A CASE STUDY ON FEEDER MODE CHOICE PREFERENCE OF METRO RAIL TRAVELERS

By

MD HAFIZUR RAHMAN KHAN

MST LIPI BANU

KEYA KHATUN

MD REZAUL KARIM REZA

MD HAMIDUR RAHMAN

A thesis submitted to the Department of Civil Engineering in partial fulfillment for the degree of Bachelor of Science in Civil Engineering



Department of Civil Engineering

Sonargaon University

147/I, Green Road, Dhaka-1215, Bangladesh

Section: (25B)

Summer-2025

A CASE STUDY ON FEEDER MODE CHOICE PREFERENCE OF METRO RAIL TRAVELERS

By

MD HAFIZUR RAHMAN KHAN	CE2201025122
MST LIPI BANU	CE2201025004
KEYA KHATUN	CE2201025155
MD REZAUL KARIM REZA	CE2201025126
MD HAMIDUR RAHMAN	CE2201025046

Supervisor
M.A. Bashar Bhuiyan,
Lecturer
Department of Civil Engineering
Sonargaon University (SU)

A thesis submitted to the Department of Civil Engineering in partial fulfillment
for the degree of Bachelor of Science in Civil Engineering



Department of Civil Engineering

Sonargaon University

147/I, Green Road, Dhaka-1215, Bangladesh

Section: (25B)

Summer 2025

BOARD OF EXAMINERS

The thesis titled "A case study on Feeder Mode choice preferences of Metro Rail Travelers." submitted by Name: Mst. Lipi Banu, Student ID: CE2201025004**,** Name: Keya Khatun, Student ID: CE2201025155, Name: Md. Hamidur Rahman, Student ID: CE2201025046, Name: Md Hafizur Rahman Khan, Student ID: CE2201025122, Name: Md. Rezaul Karim Reza, Student ID: CE2201025126 has been accepted as atisfactory in partial fulfillment of the requirement for the degree of Bachelor of Science in Civil Engineering on 20th September-2025.

……

M.A. Bashar Bhuiyan, Chairman
Lecturer
Department of Civil Engineering
Sonargaon University (SU)

……

1. Internal / External Member Member

……

2. Internal / External Member Member

DECLARATION

This thesis is a presentation of our original research work. Wherever contributions of others are involved, every effort is made to indicate this clearly, with due reference to the literature and acknowledgement of collaborative research and discussion. The work was done under the supervision of M.A. Bashar Bhuiyan, Lecturer, Department of Civil Engineering, Sonargaon University.

STUDENT NAME	STUDENT ID.	SIGNATURE
MD HAFIZUR RAHMAN KHAN	CE2201025122	
MST LIPI BANU	CE2201025004	
KEYA KHATUN	CE2201025155	
MD REZAUL KARIM REZA	CE2201025126	
MD HAMIDUR RAHMAN	CE2201025046	

Dedicated

To

"Our Parents,

And

Our Honorable Teachers"

ACKNOWLEDGEMENT

First, we are deeply grateful to Almighty Allah (SWT) for granting us the opportunity, knowledge, and patience to complete this work successfully.

We would like to express our heartfelt gratitude to our respected supervisor, M.A. Bashar Bhuiyan, Lecturer of the Civil Engineering Department at Sonargaon University, for his valuable guidance, continuous support, and encouragement throughout this work. His humble approach to research has truly inspired us. We are also thankful to the Department of Civil Engineering, Sonargaon University, for their cooperation and support during this project.

Finally, we dedicate this work to our beloved parents for their unconditional love, constant encouragement, and sacrifices that have guided us to this point. We also extend our thanks to all the faculty members and staff of the Civil Engineering Department for their kind assistance.

ABSTRACT

FPTS, or feeder public transit service, is crucial to fostering economic growth and providing commuters with access to urban areas. The perception of a service or mode by passengers has an impact on all public transport systems. The objective of this study is to identify passengers, preferred feeder transport modes and influencing factors along the metro rail route from Uttara North to Agargaon. The study explores the preferences of metro rail travelers towards feeder mode selection, focusing on factors such as cost, convenience and accessibility. The perceptions of passengers using the Uttara North to Agargaon Metro Rail corridor about four feeder modes - Bus, CNG, Microbus, and Auto-Rickshaw are investigated. Factors such as feeder mode attributes (comfort, safety, availability), trip characteristics (journey time, cost, frequency) and demographic and socio-economic characteristics of the travelers (Age, Gender, Income, Occupation) are considered. A total of 500 respondents are surveyed, of which 14% are government employees, 39% are private sector employees, 27% are self-employed, 14% are students and 1% are retired persons. A multinomial logistic model (MLM) is applied to analyze the relationship between feeder mode characteristics and overall mode choice behavior. The model reveals that male respondents are 2.03 times more likely to choose bus as a feeder mode than female respondents. Other important factors influencing feeder mode choice include cost sensitivity, perceived reliability, convenience and travel purpose.

Table of Content

Title	Page
ABSTRACT	vii
TABLE OF CONTENT	viii
LIST OF TABELS	x
LIST OF FIGURES	xi
LIST OF APPENDIXES	xii
CHAPTER ONE: INTRODUCTION	1
1.1 General	1
1.2 Problem Identification	2
1.3 Objectives of the study	2
1.4 Organization of the Thesis	2
CHAPTER TWO: LITERATURE REVIEW	3
2.1 General	3
2.2 Literature on Transportation Mode Choice	3
2.3 Literature on Feeder Mode choice	4
2.4 Literature on Factors Affecting Feeder Mode Choice	5
2.5 An Overview on Bangladesh Mode Choice Studies	6
CHAPTER THREE: METHODOLOGY	8
3.1 General	8
3.2 Research Framework	8
3.3 Selection of Study Area	9
3.3.1 Uttara Uttar Metro Rail Station	9
3.3.2 Agargaon Metro Rail Station	10
3.4 Survey Locations and Schedule	11
3.5 Questionnaire Survey	13
3.6 Questionnaire	13
3.7 Respondents	13
CHAPTER FOUR: DATA COLLECTION	15
4.0 Introduction	15
4.1 Demographic Information	15
4.1.1 Gender	16
4.1.2 Age	16
4.1.3Level of Education	17
4.1.4 Type of Occupation	17
4.1.5 Income	18
4.1.6 Travel Information	18
4.1.7 Use of Public Transportation	19
4.2 Safety	20
4.2.1 Riding safety	20
4.2.2 Drivers Behavior	21
4.2.3 Obeying Traffic Rule	21
4.2.4 Reckless Driving	22

Table of Content

Title		Page
4.3	Comfort	23
	4.3.1 Riding Comfort	23
	4.3.2 Crowdedness inside the vehicle	23
4.4	Feasibility	24
	4.4.1 Time Saving	24
	4.4.2 Rate of Availability	25
	4.4.3 Efficiency in Picking up	25
4.5	Economy	26
	4.5.1 Travel Cost	26
CHAPTER FIVE: DATA ANALYSIS		27
5.1	Introduction	27
5.2	Derivation of Multinomial Logistic Model (MNL)	27
5.3	Study Variables	27
	5.3.1 Factors that Influence Choice of Feeder Travel Mode	27
	5.3.2 Categories of response Variables	29
	5.3.3 Regress or Variables	30
5.4	Postulated Model	34
5.5	Estimation and test of Postulated Model	36
	5.5.1 Likelihood Ratio Test	36
5.6	Estimated Model	61
5.7	Interpretation or Estimated Model	61
	5.7.1 Interpretation of the intercepts	61
	5.7.2 Interpretation of the slope coefficients	62
CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS		63
6.1	General	63
6.2	Summary	63
	6.2.1 Demographic Information	64
	6.2.2 Transportation Mode Choice	64
	6.2.3 Multinomial Logistic Model	66
6.3	Limitations of the Study	66
6.4	Recommendations for Future Study	66

Table of Content

Title	**Page**
REFERENCES	67
APPENDIX A	68
APPENDIX B	71

List of Tables

Number	Title	Page
Table 3.1	Survey Locations and Schedule	12
Table 4.1	General information of the Respondents	15
Table 4.2	Summary of Sample Data	16
Table 5.1	Categories of regress or Variables	31
Table 5.2	Operational Delimitation	33
Table 5.3	Model Fitting Information	37
Table 5.4	Likelihood Ratio Tests	37
Table 5.5	Estimation and Wald test	38
Table 5.6	Estimated values of intercept terms	61

LIST OF FIGURES

Number	Title	Page
Figure 3.1	Research Framework	9
Figure 3.2	Study Location in Uttara Uttara Metro Rail Station	10
Figure 3.3	Study Location in Agargaon Metro Rail Station	11
Figure 3.4	Filed Survey inside Uttara Uttar Metro Rail Station	13
Figure 3.5	Filed Survey inside Uttara Uttar Metro Rail Station	13
Figure 3.6	Filed Survey inside Agargaon Metro Rail Station	14
Figure 3.7	Filed Survey inside Agargaon Metro Rail Station	14
Figure 3.8	Filed Survey inside Uttara Uttar Metro Rail Station	14
Figure 3.9	Filed Survey inside Agargaon Metro Rail Station	14
Figure 4.1	Gender	16
Figure 4.2	Age	17
Figure 4.3	Level of Education	17
Figure 4.4	Type of Occupation	18
Figure 4.5	Income	18
Figure 4.6	Travel Information	19
Figure 4.7	Use of Public Transportation	19
Figure 4.8	Riding safety	20
Figure 4.9	Drivers Behavior	21
Figure 4.10	Obeying Traffic Rule	22
Figure 4.11	Reckless Driving	22
Figure 4.12	Riding Comfort	23
Figure 4.13	Crowdedness inside the vehicle	24
Figure 4.14	Time Saving	24
Figure 4.15	Rate of Availability	25
Figure 4.16	Efficiency in Picking up	26
Figure 4.17	Travel Cost	26
Figure 5.1	Factors that Influence Choice of Feeder Travel Mode	29

LIST OF APPENDIXES

Title	Page
APPENDIX A	68
APPENDIX B	71

CHAPTER 1

INTRODUCTION

1.1 General

Feeder public transit service (FPTS) plays a vital role in economic. Development for access of the commuters to the city centers of the city. A transit system facility offers direct services and accessibility to the transit line acting as platforms for facilitating these services. An effective and efficient way of integration of feeder service with the public transport can improve the existing public transport system in the present urban scenario. The attitude of the commuters toward the feeder system also plays an important role in the public transit system.

To connect the first and last miles of mass rapid transit (MRT), feeder transport services are essential. They are especially helpful in places with low demand, where private transportation is frequently the primary means of transportation.

For commuters to have access to the city centers, feeder public transit service (FPTS) is crucial to economic growth.

The method of arriving at the decision to use a mode or service under a certain set of conditions is attitude analysis of the mode or service. The way commuters feel about a single mode or service has an impact on the entire public transportation system. Data from revealed and expressed preference surveys are used in the bus stop and onboard survey methods. In the current study, feeder mode attributes, trip/travel characteristics, demographic and socio economic characteristics of individuals were employed as explanatory variables in multi nominal logit models.

Application:

- Impact of vehicle automation and electrification on the feeder transit design.
- Two operating strategies, fixed routes versus door-to-door trips, are compared.
- Variations of the cost structure of the service define different scenarios of study.
- Automation presents the main impact on the applicability of door-to-door trips.
- Significant impacts require mature technologies, small areas and high values of time.

The trip's characteristics, including length, time of day, and route availability (such as reserved lanes), the characteristics of the train station, including parking conditions and facilities (such as parking restrictions, parking fees, and guarded facilities for bicycles), and the characteristics of the train (such as frequency, bicycle carrying capacity), are all taken into consideration when choosing the train-feeder mode among the alternatives.

1.2 Problem Identification

Feeder vehicle is a very new concept in the Bangladesh Transport system. No work has been done previously with the preference of mode choice for Feeder vehicle in Bangladesh. Therefore, the current study is planning to focus on developing a travel system for the people who uses Metro Rail near Diabari station.

1.3 Objectives of the Study

i. Identify the factors affecting feeder mode choice of metro commuters.
ii. Develop a relationship between the factor sand feeder mode choices.

1.4 Organization of the Thesis

The thesis consists of five chapters including the present one. The first chapter deals with the introduction, problem identification and objectives of the study. Chapter 2 presents a literature review on the theme of this study. Chapter 3 gives details of research methodology. Chapter 4 is devoted to the data collection and Chapter 5 consists of data analysis of mode choice behaviors. Finally, Chapter 6 deals with the conclusion and recommendation**.**

CHAPTER 2

LITERATURE REVIEW

2.1 General

This chapter gives a brief overview of the travel behavior and its factors that influence choice of feeder vehicle. It also summarizes some mode related studies into Metro Rail Station in Dhaka city. The literature on transportation related studies and multinomial logistic model have been presented at the part of this chapter.

2.2 Literature on Transportation Mode Choice

A decision maker can select one option from a limited collection of options that are mutually exclusive and collectively exhaustive using discrete feeder choice models, which can assess and forecast this choice. Given that many behavioral reactions are discrete or nonlinear, such models have various applications. They are qualitative in nature, meaning that they relate to picking one or the other from a list of options. On the preferred mode of transportation, in-depth investigations have been done in the past. The most significant factors in several of these studies were found to be socio economic and demographic variables.

A study on Traffic Safety Perception, Attitude, and Feeder Mode Choice of Metro Commute revealed that Walking is the most frequently used travel mode and Variances in traffic safety perception and attitude exist across gender and location (Guo, Y. et al., 2020)

Another study found that demo graphic and socio-economic characteristics of individuals, trip and travel characteristics etc. affect feeder mode choice behavior (Balya, M. and Kumar, R. 2018,Logistic Model is used for Mode choice (Rahman, D. et.,2021)

There can be more than two categories of the dependent or outcome variable in a multinomial logistic model, which is a straight forward expansion of binary logistic regression. Based on several in dependent variables, multinomial logistic regression is used to forecast where categories will appear on a dependent variable or the likelihood that they will be present. Both Continuous (i.e., interval or ratio in scale) and dichotomous (i.e., binary) independent variables are acceptable. When a categorical dependent variable (i.e., two or more discrete outcomes) has two or more unordered levels, multinomial logistic regression is utilized.

Except for the fact that there is more than one potential result, it is essentially identical to logistic regression. One category of the dependent variable is chosen as the reference category when employing multinomial logistic regression. Except for the reference category, which is left out of the analysis, separate odds ratios are calculated for each category of the dependent variable for each in dependent variable.

2.3 Literature on Feeder Mode Choice

A minimal amount of research is focused on interactions between feeder mode choice and transit accessibility. Hence, literature review presented in this section covers various aspects of feeder modes and transit accessibility. It creates a comprehensive background for the current research work presented in this paper. As terms “access” and “accessibility” offer consider blow confusion, it is essential to outline their distinct meanings. The term “access” refers to the opportunity of using the service based on proximity and cost. In contrast, the term “accessibility” is the suitability of network to get the people from their origin to destination [2]. There is a great diversity of perceptions that define the term “accessibility” [7–11].

In a simple way, accessibility is the ease of access in terms of “where”—where the opportunities are situated includes built environment that satisfies the need of people [12], “who”—the ease with which individuals can reach opportunities [9], and “how”—how easily people can get to the opportunities by overcoming barriers such as time, cost, and distance [7, 13, 14]. Ideally, all the components of accessibility—people, place, built environment, and travel characteristics—should be considered in its study. But in practice, researchers have only considered one or more components based on the view taken [4].

