed and running speed.

2.2 Study Area

Afilgate to Fulbarigate midblock of Khulna-Jessore Highway has been selected as the study area for this project. Because of the linear shape of Khulna division Khulna-Jessore Highway is the most important transport road way for both intra and inter Khulna city transportation network. The length of the study area segment is 4.8km. About 50% surrounding space is used for government services such as eye hospital, transport authority etc. that reflects high trip attracting characteristics. Besides commercial activities occupy 7% of the space and recreational area occupies almost 8% which is located in Jahanabad. Again, 19% residential and 8% manufacturing industries are mainly the trip generator.

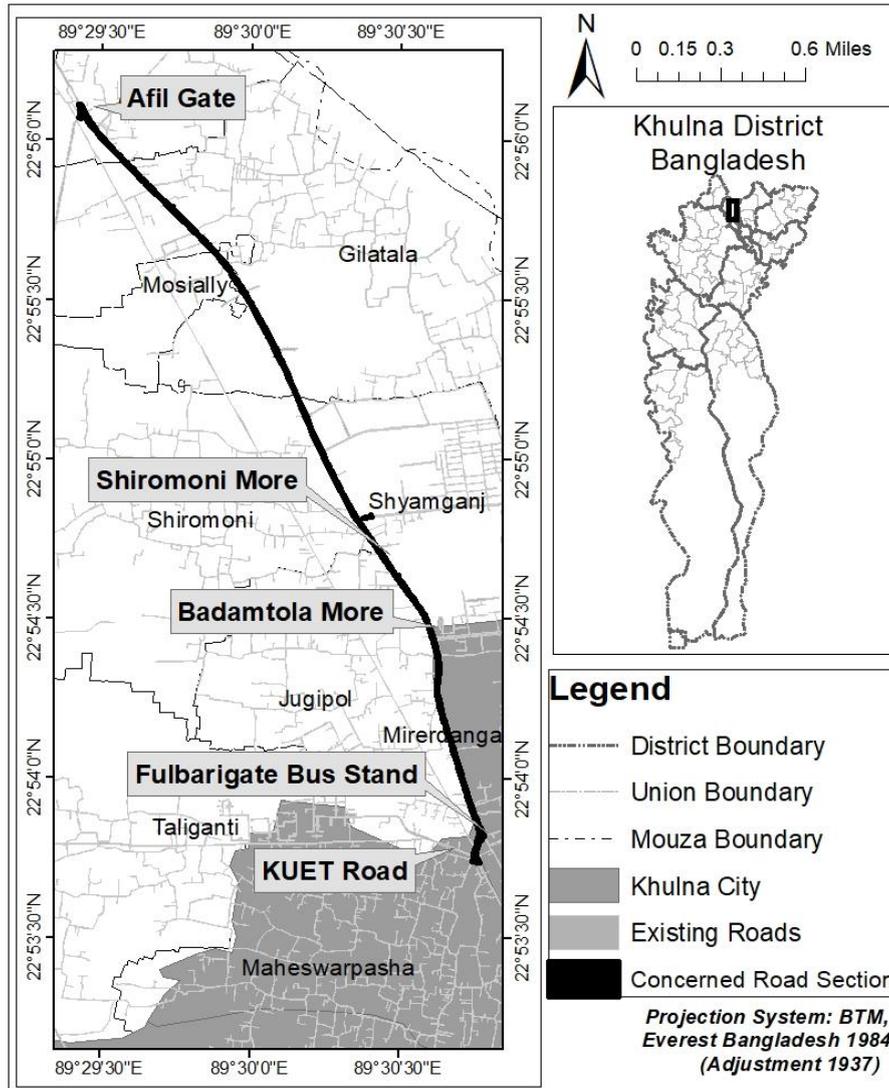


Figure 1: Study area location;
Source: Author; Generated in ArcGIS; Date: 28/12/16

2.3 Survey Design

Data has been collected from a questionnaire survey considering the indicators of measuring performance of the operational features of public transport. The sample size has been estimated 140 (100 road users, 20 vehicle drivers and owners as well as 20 traffic polices) for the survey. The survey has covered the issues necessary to evaluate the performance of existing public transport with different fixed facilities and control system. Again, the survey output is a reflection of satisfaction level of the public transport users. For assistance of the research and reliability issues some other survey has been conducted in the study area; those are physical feature survey, volume survey and speed survey.

