VIABILITY OF WATER TRANSPORT: ANALYSIS IN THE CONTEXT OF DHAKA (GABTOLI-BABUBAZAR).

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



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Section: 13B
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“Our Parents

&

Respectable Supervisor”

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Abstract

The transport sector of Dhaka city is categorized by terrible, congestion and delays, insufficient traffic management, poor organization among agencies, and also lack of integration between different transportation modes. It is perhaps the only city in the world of this size without having a well-organized and scheduled mass transit system. Implementing and improving circular water transport can facilitate the Government of Bangladesh to achieve this goal. The main objective of this study is to investigate the existing situation of the Ghats and riverbank conditions of the circular waterway transportation of Gabtoli to Babubazar; analyze the problems and expectations of the waterway and recommend necessary measures to enable circular river transport to play a greater role in the transportation system of Dhaka city. From the study on water transport from Gabtoli to Babubazar, it was understood that in the near future waterbus can travel periodically with a number of prospective passengers. An efficient water transport system should provide proper and effective linkage to the existing transport system. All the possible road transport options should be available at the landing stations from bus service to subway. A possible linkage should be provided between the landing stations and nearby public transport facilities. Para-transport facilities should also be provided to connect the water-bus users to the nearest public transport facilities. To ensure swift, safe and unhindered turning of waterbus, modern landing facilities should be provided. There should be the availability of adequate information on the various routes, fares, and timing of the waterway services. After analysis prospective routes of water buses from Gabtoli to Babubazar have been proposed based on demand and respondents' responses.

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Chapter 1

Introduction

Chapter 1 introduces this study, which is about "Viability of Water Transport: Analysis in the context of Dhaka (Gabtoli-Babubazar)." The chapter briefly describes the context of research, aim and objectives research, followed by a research process.

1.1 Background of the Study

Dhaka city, established by the Mughals on the banks of the Buriganga, is surrounded by six rivers like a garland. There are Balu and Sitalakhya on the eastern side, Turag and Buriganga on the western side, Tongi *Khal* to the north and Dhaleshwari to the south. Tongi *Khal* connects both Turag and Balu rivers. Dhaleshwari and Sitalakhya join the south of Narayanganj and flow into the Meghna River. Dhaka once renowned for its waterways and lavish greeneries, inspiring travelers to call it the "Venice of the East" - has now turned into one of the most polluted and crowded cities in the world. Transportation is one of those qualities of a city that make lives of city dwellers happier, satisfactory and fruitful (Hossain, et.al. 2015). The popularity of water based transportation is very clear and significant in the history of Bangladesh. During 1800s and until 1940s the "Buckland Bund" was the famous boardwalk place for the city dwellers and also acted as leisure center.

1.2 Context of Research

The main Transport in Dhaka city are Bus, Train, Car, Rickshaw, Leguna, Motorcycle, and Cycle. According to the recent strategic Transport plan for Dhaka – the primary mode of transport for personal trips is about a third (34%) non–motorized rickshaws, another one third (34%) buses and the remaining 30% using walking or other motorized vehicles (Sultana, 2013). Dhaka city has a complex transportation system and huge transportation demand but the public transport system seemingly inefficient. The transportation sector of Dhaka city is characterized by awful mobbing and delays, insufficient traffic management, poor form

among agencies, and also lack of addition between different transportation modes (Hossain et.al, 2015). The ever increasing chaos and mobbing, high rate of accident and rapidly worsening environmental condition calls for immediate contemplation of an alternative transport option that could reduce the loads on road transport.

Dhaka is a tender land-mass virtually an island framed by rivers that form 110 km Circular Waterways around the city (Sultana, 2013). These waterways carry a considerable amount of freight traffic from the adjoining areas bound for Dhaka. Waterbuses can easily travel through Buriganga river because the river connects with many populated areas of Dhaka city. These waterways carry a large amount of consignment traffic from the connecting areas bound for Dhaka. The western periphery of Dhaka is skirted by Buriganga and Turag rivers for about 26 miles following a zigzag course (GoB, 2001). The river act as a major linkage between a portion of keraniganj Upazila and the old city of Dhaka. Under the circumstances, the river Buriganga may be potential transport option for the city, provided there has been an organized and efficient water transport network along the waterways.

Sadarghat boat terminal in river Buriganga, which is the largest, has significant traffic demand. The reason for this demand is mainly because this area is located in old Dhaka where the road is only 1.2 lanes wide. According to the officials at the terminal, 150,000 people, in average, use the terminal for departure and arrival every day. Availability of water bus service can help to relieve traffic congestion of the area in the short-and mid–term. Therefore, providing waterbus from Gabtoli to Babubazar is important because it can provide comfortable, low cost, time saving journey to people. According to officials, around 200 people use the Gabtoli terminal for one trip at peak hours.

The BIWTA under its scheme called “The Development of the Circular Waterways of Dhaka”, is improving the navigability of the rivers and is also building landing stations along the waterways. It is expected that after the improvement of the circular waterways, consignment and passengers will move more suitably through the waterway system. Under the Revision and Updating of the Strategic Plan for Dhaka (RSTP), these landing stations will be integrated with the land transport system of the city so that the cargo and passengers from the waterways can move more easily into the city. The plan envisions a network of landing stations positioned along the Buriganga, Turag, and Balu Rivers provided that passenger and consignment contact to a variability of water-borne transport vehicles. Along with the landing stations, land based transport services to and from the landing stations are required. Also

required, is a major dredging effort, in some areas, in order to establish and maintain sufficient depth for navigational purposes. That's why the thesis has a focus point on analyzing the viability of passenger water bus from Gabtoli to Babubazar.

At first, the water bus services were carrying around 35 passengers every trip from Gabtoli to Sadarghat after a pause of one and half hours. The buses scheduled to carry passengers from 7:00 am to 6:00 pm would take 30 minutes. Last but not the least, the waterbus service does not have a good intermodal connection and passengers who have destinations in the city center still have to experience severe traffic jamming to get from the waterbus terminal to the city center. Nowadays the waterbus services are carrying around 50-140 passengers in one trip from Gabtoli to Babubazar. The waterbuses scheduled to carry passengers only two times in a day. Gabtoli to Babubazar route is important because it covers many areas like Bosila, Sikdar Medical, Kamrangir Char, Kholamura, Madrasa Ghat, Borishur Ghat, Madbarbazar Ghat, Showari Ghat etc. However, very limited research was conducted that analysed the prospect and deficiencies of the water-bus service along this route. This research will try to overcome that vacuity and investigate the prospects and deficiencies of existing water-bus service from Gabtoli to Babubazar route.

Figure 1.1 illustrates the study area (from Gabtoli to Babubazar Ghat) for this research.

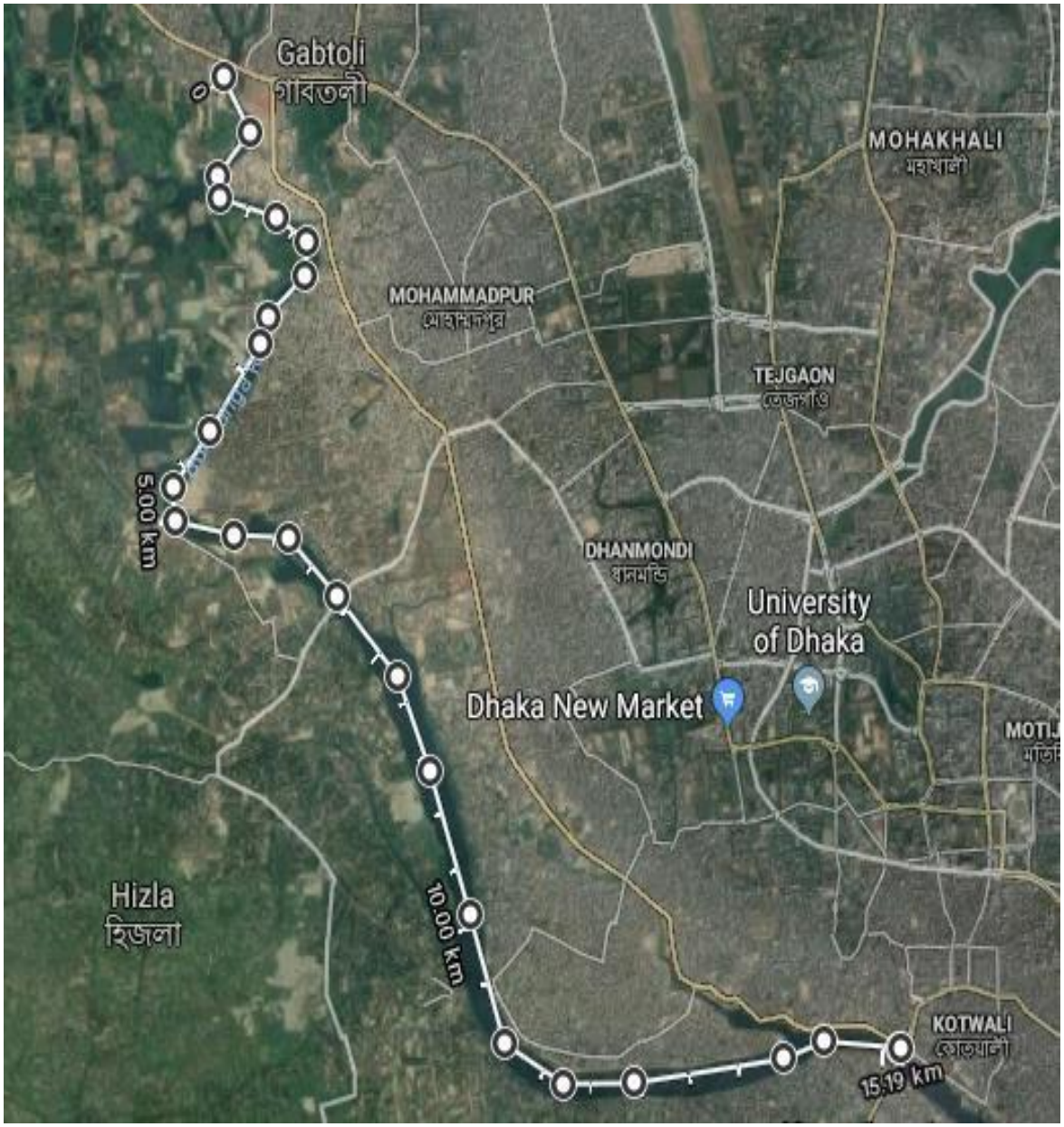


Figure 1.1 Study Area-Route of Gabtoli Ghat to Babubazar Ghat

1.3 Research Aim and Objective

The prime aim of this research is to analyze the viability of inner circular waterway system in Dhaka. To achieve this aim following objectives will be achieved

- To investigate the existing situation of the waterways transportation.
- To analysis the problems and expectations of the waterways.

1.4 Research Questions

To achieve objectives stated in section 1.3 the research questions that will be addressed are as follows:

- What are the condition landing station and user's satisfaction?
- What are the people's expectation from water transportation?
- How is the demand of water transport?
- What kind of effect will produce water transport on road transport system?
- Why is it necessary to increase water transport in this route?
- Why will people use water transport instead of road transport?

1.5 Significance of the Study

The prospects of river transportation and the impacts it could have on the overall transportation sector of Dhaka city, as well as its pattern of future growth, requires in depth studies and research. However, this potential factor has always been neglected in our development plans. Under the circumstances, a detailed study on the present water transportation system is undoubtedly significant for the planned development of Dhaka city as a whole. The scope of the research is limited to identify the scope of waterways of Dhaka city in terms of passenger transport. Geographic Information System (GIS) has been used to show the location of Ghats. The findings may be used by the concerned authorities to raise the standards of provided facilities up to the level. The study is expected to provide some information and a comparative picture of the pattern of waterway transportation and nature of activities by the users and their expected convenience. The thesis also tried to explore the

user's perception about the waterway around Dhaka and how users' perception are influenced by user's socio- economic background, age, income, etc. and has also provided some a venues for future research and study in this field. If further study will conduct, it should have focused on detailing of the route design development.

