An Investigation on Railway Ridership Response Under Different Scenarios

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APPROVAL

The Thesis and Project titled "An investigation on railway ridership response under different scenarios" Submitted to the Department of Civil Engineering has been examined Thoroughly and satisfactorily accepted in partial fulfillment of the requirement for the Degree of Bachelor of Science (B.Sc.) in Civil Engineering on March 2021
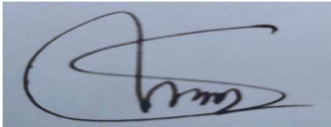
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CANDIDATE'S DECLARATION

This is hereby declared that this thesis or any part of it has not been submitted elsewhere and any degree.

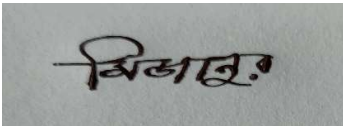**Md. Injamul Haque Shawon**   **ID: 182-47-132**
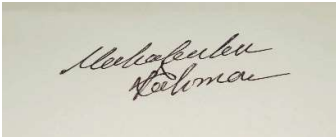
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DEDICATED
TO MY FAMILY

Father & Mother

Their continuous inspirations made this effort possible.

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Abstract

Railway is a mass transit system, which has high ridership potential. Compare to other competitive mode of transportation for long distance travel, train is inexpensive, takes smaller space and haul large number of passengers. Since, train has separate right of way, it does not interfere or share with other modes. Railway is an effective congestion reliving alternative. Bangladesh is a developing country and train is the most preferred public transit mode for public. It is essential to assess preference sensitivity of train. Several factors can influence train mode choice. Those are—departure time (DT), train fare (TF), travel time (TT) and service quality (SQ). The study investigated sensitivity of these factors over train ridership. We carried out a question survey on 130 passengers on two different routes, Dhaka to Sylhet and Dhaka to Rajshahi. Almost half of the passengers are income within 30-60k BDT per month. Almost 40% of the respondents are captive train rider in this study. Our study found that increase of departure time and travel time delay <30 minutes have very small influence on ridership. However, ridership decreases very rapidly with the increase of departure time and increase of travel time delay more than 30 minutes. All of the factors of ridership are linearly related with %ridership. Service quality of train is categorized into scale 1 to 4. 1 stands for AC train service with no standing passengers, whereas, 4 stands for non-AC train service with large standing passengers. Ridership declining straightly with the lowering service quality (SQ). 10% increase in departure time will decrease ridership by 14% and 10% increase in fare will decrease ridership by 6%. %Ridership has little influence, if fare increase is <50 BDT. However, if train fare increased by 100 BDT or more, the reduction of %ridership is very high and people are reluctant to travel on train. From our study since the above-mentioned factors have strong influence on train ridership, therefore, it provides fruitful information on strategic planning to promote train service. Railway and transportation authority can predict future train demand and understand passengers'

expectation, requirement from this study. Future transportation planning and policy making can focus on those issues based on analysis, judgement and framework proposed in this research.

Chapter 01

Introduction

1.1 General

Railway is one of the major modes of public transportation system for long distance travel. It can carry large number of passengers at a time and has separate right-of-way. Train is more potential congestion relieving mode than alternative bus service. Therefore, promoting railway ridership can be a viable solution to reduce traffic congestion and provide ease to public.

1.2 Back ground

Several factors can influence railway ridership, such as, departure time (DT), train fare (TF), service quality (SQ), travel time (TT). It is necessary to study the involvement of those factors and corresponding passengers' response under different scenarios. The aim of this study is to investigate passengers' sensitivity on different factors which can influence railway % ridership. Compare to other competitive mode of transportation for long distance travel, train is inexpensive, takes smaller space and haul large number of passengers. Since, train has separate right of way, it does not interfere or share with other modes. Railway is an effective congestion reliving alternative.

1.3 Work Plan

Design survey form based on pilot survey and literature review.

Perform field survey on passengers to observe varying scenarios for departure time (DT) increase, train fare (TF) increase, service quality (SQ) decrease and travel time (TT) decrease over % ridership.

Record interview of the passengers and data analysis.

Sensitivity study on ridership with respect to departure time, service quality, train fare and travel time.

Identify future scope and recommendation of the study.

1.4 Summary

This chapter discuss the introduction to railway ridership and its factors. The next chapter discuss the literature review.

Chapter 2

Literature Review

2.1 General

Bangladesh is a developing country and train is the most preferred public transit mode for public. It is essential to assess preference sensitivity of train. Several factors can influence train mode choice. Those are—departure time (DT), train fare (TF), travel time (TT) and service quality (SQ).

2.2 Prior studies

Studied references are mentioned in the following:

Reference	Topics	Remarks
Armbruster (2010)	Factors affecting transit ridership at the metropolitan area	1 USD fare increase reduce 21% per capita transit ridership
Ding et al. (2016)	Influencing factors in subway ridership	Develop decision tree model to predict subway ridership
Lindsey (2010)	Proximity to train station and ridership relation	Work on work trip data of Chicago city

Reference	Topics	Remarks
Voith (1997)	Service quality and fare is related to commuter train ridership	Incorporate demographic feaure along with others for considering influence factors for ridership
Andrade (2014)	Study explanatory variables of train ridership	Study train passengers' information in Rio de Janeiro city, Brazil

2.3 Factors of Ridership

Railway is one of the major modes of public transportation system for long distance travel. It can carry large number of passengers at a time and has separate right-of-way. Train is more potential congestion relieving mode than alternative bus service. Therefore, promoting railway ridership can be a viable solution to reduce traffic congestion and provide ease to public.

2.4 Summary

In this chapter we discuss prior study of railway ridership. The third chapter deals with methodology of the study.

Chapter 3

Methodology

3.1 General

The aim of this study is to investigate passengers' sensitivity on different factors which can influence railway % ridership. Since, train has separate right of way, it does not interfere or share with other modes. Railway is an effective congestion reliving alternative.

3.2 Survey design

> Perform stated preference survey on train passengers.

> The survey form has following general information

Route names: 1. Dhaka-Sylhet route, 2. Dhaka-Rajshahi route

Household income (BDT): 1. <30k , 2. 30-60k, 3. 60-100k and 4. >100k.

> Alternative mode choice: 1. Bus, 2. Personal vehicle, and 3. not willing to change mode (captive rider of train)

The survey core questions are:

1. Increment of departure time (minutes): 15, 30, 45, 60 and 90.

2. Increment of train fare (BDT): 25, 50, 100, 150 and 250

3. Decreasing service quality: AC without standing passengers, AC with few standing passengers, non-AC with few standing passengers and non-AC with larger standing passengers. The service quality are labelled as 1 to 4 respectively in the form.

4. Increment of travel time delay (minutes): 15, 30, 60, 90 and 120

Each of core questions have close ended answer either "Yes" or "No".

3.3 Summary

Promoting railway ridership can be a viable solution to reduce traffic congestion and provide ease to public. It is necessary to study the involvement of those factors and corresponding passengers' response under different scenarios.

Chapter 4

Data Collection

4.1 General

We design survey form based on pilot survey and literature review. We perform field survey on passengers to observe varying scenarios for departure time (DT) increase, train fare (TF) increase, service quality (SQ) decrease and travel time (TT) decrease over % ridership.

4.2 Field survey

- The survey performed field survey on the passengers of two routes one is Dhaka-Sylhet route and another one is Dhaka-Rajshahi route.

- Total 130 passengers participated in the survey.

- The survey data collected through interview are recorded in google form.