Accessibility to transit has remained a key focus for researchers and policymakers for a long time and continues to be getting attention [15]. A variety of measures have been used to define transit accessibility in literature. It can be estimated in terms of spatial and temporal coverage [16, 17], service are a coverage [18, 19], number of jobs and destination served [19, 20], travel impedance [15, 21], or comfort and convenience [22]. Past studies offer a significant contribution towards estimation of walk access senility [23–26]. Zou et al. [27] defend transit coverage in terms of a walk and bicycle accessibility based on threshes old distance and, population and job served. Ryan et al. [28] considered bus and private modes to evaluate accessibility to rail transit considering

distance and time parameters, parking facility, facility at transit stop, and land-use mix around transit stops. Li et al. [4] investigated accessibility to metro station by walking and bus considering time cost, fare cost, and fatigue cost.

Study of accessibility to transit mainly focuses on walk mode [1], and very few studies have considered other modes to determine transit accessibility. The present study contributes to the existing literature by considering all feeder modes to estimate transit accessibility. Public transportation has a higher propensity of use only if easily accessible by users in terms of distance, time, cost, convenience, and safety, and it is also Arabian Journal for Science and Engineering (2022)47:4483–4497448513 applicable in the frame work of any mode choice decisions. Access and egress prove to be the weakest links for any public transport to be successful [29]. With an increase in access/egress time, the use of public transit goes on decreasing [30].T

2.4 Literature on Factors Affecting Feeder Mode Choice

A literature review of publications related to transit ridership models, transit accessibility evaluation, mode choice and urban forms, transit use, and urban design was conducted. There view indicated that the most common analysis approaches found were multiple regression and time-series analysis. While structural models are capable of modeling interrelated variables and are appropriate if the calibration of a model is necessary to predict the modal split, few were employed. Nevertheless, the objective of this research was to determine the relevance of different variables and their relative importance in transit use, which should be adequately served with regression methods. The weaknesses of the multiple regression approach, such as auto correlation, non-normal distributions and invalidity of the independent, identically distributed (IID) normal assumption, were discussed. Although flawed in theory, multiple regression analysis is still widely applied since its concept is easy to understand. Thus, from a practitioner's point of view, this approach may be worth further investigation.

The factors that affect transit use can generally be classified in to the following categories:

(1) Transit level of service (LOS).
(2) Accessibility.
(3) Land use/urban design; and
(4) Transit users' socioeconomic/demographic characteristics.

Transit service quality may be considered in terms of rider comfort, cleanliness and appearance, safety and security, pedestrian environment, amenities, headway, hours of service, parking spaces, reliability, service coverage, transfer, cost, etc. Some of these are traditional LOS variables, such as transit service frequency, route coverage, and fares; others have been recently included as transit LOS factors (Kittel son & Associates, Inc. 1999a, 1999b). The literature generally supports the ability of transit systems with high-quality services to attract more users. However, many of the LOS'S factors affecting transit use often cannot be easily quantified. For example, most of the studies point out the conceptual importance of the LOS measures of effectiveness (MOEs) without further suggesting the appropriate approaches to quantify many if not all of them. Some examples of such MOEs include passenger comfort in vehicle and in stations, security, and pedestrian environment. Consequently, it is still difficult to formulate LOS variables in models for estimating transit share. As a result, statistics such as Person per Minute Served were developed and implemented to determine the quality of transit service. Although tremendous efforts have been devoted to exploring the LOS factors that significantly affect transit use, contradictory findings were cited by different researchers and practitioners in different study areas (e.g., Ulberg (1982) and Vazirietal.(1990) did not find service hours to be significant in contrast too ther researchers) indicating that some of the transit LOS MOEs may not be transferable from one urban area to the other.

2.5 An over view on Bangladesh Transportation Mode Choice Studies

The first initiative to develop the mode choice model for Dhaka was the Greater Dhaka Metro polite Area Integrated Transport Study (DITS, 1993). It was intended to evaluate the long- term travel demand of Dhaka applying the traditional four-step model. The model considered walk, rickshaw, public transport, and private transport modes and data were collected from the Household Interview Survey (HIS). It was simplified into the binary logit model. However, since not all these modes are competing for modes of each other, the estimation could not produce a Realistic result. The model was estimated that 60% of the trips are walking which are unrealistically high trips. Again, the bus and tempo were both considered as public transport while taxi and car both considered private transport modes.

This generalization could not explore the diversity of the mode choice of travelers. Strategic Transport Plan (STP) developed a mode choice for Dhaka as a part of the travel demand model forecasting model in2005 (STP, 2005). The model considered only two types of mode transit and non-transit motorized modes were considered. But walking and Non-Motorized Transport were not included in the model although a considerable number of people in Dhaka use those modes. Only travel time and cost were considered as mode choice variables although socio-demographic characteristics of the travelers and other attributes of the transport modes influence the travel behavior. Enam (2010) pointed out the inconsistency of STP model estimation as the value of time of low-income and high-income groups gave counterintuitive results.

Hasan (2007) also studied the mode choice behavior according to the trip purpose (home base work trip, home base education trip, home base other trip and non-home base trip). Besides, it adopted a rule base approach for model development. The decision followed in such a way that travelers with car ownership will always choose a car for traveling and others will choose from the rickshaw, auto-rickshaw, and transit. Mode choice behavior among different alternatives was studied using the Multinomial Logit (MNL) model. Enam (2010) studied the mode choice behavior of travelers to capture the preference for the proposed BRT and MRT.

The mode choice model was developed combining SP and RP data. The study incorporates socio-economic variables like income, age, gender, occupation, employment, etc. into the model. The value of time of different modes was calculated and compared with the previous studies. In the first step, the modal split has been made among walking, rickshaw and other modes (which includes private car, bus, and auto-rickshaw) using the shortest path distance as the only explanatory variable. In the second step, other modes have divided into a private car, bus, and auto-rickshaw using respective travel costs as the only explanatory variable. However, such a generalizedmodelcannotpredicttheactualbehaviorasitdidnotconsiderthetasteheterogeneity in terms of other factors that is likely to affect the choice of modes.

CHAPTER 3
METHODOLOGY

3.1 General

The research methodology employed in this study is described in this chapter, including the research design, study area selection, questionnaire survey, schedule for the survey, and questionnaire itself. For research and analysis purposes, a personal survey method has been used.

3.2 Research Frame work

A two-step methodology was adopted for this study. The first step was a data collection approach incorporating purpose-built questionnaire survey. The questionnaire contains three parts. The first part was about the respondent's socio-economic information. The second part involved questions about travel characteristics and the final part involved information about travel modes. The respondents were asked to fill out the questionnaire at 2 different Metro Rail Station areas in Dhaka. Respondents were asked to rate their individual opinion on the questionnaires. The data collection method was used to extract the view of the passengers towards different attributes related to made choice. A total of 500 questionnaires were completed by the travel makers. And out of 500 questionnaires, 500 were taken for research. The interviews were conducted through a field survey. The locations where filed survey field was conducted were Uttara North and Agargaon Metro Rail station and the survey time was between 4.00 pm to 7.00 pm. The filed survey was completed in the different areas of the selected two Metro Rail Station from **May 10 2025 to August 10, 2025.**

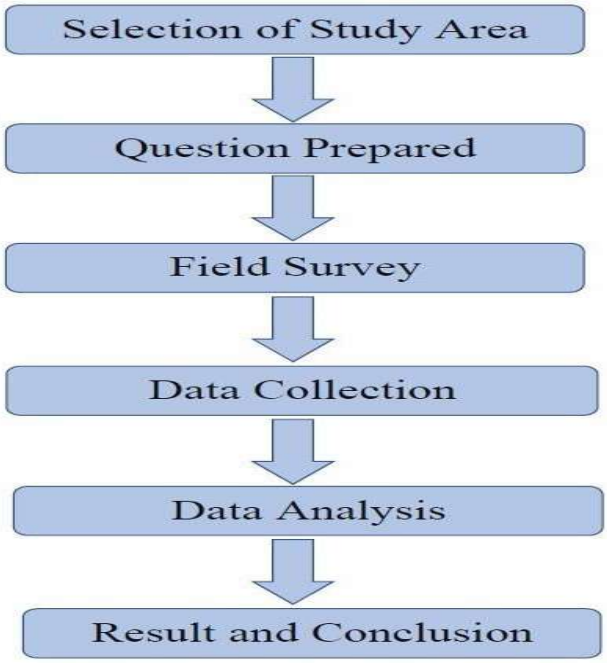


Figure 3.1: Research Frame work

3.3 Selection of Study Area:

Metro rail is a new addition in transportation sight of Bangladesh.11.73 km part of the Mass Rapid Transit (MRT) Line-6 is open which is from Diabari to Agargaon and vice versa. This public transport system will aid in the economic and social development of the greater Dhaka area, which is facing traffic congestion and pollution issues.

3.3.1 Uttara Uttar Metro Station:

Uttara Uttar Metro is a station on Line 6 of the Dhaka Metro. Located at the coordinates of 23°05'03.28" North Latitude and 90°02'03.46" East Longitude, Uttara Uttar Metro station is strategically positioned within the neighborhood. Its geographical coordinates place it right at the heart of the action, making it easily accessible for residents and visitors alike. The station is surrounded by various land marks: to the north is the Metro Rail depot, to the south is Diabari Lake to the east is Uttara Residential Model Town, and to the west are residential with numerous houses, shop and commercial offices.



Figure 3.2: Study location in Uttara Uttar Metro station Area

3.3.2 Agargaon Metro Rail Station:

The Dhaka Metro's MRT Line 6 includes the Agargaon Metro station, which is in the bustling Agargaon district. This station is strategically positioned in the middle of the region at the coordinates 23°46'41.87" North Latitude and 90°22'48.28" East Longitude. Geographically speaking, it is at the center of the action, making it easily accessible to both locals and guests. The prestigious Bangladesh Air Force Museum is located to the east of Agargaon Metro station, giving the area more cultural and historical value. IDB Bhaban, which houses various government buildings, is prominently situated on the station's western side. This concentration of government buildings highlights the station's significance as a practical transportation hub for representatives and other people on official business. The station also gains from the connectivity that the north and south junction paths offer by connecting it to diverse Locations. This effective system of routes broadens the station's reach and improves its value for travelers by making it convenient for commuters to visit many locations. The station functions as a vital transit hub, connecting commuters to the Bangladesh Air Force Museum to the east and IDB Bhaban with its government buildings to the west by well-connected north and south connection pathways.

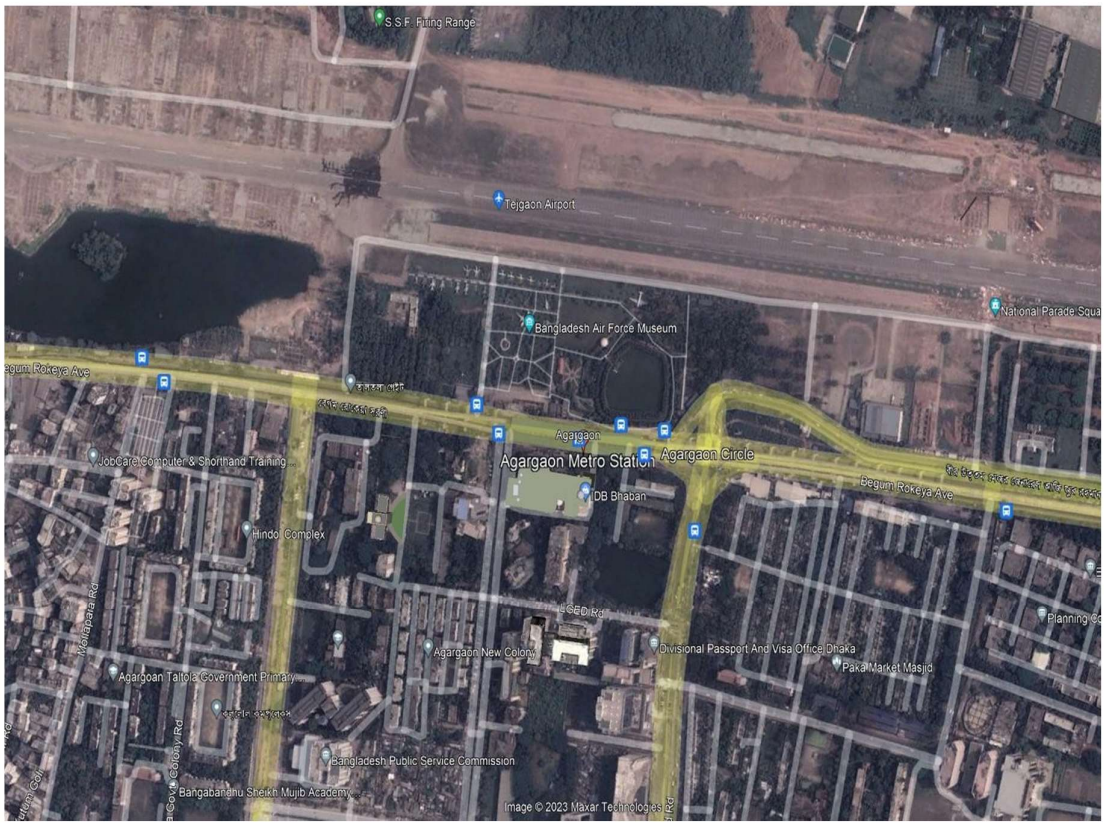


Figure 3.3: Study location Agargaon Metro Station Area

3.4 Survey Location sand Schedule:

The locations were picked because those roads connect Metro Rail Station. They have been the two terminal points of the Metro Rail since its beginnings and are home to numerous educational institutions, offices, business centers, and parks. There were a lot of people there who went to work. Table 3.1 below displays the survey's timetable and locations.

Table 3.1: Survey Locations and Schedule

Sl. No	Date	Time	Location of Field Survey
01	01/05/2025	4.00 pm to 7.00 pm	Uttara Uttar metro rail Station
02	05/05/2025	9.00 am to 1.00 pm	Uttara Uttar metro rail Station
03	07/05/2025	9.00 am to 2.00 pm	Agargaon metro rail Station
04	09/05/2025	5.00 pm to 7.00 pm	Uttara Uttar metro rail Station
05	11/05/2025	9.00am to 2.00 pm	Uttara Uttar metro rail Station
06	20/05/2025	9.00am to 2.00 pm	Agargaon metro rail Station
07	25/05/2025	5.00 pm to 7.00 pm	Uttara Uttar metro rail Station
08	30/05/2025	4.00 pm to 7.00 pm	Uttara Uttar metro rail Station
09	11/06/2025	10.00 am to 12.00 pm	Agargaon metro rail Station
10	13/06/2025	5.00 pm to 8.00 pm	Uttara Uttar metro rail Station
11	18/06/2025	10.00 am to 2.00 pm	Agargaon metro rail Station
12	22/06/2025	9.00 am to 2.00 pm	Uttara Uttar metro rail Station
13	25/06/2025	11.00 am to 2.00 pm	Agargaon metro rail Station
14	29/06/2025	5.00 pm to 7.00 pm	Agargaon metro rail Station
15	05/07/2025	9.00 am to2.00 pm	Uttara Uttar metro rail Station
16	09/07/2025	5.00 pm to 7.00 pm	Uttara Uttar metro rail Station
17	15/07/2025	9.00 am to2.00 pm	Uttara Uttar metro rail Station
18	18/07/2025	4.00 pm to 7.00 pm	Agargaon Metro Rail station
19	21/07/2025	4.00 pm to 8.00 pm	Agargaon Metro Rail station
20	24/07/2025	4.00 pm to 7.00 pm	Uttara Uttar Metro Rail station
21	27/07/2025	6.00 pm to 8.30 pm	Agargaon Metro Rail station
22	29/07/2025	4.00 pm to 7.00 pm	Agargaon Metro Rail station
23	01/08/2025	9.00 am to 2.00 pm	Uttara Uttar Metro Rail station
24	05/08/2025	9.00 am to 2.00 pm	Agargaon Metro Rail station

3.5 Questionnaires Survey:

The questionnaire has 29 questions that are based on the user's travel preferences, mode of transportation, income level, amount of journey time, level of comfort,etc.Table 3.1 provides the Field survey locations and timeline. These are the two locations where Metro Rail ends. Many individuals use the metro rails for their transportation needs. The study's final analysis will focus on 15 of the study's 29 questions.