1.6 Research Process

Figure 1.2 illustrates the research process for this study

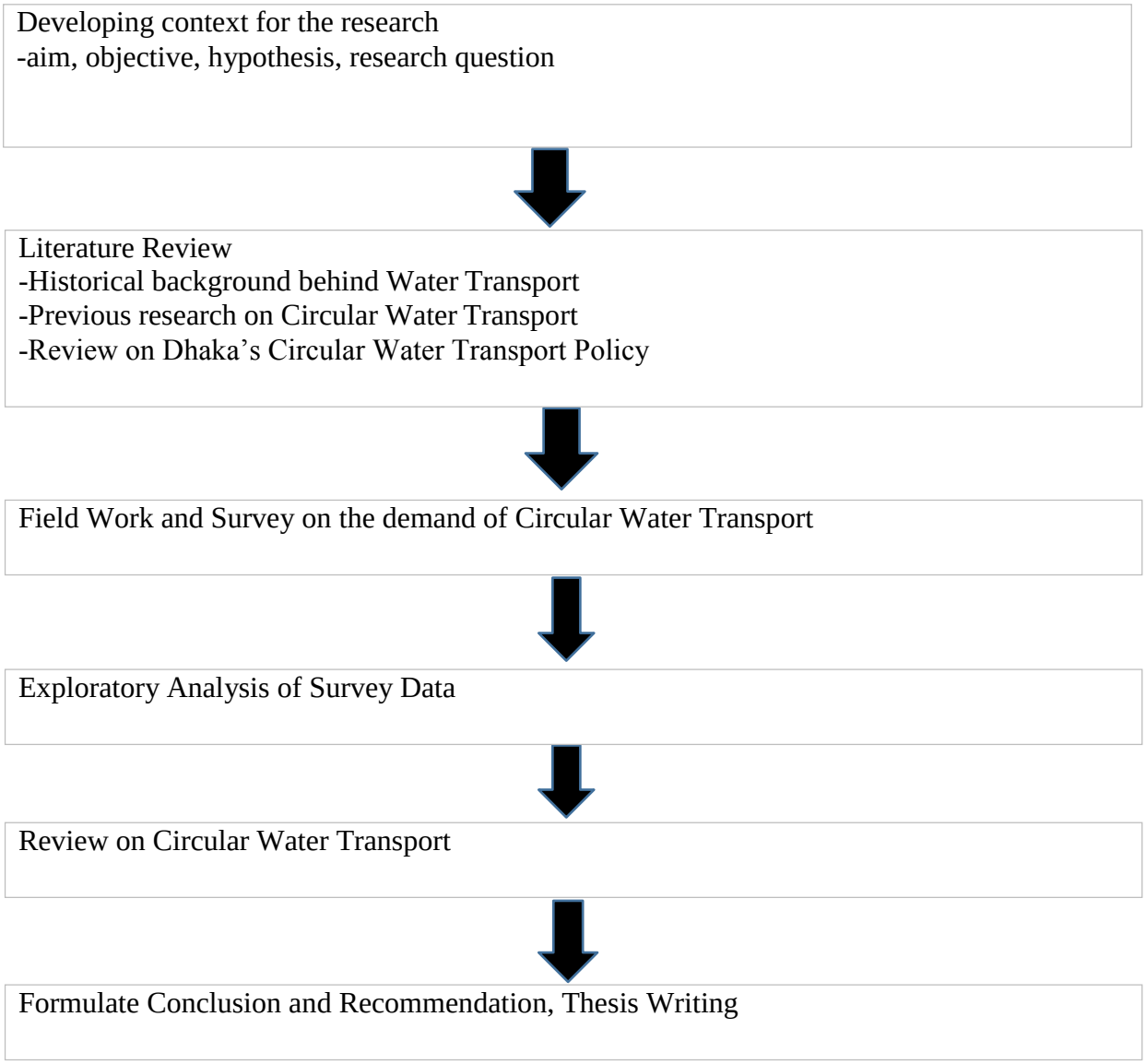


Figure 1.2 Sequence of Research Process for this Research

1.7 Organization of the study

1 Chapter 1 describes the background, context of research, research aim and objective and significance of this study.

2 Chapter 2 reviews the literature relevant to topic of this research and some over view of GIS.

3 Chapter 3 describes the methodological approach adopted for this research.

4 Chapter 4 presents the data collection procedures with some specific limitation of this study.

5 Chapter 5 describes the data analysis.

6 Chapter 6 provides recommendation and conclusion. This chapter also provides direction for future research.

Chapter 2

Literature review

The review of literature related to previous research on waterways of Dhaka city. Historical Background, Present situation, Different Case study of Different cities are existed in this review.

2.1 Importance of Water Transport

Water transport was historically the fastest way to get around. The world's most successful cities were all founded on navigable bodies of water. Better and improved water transport is one of the key factor to prosper and increase the GPD of any country. Freight carrying capacity by water is more than ten folds higher than carrying capacity by road. Fuel consumption per unit weight is very low. Operating cost per unit weight is very low. If the same quantities of goods are transported by road, greenhouse gas emissions will be way higher than water transportation. Depending on the depth of the port variable capacities of vessels can be employed. Due to low operating costs and fuel consumption, international trade is comparatively cheaper.

2.2 Water Transport System Related Actions for Dhaka City

2.2.1 Greater Dhaka Metropolitan Integrated Transport Study (DITS)

The DITS has made a number of both short term and a long term recommendation as well as recognized and policy improvements and physical outlay to develop urban transport environment of Dhaka. The DITS final report recommended the strategic path for the Transport Development Strategy (DTS) to develop waterways for water based transport of inner-city personal travel in Dhaka.

2.2.2 Waterbus and Water taxi services

A project was supposed to continue with inventiveness by BIWTA to upgrading the rivers and canals which form a ring route around the Dhaka urban area. The first phase of the project was initiated by BIWTA in 2000 and it was planned to be ended by 2005. The project contains the combing of river ways to improve navigability and also the expansion of twelve landing station on both sides of the Buriganga and Turag rivers. Although the opportunity to familiarize riverine transport services is being eroded by the drainage management and flood control works, the project for waterbus services was theoretical to be an effort to recognize the objective of some policy makers to bring back riverine services particularly for passenger travel.

2.3 Role of Buriganga in Water Transport System in Dhaka City

The Buriganga is famous distributaries of the Dhaleswary River and following a zigzag course for about twenty-six miles, fudging the verge of the old alluvium before retorting the huge torrent. The main viable clearance attributable to water transport was, of course, the Sadar Ghat river port and Buckland Bund that acted as a pivot of city business. Buckland Bund spreads from Badamtali Ghat to shambazar Ghat having a huge length of 4700 ft (Halim, 1985). The ghats other than the terminals endured tiring all over the day-by-day ferrying passengers from both the banks typically by small boats. There were six projecting ghats on the Buckland Bund e.g. Shambazar Ghat, Kaliganj Ghat, Nawabbari Ghat and badamtali Ghat (Nabi, 2006). About 10,000 passengers arrived and gone the city through this river port and another 10,000 by different ghats between Swarighat to Shambazar Ghat. (Halim, 1985). In the 20th century, with speedy development of road transportation system, road became the major mode of transportation for the city residents, and the water way slowly lost its importance (Hossain et.al. 2015). At present Buriganga is woeful situation. The riverfront of Dhaka once represented as the gateway of the city is now used as the back way of the gutter (Hossain et.al, 2015). The areas laterally the river have become a copy of the sharp filth of the Buringa River and the riverfront. The river is being dried as a dumping location, while most of the riverside locations are under threat to unplanned occupation (Mitra et.al, 2003). The Buriganga River still shows a vital role in linking the people of both banks of the river. The river is still the major resources of transportation

of products and goods of massive commercial clearings and small industries on both banks of the river, but over usages and poor maintenance, together with high overcrowding on riverside roads and other land uses make the situation foulest (Hossain et.al, 2015).

2.4 Relevant Case study in Developed Countries

Three mighty rivers, which enter Bangladesh from India at different points, play a very important role in the areas of transportation, cultural practices and livelihoods of the people. Eastern states of India, Nepal, Bhutan and Bangladesh are more or less connected by these rivers. These rivers were once the main communication links for people of this region for traversing from one place to another.

Using the waterways benefits trade as it is less expensive than other modes of transportations. In the age of globalization, the scope of connectivity through these old waterways become more important. The mobility and access to the facilities depend on the sound infrastructure of both circular waterways and road transport of any city.

In India, Hooghly River in Kolkata city has circular waterway system to support road and rail service (Dey, 2013). In Kochi city, waterways are quiet popular to travel (Jegan, 2015). A waterbus service began operating on the Nakagawa Canal (which connects the Sasashima Live 24 area just south of Nagoya Station with the Port of Nagoya) in October 2017. The best public transport that the Netherlands offers that is waterbus services. London has quiet popular waterbus services. Instead of public buses, Venice has the vaporetti, a flotilla of public water ferries. A vaporetto, the Venetian waterbus or public ferry, arriving on the Grand Canal in Venice. The vaporetto is a public ferry service that operates, essentially, as the bus network of Venice (Nowakawski et.al 2015). The Buriganga is notable distributaries of the Dhaleswary River and following a zigzag course for about twenty-six miles, skirting the edge of the old alluvium before rejoining the large stream. Therefore, that's why Buriganga river perfect for waterbus services.

2.5 Introduction of GIS

A geographic information system (GIS) of geographical information system captures, stores, analyzes, manages, and present data that is linked to location. Technically, a GIS is a system, which includes mapping and its application to remote sensing, land surveying, aerial photography, mathematics, photogrammetry, geography, and tools that can be implemented with GIS software. In order to aid in comprehension, it important to explain GIS, its application, its components, its working principle, its computer system and software and the implement of that thing in water route analysis.

Components of GIS

. People

. Data

. Analysis

. Hardware

. Software

2.6 Chapter Summary

This chapter gave an overview of various studies conducted on circular waterways. At first discussed the previous research related on total waterways of Dhaka city. Then reviewed the literature of Buriganga river's transport system and present condition of Gabtoli, Babubazar, Sadarghat landing station.

Chapter 3

Methodology

Methodology is generally a guideline for solving a problem, with specific components such as phases, tasks, methods, techniques and tools. To achieve the primary aim of this research, which is to assess the physical condition of Gabtoli to Babubazar waterway route. This chapter starts by explaining methodological approach for this research. Then it discusses theory behind mode. Later on, provide a brief discussion on transport policy analysis.

3.1 Methodological Approach

Figure 3.1 illustrates methodological framework for this research

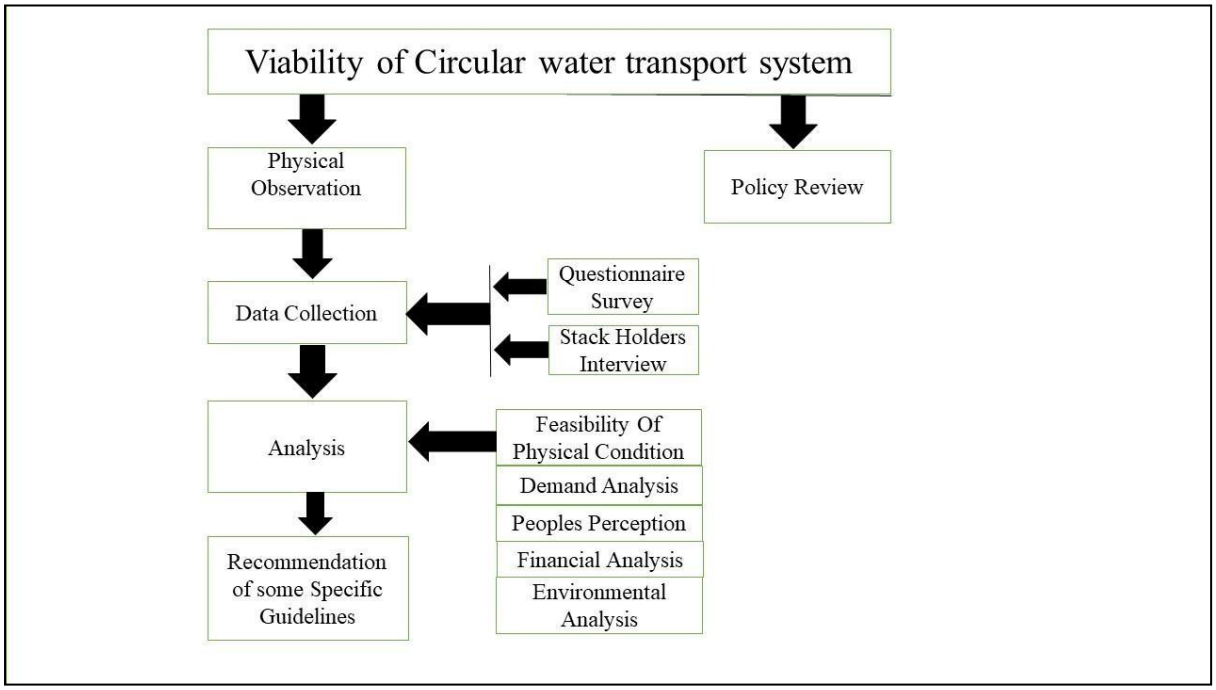


Figure 3.1 Methodological Approach

3.2 Physical observation

3.2.1 Physical Condition of the Landing Stations

Physical condition of a landing station proves in adequacy through good passenger handling facility. However, the physical setting of the landing stations of the study area is very poor. Most of the landing stations are starved of structural setup. In most cases, passengers and goods are loaded and unloaded on the slope of the embankment and there is no provision of sheds as well. As a result, in the rainy season the passengers have to suffer miserable condition. Moreover, there is no standard form regarding the size and quality of the landing facilities according to the passenger's volume generated. For example, Kholamura generates a high volume of passengers every year (20.92 lac) but there is no permanent berthing facilities provided at the landing stations and passengers are handled through wood and bamboo made temporary structures (Sifat, 2015).

3.3 Demand Analysis

Though huge people use bus, Leguna, CNG as road transport to travel Gabtoli to Babubazar, waterbus is quiet demandable. According to BIWTC, when the waterbus service has started, it has clearly a magnificent demand. However, day by day the service had lost their popularity improper management of authority. The waterbus service could not maintain their time schedule properly. Speed of the waterbus is a factor of losing popularity. Waterbuses take really short time to the destination but the high speed of waterbus hamper the cockleboats in the Buriganga River. In rainy & dry season passengers, demand is high. However, in winter season, passenger demand is low due to odor of the water. However, nowadays Tanneries are shifted from the bank of Buriganga River. So odor problem is allayed day by day. Nowadays so many young people travel on the waterbus for their daily purposes. At the survey time, it is noticed that so many people came to travel on waterbus but improper time schedule make them disappoint.