Physical feature survey has been done which has reflected the existing condition of fixed facilities of roadway including cross sectional elements, road side land uses and various control systems.

To get an overview of the vehicular flow on the midblock, volume survey has been done at peak and off-peak period of both weekday and weekend. Again, the number of pedestrian passes on the midblock has been counted.

Spot speed of all public transport has been measured at different segments of the midblock. Moving observer method has been used to determine the journey and running speed of two vehicle; viz: town service (public transport) and microbus (private transport).

2.4 Analysis

Analysis has focused on to evaluate travel behavior of public transport users, the major transportation related problems, the satisfaction level on different operational features of public transport and the suggestions to make efficient and convenient public transport facilities.

A data set has been prepared in SPSS regarding the questionnaire survey and different statistical analysis has been completed.

The most congested node of the midblock has been identified based on the user's perspective and this opinion has been validated through volume and speed of the vehicles for each node of the road midblock.

The finding has showed the satisfaction level of road users on operational features. After the analysis, a decision has been taken if the operational features of public transport of the study area are good or bad based on the typical public transport system. A set of recommendation has been provided based on the user's requirement and planning standard.

Customer Satisfaction Index (CSI) measures how satisfied customers currently are with each service provided. 13 performance indicators have been selected based on different secondary sources (Rabby, Hossain, & Rahman, 2016; Transport for NSW, 2015). The indicators have been calculated on the basis of user judgments expressed by a numerical scale. The scale of both satisfaction level and importance score is 1 to 10. Where 10 expresses highest satisfaction and importance level whereas 1 expresses that of the lowest. The following formula has been used:

$$CSI = \sum_{k=1}^N MSS * IW \dots\dots\dots(1)$$

Where, *MSS* = the mean of the satisfaction rates expressed by users on the service quality of k indicator,

IW(Importance Weight) = A weight of the k indicator, calculated on the basis of the importance rates expressed by experts and customers. Specifically, it is the ratio between the mean of the importance rates expressed by them on the k indicator and the sum of the average importance rates of all the performance indicator. [$IW = \frac{MIS_k}{\sum_{k=1}^N MIS_k}$; I_k = Importance factor of k attribute] (Eboli & Mazzulla, 2009)

CSI score has been interpreted on the basis of following criteria showed in (Table 1).

Table 1: Criteria for customer satisfaction index (CSI)

CSI Value	Criterion of CSI
0.81-1.00	Very satisfied
0.66-0.80	Satisfied
0.51-0.65	Quite satisfied
0.4-0.50	Less satisfied
0.00-0.39	Not satisfied

Source: (Rabby et al., 2016)

3. FINDINGS

After conducting a questionnaire survey, it has been noticed that maximum people travel through Afilgate to Fulbarigate are students. And the second highest number of people travel in the study area are service holder in occupation. But very less surveyed people are found unemployed. The road is mostly used by the teenagers, young adults and adults. Again, maximum time people travels for once in a day. But when it is for business purpose, people travels multiple times a day. There are some people who also travel for once in week too and frequency of those people is 2% (by surveying people). However, the trips are mostly made in Sunday as the opening day of the week which makes it the most critical day for users. Besides, people coming from Fultala is the highest in frequency. The second highest number of people comes from Shiromoni.