4.3 Dataset

Demographics

ROUTES

- Dhaka-Rajshahi rail route
- Dhaka-Sylhet rail route

Dhaka-Sylhet rail route
46%

Dhaka-Rajshahi rail route
54%
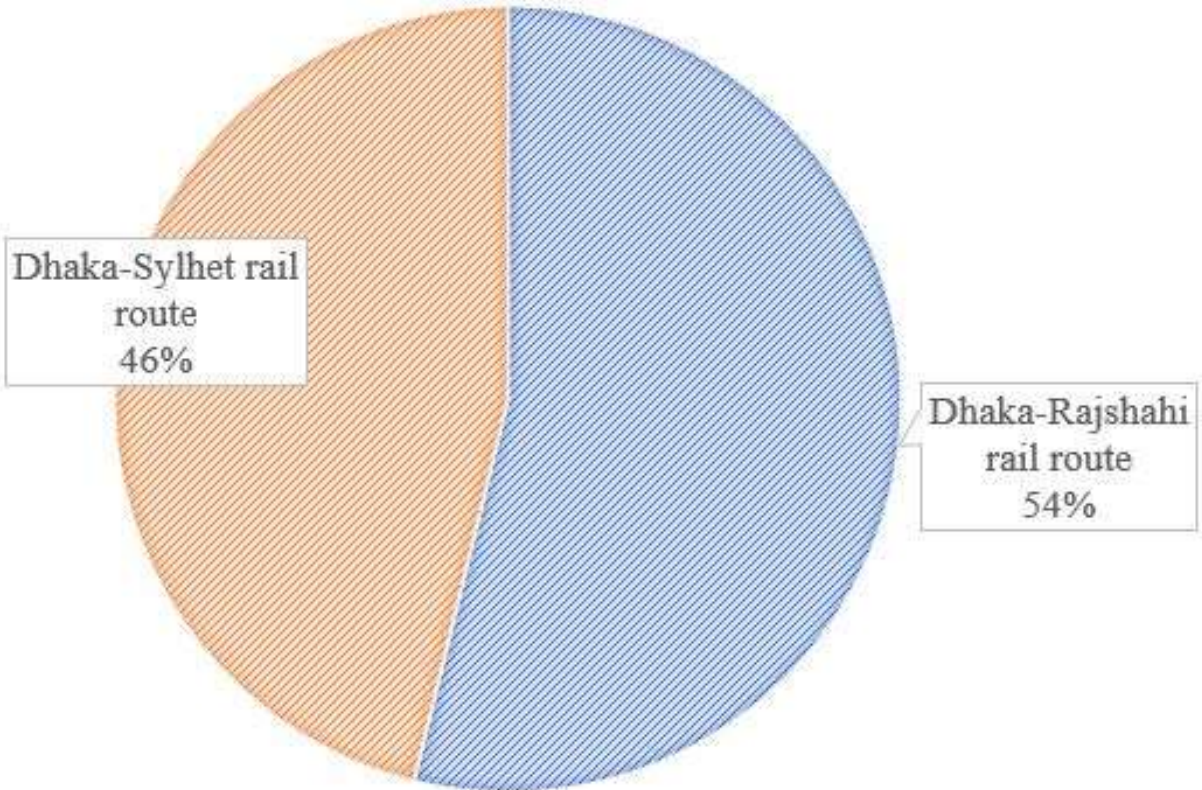
Among the respondents, 46% and 54% are in the Dhaka-Sylhet and Dhaka-Rajshahi route respectively.

HOUSEHOLD MONTHLY INCOME (BDT)

■ <30k   ■ 30-60k   ■ 60-100k   ■ >100k
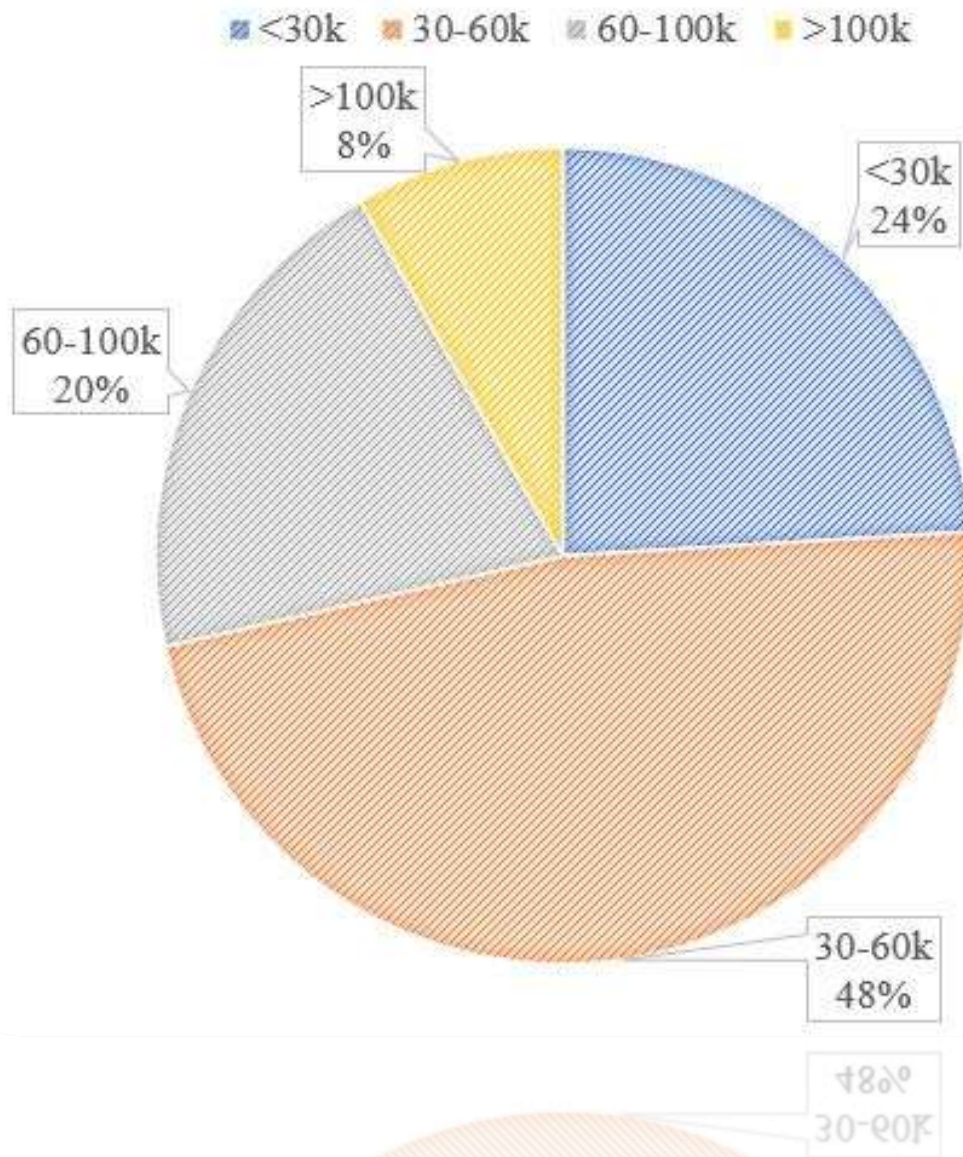
Almost 50% respondents have monthly income 30-60k BDT.