3.4 Financial Analysis

Mainly circular waterbus service spread on Buriganga, Sitalakkha Rivers. In every fiscal year huge budget was authorized from government in this circular water transport route. Usually

communication by waterway costs half or even one third in evaluation to road or railway transport costs. The water way has not only fabulous effect on the existing transportation system, but also helps to increase the scenic beauty of the area. In Gabtoli- Babubazar route, there are three waterbuses are available now. Their seat capacity is 81, 46 and 35 respectably. From the waterbus master it is heard that in recent days they even cannot raise their fuel cost. Sometimes passengers' number are very low to travel. However, the fuel cost remains the same as per trip. So at end of the month the project sometimes viewed some losses.

3.5 Environmental Analysis

In road, bus, Taxi produce so many CO_2, CO, NO_X. Compared to on- street-bus, water-bus causes less environmental pollution. In this route, many cargo vessels are travelling. Therefore, travelling by waterbus daily in the same route is not harmful. The present level of culture and capture of fisheries is expressively lower in this area.

3.6 Social Benefit

The proposed intervention is likely to have indirect and direct income effects at household's level. The household will earn income from water born navigation including boat owner, operator and user. If waterbus services are launching regularly at proposed time, it will produce the employment. Nowadays demand is high but supply is low. If passengers get waterbus timely, they will travel more. Huge man management is needed for the maintenance of each waterbus, ticket collection, each landing station maintenance.

3.7 Policy

According to BIWTA, as per Section 15 of the Ordinance E. P. Ordinance No. LXXV of 1958; amendment Ordinance No. LV of 1977, the Authority performs statutory functions of development, maintenance and regulatory nature. The Functions in brief:

- Carry out river conservancy works including river training works for navigational purposes and for provision of aids to navigation including marks, buoys, lights and semaphore signals;
- Circulate navigational and meteorological information including publication of river charts;
- Provided pilotage and hydrographic survey services;

- Draw up programmers of dredging requirements and significances for efficient maintenance of existing navigable waterways and for revival of dead or dying rivers, channels, or canals, including development of new channels and canals for navigation;
- Develop, maintain and operate inland river ports, landing/ferry Ghats and terminal facilities in such ports or Ghats;
- Carry out removal of wrecks and obstruction in inland navigable waterways;
- Conduct traffic surveys to establish passenger and cargo requirements on the main rivers, feeders and brook routes;
- Develop rural water transport by progressing of schemes for modernizing and mechanizing country craft;
- Ensure co-ordination of Inland Water Transport with other forms of transport, with major sea ports, and with trade and agricultural interests for the optimum utilization of the available transport capacity;
- Conduct research in matters relating to Inland Water Transport including development of
    - Craft design
    - Technique of towage
    - Landing and terminal facilities
    - Port installations
- Arrange programs of technical training for Inland Water Transport personnel
- Maintain liaison with the shipyard and ship repair industry to meet the requirements of the Inland
- Water Transport fleet repairs and new constructions
- Maintain liaison with the Government and facilitate import of repair materials for the Inland Water Transport Industry
- Prepare plans or schemes for carrying out any of the above-mentioned functions.

Regulatory Functions:

- Fixation of maximum and minimum fares and freight rates for Inland Water Transport on behalf of the Government;
- Approve time tables for passenger launch services;
- Inspection shies, cargo and inland vessel to ensure compliance with the provision of ISO -1976;

- Act as the Competent Authority of Bangladesh for the protocol on Inland Water Transit and Trade, looking after the use of waterways of Bangladesh on behalf of the Govt. of Bangladesh for the purpose of trade and transit between Bangladesh and India as provided in the Protocol.

BIWTC always follow the policy of BIWTA. BIWTC makes all the development, maintenance, control of circular water system according to the policy of BIWTA.

3.8 Stakeholders Acceptance

Increased emphasis is given to the development and use of water transport as a means to serve passenger and freight transport needs. The plan predicts a system of landing stations situated along the Buriganga, Turag, and Balu Rivers providing passenger and freight access to a variability of water-borne transport vehicles. In addition to the landing stations, land based transport services to and from the landing, stations are required. Also required, a major dredging effort, in some areas, in order to establish and maintain sufficient depth for navigational purposes. Since the completion of the feasibility study, BIWTA has proceeded with the implementation of the recommendations for the western section of the Circular Waterways System, including dredging and construction of landing stations. Cost information, associated with the implementation of landing stations in the western section, indicates that the total cost to construct the four major landing stations is Tk 2.5 crore ($416,000) or an average of Tk 6.25 million ($104,000) per major landing station. Similar information for the four minor landing stations is a total cost of Tk 1.5 crore ($250,000) or an average of Tk 3.75 million ($63,000) per minor landing station (GoB BIWTA, 2001). The cost of constructing one of the other landing stations (concrete steps and toll office is Taka 12 lakhs ($20,000) per location. BIWTA has started another viability study of the Circular Waterways System (Ashulia to Demra), including waterway connections to some of the existing canals. Application of the Circular Waterway system from Ashulia to Kachpur through Tongi over a five-year period (2004-2009) is Taka 147 crore ($25 million) (GoB BIWTA, 2001). This includes provision for 15 landing stations plus improvements at Tongi River Port and redevelopment of three canals. Local Government Engineering Department and Dhaka City Corporation, both with responsibility for the construction of 15 roads connecting to the landing stations. The estimated cost of the project has been increased to Taka 294 crore ($49 million) with anticipated financing to include 30% from the Government of Bangladesh and 70% from donor agencies (GoB BIWTA, 2001).

3.9 Accident Data

This research involves the traffic accident data collection by using microcomputer Accident Analysis Package (MAAP5) software.

3.10 Data Collection

The accident analysis was done in Gabtoli-Sadarghat road by analyzing 7 years' accident data from the year 2009-2015. The accident data was collected from the MAAP5 software of Accident Research Institute (RRI) OF Bangladesh University of Engineering and Technology (BUET). The accident Report Forms (ARF), is initially filled up by police personal nearby the location later the ARF is composed by ARI to work it with MAAP5 software.

Figure 3.2 illustrate the method of Accident Data Extraction from MAAP5 software

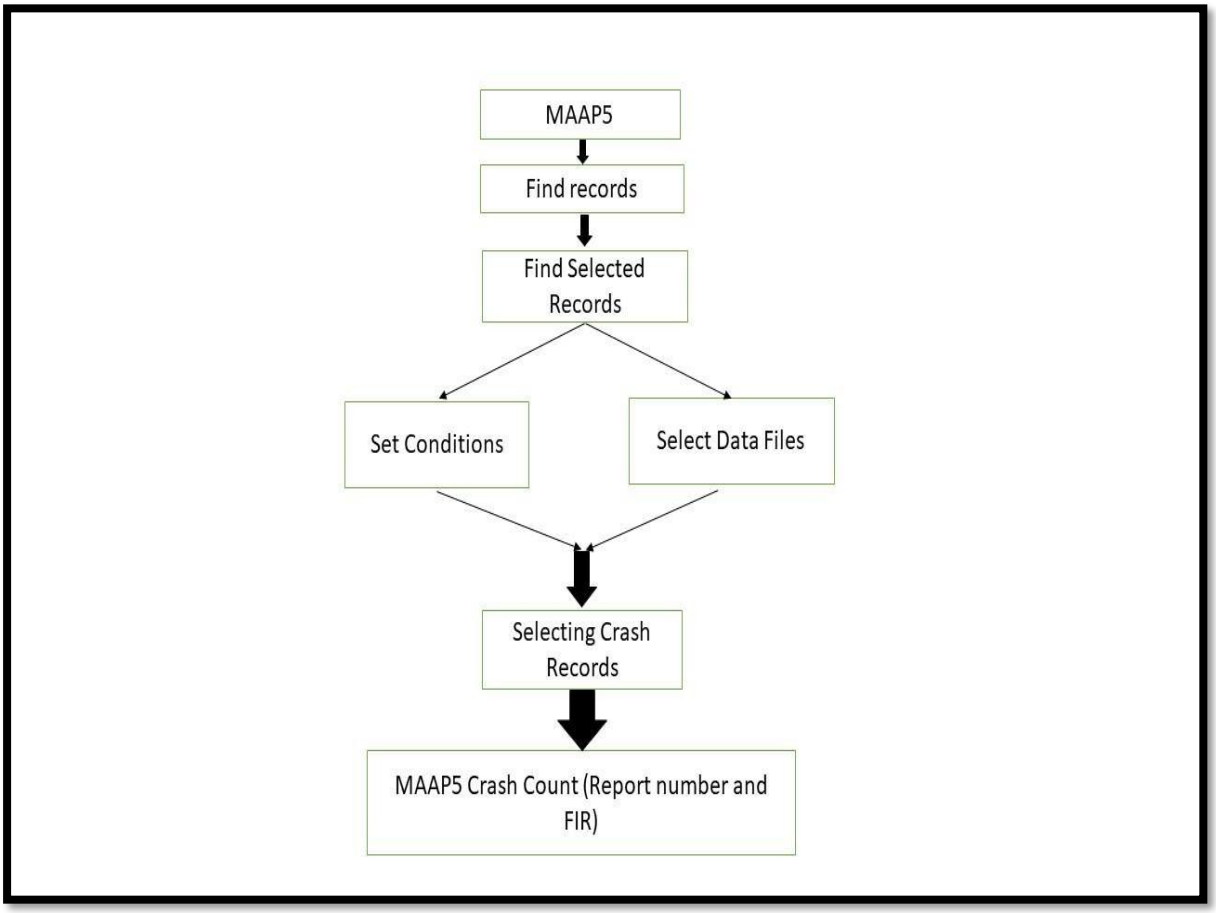


Figure 3.2: Method of Accident Data Extraction from MAAP5 Software

3.11 Chapter Summary

This chapter summarizes the systematic approaches to study the viability of water transport of Gabtoli-Babubazar route. It also demonstrated the steps GIS mapping of the existing route.

Chapter 4

Data collection

In Dhaka city, the study area is Gabtoli to Babubazar waterways. In field survey physical condition, Demand of people to on waterbus, financial condition of the study, Social Benefits of waterbus etc.

4.1 Primary Data Collection from field Investigation

- The number of people travel per day in waterbus.
- The number of people travel per day in bus.
- People is Perception about waterbus.
- People's perception about road transport.
- People's demand on waterbus.

4.2 Physical Condition of Landing Station

Physical condition with survey pictures will be addressed the next chapter, which is Data Analysis. In that chapter, pictures and description will be added.

4.3 Details of Waterbus

Types and details of waterbus (description of vehicle, loading detail, vehicular defects) are described in the next chapter paragraph no 5.12.

4.4 Preliminary Data Collection from Secondary Sources (BIWTC)

For this research, annual passengers' number of waterbus as per fiscal year of Gabtoli to Babubazar route is needed which is collected from BIWTC. Vehicle types and details of vehicle is also collected from BIWTC. Annual loss and profit of these waterbus services is also given by BIWTC. The passenger data and profit and loss data would be analyzed for the period of 5 fiscal years' time (2015-2020).

4.5 Preliminary Data Collection from Secondary Sources (Accident Data)

The research involves the accident data collection and data analysis by using MAAP5 software locating Total number of accident in a certain route using GIS. In Bangladesh, there are many sources for accident data collection like as police records, newspaper reporting, hospitals etc. The fundamental source of accident data is the Accident Report Form (ARF), which is filled up by police personnel. Accident Research Institute (ARI), BUET, accomplishes these ARF and MAPP5 soft copy. Therefore, all type of accident data needed for this research would be collected from ARI, BUET. The accident data would be analyzed for the period of 6 years' time (2013-2019).

4.6 Chapter Summary

The research work has been performed by the systematic collection of required data for analysis with MAAP5 and also analysis of field data which collected from questionnaire survey. The result of MAAP5 and field data analyses are reported on and discussed in the following chapter.

Chapter 5

Data analysis

This chapter shows the analysis of survey report, which is described in chapter 4. In this chapter, mainly graphical analysis is described in which passengers number in particular month, profit and loss of water bus service are existed.

5.1 Monthly Statistics of water transport

Figure 5.1 illustrates the monthly statistics of passengers travel from Gabtoli to Babubazar by waterbus. From this graph it is seen that highest 148 passengers travel in a day and lowest 70 passengers travel in a day. There are 4 different types of boats which travel on passenger's demand in a single day. The seat capacity of waterbuses is either 81, 46 or 35. However, the waterbus sometimes carries more passengers than the seat capacity. On Friday and Saturday passengers, demand is less. However, other working days passengers demand is high. The waterbus travel only two times in a day. First, one starts from Gabtoli at early morning in between of 8.15-9.00 am. Second, one starts from Babubazar at afternoon in between of 5.00-5.30 pm. However, the problem is varying time schedule. That is why waterbuses lost its popularity.