3.6 Questionnaire:

The questionnaire has two parts:

The first section of the questionnaire asks about the passengers' demographics. This section includes inquiries about the respondent's gender, age, occupation, level of education, marital status, details about their family etc.

The second section of the survey asks about travel-related qualities. This section asks questions on the respondent's trip comfort.

Questionnaires of the survey are shown at Appendix A

3.7 Respondents:

The respondents, who resided close to the Agargaon Metro Station and the Uttara Uttar Metro Rail Station, ranged in age from 15 to 75. The age range was selected because individuals in this age group typically commute by the same mode of transportation and are likely to have done so as their principal means of travel. At the field survey, the respondents were requested to complete the questionnaire. In chapter four, an overall data analysis was demonstrated. The surveyors did their utmost during the survey period to get correct data. Following that, all the photographic images from the field surveys taken in various areas with a caption are displayed.



Figure-3.4: Field survey Inside Uttara Uttar station



Figure-3.5: Field survey Outside Uttara Uttar station



Figure-3.6: Field survey Inside Agargaon station



Figure-3.7: Field survey Inside Agargaon station



Figure-3.8: Field survey Outside Uttara Uttar station



Figure-3.9: Field survey Inside Agargaon station

CHAPTER 4

DATA COLLECTION

4. Introduction

At two different stations in Dhaka city, including Uttara Uttar Metro Rail Station and Agargaon Metro Rail Station, 500 passengers in total were questioned for this study. Field surveys were used to collect the data. Excel and a multinomial logistic model were then used to analyze the data. To determine the method of transportation and the distance traveled outside the home for work-related purposes in various locations, a series of correlations were created. Identifying the factors influencing mode selection is the goal.

4.1 Demographic Information

General information of their presents is given in table 4.1

Table 4.1: General information of the respondents

Features	Statistics
Gender	Male (67%), Female (33%)
Age	Under 25 years(26%),Between 25-35years(50%),Between 35-45 Years (16%), Between 45-55years (7%), Above 55years (1%)
Occupation	Govt. Employee (14%), Private Employee (39%), Self-Employee (27%), Student (14%), Retired person (1%)
Educational qualification	Secondary or below (16%), Higher Secondary (28%),Bachelor's Degree (44%), Master's Degree (12%), Ph.D. holders (0%).
Monthly Family Income	Less than 25000TK (17%), Between 25000-74000TK(53%), Between 74000-149000TK (27%), Between 150000-29000TK (3%).

Table 4.2: Summary of sample data

Features	Statistics
Travel Information	Less than10 KM (50%), Between 10-30KM (32%),Between30-50 KM (12%), Between 50-70 KM (6%),70 KM or more(0%)
Use of public transportation	Never Uses (15%), Rarely uses (18%), Moderately uses(26%),often uses (29%), very often uses (12%).

4.1.1 Gender

In a developing nation like Bangladesh, women travel outside the home at a rate of roughly one-third that of men. Figure 4.1.1 showed that 67% of respondents were men and 33% were women.

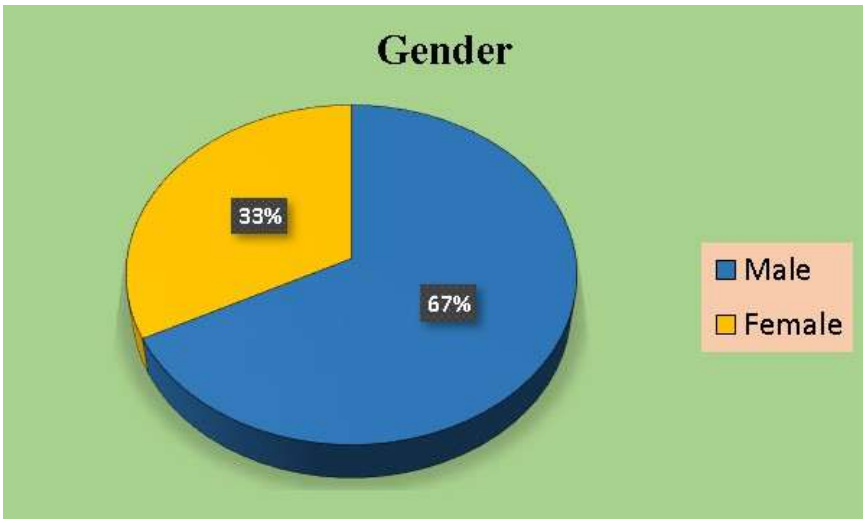


Figure: 4.1 Gender

4.1.2 Age

According to Figure 4.1.2, 50% of respondents were between the ages of 25 and 35, 26% were under 25, 16%were between the ages of 35 and 45, 7% were between the ages of 45 and 55, and 1% were over the age of 55.

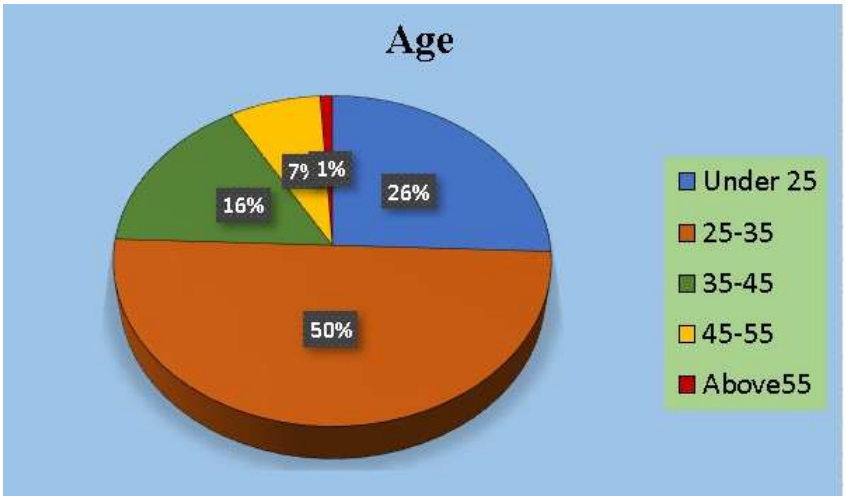


Figure: 4.2 Age

4.1.3 Level of Education

According to Figure 4.1.3, 44% of respondents had a bachelor's degree, 28% had a higher secondary education, 16% had a secondary education or less, 12% had a master's degree.

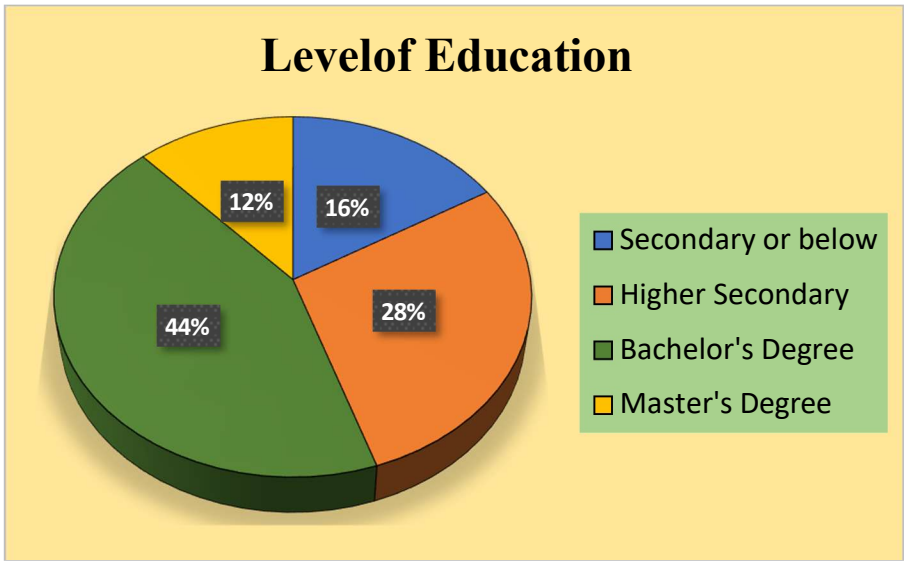


Figure: 4.3 Level of Education

4.1.4 Type of Occupation

According to Figure 4.1.4, 27% of respondents were self-employed, 19% were students, and 39% of respondents were private employees. 14% of people identified as Govt. employees and 1% as retired. Most responses, as evidenced by this private employee.

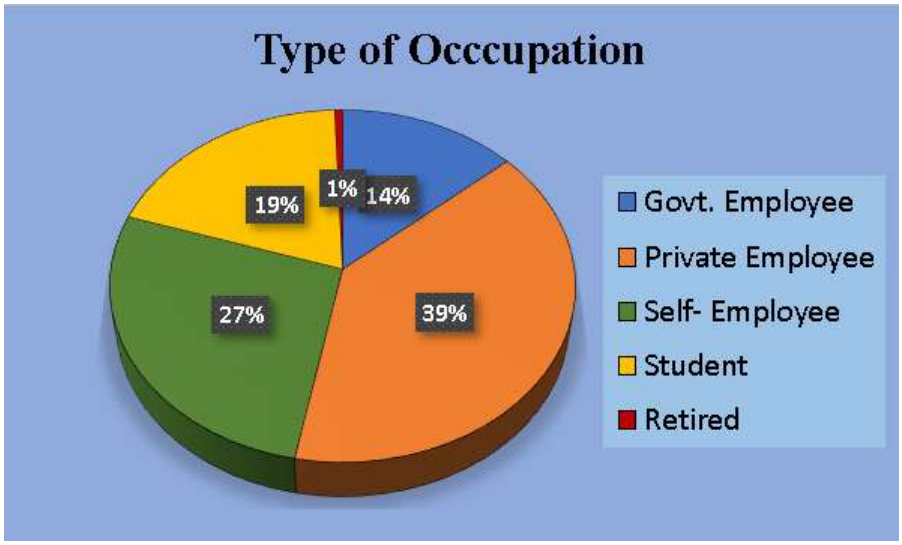


Figure: 4.4 Type of Occupation

4.1.5 Income

Figure 4.1.5 showed that 53% of respondents had an income of 25–74,27% had an income of 74–149, 17% had an income of 25–24,3% had an income of 150–299 and 0% had an income of 300-above.

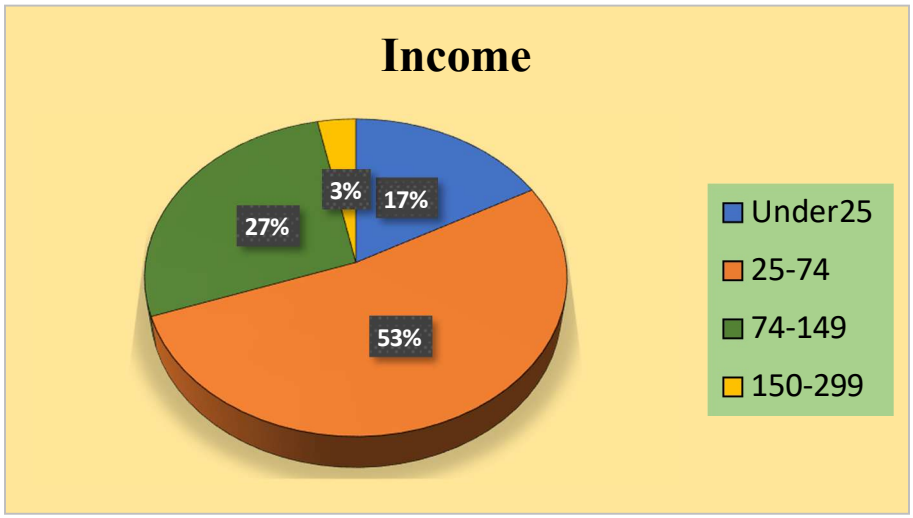


Figure: 4.5 Income

4.1.6 Travel information

People travel for different purposes to different locations and how often they make these journeys together are called travel information.

Figure 4.1.6 showed that 50% of respondents had traveled less than 10 KM, 32% had traveled10 to 30 KM, 12% had traveled 30 to 50 KM, 6% had traveled 50 to 70 KM.

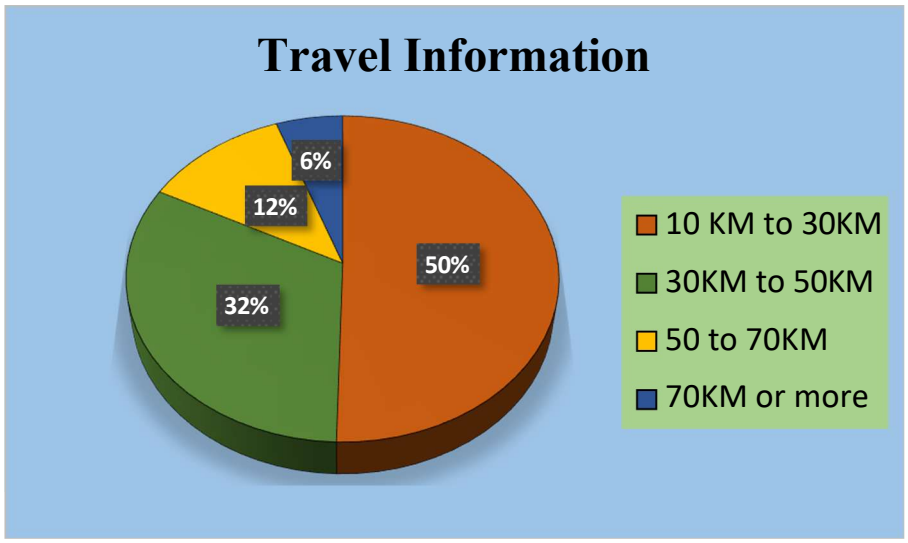


Figure: 4.6 Travel information

4.1.7 Use of Public Transportation

Figure 4.1.7 showed that 12% of respondents use public transportation very often, 29% of respondents use it moderately, 26% of respondents use it infrequently, 18% of respondents use it rarely, and 29% of respondents never use it.

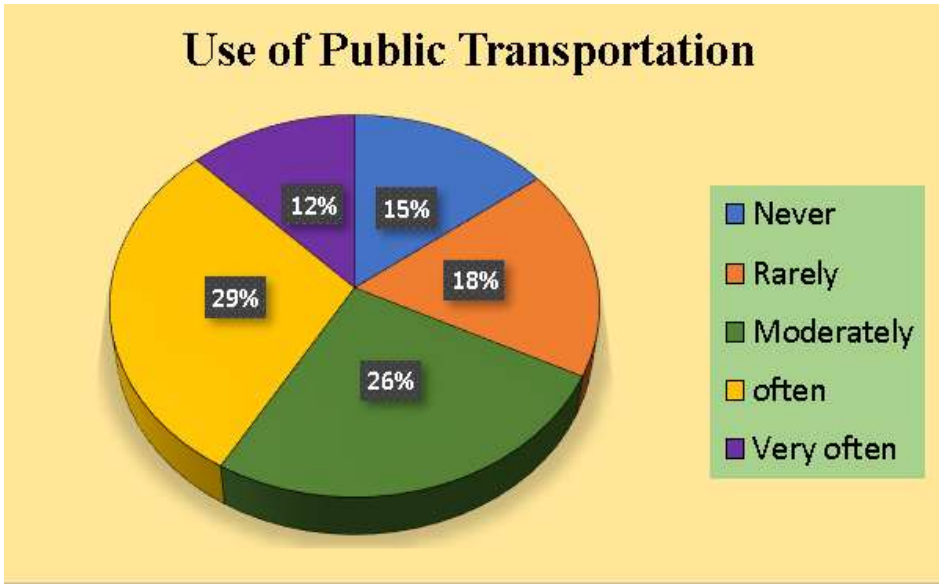


Figure: 4.7 Use of Public Transportation

4.2 Safety:

Transportation safety is concerned with the protection of life and property through regulation, management and technological development of all forms of transportation.