ALTERNATIVE MODE CHOICE

■ Bus   ■ Personal Vehicle   ■ Captive train rider
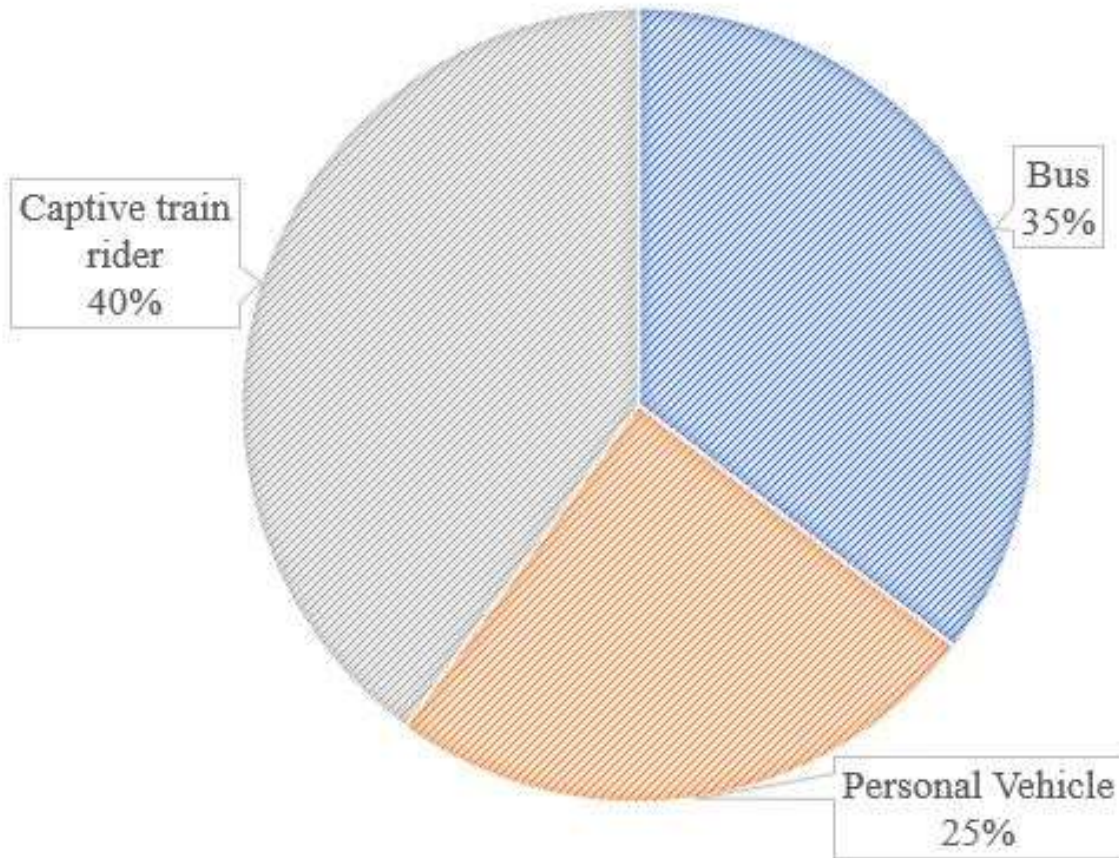
Among the respondents. 40% are captive ride, i.e., they are forced ride on train without any alternative mode choice.

Bus comprises 35% alternative mode choice, since majority of the respondents are middle income people.

4.4 Summary

This chapter discusses with field data collection. The next chapter discusses data analysis section.

Chapter 5

Data Analysis

5.1 General

Bangladesh is a developing country and train is the most preferred public transit mode for public. It is essential to assess preference sensitivity of train. Several factors can influence train mode choice. Those are—departure time (DT), train fare (TF), travel time (TT) and service quality (SQ). The study investigated sensitivity of these factors over train ridership.

5.2 Sensitivity of the factors

- ❑ 10% increase in departure time will decrease ridership by 14% and vice-versa.

- ❑ 10% increase in train fare will decrease ridership by 6%.

- ❑ Train ridership reduce drastically with the decrease of service quality, such as, air condition and seating facilities.

- ❑ 10% increase in travel time delay will decrease ridership by 1%.

% Train ridership with respect to departure time increase

$y = -0.014x + 1.23$
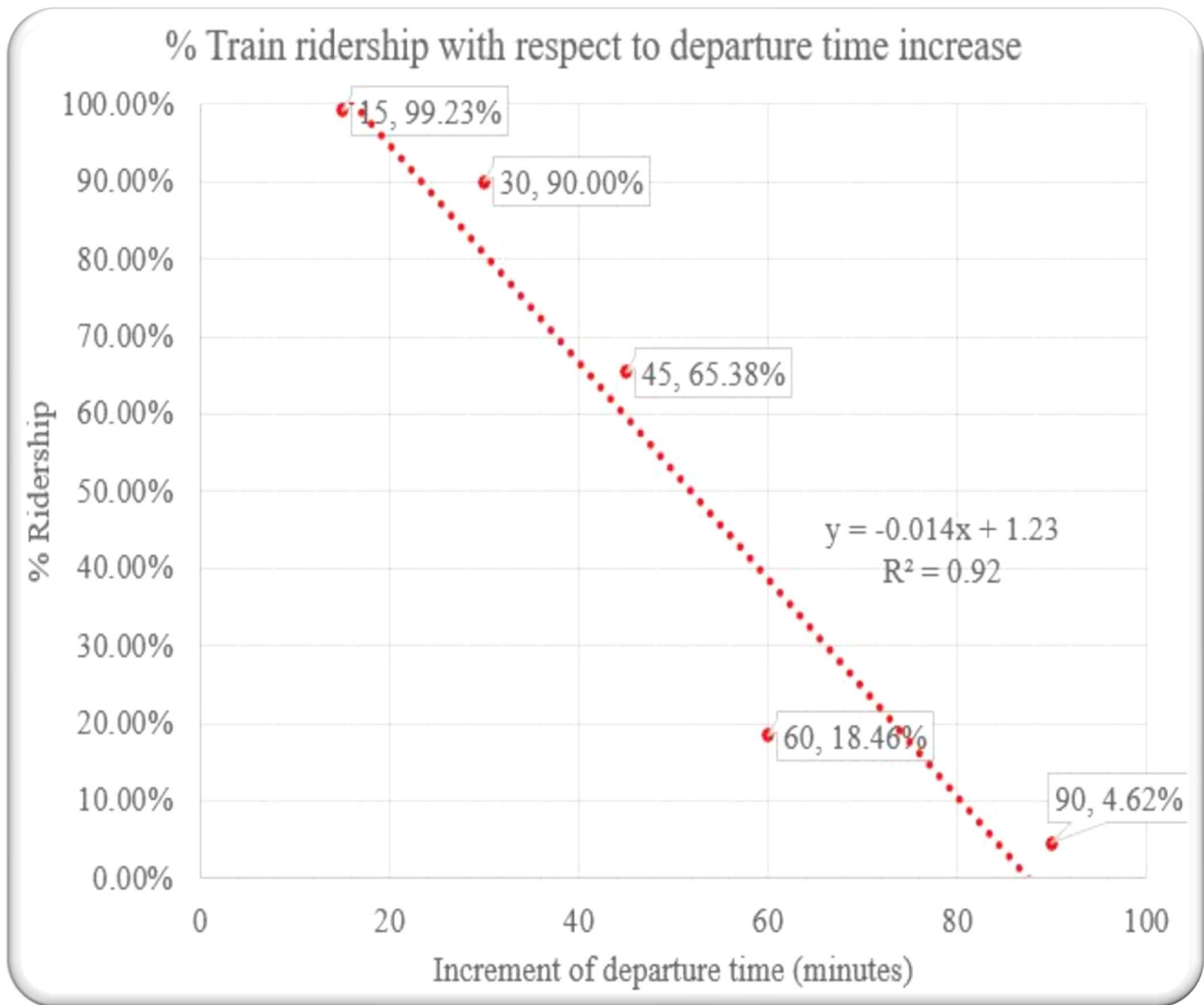
$R^2 = 0.92$

Ridership decreases linearly with the increase of train departure time with $R^2 = 0.92$, i.e., linear trend line can describe 92% data variability.

With additional departure time >45 minutes, % train ridership falls sharply.

10% increase in departure time will decrease ridership by 14% and vice-versa.