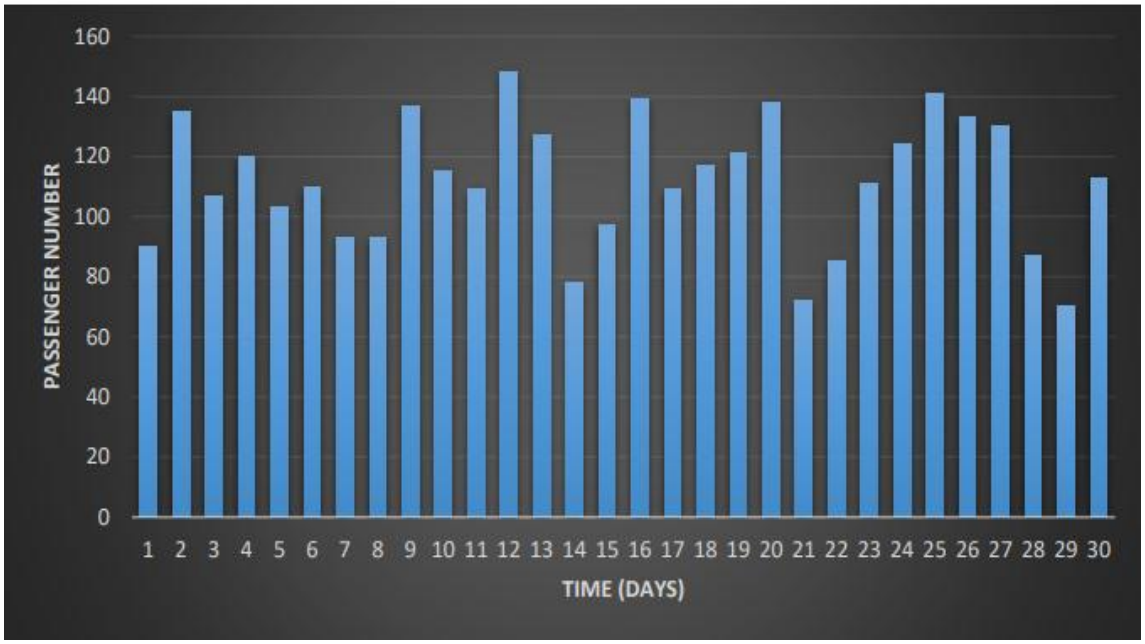


Figure 5.1: Number of Passenger Travel by Waterbus (per day)

5.2 Passengers Board and Alight from Different Ghats

From the survey, it is found that there are five landing stations (ghat) where passengers board and alight. From all these landing stations subsidiary roads exist. However, Condition of landing stations and subsidiary roads are significantly poor. From the figure 5.2, it is seen 35% passengers from Babubazar (Badamtoli) and 37% Kholamura ghat boarded, 14% passengers from Gabtoli, 14% passengers from Showari Ghat boarded. There are other stations available (zinjira ghat, madbarbazar ghat, Mitford ghat, Madrasa Ghat). From figure 4.6, 4.11, 4.13, it is seen that there are no landing stations in those area. The condition of subsidiary road is also poor.

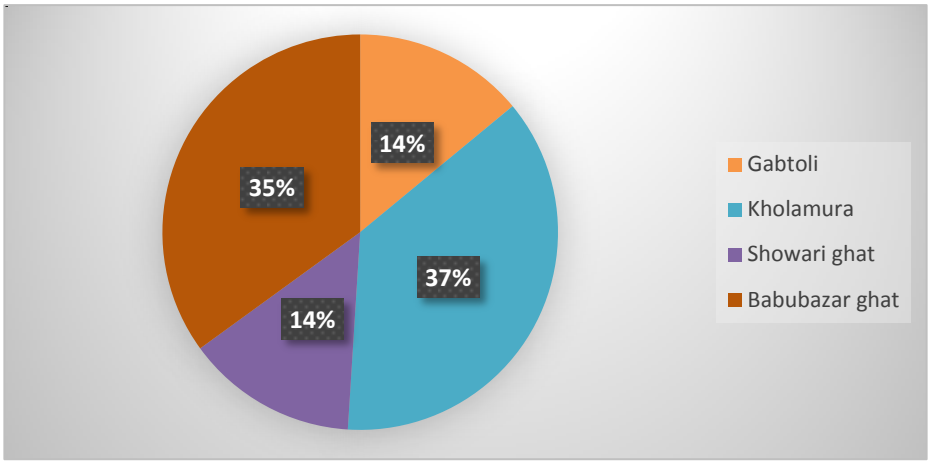


Figure 5.2: Percentages of Passenger Travelling from Different Ghat

5.3 Passengers Travel according to their Profession

From the survey, it is seen that people of different occupation travel by waterbus. From the figure 5.3, it is seen that 25% businessman, 32% labor, 20% nongovernment Employee, 11% normal people, 7% student, 5% government employee travel in waterbus as per one-month survey. Sometimes government employees do not travel because of their time schedule. Small businessperson and labor mainly travel by waterbus.

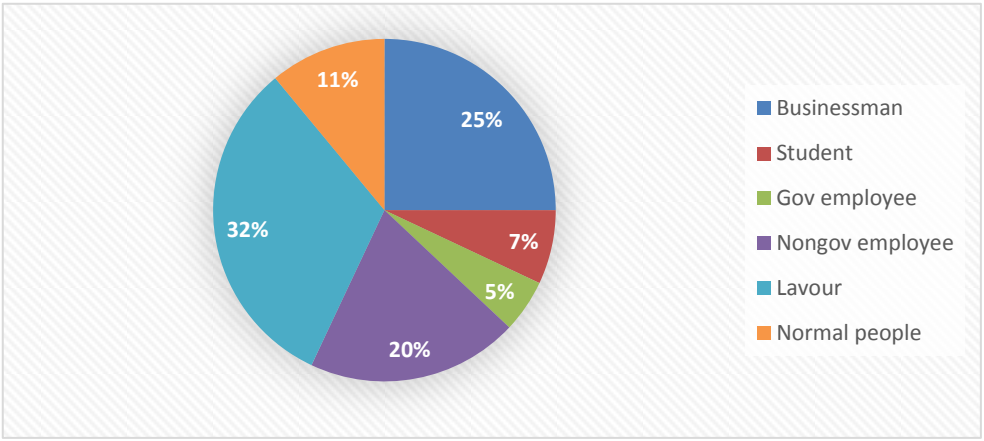


Figure 5.3: Percentages of Passenger Travelling According to Their Profession

5.4 Passengers Travel Report on both Road and Water Transport

Figure 5.4 shows the number of people who travel in a day during a month by both road transport and water transport. The number of people who travel in waterbus are less than the road transport. From the graph, it is seen that maximum 4047 people travel in a single day by road transport. However, maximum 148 people travel by water transport. It is seen that Gabtoli-Babubazar road is a busy road. Every day significant number of people travel Gabtoli-Babubazar. If waterbus service is available with its proper time schedule, people will definitely travel on it.

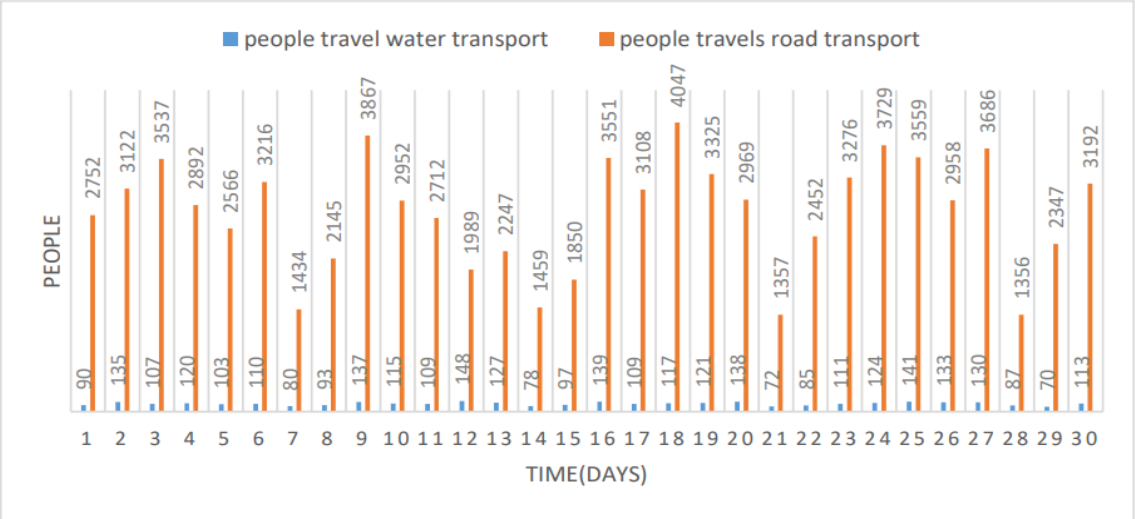


Figure 5.4: Number of Passenger Travel by Both Water and Road Transport

5.5 Road Transport according to Vehicle

By road transport, people mainly use bus for their daily transportation. From Gabtoli to Babubazar direct bus service is available. There are so many different buses like Zanzabil, Brothers, Prottoy, Tanjil which travel most in the Gabtoli to Babubazar road. CNG and Leguna haunt in Bosila area. Figure 5.5 demonstrated the percentages of daily vehicle used by people for their road transportation.

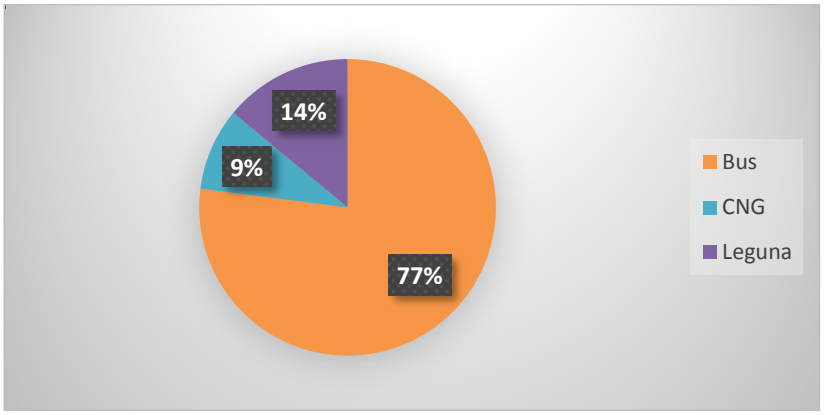


Figure 5.5: Percentage of Daily Transportation in Gabtoli-Babubazar

5.6 Passenger's number according to Fiscal year

BIWTC give 5 fiscal year's passenger number, which is from 2015 to 2020. From the Figure

it is seen that passenger number were very high in the initial stage, which is fiscal year 2015-16. However, around fifty thousand passenger number have decreased in the fiscal year of 2016-17. However, in the next fiscal year (2017-18) passenger's number have increased around fifteen thousand. In 2018-20 it was really in rouge state. Passenger number have been decreased day by day.

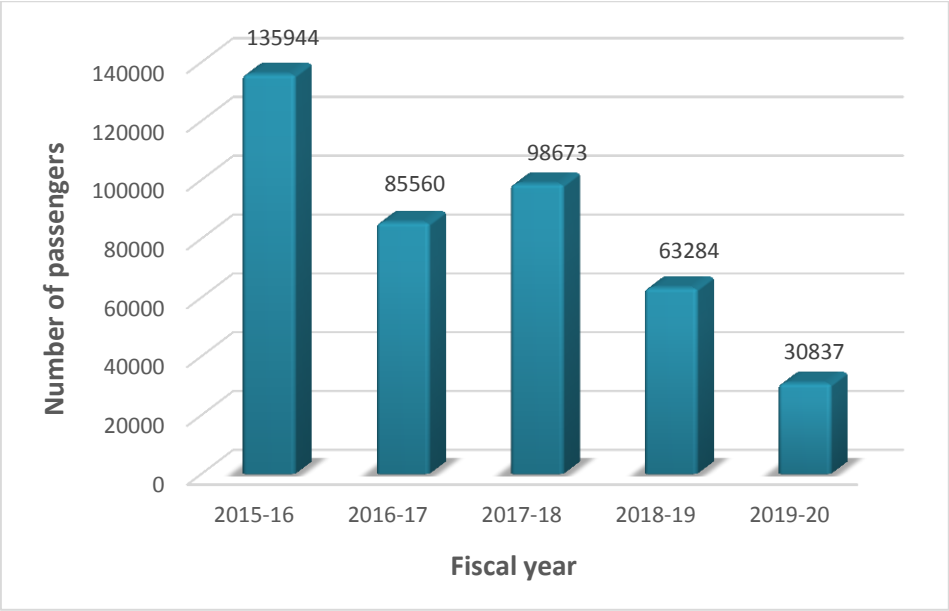


Figure 5.6: Annual Passenger Number of Waterbus

5.7 Profit and Loss of water transport

Figure 5.7 shows the profit and loss of circular water transport Gabtoli to Babubazar ghat. In 2015-16 from waterbus service, profit was around One Crore Seven lac. Investment was high that's why in first year profit didn't satisfy the service. But in 2016-17 and 2017-18 fiscal years' profit increased than the previous one. Passenger number were high in those years and waterbus travelled so many trips per day. But in last two fiscal years (2018-19) & (2019-20) the scenario was different.