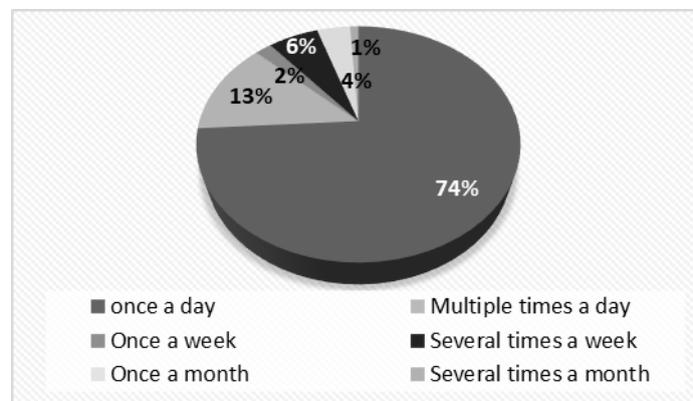


Figure 2: Frequency of Trips (Field Survey, 2016)

3.1 Modal Choice

The utmost number of the people traveling in the study area have an income of less than 5000tk. The people who are businessmen or engaged with trading activities earn 25000TK or more per month. And maximum number of people travels for non-home-based work. The travelers normally prefer Easybike as a mode of transport most of the times. But with the increasing of income, people are shifting to other preferable modes such as Atul or Motorcycles. Easybikes are mainly preferred for low transport fare and high comfort, availability and proximity to origin. But most of the surveyed people such as 25% have responded to availability as the reason. While Atul has been preferred for it's less travel time and has got 20% of total response. People who have a busy day such as travelling multiple times a day like to use Atul for its availability and less travel time. The economic level of the people surveyed has been categorized into five tires. Among them the most people make work purpose trip lied between 5001-10000 income groups that means the people of lower

income are more eager to work rather than shopping. The final tier of the income group more preferred to business trip.

Table 2: Trip Purpose vs. Preferred Vehicle

Trip Purpose		Most preferred vehicle						Total
		Bus	Atul	Easybike	Car	Motorcycles	Others	
Trip Purpose	Work	0	9	8	1	9	3	31
	Shopping	0	5	13	0	0	0	11
	Business	1	3	3	0	3	0	10
	Recreation	0	0	4	0	0	0	5
	Education	3	10	11	0	0	0	26
	Others	0	6	8	0	0	0	17
Total		4	33	47	1	12	3	100

Source: Field Survey, 2016

3.2 Problems faced by the Passengers

Most of the respondents have asserted Fulbarigate as the most congested node, followed by Shiromoni as the second and Badamtola as the third. But Afilgate and Jahanabad have not been identified as congested one. Most of the users have suggested that they have to spend less than 5 minutes in traffic jam and have to face congestion during their evening trips.

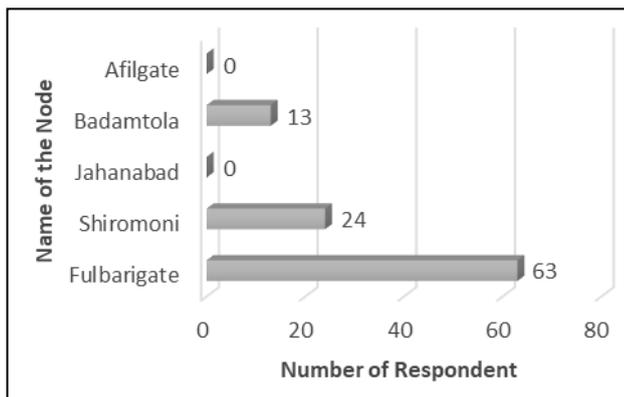


Figure 3: Rank of Congested Node (Field Survey, 2016)

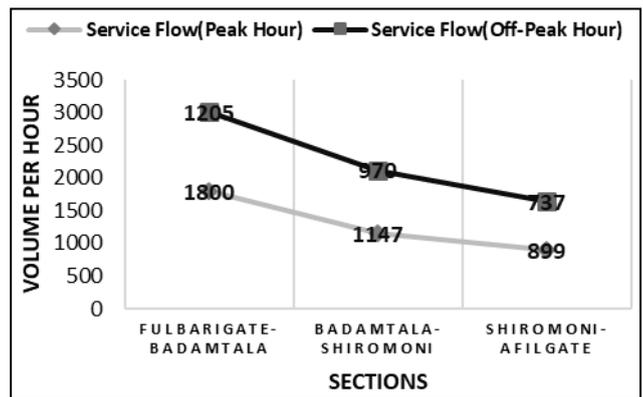


Figure 4: Flow Fluctuation Rate at week days (Field Survey, 2016)

Volume survey has showed that during week days the maximum rate of flow is 1800 vehicles per hour at Fulbarigate to Badamtala and the minimum rate of flow is 899 vehicles per hour at Shiromoni to Afilgate in peak periods which generally indicates that the Fulbarigate to Badamtola segment is more congested than the Shiromoni to Afilgate segment.