% Train ridership with respect to fare increase

$y = -0.006x + 1.07$
$R^2 = 0.92$
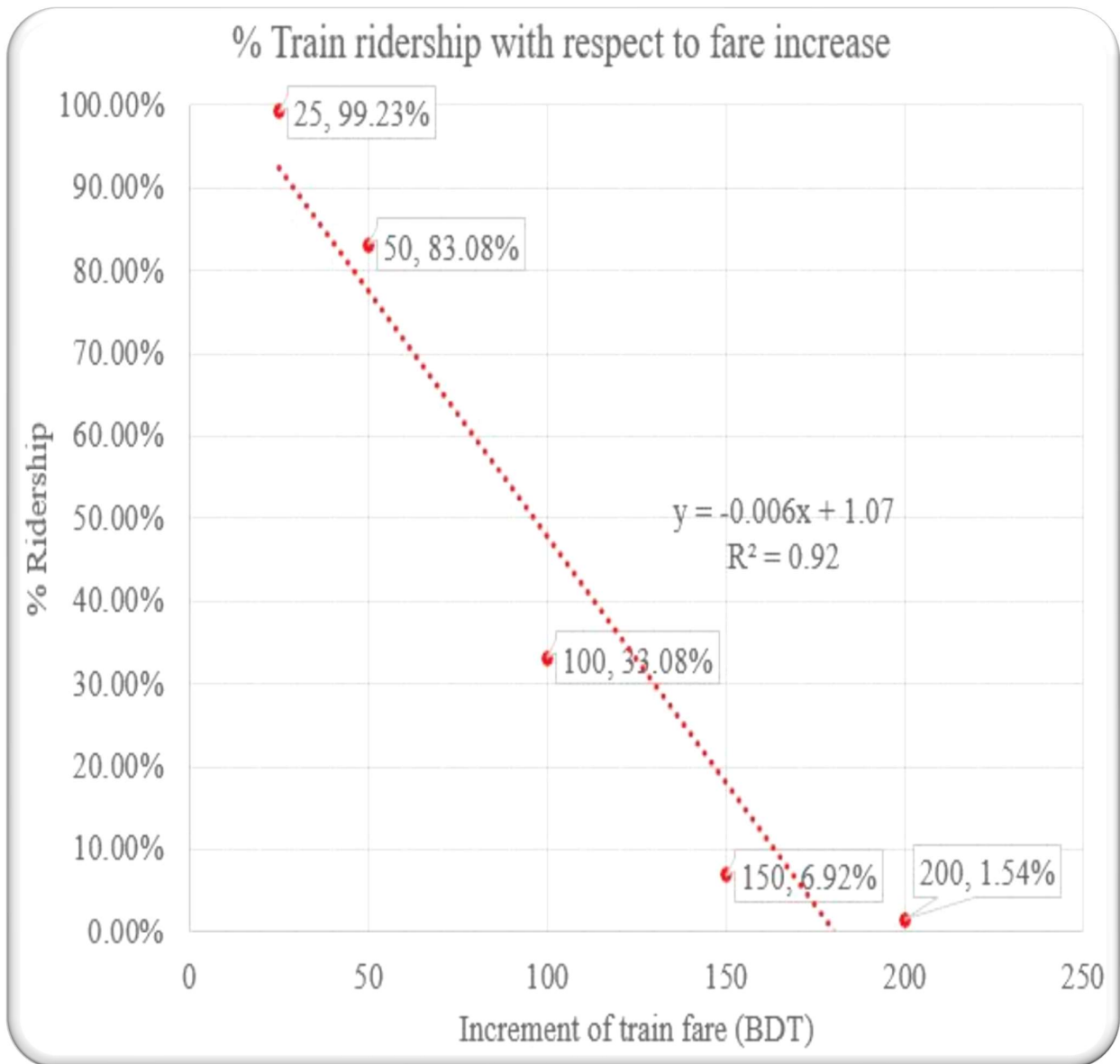
When train fare >50 BDT, the decrease in % ridership is very rapid for long distance travel.

10% increase in fare will decrease ridership by 6%.

% Train ridership with respect to service quality

$y = -0.269x + 1.19$
$R^2 = 0.97$

Service quality are scaled 1 to 4, those are 1 = AC train service without standing passengers, 2 = AC train service with very few standing passengers, 3 = non-AC train service with few standing passengers and 4 = non-AC train service with large standing passengers.

Service Quality criteria such as, air conditioning and seating facilities are very strongly linearly related with train ridership.

Train ridership reduce drastically with the decrease of service quality, such as, air condition and seating facilities.

% Train ridership with respect to travel time delay

$y = -0.01x + 1.12$
$R^2 = 0.91$

15, 97.69%
30, 94.62%
60, 39.23%
120, 6.15%
90, 7.69%

% Ridership

Increment of travel time delay (minutes)
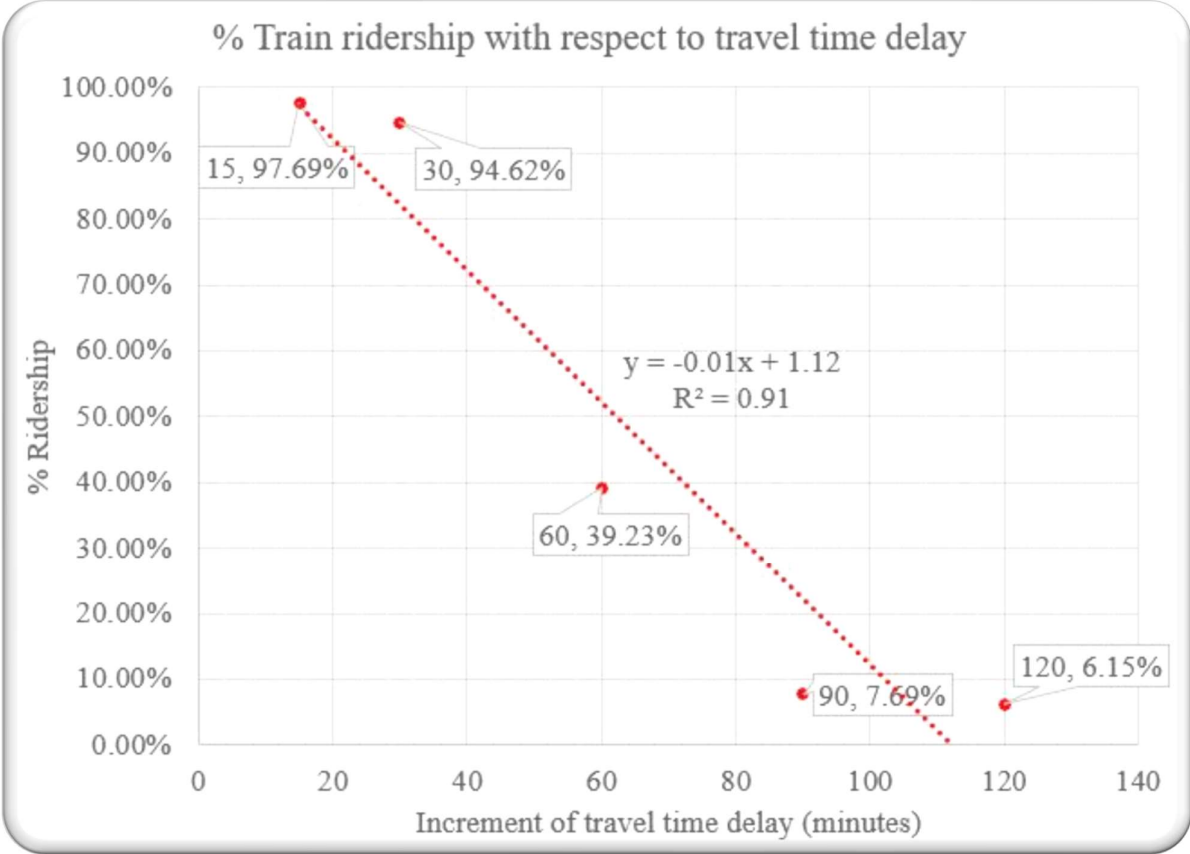
Less than or equal to 30 minutes travel time delay have very little influence on Ridership.