4.2.1 Riding Safety:

While traveling can be exciting and interesting, safety should always come first. If people or things have a safe journey, they reach their destination without harm, damage, or unpleasant things happening to them. This is called riding safety. Riding public transit is an affordable and sustainable way to go. But as you ride, safety should always be top of mind. Make sure you're alert by following these tips: Know Where You're Going, Have Your Fare Ready, Stay Away from Curbs and Edges, Keep Belongings Close to You, Don't Sit near Exits, Always Stay Alert etc.

Figure 4.2.1 showed that 40% of respondents gave a rating for riding safety that was moderate, 26% gave a rating for riding safety that was very poor, 17% gave a rating for riding safety that was poor, and 17% gave a rating for riding safety that was good.

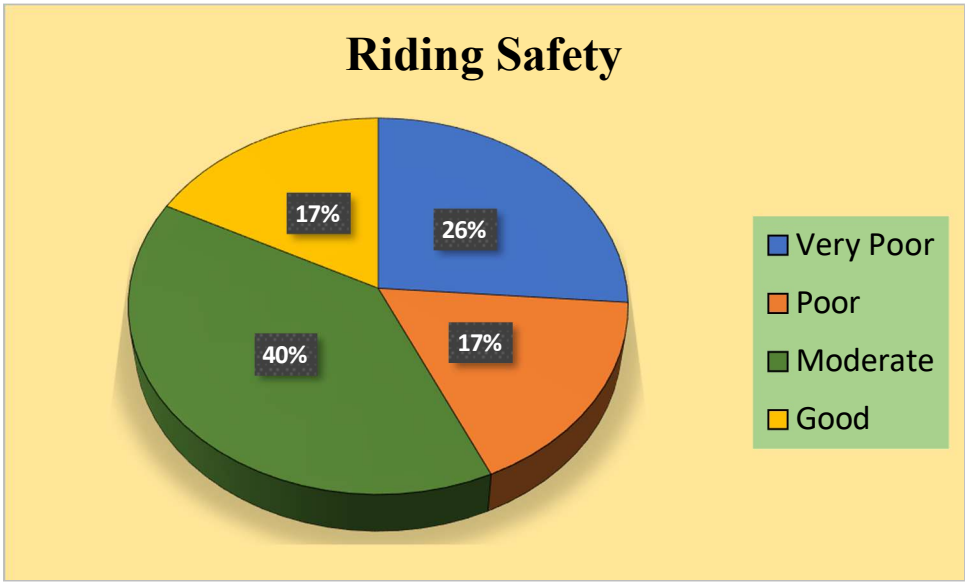


Figure: 4.8 Riding Safety

4.2.2 Driver's Behavior.

The driver's intended actions are an extension of their mental intentions, which can be utilized to guess about their internal mental states. There has been a lot of research done on driver behavior. Typical driving behaviors include head rotation, eye-gaze dynamics, hand motions, body movement, and foot dynamics.

Figure 4.2.2 showed that 35% of respondents gave a rating for poor driving behavior, 26% of respondents gave a rating for very poor driving behavior, 27% of respondents gave a rating for moderate driving behavior, and 12% of respondents gave a rating for acceptable driving behavior.

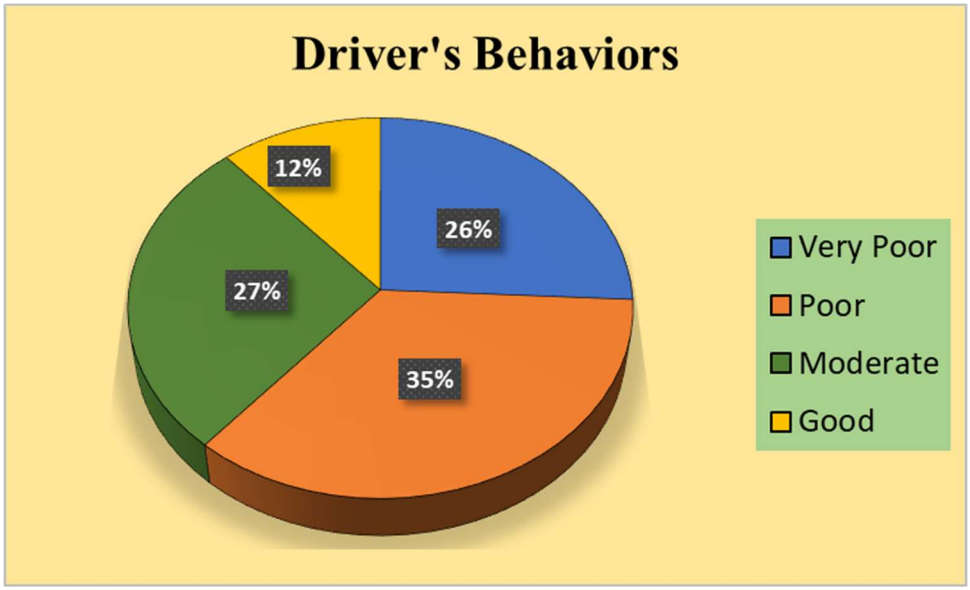


Figure: 4.9 Driver's Behavior

4.2.3 Obeying Traffic Rule

Following traffic laws and exercising common sense are crucial when it comes to defensive driving. When you drive a car on the road, traffic laws are in place to assist safeguard you and other people. Ensure that you are aware of the regulations and that you consistently follow them when you are driving.

Figure 4.2.3 shows that 35% of respondents rate drivers obey traffic rules as moderate, 34% rate driver obeying traffic rules as poor, 21% rate driver obeys traffic rules as very poor 10% rate driver obeying traffic rules as good.

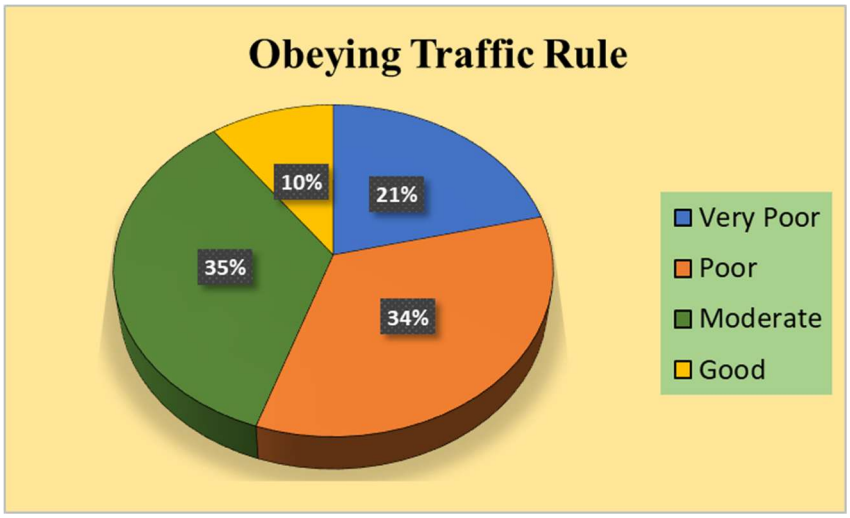


Figure: 4.10 Obeying Traffic Rule

4.2.4 Reckless Driving

Reckless driving occurs when a driver operates a vehicle carelessly and heedlessly, disregarding the rights and safety of others, acting without the required caution and circumspection, and doing so at a speed or in a way that could endanger or be likely to imperil any person or property.

Figure 4.2.4 revealed that 33% of respondents rate reckless driving of driver as less frequently, 31% of respondents rate reckless driving of driver as very frequently, 31% of respondents rate reckless driving of driver as frequently, 3% of respondents rate reckless driving of driver as rare, and 2% of respondents rate reckless driving of driver as never.

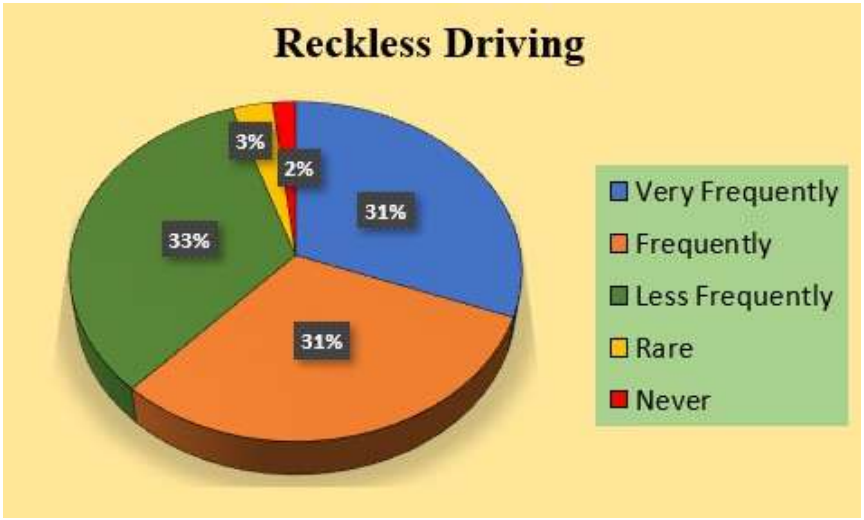


Figure: 4.11 Reckless Driving

4.3 Comfort:

In transport, comfort is about finding the right balance between the different materials that make up a seat. To provide a space where passengers can relax and enjoy the experience.

4.3.1 Riding Comfort

Figure 4.3.1 shows that 32% of respondents rate riding comfort inside bus as moderate, 36% rate riding comfort inside bus as poor, 17% rate riding comfort inside bus as poor as very poor, 15% rate riding comfort inside bus as poor as good.

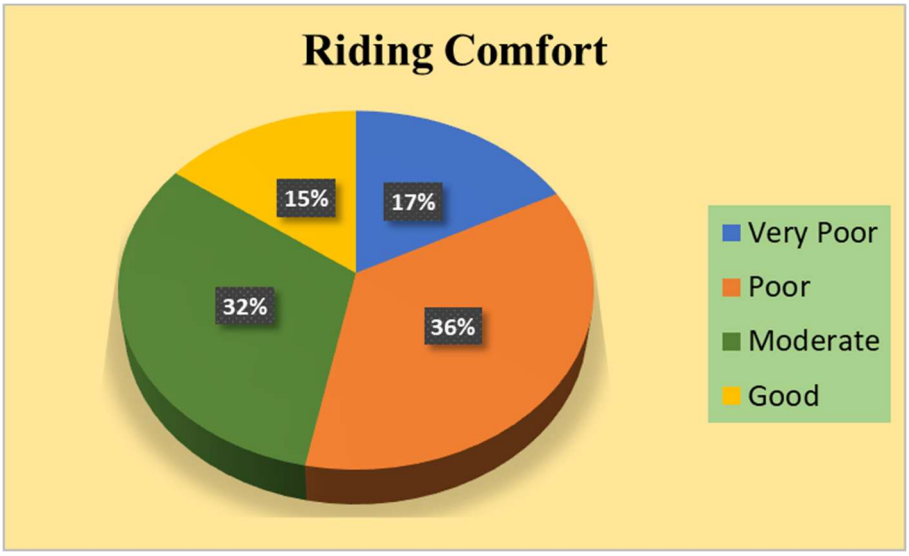


Figure: 4.12 Riding Comfort

4.3.2 Crowdedness inside the vehicle

Crowding in vehicles is a cost that passengers must pay because of using public transportation. To determine how uncomfortable crowding affects passengers 'travel decisions, it is required to put number on it. Standing density is a measure of how crowded an automobile is. The classification criteria for the degree of in-vehicle congestion in bus transit are proposed, considering both the outside environment and the passengers' subjective perceptions.

Figure4.3.2showsthat38%ofrespondentsratecrowdednessinsidethevehicleasmoderate,35% rate crowdedness inside the vehicle as height, 23% rate crowdedness inside the vehicle as very heigh,4% rate crowdedness inside the vehicleaslow,and0%ratecrowdednessinsidethevehicle as very low.

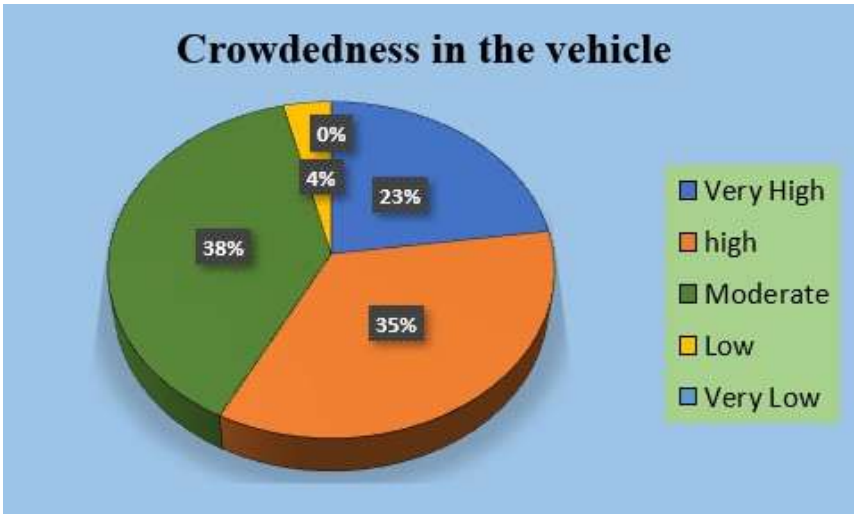


Figure: 4.13 Crowdedness inside the vehicle

4.4 Feasibility:

The purpose of a transport feasibility study is to assess how feasible it is that an abnormal load to be successfully transported through the chosen route.

4.4.1 Time-Saving

Figure 4.4.1 revealed that 41% of respondents rate public transportation as moderate, 27% rate public transportation as poor, 18% rate public transportation as good, 13% rate public transportation as very poor, and 1% rate public transportation as time saving.

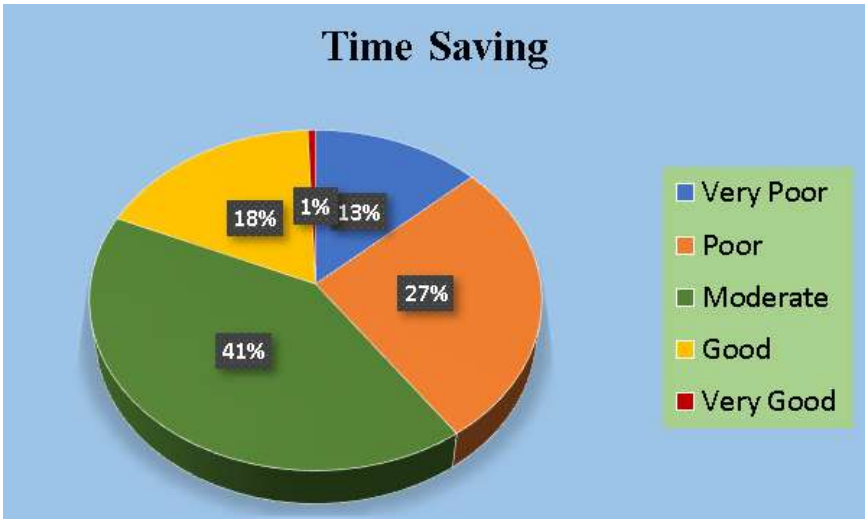


Figure: 4.14 Time Saving

4.4.2 Rate of Availability

Numerous factors can be used to gauge the accessibility of public transportation, including the number of stops (stations) in each neighborhood, the number of routes, and the frequency of service, transfer times, and more.

Figure 4.4.2 shows that 40% of respondent's rate vehicle availability as moderate, 34% rate it as good, 11% rate it as poor, 13% rate it as very poor, and 2% rate it as very good.