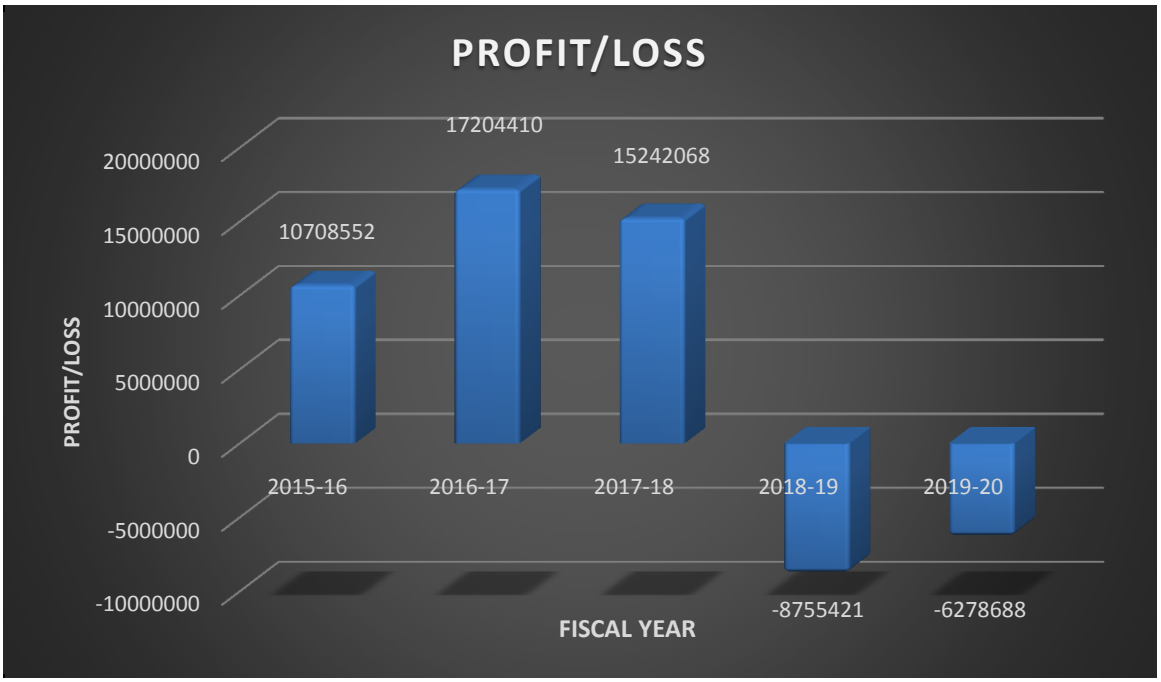


Figure 5.7: Profit and Loss of Waterbus Service According to Fiscal Year

5.8 Preference of waterbus

5.8.1 Gabtoli Area

Figure 5.8 illustrate that respondent perception about the existing water transport on Gabtoli area. From the graph 5.8, it is seen that 65% people prefer waterbus as their major transport. 21% people think water transport may be a successful transport system on this route. 8% people don't think that water transport come true as a successful transport system. 6% people is preferring water not now but in near future.

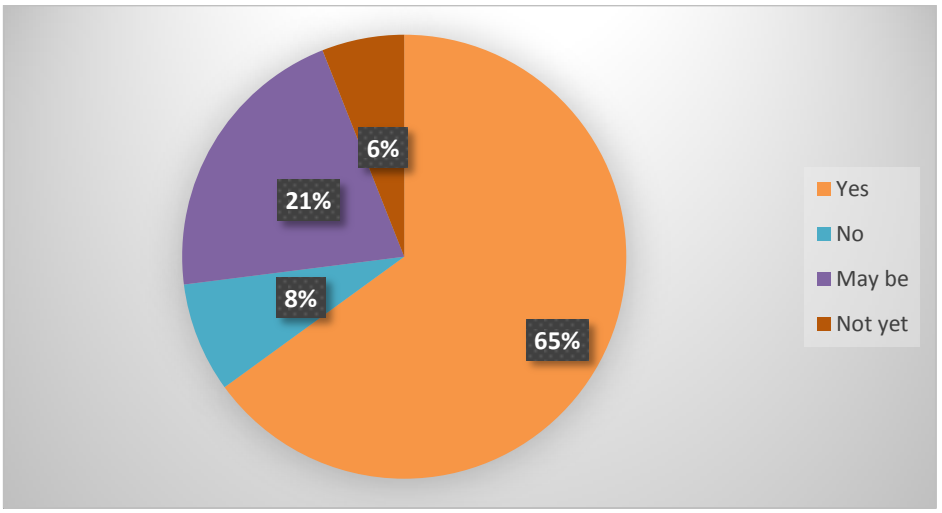


Figure 5.8 Respondent Perception about Water Transport in Gabtoli

5.8.2 Kholamora Area

Figure 5.9 illustrate that people's preference about the existing water transport on Kholamora area. It is a densely populated area. It situated in Keraniganj Upazila western union of Dhaka city. From the graph 5.9, it is seen that 60% people prefer waterbus as their major transport. 25% people think water transport may be a successful transport system on this route. 7% people don't think that water transport come true as a successful transport system. 8% people is preferring water not now but in near future.

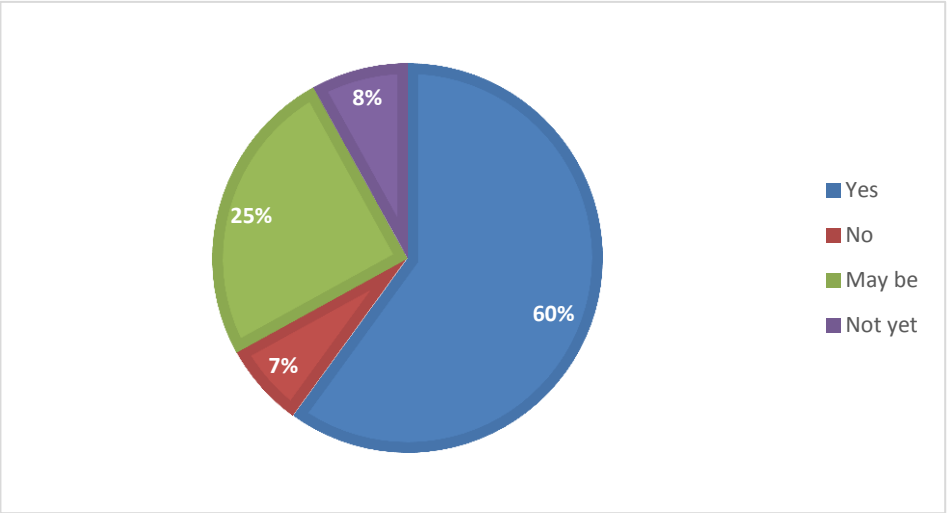


Figure 5.9 Respondent Perception about Water Transport in Kholamora

5.8.3 Showari Area

Figure 5.10 illustrate that people's preference about the existing water transport on Showari Ghat area. It is a densely populated area. It situated in Lalbag Thana of Dhaka city. From the graph 5.10, it is seen that 60% people prefer waterbus as their major transport. 25% people think water transport may be a successful transport system on this route. 7% people don't think that water transport come true as a successful transport system. 8% people is preferring water not now but in near future.

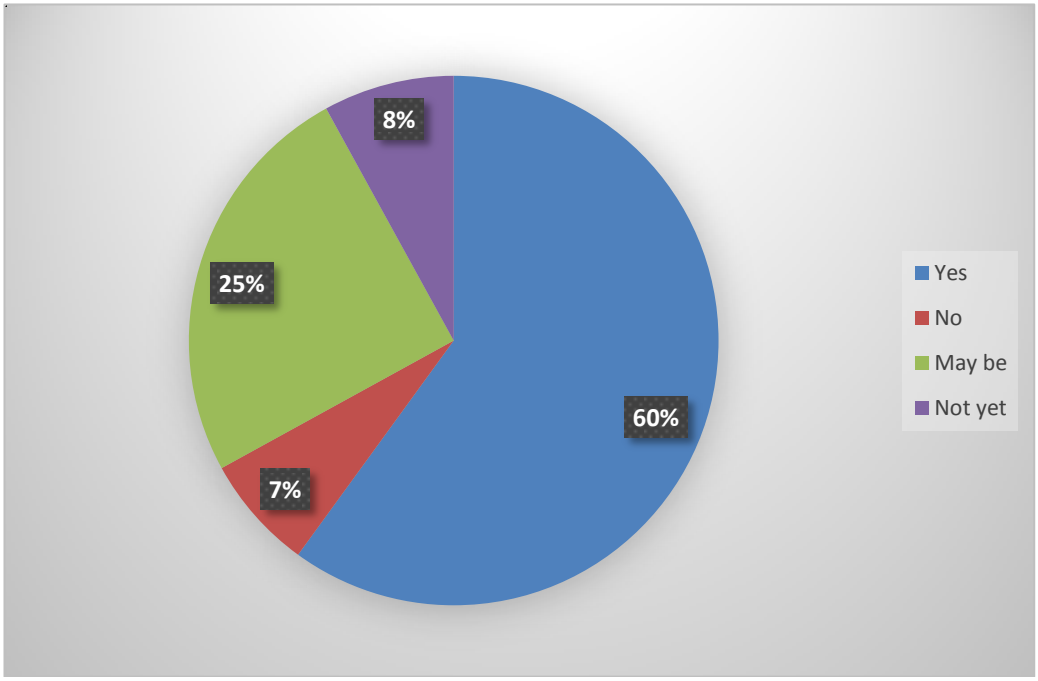


Figure 5.10 Respondent Perception about Water Transport in Showari Ghat

5.8.4 Babubazar Area

Figure 5.11 illustrate that people's preference about the existing water transport on Bbubazar area. It is a densely populated area. From the graph 5.8, it is seen that 60% people prefer water bus as their major transport. 30% people think water transport may be a successful transport system on this route. 7% people don't think that water transport come true as a successful transport system. 3% people is preferring water not now but in near future.

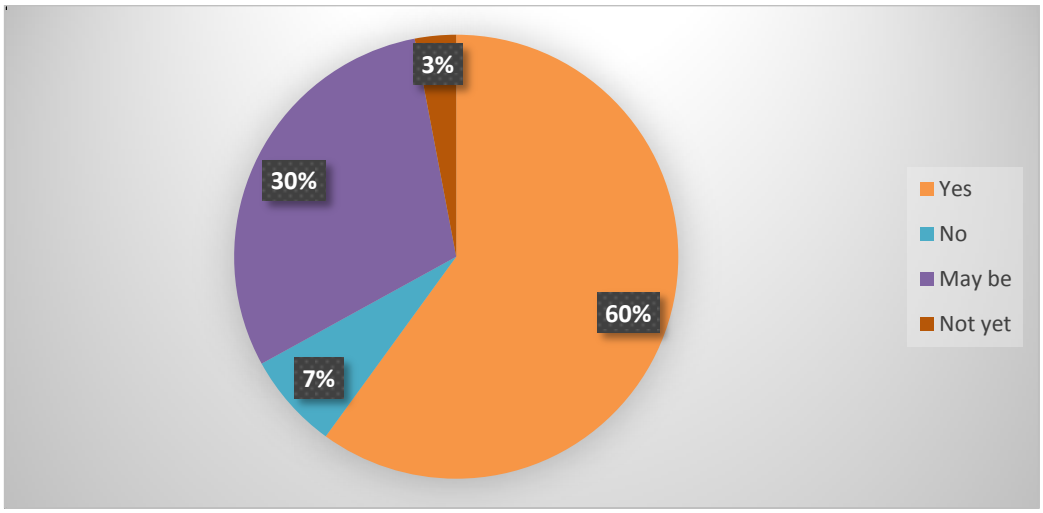


Figure 5.11 Respondent Perception about Water Transport in Babubazar Ghat

5.9 Overall Performance of road transport

5.9.1 Gabtoli Area

Figure 5.12 explain that People's satisfaction level on road transport service on the basis of water transport. Road transport service is counted only for Gabtoli- Babubazar road transport service. Gabtoli is a very busy area. People move here early and late. From the questioning survey, it is seen that only 7% people are satisfied to travel by road transport from Gabtoli. On the other side 45% people are dissatisfied about the road transport because seats are limited, sometimes roads are constructed, traffic jam and journeys are uncomfortable etc. 43% people are in neutral position. Sometimes they like road transport, sometimes they do not. 5% people don't justify the road transport facility of this route.

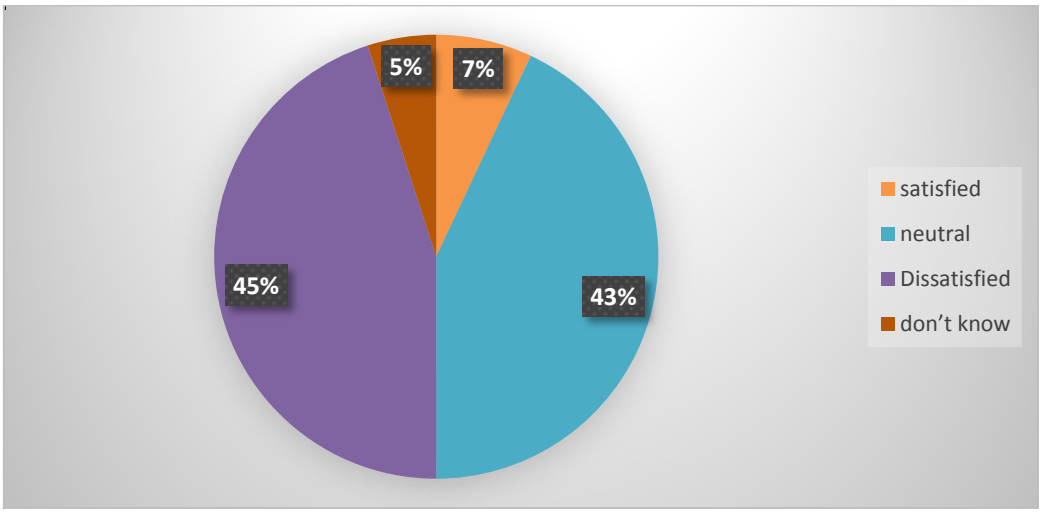


Figure 5.12 Overall Performance of Road Transport at Gabtoli

5.9.2 Kholamora Area

Figure 5.13 explain that People's satisfaction level on road transport service based on water transport. Road transport service is counted only for Gabtoli- Babubazar road transport service. Kholamora is also a very busy area. People move here early and late. From the questioning survey, it is seen that only 10% people are satisfied to travel on road transport from Kholamora. Most of the people of Kholamora area travel in boat, waterbus and mini vessel. That's why 44% people are dissatisfied about the road transport because road condition is so poor, traffic jam and journeys are uncomfortable etc. 40% people are in neutral position. Sometimes they like road transport, sometimes they don't. 6% people don't justify the road transport facility of this route.