However, ridership decreases sharply for travel time delay> 30 minutes

The trend line between travel time delay and %ridership is linear with can describe 91% variability, $R^2 = 0.91$.

10% increase in travel time delay will decrease ridership by 1%.

The relationship of departure time increment, train fare increment, service quality decrement and travel time delay increment with %Ridership is linear.

All of the above four features have linear decreasing trend line with $R^2 > 0.9$.

Both travel time delay and departure time increment have less influence on %Ridership decrease at <30 minutes time loss.

Departure time increment is more sensitive for ridership than travel time delay, i.e., delay within train.

%Ridership falls sharply for long distance train travel, such as, Dhaka-Sylhet and Dhaka-Rajshahi routes with fare increment >50 BDT.

10% increase in train fare decrease train ridership by 6% approximately.

5.3 Summary

This chapter describes data analysis part of the research. The next chapter discuss on recommendation and conclusion section of our research.

Chapter - 6

Conclusions

6.1 General

Compare to other competitive mode of transportation for long distance travel, train is inexpensive, takes smaller space and haul large number of passengers. Since, train has separate right of way, it does not interfere or share with other modes. Railway is an effective congestion reliving alternative.

6.2 Findings

Findings of the study is given in the following section:

❏ The relationship of departure time increment, train fare increment, service quality decrement and travel time delay increment with %Ridership is linear.

❏ All of the above four features have linear decreasing trend line with R^2 >0.9.

❏ Both travel time delay and departure time increment have less influence on %Ridership decrease at <30 minutes time loss.

❏ Departure time increment is more sensitive for ridership than travel time delay, i.e., delay within train.

❏ %Ridership falls sharply for long distance train travel, such as, Dhaka-Sylhet and Dhaka-Rajshahi routes with fare increment >50 BDT.

6.3 Recommendations

❏ Frequent train service encourages passengers to travel train.

❏ Train scheduling should be maintained properly to attract ridership.

❏ Train fare needs to be fixed based on public opinion and demand.

❏ Better service quality, especially air condition facility and seat availability are important criteria for ride attraction. Slight increase of train fare, little flexibility in train schedule may not hamper ridership.

❑ Railway service should focus to large middle- and low-income group people and consider their demand into account.

6.4 Future Scope

Limitation of this research are:

❑ The study should carry-on large-scale survey to get complete scenario.

❑ The investigation can be conducted for other modes of transportation, such as, bus service.

❑ The study can focus different group of people, socio-economic factors and consider their ridership sensitivity differently.

❑ Combined effect of different factors can be studied.

6.5 Summary

The framework studied in this research can be adopted for large scale survey and funded project. The trend-lines and regression equation found in this study can help to predict ridership potential. Railway authority and other relevant public transit authority should carefully investigate ridership factors. Before adopting train service quality, schedule maintenance, fare policy careful investigation should be performed so that those may not dissatisfied passengers. Government should take adequate scheme to increase train ridership so that traffic pressure on existing road transportation will reduce.

References

Armbruster, B., 2010. Factors affecting transit ridership at the metropolitan level 2002-2007. Georgetown University.

Ding, C., Wang, D., Ma, X. and Li, H., 2016. Predicting short-term subway ridership and prioritizing its influential factors using gradient boosting decision trees. Sustainability, 8(11), p.1100.

Lindsey, M., Schofer, J.L., Durango-Cohen, P. and Gray, K.A., 2010. Relationship between proximity to transit and ridership for journey-to-work trips in Chicago. Transportation Research Part A: Policy and Practice, 44(9), pp.697-709.

Voith, R., 1997. Fares, service levels, and demographics: what determines commuter rail ridership in the long run?. Journal of Urban Economics, 41(2), pp.176-197.

de Andrade, G.T., Gonçalves, J.A.M. and da Silva Portugal, L., 2014. Analysis of explanatory variables of rail ridership: the situation of Rio de Janeiro. Procedia-Social and Behavioral Sciences, 162, pp.449-458.

APPENDIX

Raw data

Route	Monthly household income (BDT)	Do you travel on train, if departure time increases 15 minutes	Do you travel on train, if departure time increases 30 minutes	Do you travel on train, if departure time increases 45 minutes	Do you travel on train, if departure time increases 60 minutes	Do you travel on train, if departure time increases 90 minutes	Do you travel on train, if railway fare increases 25 BDT	Do you travel on train, if railway fare increases 50 BDT	Do you travel on train, if railway fare increases 100 BDT	Do you travel on train, if railway fare increases 150 BDT	Do you travel on train, if railway fare increases 200 BDT	Do you travel on train, if railway service is AC without standing passengers	Do you travel on train, if railway service is AC with few standing passengers	Do you travel on train, if railway service is Non-AC few standing passengers	Do you travel on train, if railway service is Non-AC lot of standing passengers
Dhaka-Sylhet rail route	30-60k	Yes	Yes	No	No	No	Yes	Yes	Yes	No	No	Yes	Yes	Yes	No
Dhaka-Rajshahi rail route	<30k	Yes	Yes	Yes	Yes	No	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes
Dhaka-Rajshahi rail route	60-100k	Yes	Yes	No	No	No	Yes	Yes	No	No	No	Yes	Yes	No	No
Dhaka-Rajshahi rail route	60-100k	Yes	Yes	Yes	No	No	Yes	No	No	No	No	Yes	Yes	No	No
Dhaka-Sylhet rail route	30-60k	Yes	Yes	No	No	No	Yes	Yes	No	No	No	Yes	No	No	No
Dhaka-Rajshahi rail route	<30k	Yes	Yes	Yes	Yes	No	Yes	No	No	No	No	Yes	Yes	Yes	No

Route	Income														
Dhaka-Rajshahi rail route	>100k	Yes	No	No	No	No	Yes	Yes	No	No	No	Yes	No	No	No
Dhaka-Rajshahi rail route	60-100k	Yes	No	No	No	No	Yes	No	No	No	No	Yes	Yes	No	No
Dhaka-Sylhet rail route	<30k	Yes	Yes	No	No	No	Yes	Yes	Yes	No	No	Yes	Yes	No	No
Dhaka-Sylhet rail route	30-60k	Yes	Yes	Yes	No	No	Yes	No	No	No	No	Yes	Yes	Yes	No
Dhaka-Sylhet rail route	<30k	Yes	No	No	No	No	Yes	No	No	No	No	Yes	Yes	Yes	No
Dhaka-Sylhet rail route	30-60k	Yes	No	No	No	No	Yes	No	No	No	No	Yes	No	No	No
Dhaka-Rajshahi rail route	30-60k	Yes	Yes	No	No	No	Yes	Yes	No	No	No	Yes	No	No	No
Dhaka-Rajshahi rail route	30-60k	Yes	No	No	No	No	Yes	No	No	No	No	Yes	No	No	No
Dhaka-Rajshahi rail route	30-60k	Yes	Yes	No	No	No	Yes	Yes	No	No	No	Yes	No	No	No
Dhaka-Sylhet rail route	60-100k	Yes	Yes	No	No	No	Yes	Yes	No	No	No	Yes	Yes	Yes	No
Dhaka-Rajshahi rail route	30-60k	Yes	Yes	Yes	No	No	Yes	Yes	No	No	No	Yes	Yes	Yes	No
Dhaka-Rajshahi rail route	<30k	Yes	Yes	Yes	No	No	Yes	Yes	No	No	No	Yes	No	Yes	No
Dhaka-Sylhet rail route	60-100k	Yes	Yes	Yes	No	No	Yes	Yes	No	No	No	Yes	No	No	No
Dhaka-Sylhet rail route	60-100k	Yes	Yes	No	No	No	Yes	Yes	No	No	No	Yes	No	Yes	No