Figure 5: Traffic Jam Duration & Time Period (Field Survey, 2016)

On the other hand, Badamtola to Shiromoni road segment has a rate of 1147 vehicles per hour of traffic in peak periods that is less than that of Fulbarigate to Badamtola road segment. But in off-peak periods it is 1205, 970, 737 vehicles per hour in three road segments.

Again, some problems in different nodes on their travel route have been faced by the users. 44% has identified congestion as the biggest problem which is mainly caused by roadside informal parking and 24% has claimed to face problems for informal roadside commercial activities in different nodes. Besides, irregular traffic flow is another reason behind the congestion. And most of these problems are faced in Fulbarigate node. In case of the road-segment between Badamtola and Fulbarigate, a total of 25% respondents often have to go through difficult situations. Fulbarigate has been identified as the intersection with maximum issues. 48% of the respondents have expressed negative opinion about the traffic police which is a serious deal.

Table 3: Reason behind Congestion

Reason behind the congestion	No. of Response
Commercial roadside activity	24
Roadside parking	44
Roadside construction	3
Irregular flow of vehicle	18
Others	11
Total	100

Source: Field Survey, 2016

For BRTC service; some users have never experienced BRTC Bus Service while the ones who have do not consider it as a great transport mode. The users have made suggestions for improving the facility. 54% of the respondents have demanded for increasing number of buses. 16% of the users desire the bus to be on schedule and 11% think that avoiding overloading of passengers can help the service get better. The rest consider reducing the fare a better option.

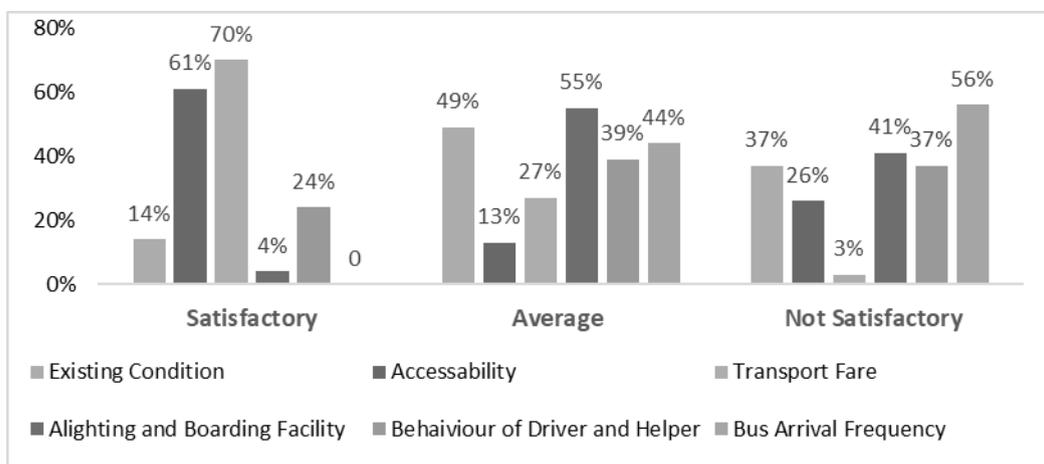


Figure 6. User's Satisfaction about Public Transport (Field survey, 2016)

Most of the users have expressed their satisfaction about the current transport fare while the dissatisfaction in vast amount rises from not having enough local buses running on the street around the clock.