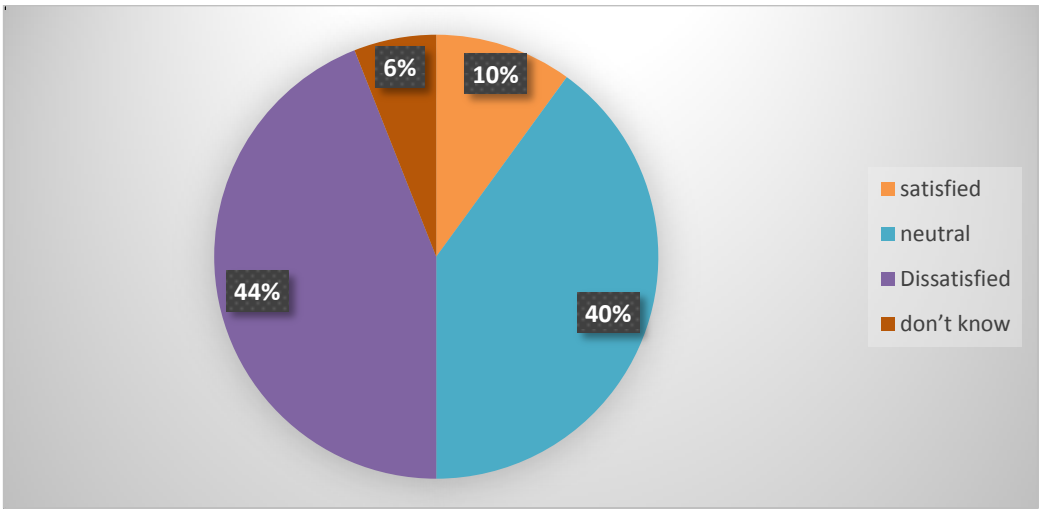


Figure 5.13 Overall Performance of Road Transport at Kholamora

5.9.3 Showari Area

Figure 5.14 explain that People's satisfaction level on road transport service on the basis of water transport. Road transport service is counted only for Gabtoli- Babubazar road transport service. Showari Ghat is also a very busy area. People move here early and late. From the questioning survey, it is seen that only 14% people are satisfied to travel on road transport from Showari Ghat. Most of the people of Showari ghat area travel in boat, waterbus, and mini vessel. So many heavy metals, belongings, products are loading and unloading in Showari Ghat. It is a stop where carriers can be loaded and unloaded both in road and water transport. So road condition remains poor all the time because of heavy traffic. That's why 38% people are dissatisfied about the road transport because road condition is so poor, traffic jam and journeys are uncomfortable etc. 42% people are in neutral position. Sometimes they like road transport, sometimes they do not. 6% people don't justify the road transport facility of this route.

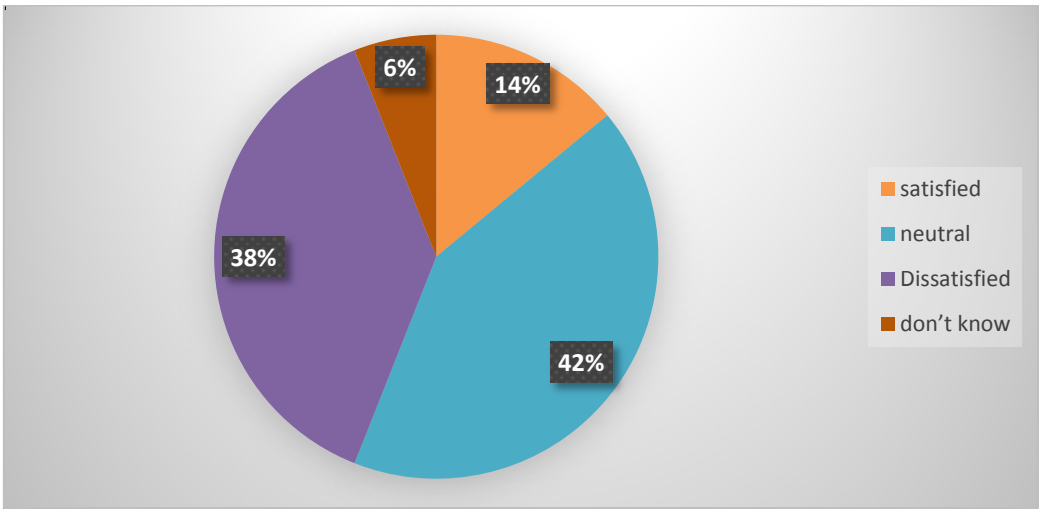


Figure 5.14 Overall Performance of Road Transport at Showari Ghat

5.9.4 Babubazar Area

Figure 5.15 explain that People's satisfaction level on road transport service based on water transport. Road transport service is counted only for Gabtoli- Babubazar road transport service. People move here early and late. From the questioning survey, it is seen that only 10% people are satisfied to travel on road transport from Babubazar. Therefore, road condition remains poor all the time because of heavy traffic. That's why 46% people are dissatisfied about the road transport because road condition is so poor, traffic jam and journeys are uncomfortable etc. 42% people are in neutral position. Sometimes they like road transport and sometimes they do not. 2% people don't justify the road transport facility of this route.

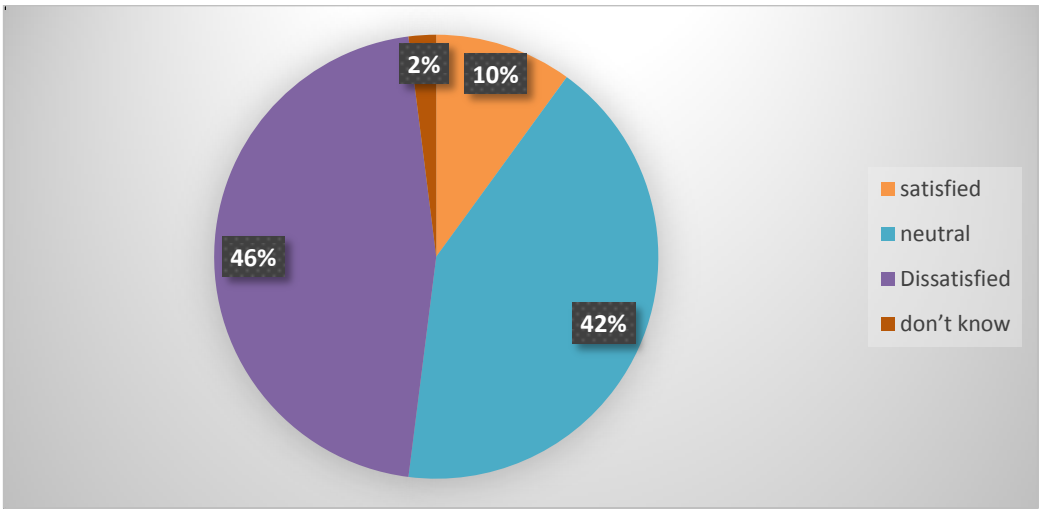


Figure 5.15 Overall Performance of Road Transport at Babubazar

5.10 Reason why people travel by waterbus

5.10.1 Gabtoli Ghat

Figure 5.16 illustrate that the specific reason why people travel on waterbus from Gabtoli Ghat. From the figure 5.16 it is seen that 45% people travel in waterbus because they can save time in travelling. 25% people travel in waterbus because they want their comfort in travelling. 15% people travel in waterbus because Ghat is situated near their residence. They can easily reach the Ghat at the scheduled time. Only 15% people travel in waterbus for cost saving than the road transport.

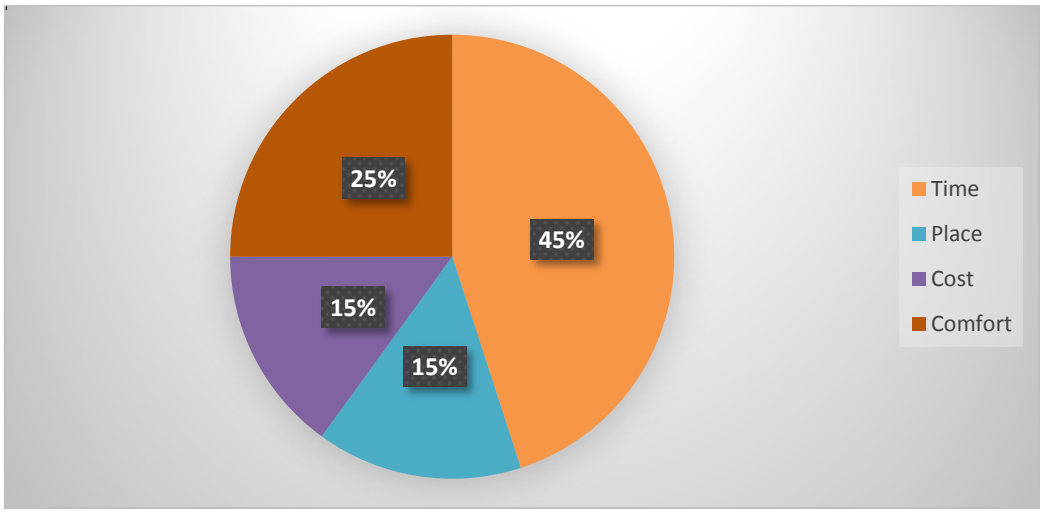


Figure 5.16 Percentage of Reasons for Travelling by Waterbus in Gabtoli Ghat

5.10.2 Kholamora Ghat

Figure 5.17 illustrate that the specific reason why people travel on waterbus from Kholamora Ghat. From the figure 5.17 it is seen that 42% people travel in waterbus because they can save time in travelling. 24% people travel in waterbus because they want their comfort in travelling. 23% people travel in waterbus because Ghat is situated near their residence. They can easily reach the Ghat at the scheduled time. Only 11% people travel in waterbus for cost saving than the road transport.

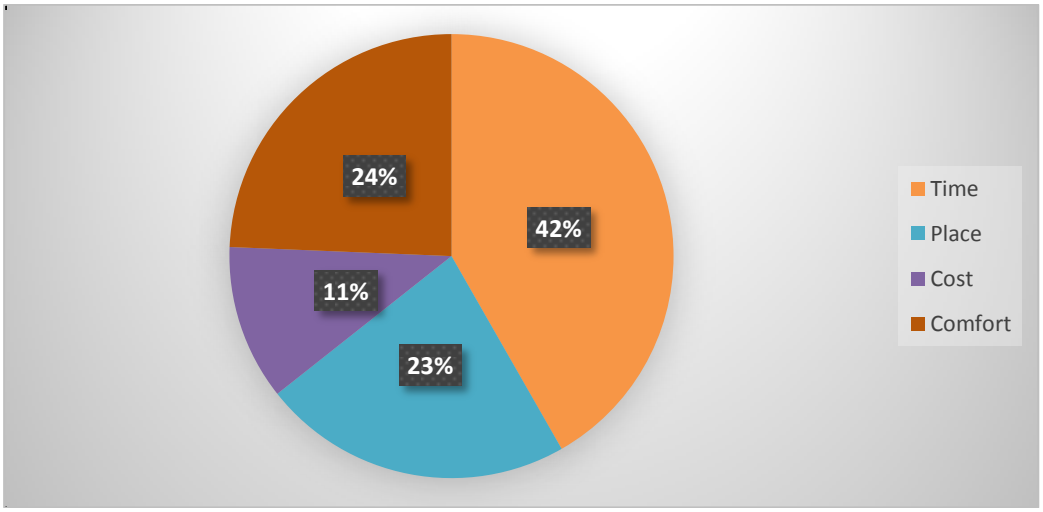


Figure 5.17 Percentage of Reasons for Travelling by Waterbus in Kholamora Ghat

5.10.3 Showari Ghat

Figure 5.18 illustrate that the specific reason why people travel on waterbus from Showari Ghat. From the figure 5.18 it is seen that 45% people travel in waterbus because they can save time in travelling. 25% people travel in waterbus because they want their comfort in travelling. 15% people travel in waterbus because ghat is situated near their residence. They can easily reach the ghat at the scheduled time. Only 15% people travel in waterbus for cost saving than the road transport.