Route	Income	Responses
Dhaka-Rajshahi rail route	30-60k	Yes Yes Yes No No Yes Yes No No No Yes No Yes No
Dhaka-Rajshahi rail route	30-60k	Yes Yes Yes No No Yes Yes No No No Yes Yes Yes No
Dhaka-Rajshahi rail route	60-100k	Yes Yes Yes No No Yes Yes Yes No No Yes No No No
Dhaka-Rajshahi rail route	60-100k	Yes Yes Yes No No Yes Yes Yes Yes No Yes Yes No Yes
Dhaka-Rajshahi rail route	60-100k	Yes Yes Yes No No Yes Yes Yes No No Yes No Yes No
Dhaka-Sylhet rail route	<30k	Yes Yes Yes No No Yes No No No No Yes Yes Yes No
Dhaka-Rajshahi rail route	<30k	Yes Yes No No No Yes No No No No Yes Yes Yes No
Dhaka-Rajshahi rail route	>100k	Yes No No No No Yes Yes Yes No No Yes No No No
Dhaka-Sylhet rail route	30-60k	Yes Yes Yes Yes No Yes Yes No No No Yes Yes Yes No
Dhaka-Rajshahi rail route	60-100k	Yes Yes Yes Yes No Yes Yes No No No Yes No No No
Dhaka-Sylhet rail route	<30k	Yes Yes Yes Yes No Yes No No No No Yes Yes Yes Yes
Dhaka-Sylhet rail route	60-100k	Yes No No No No Yes Yes Yes No No Yes Yes No No
Dhaka-Sylhet rail route	60-100k	Yes Yes No No No Yes Yes No No No Yes Yes Yes No
Dhaka-Sylhet rail route	30-60k	Yes Yes No No No Yes Yes Yes No No Yes Yes No No

Dhaka-Rajshahi rail route   <30k   Yes   Yes   Yes   Yes   Yes   Yes   No   No   No   No   No   No   Yes   Yes

Dhaka-Rajshahi rail route   30-60k   Yes   Yes   Yes   Yes   No   Yes   Yes   No   No   No   Yes   Yes   No   No

Dhaka-Rajshahi rail route   60-100k   Yes   No   No   No   No   Yes   Yes   Yes   Yes   No   Yes   No   No   No

Dhaka-Rajshahi rail route   30-60k   Yes   Yes   Yes   No   No   Yes   Yes   No   No   No   Yes   Yes   No   No

Dhaka-Sylhet rail route   <30k   Yes   Yes   Yes   Yes   Yes   Yes   No   No   No   No   No   No   No   No

Dhaka-Sylhet rail route   <30k   Yes   Yes   Yes   No   No   Yes   Yes   No   No   No   Yes   Yes   Yes   No

Dhaka-Rajshahi rail route   60-100k   Yes   Yes   Yes   No   No   Yes   Yes   Yes   No   No   Yes   No   No   No

Dhaka-Sylhet rail route   <30k   Yes   Yes   Yes   Yes   Yes   No   No   No   No   No   Yes   Yes   Yes   Yes

Dhaka-Rajshahi rail route   >100k   Yes   No   No   No   No   Yes   Yes   Yes   Yes   No   Yes   No   No   No

Dhaka-Sylhet rail route   30-60k   Yes   Yes   Yes   Yes   No   Yes   Yes   Yes   No   No   Yes   Yes   Yes   No

Dhaka-Rajshahi rail route   30-60k   Yes   Yes   Yes   No   No   Yes   Yes   No   No   No   Yes   Yes   Yes   No

Dhaka-Rajshahi rail route   30-60k   Yes   Yes   Yes   No   No   Yes   Yes   No   No   No   Yes   Yes   Yes   No

Dhaka-Sylhet rail route   <30k   Yes   Yes   Yes   Yes   No   Yes   No   No   No   No   Yes   Yes   Yes   Yes

Dhaka-Sylhet rail route   30-60k   Yes   Yes   No   No   No   Yes   Yes   No   No   No   Yes   No   No   No

Route	Fare														
Dhaka-Rajshahi rail route	30-60k	Yes	Yes	No	No	No	Yes	No	No	No	No	Yes	Yes	Yes	No
Dhaka-Rajshahi rail route	30-60k	Yes	Yes	Yes	No	No	Yes	Yes	No	No	No	Yes	Yes	No	No
Dhaka-Rajshahi rail route	30-60k	Yes	Yes	Yes	No	No	Yes	No	No	No	No	Yes	Yes	Yes	No
Dhaka-Sylhet rail route	30-60k	Yes	Yes	No	No	No	Yes	No	No	No	No	Yes	Yes	No	No
Dhaka-Sylhet rail route	>100k	Yes	No	No	No	No	Yes	Yes	Yes	No	No	Yes	No	No	No
Dhaka-Rajshahi rail route	<30k	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes	Yes	Yes
Dhaka-Rajshahi rail route	60-100k	Yes	Yes	No	No	No	Yes	Yes	No	No	No	Yes	Yes	No	No
Dhaka-Sylhet rail route	>100k	Yes	No	No	No	No	Yes	Yes	Yes	Yes	No	Yes	No	No	No
Dhaka-Rajshahi rail route	30-60k	Yes	Yes	Yes	No	No	Yes	Yes	No	No	No	Yes	Yes	Yes	No
Dhaka-Sylhet rail route	60-100k	Yes	Yes	Yes	Yes	No	Yes	Yes	No	No	No	Yes	Yes	Yes	No
Dhaka-Rajshahi rail route	30-60k	Yes	Yes	No	No	No	Yes	Yes	No	No	No	Yes	Yes	No	No

Do you travel on train, if travel time delays 15 minutes   Do you travel on train, if travel time delays 30 minutes Do you travel on train, if travel time delays 60 minutes   Do you travel on train, if travel time delays 90 minutes   Do you travel on train, if travel time delays 120 minutes   Do you switch to other mode of transportation

Yes   Yes   No   No   No   Bus

Yes	Yes	Yes	No	No	Will not interested to switch from train
Yes	Yes	No	No	No	Personal vehicle
Yes	Yes	No	No	No	Bus
Yes	Yes	No	No	No	Bus
Yes	Yes	Yes	No	No	Bus
Yes	Yes	No	No	No	Personal vehicle
Yes	No	No	No	No	Personal vehicle
Yes	Yes	No	No	No	Bus
Yes	Yes	No	No	No	Will not interested to switch from train
Yes	Yes	No	No	No	Bus
Yes	No	No	No	No	Personal vehicle
Yes	Yes	No	No	No	Will not interested to switch from train
Yes	No	No	No	No	Bus
Yes	Yes	No	No	No	Bus
Yes	Yes	No	No	No	Will not interested to switch from train
Yes	No	No	No	No	Personal vehicle
Yes	Yes	No	No	No	Personal vehicle
Yes	Yes	No	No	No	Bus
Yes	Yes	No	No	No	Personal vehicle
Yes	Yes	No	No	No	Personal vehicle
Yes	Yes	No	No	No	Will not interested to switch from train
Yes	Yes	No	No	No	Will not interested to switch from train
Yes	Yes	Yes	No	No	Will not interested to switch from train
Yes	Yes	No	No	No	Bus
Yes	Yes	Yes	No	No	Will not interested to switch from train
Yes	Yes	Yes	No	No	Bus
Yes	Yes	No	No	No	Personal vehicle
Yes	Yes	No	No	No	Bus