Figure: 4.15 Rate of Availability

4.4.3 Efficiency in Picking Up

The term "transportation efficiency" refers to the ratio of the total number of employees, visitors, or customers of a residential, retail, commercial, sporting, cultural, entertainment, or recreational use project to the number of vehicle trips made by those individuals. Figure4.4.3showsthat28% of respondents rate their rate of efficiency in picking up as moderate, 9% rate their rate of efficiency in picking up as good, 29% rate their rate of efficiency in picking up as poor, 34% rate their rate of efficiency in picking up as very poor.

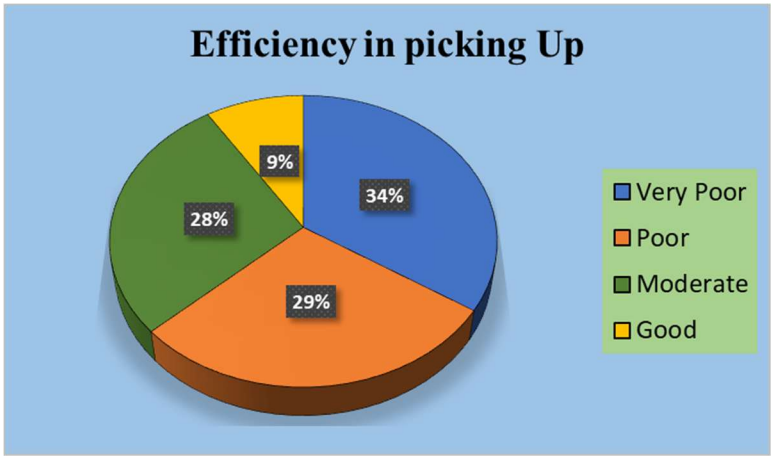


Figure: 4.16 Efficiency in Picking Up

4.5 Economy:

Transport Economics is the study of the movement of people and goods over space and time. It is a branch of economics that deals with the allocation of resources within the transport sector.

4.5.1 Travel Cost:

According to Figure 4.5.1, 67% of respondents rate the rate of travel cost as moderate, 17% rate the rate of travel cost as high, 12% rate the rate of travel cost as very high, 4% rate the rate of travel cost as low.

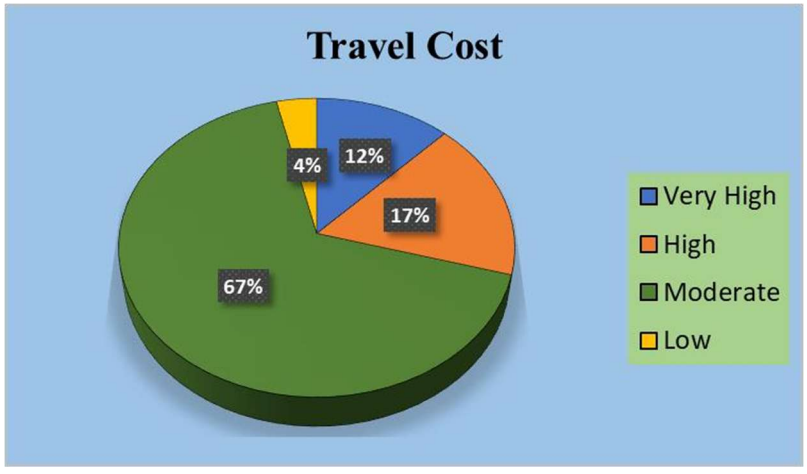


Figure: 4.17 Travel Cost

Chapter 5

Data Analysis

5.1 Introduction

The main characteristics of Bangladesh's transport at industries are outlined in this study, along with future changes. This paper explains how a multinomial logistic model is derived, estimated, and used to solve the problem of choosing between different modes of transportation. There are numerous kinds of transportation in Bangladesh. Four means of transportation, including buses, CNG vehicles, Microbus, and Lagunas, have been taken into consideration for the research region.

5.2 Derivation of Multinomial Logistic Model (MNL)

A multinomial logistic model is used to simulate the relationship between a collection of regress or variables and a set of polychromous response variables. The term "multinomial" refers to a wide range of models. Multinomial logistic analysis is a well-known technique for assessing the impact of explanatory variables on a group of dependent variables. In order to develop a multinomial logistic model for the selection of a mode of transportation, we have therefore taken into account the factor that is likely to have an impact on that decision as a response variable and taken into account some factors like gender, age, occupation, educational level, monthly family income, use of public transportation, riding safety, riding comfort, crowdedness inside the vehicle, saving time, availability at any time, efficiency of picking up, and travel companies. Multinomial logistic regression is created using SPSS software by taking these variables into account. The variables are then grouped as shown below.

5.3 Study variables

Transportation methods have been considered as a response variable in this.

5.3.1 Factors that Influence Choice of Feeder Travel Mode

The Mode Choice related to the traveler can be examined basically with five categories. The categories are below-

1. Demographic Information factors
    a. Age
    b. Sex
    c. Educational Qualification
    d. Employment status
    e. Monthly family income
    f. Use of public Transportation

2. Safety–specific Factors
    a. Rate of Riding Safety
    b. Rate of Diver's Behavior
    c. Rate of Driving Skill of Driver.
    d. Rate of Overtaking Tendency,
    e. Rate of personal and Property safety

3. Comfort Specific Factors
    a. Rate of Riding Comfort,
    b. Rate of Congestion Degree inside the vehicle
    c. Rate of seat Comfort.

4. Flexibility-Specific Factors
    a. Rate of time saving in using public transport
    b. Rate of Availability at any time
    c. Rate of efficiency in picking up.

5. Economy-Specific Factors
    a. Rate of Travel Cost
    b. Rate of Cost with Monthly income

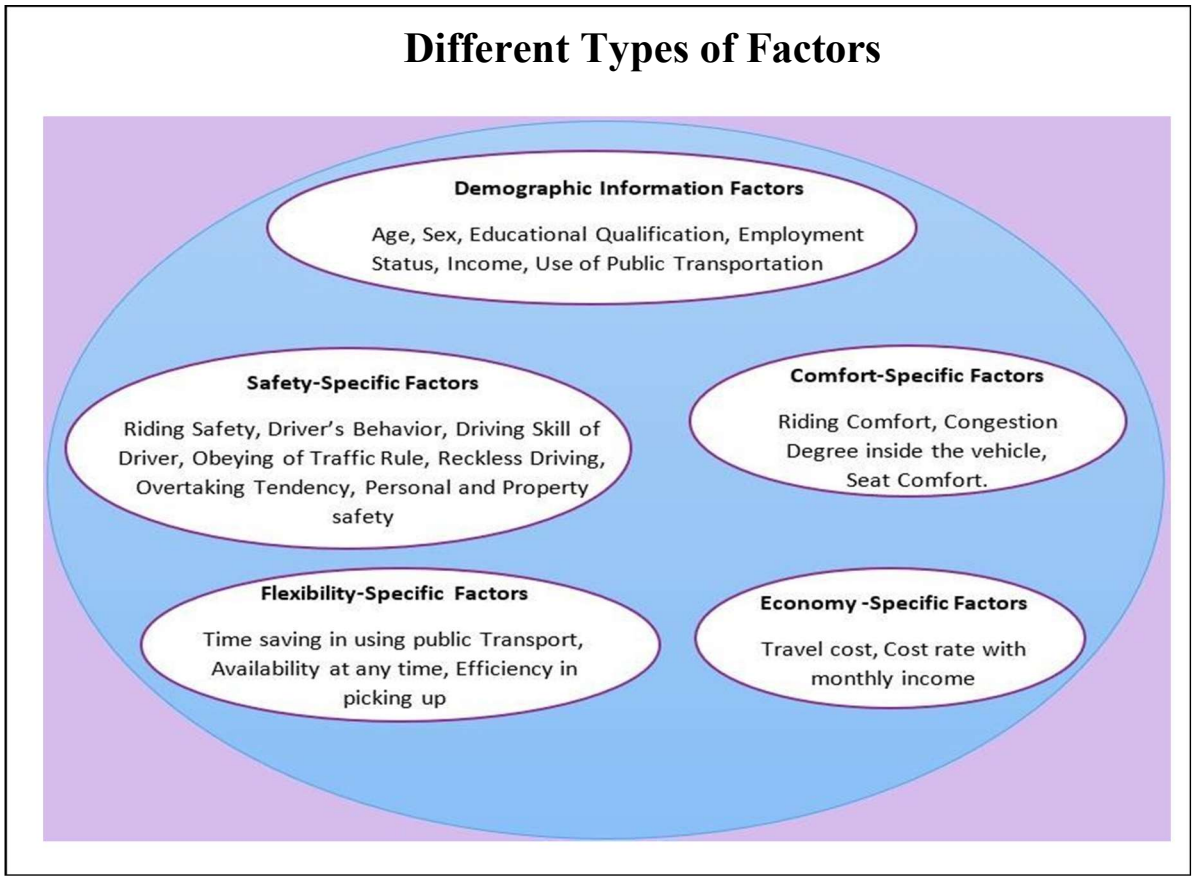


Figure: 5.1 Factors that Influence Choice of Feeder Travel Mode

Before entering in the theme of the present study, it is desirable and informative to review the past transport studies in Bangladesh. This section summarizes those studies.

5.3.2 Categories of response variables

Following Four categories of transportation mode are considered:

1. Bus
2. CNG
3. Microbus
4. Auto-Rickshaw

5.3.3 Regress or Variables

As regress or variables, there are several factors that could affect the decisions. Only fifteen such criteria have been considered here.

1. Gender.
2. Age.
3. Education Qualification (EQ)
4. Occupation (Occupy).
5. Monthly Family Income (MFI).
6. Uses of Public Transportation (UPS).
7. Rate of Riding Safety (RS).
8. Rate of Driver's Behavior (DB).
9. Rate of Riding Comfort (RC).
10. Rate of Congestion Degree inside the Vehicle (CDV) .
11. Rate of Time Saving in Public Transport (TS)
12. Rate of Availability at any Time (AT) .
13. Rate of Efficiency of Picking up (EP)
14. Rate of Travel Cost (TC).
15. Mode Choice

Table 5.1: Categories of regress or Variables

Name of Variable	Categories
Mode Choice	Auto-Rickshaw CNG Microbus Bus
Gender	Female Male
Age	Under25 25-35 35-45 45-55 Above45
Education Qualification(EQ)	Secondary or below Higher Secondary Bachelor's Degree Master's Degree
Occupation	Student Govt. Employee Private Employee Self – Employee
Monthly Family Income (MFI)	Under25000 25000-74000 75000-150000
Uses of Public Transportation (UPS).	Never Rarely Moderately Often Very Often
Rate of Riding Safety(RS).	Very Poor Poor Moderate Good Very Good

Table 5.1: Categories of regress or Variables

Name of Variable	Categories
Rate of Driver's Behavior (DB).	Very Poor Poor Moderate Good Very Good
Rate of Riding Comfort (RC).	Very Poor Poor Moderate Good Very Good
Rate of Congestion Degree inside the Vehicle (CDV	Very High High Moderate Low Very Low
Rate of Time Saving in Public Transport (TS)	Very Poor Poor Moderate Good Very Good
Rate of Availability at any Time(AT)	Very Poor Poor Moderate Good Very Good
Rate of Efficiency of Picking up (EP)	Very Poor Poor Moderate Good Very Good
Rate of Travel Cost (TC)	Very High High Moderate Low Very Low

Table 5.2: Operational Definition of Variables

Name of Variable	Reference Category	Operational Definition
Mode Choice	Auto-Rickshaw	2: Bus 3: CNG 4: Microbus
Gender	Female	1: Male 0: Otherwise
Age	Above-45years	1:Under 25 years 0: Otherwise 1:25-45years 0: Otherwise
Education Qualification(EQ)	Master's Degree	1:Higher secondary or below 0: Otherwise 1:Bachelor's Degree 0: Otherwise
Occupation	Retired	1: Govt. Employee 0: Otherwise 1:Private Employee 0: Otherwise 1: Student or Self- employee
Monthly Family Income (MFI)	74000-149000TK	1:Under 25000TK 0: Otherwise 1:25000-74000Tk 0: Otherwise
Uses of Public Transportation (UPS).	Often	1: Never 0: Otherwise 1: Moderate 0: Otherwise
Rate of Riding Safety (RS)	Good	1: Poor 0: Otherwise 1: Moderate 0: Otherwise
Rate of Driver's Behavior (DB)	Good	1: Poor 0: Otherwise 1: Moderate 0: Otherwise

Table 5.2: Operational Definition of Variables

Name of Variable	Reference Category	Operational Definition
Rate of Riding Comfort (RC)	Good	1: Poor 0: Otherwise 1: Moderate 0: Otherwise
Rate of Congestion Degree inside the Vehicle (CDV)	Low	1: High 0: Otherwise 1: Moderate 0: Otherwise
Rate of time Saving in Public Transport (TS)	Good	1: Poor 0: Otherwise 1: Moderate 0: Otherwise
Rate of Availability at any Time (AT)	Good	1: Poor 0: Otherwise 1: Moderate 0: Otherwise
Rate of Efficiency of Picking up (EP)	Good	1: Poor 0: Otherwise 1: Moderate 0: Otherwise
Rate of Travel Cost (TC)	Low	1: High 0: Otherwise 1: Moderate 0: Otherwise

5.4 Postulated Model

The multinomial logistic model of mode of transportation choices are given below:

General Equation:

$$L = \ln (P_1/P_0) = \beta_0 + \beta_1 G_1 + \beta_2 A_1 + \beta_3 A_2 + \beta_4 A_3 + \beta_5 EQ_1 + \beta_6 EQ_2 + \beta_7 EQ_3 + \beta_8 OCCUP_1 + \beta_9 OCCUP_2 + \beta_{10} OCCUP_3 + \beta_{11} MFI_1 + \beta_{12} MFI_2 + \beta_{13} MFI_3 + \beta_{14} UPT_1 + \beta_{15} UPT_2 + \beta_{16} UPT_3 + \beta_{17} RS_1 + \beta_{18} RS_2 + \beta_{19} RS_3 + \beta_{20} DB_1 + \beta_{21} DB_2 + \beta_{22} DB_3 + \beta_{23} RC_1 + \beta_{24} RC_2 + \beta_{25} RC_3 + \beta_{26} CDV_1 + \beta_{27} CDV_2 + \beta_{28} CDV_3 + \beta_{29} TS_1 + \beta_{30} TS_2 + \beta_{31} TS_3 + \beta_{32} AT_1 + \beta_{33} AT_2 + \beta_{34} AT_3 + \beta_{35} EP_1 + \beta_{36} EP_2 + \beta_{37} EP_3 + \beta_{38} TC_1 + \beta_{39} TC_2 + \beta_{40} TC_3 + U1$$

Here, Equation-1 is defined for P0= reference vehicle vs. P1= operational vehicle Where, β0 denotes the constant terms for all reference categories of respondents.

G_1 is a dummy variable denoting the two categories for gender: male and female.

A_1, A_2, A_3 are set of three categories representing dummy variable for different types of age of the respondents, such as under 25 years, between 25-45 years, and above 45 years is considered reference categories.

$OCCUP_1$, $OCCUP_2$, $OCCUP_3$ are set of two categories representing the dummy variable for different types of occupation of the respondents, such as, Govt. employee, and Private employee where student or self-employment is considered as reference categories.

EQ_1,EQ_2, EQ_3 are set of two categories representing the dummy variable for difference type of educational qualification of the respondents, such as Higher secondary or below, bachelor's degree, and master's degree is considered as reference categories.

MFI_1,MFI_2, MFI_3 are set of three categories representing the dummy variable for difference type of Monthly family Income of the respondents, such as under 25000TK, 25000-74000Tk,74000-149000 TK and 150000-299000 TK are reference categories.

UPT_1, UPT_2 ,UPT_3 are set of two categories representing the dummy variable for different type of answer for Use of Public transportation of the respondents such as never, mode rate, and often is reference categories.