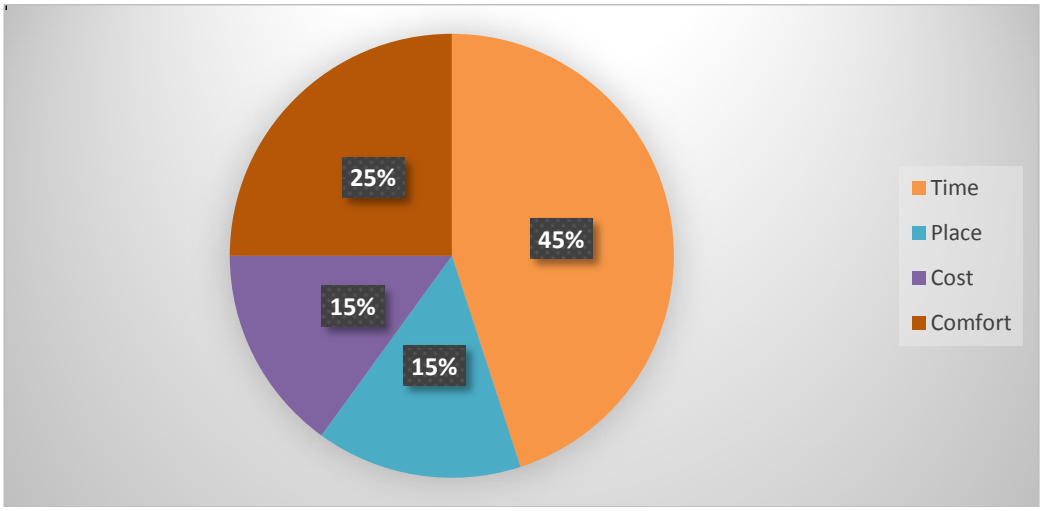


Figure 5.18 Percentage of Reasons for Travelling by Waterbus in Showari Ghat

5.10.4 Babubazar Ghat

Figure 5.19 illustrate that the specific reason why people travel on waterbus from Babubazar Ghat. From the figure 5.19 it is seen that 42% people travel in waterbus because they can save time in travelling. 30% people travel in waterbus because they want their comfort in travelling. 22% people travel in waterbus because ghat is situated near their residence. They can easily reach the ghat at the scheduled time. Only 6% people travel in waterbus for cost saving than the road transport.

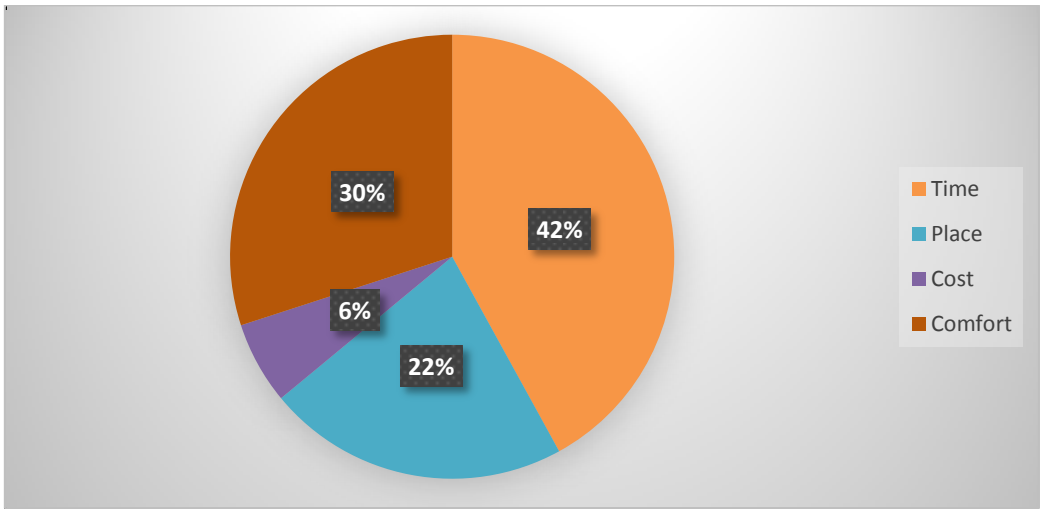


Figure 5.19 Percentage of Reasons for Travelling by Waterbus in Babubazar Ghat

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5.11 Analysis of Physical Condition of Landing Station

5.11.1 Ghat with Landing station

Gabtoli Ghat

Figure 5.20 shows the Gabtoli Ghat, Figure 5.22 shows the landing station of this ghat and figure 5.21 shows the access path between ghat and the landing station. The path is risky for people to travel. Sometimes people injured for crossing the path. The ghat has a sitting area where people are waiting and taking rest. The ghat connects with main road, which is shown in figure 5.23.



Figure 5.20 Gabtoli Ghat



Figure 5.21 Gabtoli Landing Station with Ghat



Figure 5.22 Gabtoli Landing Station



Direction shows the connecting paths

Figure 5.23 Subsidiary Road Connecting with Gabtoli Ghat

Kholamora Ghat

Figure 5.24 shows the Kholamora ghat with a strong landing station. In figure 5.25 shows the landing station of Kholamora ghat where so many vessels are parked. That creates some problems sometimes for waterbuses. Figure 5.26 shows the link road from landing station.

The subsidiary road in front of the ghat is poor. In peak hour, 50-60 people travel in waterbus every day.



Figure 5.24 Kholamora Ghat



Figure 5.25 Kholamora Landing Station



Figure 5.26 Kholamora Ghat with Link Road

Showari Ghat

Figure 5.27 shows the Landing station of Showari ghat. Figure 5.28 shows the link road, which connects the ghat and landing station. It is also a very busy ghat with much vessels, which are always busy loading and unloading things. Ghat is directly connected with main road. So there is no safety for people in front of ghat. It is a densely populated business area so in peak hour 40-50 people travel on water bus per trip. But there are also some mini vessels which is used foe passengers travelling.



Figure 5.27 Showari Ghat



Figure 5.28 Showari Ghat with Link Road



5.29 Showari Ghat Landing station



5.30 Showari Ghat Landing station

Babubazar Ghat

Figure 5.31 shows the Babubazar waterbus landing station. But the access route of landing station is poor. There are lots of garbage behind the landing station. The condition of landing station is nor also good. Ghat is directly connected with main road (figure 5.32). So there no safety for people in front of ghat.



Figure 5.31 Babubazar (Badamtoli) Ghat



Figure 5.32 Babubazar Ghat with Link to Road

5.11.2 Ghat without Landing

Station Bosila



Figure 5.33 Bosila Ghat without Landing Station

Kamrangirchar Ghat



Figure 5.34 Jhauchor-Kamrangirchar Ghat



Figure 5.35 Jhauchor-Kamrangirchar Ghat without Landing Station



Figure 5.36 Jhauchor-Kamrangirchar Ghat Link Road

Madrasa Ghat



Figure 5.37 Madrasa Ghat without Landing Station

Madbar Bazar Ghat



Figure 5.38 Madbar Bazar Ghat without Landing Station



Figure 5.39 Madbar Bazar Ghat with Link to Main Road

5.12 Analysis the condition of Waterbus



Figure 5.40 Waterbus Front View

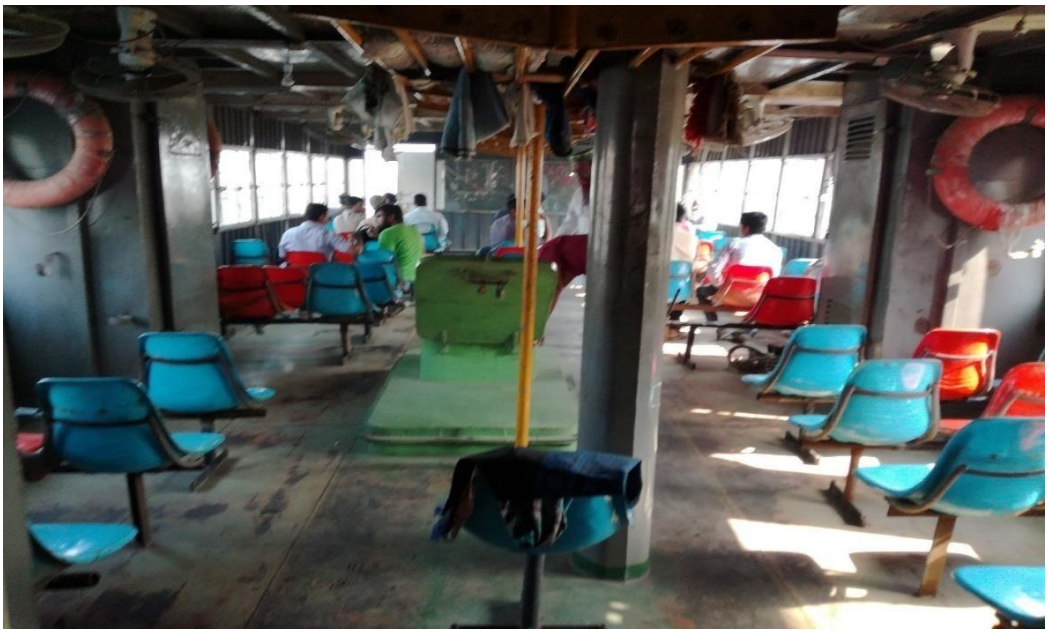


Figure 5.41 Inside View of Water Bus



Figure 5.42 People are Eagerly Waiting for Waterbus



Figure 5.43 Survey or Conducting the Survey



Figure 5.44 Inside view of Waterbus which Seat Capacity is 46.

5.13 Analysis demand of people in Ghat without Landing Station

From Table 5.1 it is seen that significant number of people travel from each Ghat in peak hour(8 am-10 am). The data was collected from every minute passenger count approximately. Passengers travel from here to the nearest Ghat on Pontoon and Shallow boat. These transport vehicles are non-authorized.

Table 5.1 Passenger Number in per Ghat (1 Day)

Name of the Ghat	Passenger Number (8 am- 10 am)
Bosila	369
Kamrangirchar	744
Madrasa	153
Madbarbazar	829

5.14 Existing Routes and Services

Table 5.2 lists the existing waterbus route and the cost of ticket of waterbus.

Table 5.2 Existing Routes with Their Ticket Price

Existing routes	Existing Cost	Existing services
Gabtoli to BabuBazar Ghat	40	Direct service
Gabtoli to Kholamora Ghat	30	Local service
Gabtoli to Showari Ghat	35	Local service
Kholamora to Showari Ghat	20	Local service
Kholamora to BabuBazar Ghat	25	Local service
Showari to BabuBazar	15	Local service

Table 5.3 lists the existing route and the cost of the ticket by road.

Table 5.3 Existing Routes with Their Ticket Price

Existing routes	Existing Cost	Existing services
Gabtoli to BabuBazar Ghat	60	Direct service
Gabtoli to Kholamora Ghat	40	Local service
Gabtoli to Showari Ghat	50	Local service
Kholamora to Showari Ghat	30	Local service
Kholamora to BabuBazar Ghat	35	Local service
Showari to BabuBazar	20	Local service

5.15 Accident on Road Transport

From Table 5.1 it is seen that in road transport accident occurred 53 and casualty of these accident number 60. These data was recorded in 2009-2011 on Gabtoli-Babubazar road. But from 2012 to 2015 accident recorded as 188 and casualty 292. From these data, it is seen that accident number was increased as tripled. Casualty increased as fourfold over 4 years. This is indicate that accident in road transport is increasing day by day. These data were collected with the help of the software MAAP5.

Table 5.4 Accident Number and Casualty of Gabtoli-Babubazar Road

Year	Accident Number	Casualty
2009,2010,2011	53	60
2012,2013,2014,2015	188	292
2016,2017,2018,2019	274	489

5.16 GIS Analysis

In GIS, selected waterway route is shown in figure 5.8. In the figure 5.8 all ghats are shown which has landing station. There are some ghats, which has no landing station already shown in figure 4.6, 4.11, 4.13. Figure 5.43 demonstrated the existing route from Gabtoli to Babubazar in Buriganga River.