Yes	Yes	No	No	No	Bus
Yes	Yes	Yes	No	No	Will not interested to switch from train
Yes	Yes	No	No	No	Bus
Yes	Yes	Yes	No	No	Bus
Yes	Yes	No	No	No	Bus
Yes	Yes	Yes	Yes	Yes	Will not interested to switch from train
Yes	Yes	Yes	Yes	No	Will not interested to switch from train
Yes	Yes	No	No	No	Will not interested to switch from train
Yes	Yes	No	No	No	Bus
Yes	Yes	Yes	Yes	Yes	Will not interested to switch from train
Yes	Yes	Yes	No	No	Bus
Yes	Yes	No	No	No	Personal vehicle
Yes	Yes	Yes	No	No	Will not interested to switch from train
Yes	No	No	No	No	Bus
Yes	Yes	No	No	Yes	Will not interested to switch from train
Yes	Yes	No	No	No	Will not interested to switch from train
Yes	Yes	Yes	No	No	Will not interested to switch from train
Yes	Yes	Yes	No	No	Will not interested to switch from train
Yes	Yes	No	Yes	Yes	Bus
Yes	Yes	No	No	No	Bus
Yes	Yes	Yes	No	No	Bus
Yes	Yes	Yes	No	Yes	Will not interested to switch from train
Yes	Yes	No	No	No	Bus
Yes	Yes	No	No	No	Personal vehicle
Yes	Yes	Yes	Yes	No	Will not interested to switch from train
Yes	Yes	No	No	No	Bus
Yes	Yes	No	No	No	Bus
Yes	Yes	Yes	No	No	Will not interested to switch from train

Yes	Yes	Yes	No	No		Will not interested to switch from train						
Yes	Yes	No	No	No		Bus						
Dhaka-Rajshahi rail route			<30k	Yes	Yes	Yes	Yes	No	Yes	No	No	No
	No	Yes	Yes	Yes	Yes							
Dhaka-Sylhet rail route	30-60k	Yes	Yes	No	No	No	Yes	Yes	No	No	No	
	Yes	Yes	Yes	No								
Dhaka-Sylhet rail route	30-60k	Yes	Yes	No	No	No	Yes	Yes	No	No	No	
	Yes	No	No	No								
Dhaka-Rajshahi rail route			30-60k	Yes	Yes	No	No	No	Yes	No	No	No
	No	Yes	No	No	No							
Dhaka-Sylhet rail route	30-60k	Yes	Yes	No	No	No	Yes	Yes	No	No	No	
	Yes	Yes	No	No								
Dhaka-Rajshahi rail route			<30k	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No
	No	Yes	Yes	Yes	Yes							
Dhaka-Rajshahi rail route			30-60k	Yes	Yes	Yes	No	No	Yes	Yes	No	No
	No	Yes	Yes	No	No							
Dhaka-Rajshahi rail route			>100k	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes
	No	Yes	No	No	No							
Dhaka-Rajshahi rail route			30-60k	Yes	Yes	Yes	Yes	No	Yes	Yes	No	No
	No	Yes	No	No	No							
Dhaka-Rajshahi rail route			30-60k	Yes	Yes	No	No	No	Yes	Yes	No	No
	No	Yes	Yes	No	No							
Dhaka-Rajshahi rail route			30-60k	Yes	Yes	No	No	No	Yes	Yes	No	No
	No	Yes	No	No	No							
Dhaka-Rajshahi rail route			30-60k	Yes	Yes	Yes	No	No	Yes	Yes	No	No
	No	Yes	No	Yes	No							
Dhaka-Rajshahi rail route			<30k	Yes	Yes	Yes	Yes	No	Yes	Yes	No	No
	No	Yes	Yes	Yes	Yes							

Route	Income	Responses
Dhaka-Sylhet rail route	30-60k	Yes Yes Yes No No Yes Yes No No No Yes Yes Yes No
Dhaka-Rajshahi rail route	>100k	Yes No No No No Yes Yes Yes Yes No Yes No No No
Dhaka-Rajshahi rail route	>100k	Yes Yes Yes No No Yes Yes Yes No No Yes Yes Yes No
Dhaka-Sylhet rail route	60-100k	Yes Yes Yes No No Yes Yes Yes No No No No No Yes
Dhaka-Sylhet rail route	60-100k	Yes Yes Yes Yes No Yes Yes Yes No No Yes No Yes No
Dhaka-Sylhet rail route	30-60k	Yes Yes Yes No No Yes Yes No No No Yes Yes Yes No
Dhaka-Sylhet rail route	60-100k	Yes Yes No No No Yes Yes Yes No No Yes Yes Yes No
Dhaka-Sylhet rail route	30-60k	Yes Yes Yes No No Yes Yes Yes No No Yes Yes Yes No
Dhaka-Sylhet rail route	30-60k	Yes Yes Yes No No Yes Yes Yes No No Yes Yes Yes No
Dhaka-Rajshahi rail route	<30k	Yes Yes Yes No No Yes Yes Yes No No Yes Yes Yes No
Dhaka-Sylhet rail route	30-60k	Yes Yes Yes Yes No Yes Yes No No No Yes No No No
Dhaka-Sylhet rail route	<30k	Yes Yes Yes No No Yes Yes Yes No No No Yes No No
Dhaka-Rajshahi rail route	60-100k	Yes Yes Yes No No Yes Yes No No No Yes No Yes No
Dhaka-Rajshahi rail route	30-60k	Yes Yes Yes No No Yes Yes Yes No No Yes No No No

Route	Fare	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14
Dhaka-Rajshahi rail route	30-60k	Yes	Yes	Yes	No	No	Yes	Yes	Yes	No	No	Yes	No	No	No
Dhaka-Rajshahi rail route	30-60k	Yes	Yes	Yes	No	No	Yes	Yes	No	No	No	Yes	No	Yes	No
Dhaka-Rajshahi rail route	30-60k	Yes	Yes	Yes	No	No	Yes	Yes	No	No	No	Yes	No	No	No
Dhaka-Rajshahi rail route	30-60k	Yes	Yes	Yes	No	No	Yes	Yes	Yes	No	No	Yes	No	No	No
Dhaka-Sylhet rail route	60-100k	Yes	Yes	Yes	No	No	Yes	Yes	Yes	No	No	Yes	No	No	No
Dhaka-Sylhet rail route	30-60k	Yes	Yes	Yes	No	No	Yes	Yes	Yes	No	No	Yes	No	Yes	No
Dhaka-Sylhet rail route	<30k	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	No	Yes	No	Yes	No
Dhaka-Rajshahi rail route	60-100k	Yes	Yes	Yes	No	No	Yes	Yes	Yes	No	No	Yes	No	No	No
Dhaka-Sylhet rail route	<30k	No	Yes	Yes	No	No	Yes	Yes	No	No	No	Yes	No	Yes	No
Dhaka-Rajshahi rail route	<30k	Yes	Yes	No	No	No	Yes	Yes	Yes	No	No	Yes	No	Yes	No
Dhaka-Rajshahi rail route	<30k	Yes	Yes	Yes	No	No	Yes	Yes	Yes	No	No	Yes	No	Yes	No
Dhaka-Sylhet rail route	30-60k	Yes	Yes	No	No	No	Yes	Yes	No	No	No	Yes	No	Yes	No
Dhaka-Rajshahi rail route	30-60k	Yes	Yes	Yes	No	No	Yes	Yes	No	No	No	Yes	No	Yes	No
Dhaka-Rajshahi rail route	30-60k	Yes	Yes	Yes	No	No	Yes	Yes	No	No	No	Yes	No	Yes	No