RS_1, UPT_3 are set of two categories representing the dummy variable for different type of answer for rate of riding safety of the respondents such as poor, Mode rate, and good is the reference categories.

DB_1, DB_2, DB_3 are set of two categories representing the dummy variable for different type of answer for rate of driver's behavior of the respondents such as poor, Moderate, and good is the reference categories.

RC_1, RC_2, RC_3 are set of two categories representing the dummy variable for different type of answer for rate of riding comfort of the respondents such as poor, Moderate, and good is the reference categories.

CDV_1, CDV_2, CDV_3 are set of two categories representing the dummy variable for different type of answer for rate of Congestion Degree inside the Vehicle of the respondents such as high, Moderate, and low is the reference categories.

TS_1, TS_2, TS_3 are set of two categories representing the dummy variable for different type of answer for rate of time Saving in Public Transport of the respondents such as poor, Moderate, and good is the reference categories.

AT_1, AT_2, AT_3 are set of two categories representing the dummy variable for different type of answer for rate of time Availability at any Time of the respondents such as poor, Moderate, and good is the reference categories.

EP_1, EP_2, EP_3 are set of two categories representing the dummy variable for different type of answer for rate of Efficiency of Picking up of the respondents such as poor, Moderate and good is the reference categories.

TC_1, TC_2, TC_3 are set of two categories representing the dummy variable for different type of answer for rate of Travel Cost of the respondents such as high, Moderate and low is the reference categories.

5.5 Estimation and Test of Postulated model

Here the estimation of the parameters of the multinomial logistic model has been carried out by using maximum likelihood procedure; likelihood ratio test and Wald test have been employed for testing the formulated hypothesis. By using SPSS program, we get the following model fitting information.

5.5.1 Likelihood Ratio Test

In statistics, the likelihood-ratio test assesses the goodness of fit of two competing statistical models, specifically one found by maximization over the entire parameter space, and another found after imposing some constraint, based on the ratio of their likelihoods.

Hypothesis:

H_0: There is no significant difference among the effects of selected variables.

Table 5.3: Model Fitting Information

Model	Model Fitting Criteria	Likelihood Ration Tests		
	-2LogLikelihood	Chi-Square	df	Sig.
Intercept Only Final	1139.136 7740689	364.447	148	0.000

From referencing of Rahman, D.et al (2021), significant value is 0.05.So, the model fitting is ok.

From referencing of Rahman, D et al (2021), significant value is 0.05. So, the model fitting is ok.

Table 5.4: Likelihood Ratio Tests

Effect	**Model Fitting Criteria**	**Likelihood Ratio Tests**		
	-2Log Likelihood of Reduced Model	Chi-Square	df	Sig.
Intercept	774.689[a]	000	0	
Ageunder25	786.984[b]	12.295	4	.015
Age 25 to 45	787.868[b]	13.179	4	.010
Age above 45	790.961[b]	16.272	4	.003
Use of public transportation Never	797.611[b]	22.922	4	.000
Use of public transportation Often	795.306[b]	20.617	4	.000
Riding Safety Poor	821.202[b]	46.513	4	.000
Riding Safety Moderate	807.244[b]	32.555	4	.000
Riding Safety Good	799.107[b]	24.418	4	.000
Travel Cost High	787.526[b]	12.837	4	0.12

Table 5.5: Estimation and Wald test

Mode [a]	B	Std. Error	Wald	df	Sig.	Exp(B)
Bus	Intercept	-495.707	110.715	20.047	1	.000
	[G=0]	496.041	5.135	9331.099	1	.000
	[G=1]	496.218	.000	.	1	.
	[G=Male]	0[b]	.	.	0	.
	[A_1=0]	.087	20.123	.000	1	.997
	[A_1=1]	0[b]	.	.	0	.
	[A_1=Under25]	0[b]	.	.	0	.
	[A_2=0]	.218	20.155	.000	1	.991
	[A_2=1]	0[b]	.	.	0	.
	[A_2=25-45]	0[b]	.	.	0	.
	[A_3=0]	.534	22.099	.001	1	.981
	[A_3=1]	0[b]	.	.	0	.
	[A_3=Above45]	0[b]	.	.	0	.
	[EQ_1=0]	-.207	9.142	.001	1	.982
	[EQ_1=1]	0[b]	.	.	0	.
	[EQ_1=Higher Secondary or below]	0[b]	.	.	0	.
	[EQ_2=0]	-.173	8.228	.000	1	.983
	[EQ_2=1]	0[b]	.	.	0	.
	[EQ_2=Bachelor's Degree]	0[b]	.	.	0	.

Table 5.5: Estimation and Wald test

Mode[a]	B	Std. Error	Wald	df	Sig.	Exp(B)
Bus	[$Occup_1$=0]	-.736	35.031	.000	1	.983
	[$Occup_1$=1]	0[b]	.	.	0	.
	[$Occup_1$=Govt. Employee]	0[b]	.	.	0	.
	[$Occup_2$=0]	.116	34.630	.000	1	.997
	[$Occup_2$=1]	0[b]	.	.	0	.
	[$Occup_2$=Private Employee]	0[b]	.	.	0	.
	[$Occup_3$=0]	.020	34.210	.000	1	1.000
	[$Occup_3$=1]	0[b]	.	.	0	.
	[$Occup_3$=Self-Employee or Student]	0[b]	.	.	0	.
	[MFI_1=0]	.782	16.182	.002	1	.961
	[MFI_1=1]	0[b]	.	.	0	.
	[MFI_1=Under 25]	0[b]	.	.	0	.
	[MFI_2=0]	.565	15.714	.001	1	.971

Table 5.5: Estimation and Wald test

Mode[a]	B	Std. Error	Wald	df	Sig.	Exp(B)
Bus	[[MFI_2=1]	0[b]	.	.	0	.
	[[MFI_2=25000-74000 TK]	0[b]	.	.	0	.
	[[MFI_3=0]	.508	14.772	.001	1	.973
	[[MFI_3=1]	0[b]	.	.	0	.
	[[MFI_3=74000-149000 TK]	0[b]	.	.	0	.
	[UPT_1=0]	.878	9.847	.008	1	.929
	[UPT_1=1]	0[b]	.	.	0	.
	[UPT_1=Never]	0[b]	.	.	0	.
	[UPT_2=0]	.410	8.752	.002	1	.963
	[UPT_2=1]	0[b]	.	.	0	.
	[UPT_2=Moderate]	0[b]	.	.	0	.
	[UPT_3=0]	-.041	7.575	.000	1	.996
	[UPT3=1]	0[b]	.	.	0	.
	[UPT3=often]	0[b]	.	.	0	.
	[RS_1=0]	1.787	11.225	.025	1	.873
	[RS_1=1]	0[b]	.	.	0	.
	[RS_1=Poor]	0[b]	.	.	0	.
	[RS_2=0]	1.619	11.670	.019	1	.890
	[RS_2=1]	0[b]	.	.	0	.
	[RS_2=Moderate]	0[b]	.	.	0	.
	[RS_3=0]	1.648	13.435	.015	1	.902
	[RS_3=1]	0[b]	.	.	0	.

Table 5.5: Estimation and Wald test

Mode[a]	B	Std. Error	Wald	df	Sig.	Exp(B)
Bus	[RS3=Good]	0[b]	.	.	0	.
	[DB_1=0]	-.315	8.570	.001	1	.971
	[DB_1=1]	0[b]	.	.	0	.
	[DB_1=Poor]	0[b]	.	.	0	.
	[DB_2=0]	-.085	8.280	.000	1	.992
	[DB_2=1]	0[b]	.	.	0	.
	[DB_2=Moderate]	0[b]	.	.	0	.
	[RC_1=0]	-.587	32.235	.000	1	.985
	[RC_1=1]	0[b]	.	.	0	.
	[RC_1=Poor]	0[b]	.	.	0	.
	[RC_2=0]	-1.075	31.736	.001	1	.973
	[RC_2=1]	0[b]	.	.	0	.
	[RC_2=Moderate]	0[b]	.	.	0	.
	[RC_3=0]	-1.382	32.198	.002	1	.966
	[RC_3=1]	0[b]	.	.	0	.
	[RC_3=Good]	0[b]	.	.	0	.
	[CDV_1=0]	.202	11.847	.000	1	.986
	[CDV_1=1]	0[b]	.	.	0	.
	[CDV_1=High]	0[b]	.	.	0	.

Table 5.5: Estimation and Wald test

Mode[a]	B	Std. Error	Wald	df	Sig.	Exp(B)
Bus	[CDV_2=0]	.295	11.622	.001	1	.980
	[CDV2=1]	0[b]	.	.	0	.
	[CDV2=Moderate]	0[b]	.	.	0	.
	[TS_1=0]	.854	38.823	.000	1	.982
	[TS_1=1]	0[b]	.	.	0	.
	[TS_1=Poor]	0[b]	.	.	0	.
	[TS_2=0]	.785	38.561	.000	1	.984
	[TS_2=1]	0[b]	.	.	0	.
	[TS_2=Moderate]	0[b]	.	.	0	.
	[TS_3=0]	.710	38.403	.000	1	.985
	[TS_3=1]	0[b]	.	.	0	.
	[TS_3=Good]	0[b]	.	.	0	.
	[AT_1=0]	-.338	19.088	.000	1	.986

Table 5.5: Estimation and Wald test

Mode[a]	B	Std. Error	Wald	df	Sig.	Exp(B)
Bus	[AT_1=1]	0[b]	.	.	0	.
	[AT_1=Poor]	0[b]	.	.	0	.
	[AT_2=0]	-.248	19.042	.000	1	.990
	[AT_2=1]	0[b]	.	.	0	.
	[AT_2=Moderate]	0[b]	.	.	0	.
	[AT_3=0]	-.015	17.956	.000	1	.999
	[AT_3=1]	0[b]	.	.	0	.
	[AT_3=Good]	0[b]	.	.	0	.
	[EP_1=0]	.094	8.948	.000	1	.992
	[EP_1=1]	0[b]	.	.	0	.
	[EP_1=Poor]	0[b]	.	.	0	.
	[EP_2=0]	.182	9.576	.000	1	.985
	[EP_2=1]	0[b]	.	.	0	.
	[EP_2=Moderate]	0[b]	.	.	0	.
	[TC_1=0]	1.187	13.326	.008	1	.929
	[TC_1=1]	0[b]	.	.	0	.
	[TC_1=High]	0[b]	.	.	0	.
	[TC_2=0]	0[b]	.	.	0	.
	TC_2=1]	.902	12.702	.005	1	.943
	[TC_2=Moderate]	0[b]	.	.	0	.

Table 5.5: Estimation and Wald test

Mode[a]	B	Std. Error	Wald	df	Sig.	Exp(B)
CNG	[$Occup_1$=0]	-1.831	35.085	.003	1	.958
	[$Occup_1$=1]	0[b]	.	.	0	.
	[$Occup_1$=Govt. Employee]	0[b]	.	.	0	.
	[$Occup_2$=0]	-1.901	34.683	.003	1	.956
	[$Occup_2$=1]	0[b]	.	.	0	.
	[$Occup_2$=Private Employee]	0[b]	.	.	0	.
	[$Occup_3$=0]	-1.633	34.264	.002	1	.962
	[$Occup_3$=1]	0[b]	.	.	0	.
	[$Occup_3$=Self-Employee or Student]	0[b]	.	.	0	.
	[MFI_1=0]	-.983	16.192	.004	1	.952
	[MFI_1=1]	0[b]	.	.	0	.
	[MFI_1=Under 25]	0[b]	.	.	0	.
	[MFI_2=0]	-.798	15.723	.003	1	.960

Table 5.5: Estimation and Wald test

Mode[a]	B	Std. Error	Wald	df	Sig.	Exp(B)
CNG	[[MFI_2=1]	0[b]	.	.	0	.
	[[MFI_2=25000-74000 TK]	0[b]	.	.	0	.
	[[MFI_3=0]	-1.220	14.781	.007	1	.934
	[[MFI_3=1]	0[b]	.	.	0	.
	[[MFI_3=74000-149000 TK]	0[b]	.	.	0	.
	[UPT_1=0]	.147	9.849	.000	1	.988
	[UPT_1=1]	0[b]	.	.	0	.
	[UPT_1=Never]	0[b]	.	.	0	.
	[UPT_2=0]	.128	8.755	.000	1	.988
	[UPT_2=1]	0[b]	.	.	0	.
	[UPT_2=Moderate]	0[b]	.	.	0	.
	[UPT_3=0]	.589	7.580	.006	1	.938
	[UPT3=1]	0[b]	.	.	0	.
	[UPT3=often]	0[b]	.	.	0	.
	[RS_1=0]	-1.625	11.252	.021	1	.885
	[RS_1=1]	0[b]	.	.	0	.
	[RS_1=Poor]	0[b]	.	.	0	.
	[RS_2=0]	-.947	11.697	.007	1	.935
	[RS_2=1]	0[b]	.	.	0	.
	[RS_2=Moderate]	0[b]	.	.	0	.
	[RS_3=0]	-1.728	539.122	.000	1	.997
	[RS_3=1]	-1.064	13.460	.006	1	.937

Table 5.5: Estimation and Wald test

Mode[a]	B	Std. Error	Wald	df	Sig.	Exp(B)
CNG	[RS_3=Good]	z	.	.	0	.
	[DB_1=0]	0[b]	.	.	0	.
	[DB_1=1]	.187	8.576	.000	1	.983
	[DB_1=Poor]	0[b]	.	.	0	.
	[DB_2=0]	0[b]	.	.	0	.
	[DB_2=1]	-.163	8.285	.000	1	.984
	[DB_2=Moderate]	0[b]	.	.	0	.
	[RC_1=0]	0[b]	.	.	0	.
	[RC_1=1]	1.854	32.223	.003	1	.954
	[RC_1=Poor]	0[b]	.	.	0	.
	[RC_2=0]	0[b]	.	.	0	.
	[RC_2=1]	1.851	31.724	.003	1	.953
	[RC_2=Moderate]	0[b]	.	.	0	.
	[RC_3=0]	0[b]	.	.	0	.
	[RC_3=1]	1.735	32.186	.003	1	.957
	[RC_3=Good]	0[b]	.	.	0	.
	[CDV_1=0]	-.076	11.855	.000	1	.995
	[CDV_1=1]	0[b]	.	.	0	.
	[CDV_1=High]	0[b]	.	.	0	.

Table 5.5: Estimation and Wald test

Mode[a]	B	Std. Error	Wald	df	Sig.	Exp(B)
CNG	[CDV_2=0]	.214	11.631	.000	1	.985
	[CDV2=1]	0[b]	.	.	0	.
	[CDV2=Moderate]	0[b]	.	.	0	.
	[TS_1=0]	-1.728	38.915	.002	1	.965
	[TS_1=1]	0[b]	.	.	0	.
	[TS_1=Poor]	0[b]	.	.	0	.
	[TS_2=0]	-.942	38.654	.001	1	.981
	[TS_2=1]	0[b]	.	.	0	.
	[TS_2=Moderate]	0[b]	.	.	0	.
	[TS_3=0]	-.861	38.498	.000	1	.982
	[TS_3=1]	0[b]	.	.	0	.
	[TS_3=Good]	0[b]	.	.	0	.
	[AT_1=0]	.566	19.095	.001	1	.976

Table 5.5: Estimation and Wald test

Mode[a]	B	Std. Error	Wald	df	Sig.	Exp(B)
CNG	[AT_1=1]	0[b]	.	.	0	.
	[AT_1=Poor]	0[b]	.	.	0	.
	[AT_2=0]	.564	19.050	.001	1	.976
	[AT_2=1]	0[b]	.	.	0	.
	[AT_2=Moderate]	0[b]	.	.	0	.
	[AT_3=0]	.232	17.966	.000	1	.990
	[AT_3=1]	0[b]	.	.	0	.
	[AT_3=Good]	0[b]	.	.	0	.
	[EP_1=0]	.305	8.951	.001	1	.973
	[EP_1=1]	0[b]	.	.	0	.
	[EP_1=Poor]	0[b]	.	.	0	.
	[EP_2=0]	-.240	9.580	.001	1	.980
	[EP_2=1]	0[b]	.	.	0	.
	[EP_2=Moderate]	0[b]	.	.	0	.
	[TC_1=0]	-.254	13.336	.000	1	.985
	[TC_1=1]	0[b]	.	.	0	.
	[TC_1=High]	0[b]	.	.	0	.
	[TC_2=0]	0[b]	.	.	0	.
	TC_2=1]	-.312	12.712	.001	1	.980
	[TC_2=Moderate]	0[b]	.	.	0	.