While the speed study shows that the journey speed is less than running speed, it indicates that the journey follows a stop-go condition with enforced acceleration and deceleration (Traffic stream characteristics, n.d.). Both journey and running speed of microbus is higher than that of town service which shows a speed inequality between public and private transport system of the study area.

Table 2: Journey and Running Speed of the Study Area

Features	Town Service (Bus)	Micro Bus
Mean Journey Time (min)	10.67	8.39
Journey Speed (Kmph)	27.00	36.04
Mean Running Time (min)	10.37	8.12
Running Speed (Kmph)	27.77	37.3

Source: Field survey, 2016

3.3 Users' Suggestion:

For improving public transport facility and reducing accidents on the roadway, maximum number of users (43%) think that raising awareness is the best option. Training the drivers properly and putting up signs might help. 31% users suggest that regulatory measures can be applied for different issues, for instants, commercial activities on the footpath can be banned. 16% user desire for better signaling facility and they think auto- signaling can help. Rest of the user said that implementation of different acts is necessary and imposing penalty can be a great tool for reducing the law violation and making road way safer.

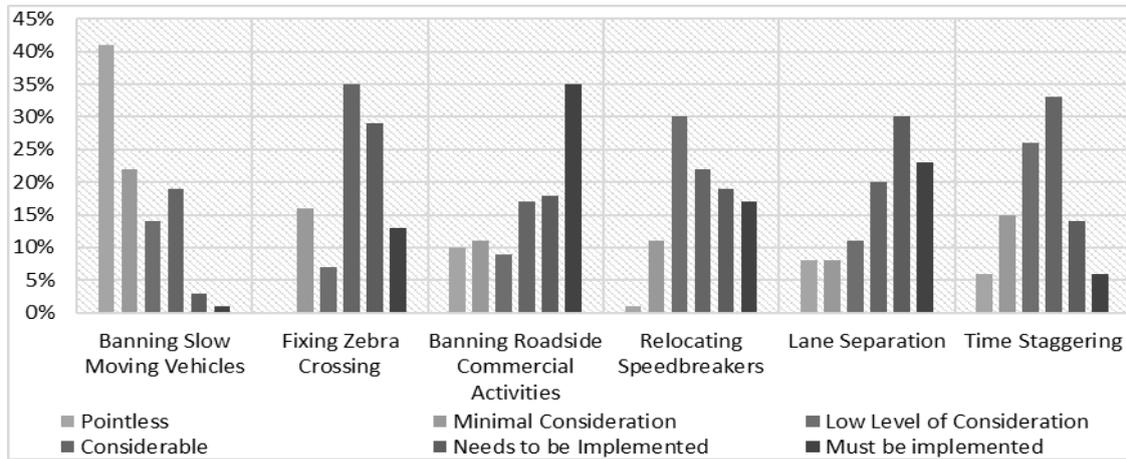


Figure 7. User Opinion for Different Regulatory Measures (Field survey, 2016)

3.4 Customer Satisfaction Index

Table 3: Calculation of CSI for bus transport (Scale of 1 to 10)

Performance Indicators	Measures of the indicators	MIS	IW	MSS	CSI (IW*MSS)
Availability	Service frequency (number of runs per day) and service time	8.00	0.09	3.8	0.36
Service Reliability	Regularity of the service	6.70	0.08	2.8	0.22
Accessibility	How easily user can get form their houses	7.00	0.08	4.6	0.38
Service coverage	No of stops and distance between stops	6.00	0.07	3.4	0.24
Information	access to information like schedule, ticket cost	5.80	0.07	3.4	0.23
Cleanliness	Internal and external cleanliness of vehicles	4.90	0.06	6.1	0.35

Performance Indicators	Measures of the indicators	MIS	IW	MSS	CSI (IW*MSS)
Comfort on trip	passenger personal comfort while transit is used including seat comfort, ride comfort	5.00	0.06	4.9	0.29
Safety	No of accident and security concerns personal against crimes	7.20	0.08	6.4	0.54
Pollution	Pollution creates by vehicle	7.40	0.09	4.8	0.42
Parking System	No of parking lots and the service quality	8.00	0.09	3.2	0.30
Behavior of driver	One of the services of public transport.	4.50	0.05	6.7	0.35
Efficiency	Travel time and journey speed	6.80	0.08	4.7	0.37
Affordable Fare	affordability of per capita Fare	8.00	0.09	8.0	0.75
Total CSI					4.80