Route	Income														
Dhaka-Sylhet rail route	<30k	Yes	Yes	Yes	No	No	Yes	Yes	No	No	No	Yes	No	Yes	No
Dhaka-Sylhet rail route	30-60k	Yes	Yes	Yes	No	No	Yes	Yes	Yes	No	No	Yes	No	Yes	No
Dhaka-Sylhet rail route	30-60k	Yes	Yes	Yes	No	No	Yes	Yes	Yes	No	No	Yes	No	Yes	No
Dhaka-Sylhet rail route	<30k	Yes	Yes	Yes	No	No	Yes	Yes	No	Yes	No	Yes	No	Yes	No
Dhaka-Sylhet rail route	30-60k	Yes	Yes	Yes	No	No	Yes	Yes	Yes	No	No	Yes	No	Yes	No
Dhaka-Sylhet rail route	<30k	Yes	Yes	Yes	Yes	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes
Dhaka-Rajshahi rail route	30-60k	Yes	Yes	Yes	No	No	Yes	Yes	No	No	No	Yes	No	Yes	No
Dhaka-Rajshahi rail route	30-60k	Yes	Yes	Yes	No	No	Yes	Yes	No	No	No	Yes	No	Yes	No
Dhaka-Rajshahi rail route	<30k	Yes	Yes	Yes	No	No	Yes	Yes	Yes	No	No	Yes	No	Yes	No
Dhaka-Rajshahi rail route	30-60k	Yes	Yes	Yes	No	No	Yes	Yes	No	No	No	Yes	No	Yes	No
Dhaka-Sylhet rail route	60-100k	Yes	Yes	Yes	Yes	No	Yes	Yes	No	No	No	Yes	No	Yes	No
Dhaka-Rajshahi rail route	>100k	Yes	No	No	No	No	Yes	Yes	Yes	Yes	No	Yes	No	No	No
Dhaka-Sylhet rail route	30-60k	Yes	Yes	No	No	No	Yes	Yes	No	No	No	Yes	No	Yes	No
Dhaka-Rajshahi rail route	<30k	Yes	Yes	Yes	No	No	Yes	Yes	No	No	No	Yes	No	Yes	No

Dhaka-Sylhet rail route 60-100k   Yes   Yes   No   No   No   Yes   Yes   No   No

No   Yes   No   Yes   No

Dhaka-Sylhet rail route 30-60k Yes   Yes   No   No   No   Yes   Yes   No   No   No

Yes   Yes   No   No

Dhaka-Sylhet rail route 30-60k Yes   Yes   Yes   No   No   Yes   Yes   Yes   No   No

Yes   No   Yes   No

Dhaka-Sylhet rail route 30-60k Yes   Yes   Yes   No   No   Yes   Yes   No   No   No

Yes   Yes   No   No

Dhaka-Rajshahi rail route   60-100k   Yes   Yes   Yes   No   No   Yes   Yes   No

No   No   Yes   No   Yes   No

Dhaka-Sylhet rail route <30k   Yes   Yes   Yes   No   No   Yes   Yes   No   No   No

Yes   Yes   No   No

Dhaka-Rajshahi rail route   <30k   Yes   Yes   Yes   No   No   Yes   Yes   No   No

No   Yes   No   Yes   No

Dhaka-Rajshahi rail route   30-60k Yes   Yes   Yes   No   No   Yes   Yes   Yes   No

No   Yes   No   Yes   No

Dhaka-Sylhet rail route 30-60k Yes   Yes   No   No   No   Yes   Yes   No   No   No

Yes   No   No   No

Dhaka-Rajshahi rail route   30-60k Yes   Yes   Yes   No   No   Yes   Yes   Yes   No

No   Yes   No   Yes   No

Dhaka-Rajshahi rail route   30-60k Yes   Yes   Yes   No   No   Yes   Yes   No   No

No   Yes   No   Yes   No

Dhaka-Rajshahi rail route   30-60k Yes   Yes   No   No   No   Yes   Yes   No   No

No   Yes   No   No   No

Dhaka-Sylhet rail route 60-100k   Yes   Yes   Yes   Yes   No   Yes   Yes   Yes   No

No   Yes   Yes   Yes   No

Dhaka-Sylhet rail route <30k   Yes   Yes   Yes   Yes   Yes   Yes   Yes   No   No   No

Yes   Yes   Yes   Yes

Dhaka-Sylhet rail route	>100k	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes		
		Yes	No	No	No								
Dhaka-Sylhet rail route	<30k	Yes	Yes	Yes	No	No	Yes	No	No	No	No		
		No	No	Yes	Yes								

Yes	Yes	Yes	Yes	No	Will not interested to switch from train
Yes	Yes	Yes	No	No	Will not interested to switch from train
No	Yes	No	No	No	Bus
Yes	Yes	No	No	No	Bus
Yes	Yes	Yes	No	No	Bus
Yes	Yes	Yes	Yes	Yes	Will not interested to switch from train
Yes	Yes	No	No	No	Bus
Yes	Yes	No	No	No	Bus
Yes	Yes	Yes	No	No	Bus
Yes	Yes	Yes	No	No	Will not interested to switch from train
Yes	Yes	No	No	No	Bus
Yes	Yes	No	No	No	Bus
Yes	Yes	Yes	Yes	No	Will not interested to switch from train
Yes	Yes	Yes	No	No	Bus
Yes	Yes	No	No	No	Bus
Yes	Yes	No	No	No	Personal vehicle
Yes	Yes	Yes	No	No	Personal vehicle
No	Yes	Yes	No	No	Bus
Yes	Yes	Yes	Yes	No	Bus
No	Yes	Yes	No	No	Will not interested to switch from train
Yes	Yes	Yes	No	No	Will not interested to switch from train
Yes	Yes	Yes	No	No	Will not interested to switch from train
Yes	Yes	No	No	No	Will not interested to switch from train
Yes	Yes	Yes	No	No	Bus

Yes	Yes	Yes	No	No	Personal vehicle
Yes	Yes	No	No	No	Will not interested to switch from train
Yes	Yes	No	Yes	No	Will not interested to switch from train
Yes	Yes	No	No	No	Will not interested to switch from train
Yes	Yes	Yes	No	No	Will not interested to switch from train
Yes	Yes	No	No	No	Personal vehicle
Yes	Yes	No	No	No	Will not interested to switch from train
Yes	Yes	No	No	No	Will not interested to switch from train
Yes	Yes	No	No	No	Will not interested to switch from train
Yes	Yes	No	No	No	Personal vehicle
Yes	Yes	No	No	No	Will not interested to switch from train
Yes	Yes	Yes	No	No	Personal vehicle
Yes	Yes	No	No	No	Will not interested to switch from train
Yes	Yes	No	No	No	Bus
Yes	Yes	No	No	No	Bus
Yes	Yes	No	No	No	Bus
Yes	Yes	Yes	No	No	Will not interested to switch from train
Yes	Yes	Yes	No	No	Will not interested to switch from train
Yes	Yes	No	No	No	Personal vehicle
Yes	Yes	No	No	No	Will not interested to switch from train
Yes	Yes	Yes	No	No	Will not interested to switch from train
Yes	Yes	Yes	No	No	Will not interested to switch from train
Yes	Yes	No	No	Yes	Personal vehicle
Yes	Yes	Yes	No	No	Will not interested to switch from train
Yes	Yes	Yes	No	No	Will not interested to switch from train
Yes	Yes	Yes	No	No	Personal vehicle
Yes	Yes	No	No	No	Will not interested to switch from train
Yes	Yes	Yes	No	No	Personal vehicle

Yes	No	No	No	No	Personal vehicle
Yes	Yes	No	No	No	Personal vehicle
Yes	Yes	No	No	No	Personal vehicle
Yes	Yes	No	No	No	Personal vehicle
Yes	Yes	No	No	No	Bus
Yes	Yes	No	No	No	Personal vehicle
Yes	Yes	Yes	No	No	Personal vehicle
Yes	Yes	Yes	No	No	Bus
Yes	Yes	Yes	No	No	Personal vehicle
Yes	Yes	Yes	No	No	Will not interested to switch from train
Yes	Yes	No	No	No	Personal vehicle
Yes	Yes	Yes	No	No	Personal vehicle
Yes	Yes	No	No	No	Will not interested to switch from train
Yes	Yes	No	No	Yes	Bus
Yes	Yes	No	No	No	Bus
Yes	Yes	No	No	No	Will not interested to switch from train
Yes	Yes	Yes	No	No	Will not interested to switch from train
Yes	Yes	No	No	No	Personal vehicle
Yes	No	No	No	No	Personal vehicle