Table 5.5: Estimation and Wald test

Mode[a]	B	Std. Error	Wald	df	Sig.	Exp(B)
Microbus	Intercept	-496.327	110.964	20.006	1	.000
	[G=0]	507.675	5.138	9763.901	1	.000
	[G=1]	507.437	.000	.	1	.
	[G=Male]	0[b]	.	.	0	.
		-1.843	20.141	.008	1	.927
	[A_1=0]	0[b]	.	.	0	.
	[A_1=1]	0[b]	.	.	0	.
	[A_1=Under25]	-2.100	20.175	.011	1	.917
	[A_2=0]	0[b]	.	.	0	.
	[A_2=1]	0[b]	.	.	0	.
	[A_2=25-45]	-2.782	22.118	.016	1	.900
	[A_3=0]	0[b]	.	.	0	.
	[A_3=1]	0[b]	.	.	0	.
	[A_3=Above45]	.647	9.145	.005	1	.944
	[EQ_1=0]	0[b]	.	.	0	.
	[EQ_1=1]	0[b]	.	.	0	.
	[EQ_1=Higher Secondary or below]	.730	8.230	.008	1	.929
	[EQ_2=0]	0[b]	.	.	0	.
	[EQ_2=1]	0[b]	.	.	0	.
	[EQ_2=Bachelor's Degree]	1.904	35.038	.003	1	.957

Table 5.5: Estimation and Wald test

Mode[a]	B	Std. Error	Wald	df	Sig.	Exp(B)
Microbus	[$Occup_1$=0]	0[b]	.	.	0	.
	[$Occup_1$=1]	0[b]	.	.	0	.
	[$Occup_1$=Govt. Employee]	.934	34.635	.001	1	.978
	[$Occup_2$=0]	0[b]	.	.	0	.
	[$Occup_2$=1]	0[b]	.	.	0	.
	[$Occup_2$=Private Employee]	.521	34.214	.000	1	.988
	[$Occup_3$=0]	0[b]	.	.	0	.
	[$Occup_3$=1]	0[b]	.	.	0	.
	[$Occup_3$=Self-Employee or Student]	.524	16.178	.001	1	.974
	[MFI_1=0]	0[b]	.	.	0	.
	[MFI_1=1]	0[b]	.	.	0	.
	[MFI_1=Under 25]	.803	15.708	.003	1	.959
	[MFI_2=0]	0[b]	.	.	0	.

Table 5.5: Estimation and Wald test

B	Std. Error	Wald	df	Sig.	Exp(B)
[[MFI_2=1]	0[b]	.	.	0	.
[[MFI_2=25000-74000 TK]	0[b]	.	.	0	.
[[MFI_3=0]	1.046	14.765	.005	1	.944
[[MFI_3=1]	0[b]	.	.	0	.
[[MFI_3=74000-149000 TK]	0[b]	.	.	0	.
[UPT_1=0]	-.497	9.851	.003	1	.960
[UPT_1=1]	0[b]	.	.	0	.
[UPT_1=Never]	0[b]	.	.	0	.
[UPT_2=0]	-.263	8.756	.001	1	.976
[UPT_2=1]	0[b]	.	.	0	.
[UPT_2=Moderate]	0[b]	.	.	0	.
[UPT_3=0]	.506	7.581	.004	1	.947
[UPT3=1]	0[b]	.	.	0	.
[UPT3=often]	0[b]	.	.	0	.
[RS_1=0]	-.633	11.259	.003	1	.955
[RS_1=1]	0[b]	.	.	0	.
[RS_1=Poor]	0[b]	.	.	0	.
[RS_2=0]	-1.144	11.703	.010	1	.922
[RS_2=1]	0[b]	.	.	0	.
[RS_2=Moderate]	0[b]	.	.	0	.
[RS_3=0]	-1.869	539.639	.000	1	.997
[RS_3=1]	-.936	13.463	.005	1	.945

Table 5.5: Estimation and Wald test

Mode[a]	B	Std. Error	Wald	df	Sig.	Exp(B)
Microbus	[RS_3=Good]	0[b]	.	.	0	.
	[DB_1=0]	-.350	8.576	.002	1	.967
	[DB_1=1]	0[b]	.	.	0	.
	[DB_1=Poor]	0[b]	.	.	0	.
	[DB_2=0]	-.480	8.287	.003	1	.954
	[DB_2=1]	0[b]	.	.	0	.
	[DB_2=Moderate]	0[b]	.	.	0	.
	[RC_1=0]	-.785	32.305	.001	1	.981
	[RC_1=1]	0[b]	.	.	0	.
	[RC_1=Poor]	0[b]	.	.	0	.
	[RC_2=0]	-.336	31.807	.000	1	.992
	[RC_2=1]	0[b]	.	.	0	.
	[RC_2=Moderate]	0[b]	.	.	0	.
	[RC_3=0]	.532	32.269	.000	1	.987
	[RC_3=1]	0[b]	.	.	0	.
	[RC_3=Good]	0[b]	.	.	0	.
	[CDV_1=0]	-.708	11.869	.004	1	.952
	[CDV_1=1]	0[b]	.	.	0	.
	[CDV_1=High]	0[b]	.	.	0	.

Table 5.5: Estimation and Wald test

Mode[a]	B	**Std. Error**	Wald	df	Sig.	Exp(B)
Microbus	[CDV_2=0]	-.734	11.644	.004	1	.950
	[CDV2=1]	0[b]	.	.	0	.
	[CDV2=Moderate]	0[b]	.	.	0	.
	[TS_1=0]	.034	38.965	.000	1	.999
	[TS_1=1]	0[b]	.	.	0	.
	[TS_1=Poor]	0[b]	.	.	0	.
	[TS_2=0]	-.407	38.704	.000	1	.992
	[TS_2=1]	0[b]	.	.	0	.
	[TS_2=Moderate]	0[b]	.	.	0	.
	[TS_3=0]	-.742	38.548	.000	1	.985
	[TS_3=1]	0[b]	.	.	0	.
	[TS_3=Good]	0[b]	.	.	0	.
	[AT_1=0]	.016	19.147	.000	1	.999

Table 5.5: Estimation and Wald test

Mode[a]	B	**Std. Error**	Wald	df	Sig.	Exp(B)
Microbus	[AT_1=1]	0[b]	.	.	0	.
	[AT_1=Poor]	0[b]	.	.	0	.
	[AT_2=0]	.031	19.103	.000	1	.999
	[AT_2=1]	0[b]	.	.	0	.
	[AT_2=Moderate]	0[b]	.	.	0	.
	[AT_3=0]	-.568	18.021	.001	1	.975
	[AT_3=1]	0[b]	.	.	0	.
	[AT_3=Good]	0[b]	.	.	0	.
	[EP_1=0]	-.493	8.960	.003	1	.956
	[EP_1=1]	0[b]	.	.	0	.
	[EP_1=Poor]	0[b]	.	.	0	.
	[EP_2=0]	-.124	9.589	.000	1	.990
	[EP_2=1]	0[b]	.	.	0	.
	[EP_2=Moderate]	0[b]	.	.	0	.
	[TC_1=0]	-.868	13.344	.004	1	.948
	[TC_1=1]	0[b]	.	.	0	.
	[TC_1=High]	0[b]	.	.	0	.
	[TC_2=0]	0[b]	.	.	0	.
	TC_2=1]	-.586	12.720	.002	1	.963
	[TC_2=Moderate]	0[b]	.	.	0	.

Table 5.5: Estimation and Wald test

Mode[a]	B	Std. Error	Wald	df	Sig.	Exp(B)
Auto-Rickshaw	Intercept	-496.922	111.266	19.946	1	.000
	[G=0]	503.212	5.143	9574.376	1	.000
	[G=1]	503.839	.000	.	1	.
	[G=Male]	0[b]	.	.	0	.
		.742	20.130	.001	1	.971
	[A_1=0]	0[b]	.	.	0	.
	[A_1=1]	0[b]	.	.	0	.
	[A_1=Under25]	.942	20.164	.002	1	.963
	[A_2=0]	0[b]	.	.	0	.
	[A_2=1]	0[b]	.	.	0	.
	[A_2=25-45]	.412	22.112	.000	1	.985
	[A_3=0]	0[b]	.	.	0	.
	[A_3=1]	0[b]	.	.	0	.
	[A_3=Above45]	-.477	9.156	.003	1	.958
	[EQ_1=0]	0[b]	.	.	0	.
	[EQ_1=1]	0[b]	.	.	0	.
	[EQ_1=Higher Secondaryor below]	-.178	8.241	.000	1	.983
	[EQ_2=0]	0[b]	.	.	0	.
	[EQ_2=1]	0[b]	.	.	0	.
	[EQ_2=Bachelor's Degree]	3.218	35.032	.008	1	.927

Table 5.5: Estimation and Wald test

Mode[a]	B	Std. Error	Wald	df	Sig.	Exp(B)
Auto-Rickshaw	[$Occup_1$=0]	0[b]	.	.	0	.
	[$Occup_1$=1]	0[b]	.	.	0	.
	[$Occup_1$=Govt. Employee]	2.266	34.626	.004	1	.948
	[$Occup_2$=0]	0[b]	.	.	0	.
	[$Occup_2$=1]	0[b]	.	.	0	.
	[$Occup_2$=Private Employee]	2.723	34.207	.006	1	.937
	[$Occup_3$=0]	0[b]	.	.	0	.
	[$Occup_3$=1]	0[b]	.	.	0	.
	[$Occup_3$=Self-Employee or Student]	-1.337	16.234	.007	1	.934
	[MFI_1=0]	0[b]	.	.	0	.
	[MFI_1=1]	0[b]	.	.	0	.
	[MFI_1=Under 25]	-1.534	15.764	.009	1	.922
	[MFI_2=0]	0[b]	.	.	0	.

Table 5.5: Estimation and Wald test

Mode[a]	B	**Std. Error**	Wald	df	Sig.	Exp(B)
Auto-Rickshaw	[[MFI_2=1]	0[b]	.	.	0	.
	[[MFI_2=25000-74000TK]	-.820	14.821	.003	1	.956
	[[MFI_3=0]	0[b]	.	.	0	.
	[[MFI_3=1]	0[b]	.	.	0	.
	[[MFI_3=74000-149000TK]	-2.398	9.873	.059	1	.808
	[UPT_1=0]	0[b]	.	.	0	.
	[UPT_1=1]	0[b]	.	.	0	.
	[UPT_1=Never]	-1.199	8.782	.019	1	.891
	[UPT_2=0]	0[b]	.	.	0	.
	[UPT_2=1]	0[b]	.	.	0	.
	[UPT_2=Moderate]	-2.127	7.606	.078	1	.780
	[UPT_3=0]	0[b]	.	.	0	.
	[UPT3=1]	0[b]	.	.	0	.
	[UPT3=often]	-1.162	11.273	.011	1	.918
	[RS_1=0]	0[b]	.	.	0	.
	[RS_1=1]	0[b]	.	.	0	.
	[RS_1=Poor]	-1.219	11.719	.011	1	.917
	[RS_2=0]	0[b]	.	.	0	.
	[RS_2=1]	0[b]	.	.	0	.
	[RS_2=Moderate]	3.223	537.142	.000	1	.995
	[RS_3=0]	-1.424	13.483	.011	1	.916
	[RS_3=1]	0[b]	.	.	0	.

Table 5.5: Estimation and Wald test

Mode[a]	B	**Std. Error**	Wald	df	Sig.	Exp(B)
Auto-Rickshaw	[RS_3=Good]	0[b]	.	.	0	.
	[DB_1=0]	1.267	8.577	.022	1	.883
	[DB_1=1]	0[b]	.	.	0	.
	[DB_1=Poor]	0[b]	.	.	0	.
	[DB_2=0]	1.530	8.288	.034	1	.854
	[DB_2=1]	0[b]	.	.	0	.
	[DB_2=Moderate]	0[b]	.	.	0	.
	[RC_1=0]	-.837	32.425	.001	1	.979
	[RC_1=1]	0[b]	.	.	0	.
	[RC_1=Poor]	0[b]	.	.	0	.
	[RC_2=0]	.000	31.928	.000	1	1.000
	[RC_2=1]	0[b]	.	.	0	.
	[RC_2=Moderate]	0[b]	.	.	0	.
	[RC_3=0]	-.274	32.391	.000	1	.993
	[RC_3=1]	0[b]	.	.	0	.
	[RC_3=Good]	0[b]	.	.	0	.
	[CDV_1=0]	.777	11.862	.004	1	.948
	[CDV_1=1]	0[b]	.	.	0	.
	[CDV_1=High]	0[b]	.	.	0	.

Table 5.5: Estimation and Wald test

Mode [a]	B	**Std. Error**	Wald	df	Sig.	Exp(B)
Auto-Rickshaw	[CDV_2=0]	-.157	11.634	.000	1	.989
	[CDV2=1]	0[b]	.	.	0	.
	[CDV2=Moderate]	0[b]	.	.	0	.
	[TS_1=0]	1.011	39.058	.001	1	.979
	[TS_1=1]	0[b]	.	.	0	.
	[TS_1=Poor]	0[b]	.	.	0	.
	[TS_2=0]	.246	38.796	.000	1	.995
	[TS_2=1]	0[b]	.	.	0	.
	[TS_2=Moderate]	0[b]	.	.	0	.
	[TS_3=0]	.919	38.641	.001	1	.981
	[TS_3=1]	0[b]	.	.	0	.
	[TS_3=Good]	0[b]	.	.	0	.
	[AT_1=0]	-.183	19.130	.000	1	.992

Table 5.5: Estimation and Wald test

Mode [a]	B	**Std. Error**	Wald	df	Sig.	Exp(B)
Auto-Rickshaw	[AT_1=1]	0[b]	.	.	0	.
	[AT_1=Poor]	-.511	19.085	.001	1	.979
	[AT_2=0]	0[b]	.	.	0	.
	[AT_2=1]	0[b]	.	.	0	.
	[AT_2=Moderate]	.550	17.998	.001	1	.976
	[AT_3=0]	0[b]	.	.	0	.
	[AT_3=1]	0[b]	.	.	0	.
	[AT_3=Good]	-.122	8.968	.000	1	.989
	[EP_1=0]	0[b]	.	.	0	.
	[EP_1=1]	0[b]	.	.	0	.
	[EP_1=Poor]	.161	9.599	.000	1	.987
	[EP_2=0]	0[b]	.	.	0	.
	[EP_2=1]	0[b]	.	.	0	.
	[EP_2=Moderate]	-1.846	13.382	.019	1	.890
	[TC_1=0]	0[b]	.	.	0	.
	[TC_1=1]	0[b]	.	.	0	.
	[TC_1=High]	0[b]	.	.	0	.
	[TC_2=0]	-1.265	12.759	.010	1	.921
	TC_2=1]	0[b]	.	.	0	.
	[TC_2=Moderate]	0[b]	.	.	0	.

5.6 Estimated Model

From table–5.5 we get this equation.