Source: Author, 2016

From the above calculation, CSI score has been obtained 4.80 out of 10 (table 6) that expresses the bus transport as a less satisfied (Table 1) and less efficient transportation mode in this midblock. Users raise their voice against low reliability, availability of the mode and bad performance of parking capacity of the midblock. On the contrary, they are highly satisfied with low fare cost.

Again, CSI of Mahindra (preferred by 33% of respondent) has been calculated 5.84 using same importance weight. However, the score is quite satisfied as its less travel time, availability and reliability. At the same time discomfort resulted due to its high speed and congested seating capacity.

3.5 In case of Drivers

Most of the drivers are illiterate and they have received informal training. The truck drivers and some easy-bike drivers have no educational qualification and they have no training either. Equal number of drivers seem to work up to 8 hours and further (12hrs.) 50% of the truck drivers work up to 12 hours a day. 75% of the rickshaw pullers work for minimum time limits a day. 70% of the drivers are satisfied with the repair facility and gas stations. Yet the Atul drivers have complained that since the vehicle has been newly introduced to the city, repair facilities have not been established yet for this vehicle.

60% drivers expressed their satisfaction with the daily amount they have to pay to the owner of the vehicle. Among the unsatisfied group, majority are truck drivers and workers of bus service.

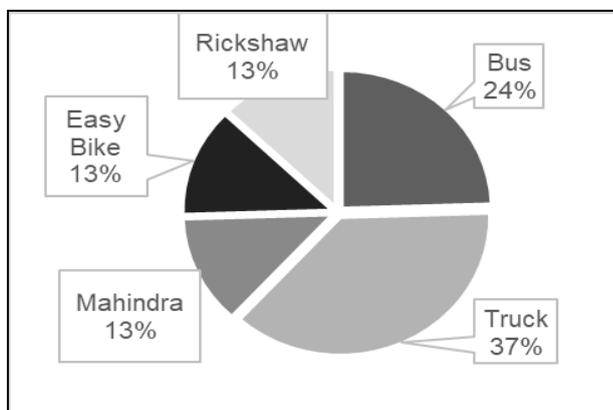


Figure 8: Dissatisfaction of Drivers (Field survey, 2016)

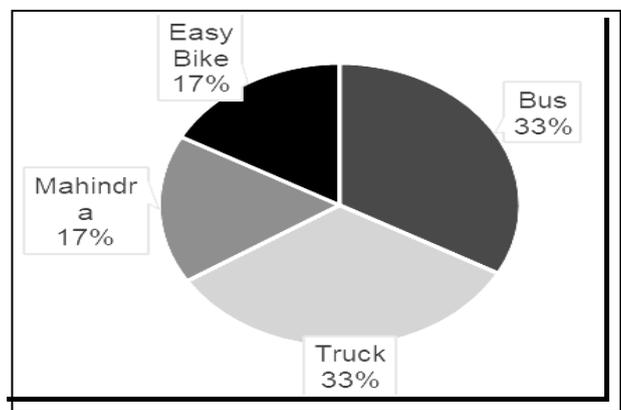


Figure 9: Dissatisfaction of Owners (Field survey, 2016)

However, Atul drivers calls out for strikes more often due to this problem. As for the owners, bus owners are most satisfied with their income. But the rickshaw owners and truck owners have the maximum complains with the amount they receive against their vehicles daily.

3.6 In case of Traffic Polices;

5 traffic polices have been queried and all of them stay on duty for up to hour 8 hours' maximum. They have identified 6-9pm as the most congested hour. 60% of the respondents suggest that motorcycles are more accident prone while the rest have identified easy-bike as so. Motor-cycle is unanimously considered to be the vehicle which is found to be unlicensed in most cases and easy-bike is chosen as the second one. Motorcycle is identified to often use the wrong direction as well, maintaining noticeably high speed.