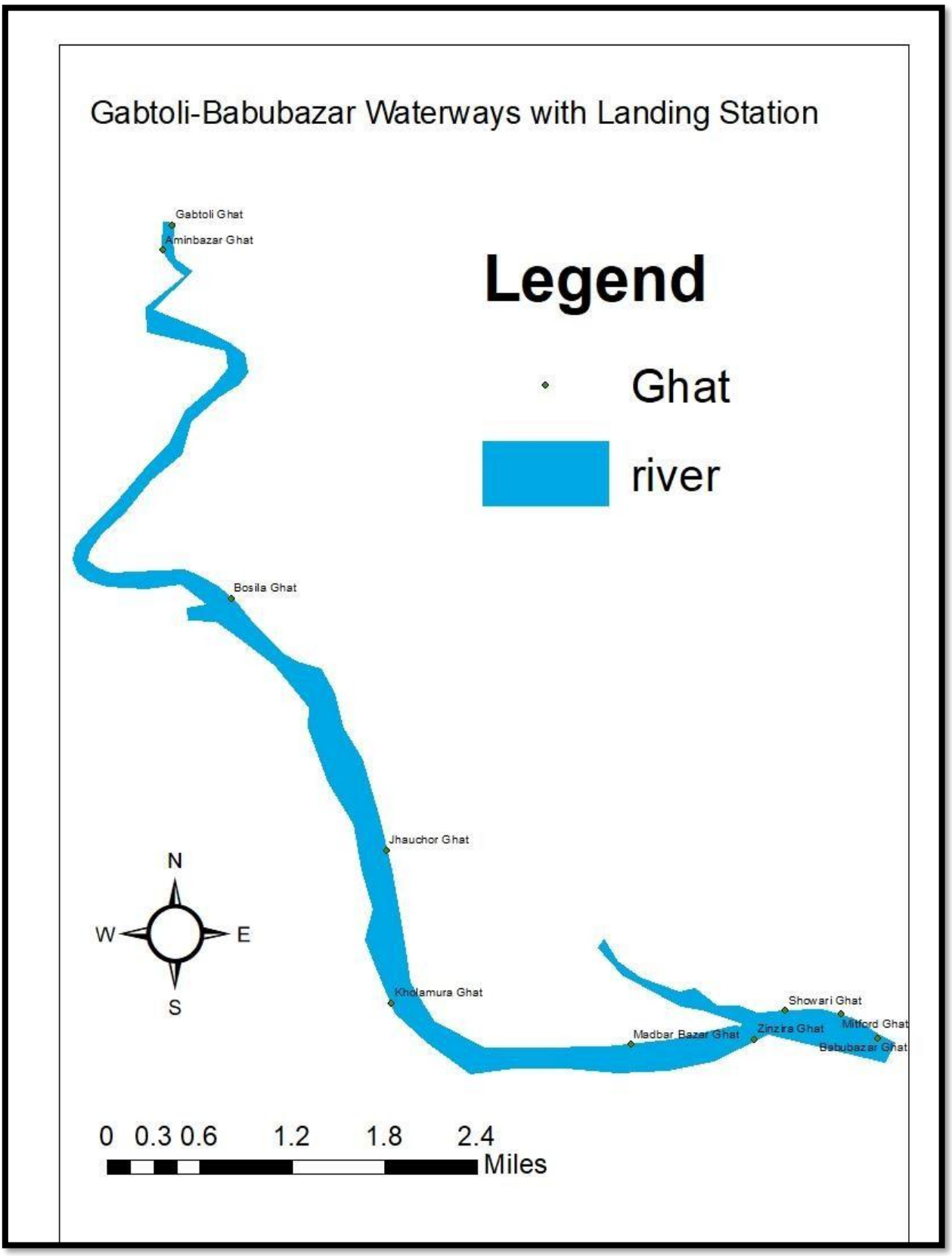


Figure 5.45 Gabtoli to Babubazar Route with Existing Ghats

5.17 Chapter Summary

This chapter represents the analysis of physical survey of the road and water transport route of Gabtoli to Babubazar. The Ghats are shown in GIS software.

Chapter 6

Conclusion and Recommendation

This section attempts at providing some solutions to the existing system of the water transport. Based on the findings of the former chapter, recommendations have been made to establish practicable and efficient water transportation system in the area under concern.

6.1 Findings from Physical and Questionnaire Survey on Gabtoli to Babubazar waterway route

In chapter 1 paragraph, 1.3 indicates two objectives of this research. To achieve objectives, some research questions will be answered after the analysis are as follows:

- What are the condition landing station and user's satisfaction?
  - From the analysis of paragraph 5.11, it is seen that Gabtoli, Kholamora, Showari and Babubazar ghat have proper landing station but there maintenance is very poor. People want to travel in waterbus but they want proper sitting facilities, ticket counter maintenance etc. From paragraph 5.6, the preference of people is around 65% positive to travel in waterbus in that route. But the poor condition of landing station, unfollowing the time schedule, lack of enough waterbus, odor of Buriganga river sometimes play the factors for which people lose interest over waterbus service.
- What are the people's expectation from water transportation?
  - Good access to the Landing Station, Good quality of waterbus with enough life jackets, maintain the time schedule.
- How are the demand of water transport?
  - From figure 5.6 it is seen that passenger's travel data in one year. From paragraph 5.6 the preference of people is around 65% positive to travel in waterbus in that route.
- What kind of effect will produces water transport on road transport system?
  - From figure 5.4 it is seen that around 3000-4000 people travel per day in that route. Day by day Accident and casualty is increasing (Table 5.1).
- Why is it necessary to increase water transport in this route?

- From figure 5.8, figure 5.9, figure 5.10, figure 5.11 it is seen that 65% people from Gabtoli, 59% people from Kholamora, people from Showari, people from Babubazar prefer the positive response about water transport. It is necessary because it will reduce the pressure from road. From figure 5.1 it is also seen that average 120 people travel in waterbus from one transit Gabtoli to Babubazar Ghat.

- Why will people use water transport instead of road transport?
  - To save time and better comfort, In particular section its reduce cost and also ensure better safety than road transport. Figure 5.16, 5.17, 5.18, 5.19 it is seen that people travel from landing station because of better time saving and comfort journey to other landing station.

6.2 Recommendations

This section attempts at providing some solutions to the existing system of the water transport. Based on the findings of the former chapter, recommendations have been made to establish practicable and efficient water transportation system in the area under concern.

6.2.1 Waterway Services and Route

At present, there is no organized water transportation network in the study area, which reduces both the reliability and the efficiency of operation and management of water transport. Therefore, formulation of a well-organized circulation pattern and designation of appropriate routes is of utmost importance to make the waterways play its potential role. After a comprehensive study on the origin destination relationships and the expected volume of traffic on each route, proposals have been made for an organized and systematic water Transport network.

Type 1: Direct Service

These are mostly long distance service carrying high volume of passengers. These will run between the origin and destination where a significant volume of passenger travels every day and will be fast to reach the people to their destinations within minimum possible time. As

they will have to carry a large volume; the vessels should be larger with high passenger capacity.

Type 2: Local Service

These are usually large vehicles with large passenger's capacity and good speed. These will run in both long distance and short routes and connect linearly various landing stations, which generate low volume of passengers. This will reduce the needs for providing direct services between various origins and destinations where it would not have been feasible because of low passenger's volume. This type of services will also enable some sorts of vertical movement through water, where road networks are least developed and also with in Dhaka City where roads are so much congested.

Type 3: Connector Service

These are small vehicles with low passenger capacity, preferably slower, which will act as the connector between small landing station and major landing station. The principal purpose of these services will be vertical movement between neighboring locations.

Table 6.1 Proposed Routes and Proposed Services

Proposed route	Proposed services	Justification
Gabtoli to Babubazar	Direct service	Fig 5.8 and 5.11 shows people's preference, Fig 5.22 & 5.29 shows the condition of Landing Station.
Gabtoli-Khamrangirchar-Bosila-Kholamora-Madrasa-Madbarbazar-Showari-Babubazar	Direct and Local service	Table 5.1, Fig 5.13,5.14,5.15 shows overall performance of water transport, demand of passengers, Fig 5.16 shows time saving & comfort journey
Khamrangichar-Bosila-Kholamora-Madrasa-Madbarbazar-Showari-Babubazar	Direct and Local service	Table 5.1, Fig 5.13,5.14,5.15 shows overall performance of water transport, demand of passengers, Fig 5.17 & 5.18, 5.19 shows time saving & comfort journey
Bosila- Kholamora-Madrasa-Madbarbazar-Showari-Babubazar	Direct and Local service	Table 5.1, Fig 5.13,5.14,5.15 shows overall performance of water transport, demand of passengers, Fig 5.17 & 5.18, 5.19 shows time saving & comfort journey
Kholamora-Madrasa-Madbarbazar-Showari-Babubazar	Direct and Local service	Table 5.1, Fig 5.13,5.14,5.15 shows overall performance of water transport, demand of passengers, Fig 5.17 & 5.18, 5.19 shows time saving & comfort journey
Madrasa-Madbarbazar-Showari-Babubazar	Direct and Local service	Table 5.1, Fig 5.13,5.14,5.15 shows overall performance of water transport, demand of passengers, Fig 5.18, 5.19 shows time saving & comfort journey
Madbarbazar-Showari-Babubazar	Direct and Local service	Table 5.1, Fig 5.13,5.14,5.15 shows overall performance of water transport, demand of passengers, Fig 5.19 shows time saving & comfort journey
Showari-Babubazar	Local service	Fig 5.11 shows people's preference, Fig 5.29 & 5.27 shows the good condition of landing station, Fig 5.18, 5.19 shows time saving & comfort journey

6.3 Physical Facilities

There is no provision for parking facilities in almost all of the landing stations. Where the facilities exist it does not fulfill the required demand. So the facilities should be provided according to the demand. As most of the trips are made principally by the lower income group of people, the demand for parking of private vehicle is very low. So emphasis should be given on the parking facilities at the best possible locations for the Para-transport services and also for the rickshaw and other public vehicles. The nearby open and unused spaces may be utilized for providing the facilities.

An efficient water transport system should provide proper and effective linkage to the existing transport system. All the possible road transport options should be available at the landing stations from bus service to subway. The possible linkage should be provided between the landing stations and nearby public transport facilities. Para transport facilities should also be provided to connect the water way users to the nearest public transport facilities. This will also help to reduce the demand for the rickshaw and other private small vehicles. To determine the best possible linkages, vigorous studies should be conducted for assessing the actual demand of the required linkages. In order to cater the comfort and safety of the passengers while traveling by waterway and to ensure swift, safe and unhindered turning of vessels, modern landing facilities should be provided.

6.3.1 Additional physical facilities

Additional physical facilities such as ticket counter, post office, police box, passenger waiting room, prayer room and small shops should be provided at the landing station where required. The facilities will enhance the smooth, efficient and user oriented functioning of the Ghats. The provided facilities may vary for different landing stations and depend on the volume accumulated in each Ghats. The facilities should be designed in the way that they do not hamper the circulation system, and at the same time be the focus of interest for the waterway users and for other peoples. Some of the facilities (like shops) may be good source of income to the authority.

River channels frequently migrate because of fluctuation of water level, heavy erosion and accretion. To solve this problem following measures should be taken:

- Maintaining the navigability of water route by dredging;

- Without carrying out dredging, shifting of Ghat according to the availability of navigable depth and construction of diverse roads;
- Combination of both options above
- To prevent the erosion of Bosila landing station is necessary. For this break field located almost inside the river should be removed and dredging is necessary.

6.4 Future Work

- The framework for this research can be applied on other waterway routes to investigate water transport viability of those routes.
- Model can be calibrated to analysis passenger shift to water transport by various software.
- Financial analysis, cost benefit analysis, traffic impact analysis etc. can be conducted.
- This research framework can be applied on to improved water transport facilities in other routes such as Babubazar to Sadarghat, Sadarghat to Hazaribagh Ghat, and Gabtoli to Narayanganj with direct and local service.

6.5 Limitations

This research has some limitations.

- Accident data was collected from secondary sources.
- Number of annual passengers of waterbus and the financial profit and loss data of waterbus service was collected from secondary sources.
- Updated accident data was not available.
- Geographic co-ordinate data of accident location is unavailable in.
- Unavailability of enough research paper.
- Environmental analysis, Financial analysis, Social benefit cannot be explained much.

6.6 Conclusion

The existing road transport system cannot meet the demand for trip making. Poor traffic management and inadequate condition, along with the absence of integration between different transportation modes have made the situation worse. Under the circumstance, the

conducted study has been formulated with a view to find an alternative solution of the transportation problems of Dhaka city. Realizing the fact that Buriganga River, lying to southwest of Dhaka city could have potentials to be developed as an effective transport option and thereby induce growth on the western bank of the river Buriganga. So finally, it can be said that Dhaka city is one of the most populated cities in the world and day by day, its population is increasing in an alarming rate. Therefore, it is very important for Dhaka city to improve its circular water transport system to prevent the traffic jam and provide good transport system for the increasing people. If the problems of the circular water transport system of Dhaka, city can be solved then it will be a very effective transport system for both people and different goods.

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Appendix

Appendix 1: Questionnaire Survey Form

SURVEY QUESTIONS

1) Name:

2) Age: 5-10 11-15 16-20 21-25 26-30 31-35 36-40 41-45 46-50 51-55 56-60 61-65 65+

3) Gender: Male Female

4) Start point:

5) Destination:

6) Trip Purpose:

7) Income: 0-5000 5001-10000 10001-15000 15001-20000 20001-25000 25001-30000 30001-40000 40001-45000 45001-50000 50001-55000 55001 above

8) Occupation:

6) How many times do you haunt in this area?

a) 1-2 b) 3-4 c) 4+ d) Many

7) What do you think that water transport in this area is effective?

a) yes, b) no c) may be d) not yet

8) The condition of this Ghat is (particular point)….

a) good b) fair c) poor d) no ghat

9) Is there any road which connects the ghat with the main road?

a) yes b) no

10) The condition of the subsidiary roads….

a) good b) fair c) poor d) no road

11) In the last 12 months, how satisfied have you been with overall performance on road transit in this area?

a) satisfied b) neutral c) dissatisfied d) don't know

12) How many people haunt in that particular area per minute?

a) 15+ b) 25+ c) 35+ d) many

13) How often do you use public transportation?

a) Daily b) several times a week c) weekly d) several times a month

14) What do you think about public transportation in this region (Amin Bazar to Puran Dhaka)? check all that apply.

a) fares too expensive b) safety c) too many transfers d) commute takes too long

15) Do you use water taxi often?

a) yes b) no

if yes a) time b) place c) cost d) comfort (safety) e) other

16) What you think why taxi in this route was not benefited enough?

17) Every segment river route condition ….

18) What is your perception from this survey?