Equation-1

$L=\ln\left(\frac{P_1}{P_0}\right) = -495.707+496.218GENDER_1$

Equation-2

$L=\ln\left(\frac{P_1}{P_0}\right) = -496.095+505.417GENDER_1$

Equation-3

$L=\ln\left(\frac{P_1}{P_0}\right) = -496.327+507.437GENDER_1$

5.7 Interpretation of Estimated model

The fitted model can be interpreted as follows.

5.7.1 Interpretation of the intercepts

Table 5.6: Estimated values of intercept terms

Equation -1	**Equation-2**	**Equation-3**
$\ln\left(\frac{P1}{P_0}\right)=5.214$ $\frac{P_1}{P_0}=Exp(5.214)$ $\frac{P_1}{P_0}=183.83$ $P_1=183.83p_0$	$\ln\left(\frac{P1}{P_0}\right)=2.501$ $\frac{P_1}{P_0}=Exp(2.501)$ $\frac{P_1}{P_0}=12.19$ $P_1=12.19p_0$	$\ln\left(\frac{P1}{P_0}\right)=4.01$ $\frac{P_1}{P_0}=Exp(4.01)$ $\frac{P_1}{P_0}=55.15$ $P_1=55.15p_0$

From the ab7ove table it has been found that the respondents, who have the likelihood of choosing Bus as Feeder vehicle is 183.83 times higher than Auto-Rickshaw in equation 1.

From the table it has been found that the respondents, who have the likelihood of choosing CNG as Feeder vehicle is 12.19 times higher than Auto-Rickshaw in equation 2.

In the table it has been found that the respondents, who has the likelihood of choosing Microbus as Feeder vehicle is 55.158 times higher than Auto-Rickshaw in equation 3.

5.7.2 Interpretation of the slope co efficient

Interpretation on the slope co efficient of our estimated model base on table 5.5

For Equation-1

For the co efficient of G_1, we have Exp(B)=3.137 this recommend that respondents who are male, would choose bus as feeder vehicle of transportations likely 3.137 times more than respondents who are female.

For Equation-2

For the co efficient of G_1,we have Exp(B)=3.162 this recommend that respondents who are male, would choose bus as feeder vehicle of transportations likely 3.162 times more than respondents who are female.

For Equation-3

For the co efficient of G_1,we have Exp(B)=2.383 this recommend that respondents who are male, would choose bus as feeder vehicle of transportations likely 2.383 times more than respondents who are female.

CHAPTER 6

CONCLUSION AND RECOMMENDATIONS

General

This study looks at how commuters' choice of feeder mode is influenced by perceived traffic safety and attitude characteristics. In the calibration of the model, several variables are used. As the model was being developed, some predictor variables, including gender, age, education level, and occupation, were dropped due to their poor statistical goodness off it. They were all thus dismissed. The variables were examined using the hypothesis testing technique, but for reasons of space, these experiments are not included here.

In order to improve the number of people using public transportation through the suggested system, the aim behind developing this model was to identify the preferences of transit users from the case study area and to direct those distant from the residential area toward the nearest bus stops. The impact will be a decrease in private car use, which will lessen traffic, reduce pollution, and reduce accidents. The parameter estimates and logical signs were all significant for all the variables that were gathered and presented.

In this study, an effort has been made to examine the connection between mode choice characteristics and traveler behavior in the targeted areas. When determining the optimal positive parameter or collection of parameters that influence the choice of mode, the preferences of the consumers are taken into consideration.

Summary

This study's major goal is to identify the factors that influence people's decisions on which mode of transportation to use to get from one place to another. At two places around Dhaka, questionnaire surveys have been conducted. On the survey, 500 participants in total took part. The study's results are summarized as follows:

Demographic Information

1. 33% of respondents were female, while 67% of respondents were men. In a developing nation like Bangladesh, women travel outside the home for work-related purposes at a rate of roughly one-third that of men.

2. Maximum 50% of respondents were between the ages of 25 and 35, 26% were under 25, 16% were between the ages of 35 and 45, 7% were between the ages of 45 and 55, and 1% were over the age of 55.

3. Maximum 44% of respondents had a bachelor's degree, 28% had a higher secondary education, 16% had a secondary education or less, 12% had a master's degree and 0% had a Ph.D. or higher.

4. 27% of respondents were self-employed, 19% were students, and 39% of respondents were private employees. 14% of people identified as Govt. employees and 1% as retired. Most responses, as evidenced by this private employee.

5. Maximum 53% of respondents had an income of 25–74, 27% had an income of 74–149, 17% had an income of 25–24,3% had an income of 150–299 and 0% had an income of 300-above.

Mode Choice Information

1. Almost 50% of respondents had traveled less than 10KM, 32% had traveled 10 to30 KM,12% had traveled 30 to 50 KM, 6% had traveled 50 to 70KM, and 0% had traveled 70KM or more.

2. Maximum 40% of respondents gave a rating for riding safety that was moderate, 26% gave a rating for riding safety that was very poor, 17% gave a rating for riding safety that was poor,17% gave a rating for riding safety that was good and 0% gave a rating for riding safety that was very good.

3. 35% of respondents gave a rating for poor driving behavior, 26% of respondents gave a rating for very poor driving behavior, 27% of respondents gave a rating for moderate driving behavior, 12% of respondents gave a rating for acceptable driving behavior and 0% of respondents gave a rating for very good driving behavior.

4. Almost 35% of respondents rate driver obeying traffic rules as moderate, 34% rate driver obeying traffic rules as poor, 21% rate driver obeying traffic rules as very poor 10% rate driver obeying traffic rules as good and 0% rate driver obeying traffic rules as very good.

5. Almost 33% of respondents rate reckless driving of driver as less frequently, 31% of respondents rate reckless driving of driver as very frequently, 31% of respondents rate reckless driving of driver as frequently,3% of respondents rate reckless driving of driver as rare, and 2% of respondents rate reckless driving of driver as never.

6. 32% of respondents rate riding comfort inside bus as moderate,36% rate riding comfort inside bus as poor, 17% rate riding comfort inside bus as poor as very poor, 15% rate riding comfort inside bus as poor as good, and 0% rate riding comfort inside bus as very good.

7. 32% of respondents rate riding comfort inside bus as moderate,36% rate riding comfort inside bus as poor, 17% rate riding comfort inside bus as poor as very poor, 15% rate riding comfort inside bus as poor as good, and 0% rate riding comfort inside bus as very good.

8. Maximum 38% of respondents rate crowdedness inside the vehicle as moderate, 35% rate crowdedness inside the vehicle as high, 23% rate crowdedness inside the vehicle as very high, 4% rate crowdedness inside the vehicle as low, and 0% rate crowdedness inside the vehicle as very low.

9. Maximum 41% of respondents rate public transportation as moderate, 27% rate public transportation as poor, 18% rate public transportation as good, 13% rate public transportation as very poor, and 1% rate public transportation as time saving.

10. Almost 40% of respondent's rate vehicle availability as moderate, 34% rate it as good, 11% rate it as poor, 13% rate it as very poor, and 2% rate it as very good.

11. 28% of respondents rate their rate of efficiency in picking up as moderate, 9% rate their rate of efficiency in picking up as good, 29% rate their rate of efficiency in picking up as poor, 34% rate their rate of efficiency in picking up as very poor, and 0% rate their rate of efficiency in picking up as very good.

12. Maximum 67% of respondents rate the rate of travel cost as moderate, 17% rate the rate of travel cost as high, 12% rate the rate of travel cost as very high, 4% rate the rate of travel cost as low, and 0% rate the rate of travel cost as very low.

Multinomial Logistic Model

According to Table 3's summary of the sample data, respondents in Bangladesh would like to travel by Bus, CNG, Microbus, and Auto-Rickshaw, in that order: 39.8%, 27%, 21.4%, and 11.8%. Most respondents favor using buses for transportation. All the parameters have been shown to be statistically highly significant based on tables 5.4 and 5.5. Wald test results, however, show that some parameters are important. According to table 5.4, respondents from the Uttara metro station who are male and have completed elementary school, make under 25,000 per month, and are less likely than other respondents to choose the bus over the Auto-Rickshaw in equation-I. Therefore, we might infer that this group of respondents would prefer buses as a means of transportation.

Limitations of the Study

1. Three months of data collection may not capture seasonal variations.
2. The concept of feeder vehicle is very new to the respondents.
3. Focused only on Uttara North to Agargaon corridor, not the entire Dhaka
4. Data Collection Problem.
5. 500 respondents may not fully represent the large and diverse metro user base.

Recommendations for Future Study

1. The findings will help to develop a sustainable urban transport system in the selected areas.

REFERENCES

1. Ashraf Uddin Fahim and Masaaki Minami (2025), Travel Mode Choices in connection to Metro Station by Multinomial Logit Model: A Case Study in Dhaka, Bangladesh.

2. Fahmida Hanif1, Md. Muntasir Bin Hossain1 and Anindya Kishore Debnath2 (2016), A Study on Mode Choice Behaviour of Working Population in Dhaka: A way towards Sustainable Transportation.

3. Rahman, D., Ahmad, J., Rahman, M., Kabir, M., Biswas, S.,(2021),Title of paper Trip Behavior of Working People in some Selected Areas of Bangladesh: A Statistical Approach.

4. Saiyad, G, Srivastava, M, Rathwa, D, (2021) Title of paper-Assessment of Transit Accessibility Through Feeder Modes and Its Influence on Feeder Mode Choice Behavior, Journal name-Arabian Journal for Science and Engineering.

5. Johansson, M, Heldt, T, Johansson, P, (2005) Title of paper-The effects of attitudes and personality traits on mode choice, Journal Name-Transportation Research Part A-Policy and Practice

6. Hu, H, Xu, J, Shen, Q, Shi, F, Chen, Y (2018), Title of paper-Travel mode choices in small cities of China: A case study of Changting, Journal Name-Transportation Research part D: Transport and Environment.

APPENDIX A

SURVEY QUESTIONNAIRES

Surveying to Assess Acceptance of Public Transportation as Metro Rail Feeder Vehicle

We, a few undergraduate students of the Department of Civil Engineering, SU, are doing research for identifying the acceptance and suitable mode of public transport to serve as feeder vehicle for metro rail.It would be very kind of you if you could manage 5-10 minutes of your valuable time in providing the following information. Your active participation and contribution will be highly appreciated. This Information obtained in this survey will be utilized for academic research purposes only. We also assure you of the anonymity of the information you provide. Do you want to continue (If your answer is 'yes' then do answering of subsequent questions by putting the tick mark on the right answer)?

☐Yes ☐No

Section 1

1)I am-	☐ Male	☐ Female	☐ Others		
2)My age is-	☐ Under25	☐ 25-35	☐ 35-45	☐ 45-55	☐ Above 55
3)The highest degree or level of education I have completed-	☐ Secondary or below	☐ Higher secondary	☐ Bachelor's degree	☐ Master' s degree	☐ Ph.D. or higher
4)My current employment status-	☐ Govt. employee	☐ Private employee	☐ Self-employed	☐ Student	☐ Retired
5) Including myself, the number of people currently living in my household?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5or more
6)The monthly household income of my family (in thousands)-	☐ Under25	☐ 25-74	☐ 74-149	☐ 150-299	☐ 300or above
7)On average, I travel daily (in kilometers)-	☐ Lessthan10	☐ 10-30	☐ 30-50	☐ 50-70	☐ 70or more
8) The number of cars owned by my house hold-	☐ 0	☐ 1	☐ 2or more		
9)How often do you use public transportation-	☐ Never	☐ Rarely	☐ Moderately	☐ Often	☐ Very Often

Section 2

Please rate the level of satisfaction with these specific aspects of your riding experience in public transportation.

Safety	**10)How would you rate Riding Safety**	☐ Very Poor	☐ Poor	☐ Moderate	☐ Good	☐ Very Good
	11)How would you rate Driver's Behavior	☐ Very Poor	☐ Poor	☐ Moderate	☐ Good	☐ Very Good
	12)How would you rate Driving Skill of Driver	☐ Very Poor	☐ Poor	☐ Moderate	☐ Good	☐ Very Good
	13)How would you rate Obeying of Traffic Rule	☐ Very Poor	☐ Poor	☐ Moderate	☐ Good	☐ Very Good
	14)How would you rate Reckless Driving	☐ Very Frequently	☐ Frequently	☐ Less Frequently	☐ Rare	☐ Never
	15)How would you rate Overtaking Tendency	☐ Very Frequently	☐ Frequently	☐ Less Frequently	☐ Rare	☐ Never
	16) How would you rate Personal and Property Safety	☐ Very Poor	☐ Poor	☐ Moderate	☐ Good	☐ Very Good
Comfort	**17)How would you rate Riding Comfort**	☐ Very Poor	☐ Poor	☐ Moderate	☐ Good	☐ Very Good
	18) How would you rate Congestion Degree inside the vehicle	☐ Very High	☐ High	☐ Moderate	☐ Low	☐ Very Low
	19)How would you rate Seat Comfort	☐ Very Poor	☐ Poor	☐ Moderate	☐ Good	☐ Very Good
Flexibility	**20) How would you rate Time Saving in using public transport**	☐ Very Poor	☐ Poor	☐ Moderate	☐ Good	☐ Very Good
	21)How would you rate Availability at any time	☐ Very Poor	☐ Poor	☐ Moderate	☐ Good	☐ Very Good
	22)How would you rate Operation Speed	☐ Very Poor	☐ Poor	☐ Moderate	☐ Good	☐ Very Good
	23) How would you rate Efficiency in Picking you up	☐ Very Poor	☐ Poor	☐ Moderate	☐ Good	☐ Very Good
Economy	**24)How would you rate Travel Cost**	☐ Very High	☐ High	☐ Moderate	☐ Low	☐ Very Low
	25)How would you rate Cost Rate with monthly income	☐ Very High	☐ High	☐ Moderate	☐ Low	☐ Very Low

Section 3

Rate your preference on transportation mode to serve as feeder vehicle					
26)Bus	☐ Strongly unwilling	☐ Unwilling	☐ Neutral	☐ Willing	☐ Strongly willing
27)Taxi	☐ Strongly unwilling	☐ Unwilling	☐ Neutral	☐ Willing	☐ Strongly willing
28)Bike	☐ Strongly unwilling	☐ Unwilling	☐ Neutral	☐ Willing	☐ Strongly willing

APPENDIX B

DECRIPTION	Variable
Gender	G
Age under 25 years	A_1
Age 25 to 45 years	A2
Age above 45 years	A2
Educational Qualification higher secondary or below	EQ_1
Educational Qualification Bachelor's Degree	EQ_2
Occupation Govt. Employee	$OCCUP_1$
Occupation Private Employee	$OCCUP_2$
Educational Qualification under 25000TK	MFI_1
Educational Qualification 25000-74000TK	MFI_2
Educational Qualification 47000-149000TK	MFI_3
Use of Public Transportation never	UPT_1
Use of Public Transportation mode rate	UPT2
Use of Public Transportation often	UPT3
Rate of Drivers Behavior poor	BD_1
Rate of Drivers Behavior moderate	BD_2
Rate Of Riding Safety poor	RS_1
Rate of Riding Safety mode rate	RS
Rate of Riding Safety good	RS3
Rate of Riding Comfort poor	$RC_!$
Rate of Riding comfort moderate	RC_2
Crowdedness inside vehicle high	CDV_1
Crowdedness inside vehicle mode rate	CDV_2
Rate of time saving poor	TS_1
Rate of time saving mode rate	TS2
Rate of time saving good	TS3
Rate of Availability at any time poor	AT_1
Rate of Availability at any time mode rate	AT_2
Rate of Availability at any time good	AT_3
Rate of Efficiency of picking up poor	EP_1
Rate of Efficiency of picking up mode rate	EP_2
Rate of Traveling cost High	TC_1
Rate of Traveling Cost Moderate	TC_2