4. POLICY IMPLICATIONS

Some recommendations may help in improving the existing public transport of Khulna-Jessore highway (Afilgate to Fulbarigate) such as;

- ✓ Formal on-street parallel parking should be introduced at Fulbarigate and Shiromoni intersections. Where the width and length of the parking space should be 2.0m and 6m respectively. Parking price should be levied according to parking duration and parking enforcement should be implemented (Mills, Dillarstone & Tucker, 2016). Very short-term drop off/ pick up places with a time of 3 to maximum 5 minutes. Short-term zones for loading or unloading or quick errands with a time limit of 5 to maximum 8 minutes.
- ✓ Land use should be controlled to single use in a place and temporary road side commercial activities should be banned.
- ✓ No of vehicles should be controlled by reducing slow moving easy bike and increasing the no of fast moving town service. Again, the schedule should be controlled for increasing the arrival frequency.
- ✓ Fulbarigate, Shiromoni and Badamtola intersection should be signalized with traffic polices and markings.
- ✓ Irregular U turn should be banned at congested intersections as like as Fulbarigate more.
- ✓ Variable message signs should be provided for the convenience of both users and drivers as well as the role of traffic polices should be enhanced.
- ✓ Alighting and Boarding facilities should be widely implemented as the most passenger suggest this.

The transportation system plays a momentous preface for a developing country to achieve a sustainable growth in all aspects such as social, economic and environmental. The present condition of the transportation system of Khulna-Jessore highway has gained people's satisfaction in some cases. Again, in some cases people are dissatisfied. But if the initiatives are taken properly and through some qualitative measures the existing condition can be more exalted. Thus, it can put some positive influences on the users.

5. CONCLUSION

This paper has aimed to find out the overall satisfaction level of the operational features of public transport. Questionnaire survey has been accomplished at a week day for finding perception of people travelling for work purpose. Again the sample size is 140 that is low for a satisfactory result. Fulbarigate more has been found as the most congested node due to illegal commercial activities and lack of proper on-site parking system. At the same time, Fulbrigate to badamtola road segment is the most overflowing section having volume of 1800 vehicle per hour and journey speed of 27 kmph (bus). City bus transport has got lower satisfaction level

than that of Easy bike and Mahindra. The availability and reliability is the main problem for this lower satisfaction level where Mahindra serves less travel time with higher availability at higher fare cost. Parking and traffic regulation system is worse here. Signalized road intersection, systematic on-site parking and controlling land use can improve the existing performance of public transport and increase the satisfaction level of the users.

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APPENDICES

Table 4 :Calculation of CSI for Mahindra (1-10 scale)

Performance Indicators	Measures of the indicators	MIS	IW	MSS	CSI (IW*MSS)
Availability	Service frequency (number of runs per day) and service time	8.0	0.09	8.7	0.82
Service Reliability	Regularity of the service	6.7	0.08	7.1	0.56
Accessibility	How easily user can get form their houses	7.0	0.08	7.5	0.62
Service coverage	No of stops and distance between stops	6.0	0.07	6.8	0.48
Information	access to information like schedule, ticket cost	5.8	0.07	3.4	0.23
Cleanliness	Internal and external cleanliness of vehicles	4.9	0.06	6.9	0.40
Comfort on trip	passenger personal comfort while transit is used including seat comfort, ride comfort	5.0	0.06	5.0	0.29
Safety	No of accident and security concerns personal against crimes	7.2	0.08	6.4	0.54
Pollution	Pollution creates by vehicle	7.4	0.09	5.8	0.50
Parking System	No of parking lots and the service quality	8.0	0.09	3.2	0.30
Behavior of driver	One of the services of public transport.	4.5	0.05	7.2	0.38
Efficiency	Travel time and journey speed	6.8	0.08	4.7	0.37
Affordable Fare	affordability of per capita Fare	8.0	0.09	3.8	0.36
Total CSI					5.84

Source: Author, 2016