

OBSERVATION OF WASTE COLLECTION ROUTE IN SHUKRABAD AREA, DHAKA CITY

Submitted By

A.H.M.M. Toufiquir Noor Fahim

ID: 201-47-1132

Dhruba Saha Jorj

ID: 201-47-1133

This Thesis submitted to the ‘Department Of Civil Engineering,
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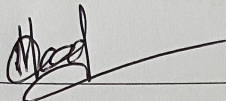


**DEPARTMENT OF CIVIL ENGINEERING
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The thesis entitled “OBSERVATION OF WASTE COLLECTION ROUTE IN DHAKA CITY” submitted by A.H.M.M. Toufique Noor Fahim (ID: 201-47-1132) Dhruba Saha Jorj (ID:201-47-1133) , has been accepted as satisfactory in partial fulfillment of the requirements for the degree of Bachelor of Science in Civil Engineering on February 2024.

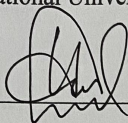
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(Supervisor)

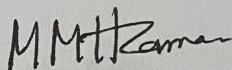
Assistant Professor
Department of Civil Engineering
Daffodil International University



Dr. Mohammad Hannan Mahmud Khan

(Chairman)

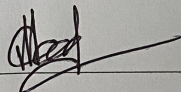
Assistant Professor & Head
Department of Civil Engineering
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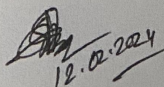
Associate Professor
Department of Civil Engineering
Daffodil International University



Md. Masud Alom

(Internal Member)

Assistant Professor
Department of Civil Engineering
Daffodil International University


12.02.2024

Md. Rasel Chowdhury

(External Member)

Deputy Director
Padma Associates and Engineers Limited

DECLARATION

This is to certify that this Project and Thesis entitled “**OBSERVATION OF WASTE COLLECTION ROUTE IN DHAKA CITY**” is done by the following student under my direct supervision and this work has been carried out by them in the laboratories of the Department of Civil engineering under the Faculty of Engineering of Daffodil International University in partial fulfillment of the requirements for the degree of Bachelor of Science in Civil Engineering on September 2023.

Fahim
.....

Name: A.H.M.M. Toufiquor Noor Fahim

ID: 201-47-1132

Dhruba Saha
.....

Name: Dhruba Saha Jorj

ID: 201-47-1133

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DEDICAION

**Dedicated to
OUR PARENTS**

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ABSTRACT

Waste generation is an indispensable part of human existence. The proportion of the waste generation in Bangladesh have been rising with population increasing. Waste management has become an important environmental challenge faced by municipalities. The collection and disposal of waste have grown more difficult as urbanization has increased. The main purpose of the study was to built the easiest and time saving waste collection route at Shukrabad area under Dhaka south city Corporation. We visited the area, collected some pictures and inspected the area with mentioned characteristics. We made some questions and collected the answer from the people of this area. We collected information from 10 van drivers transporting waste from different locations and 2 supervisors working at secondary stations, including how they routed their waste collection, reviewed their work and listened to it. After completing the whole process and the feedback of the residents we proposed a route, which will be the most suitable for this area. We could discuss some potential features that might contribute in future management of the wastes for this particular area.

Keywords

Solid Waste, Collection, Transport, Transfer Stations, Recycling.

CHAPTER 1

INTRODUCTION

1.1 Background

According to the September 2021 update, Bangladesh has a number of waste management issues, which have a significant negative impact on the environment, public health, and the country's economy. Major problems include things like excessive or inadequate waste collection, inappropriate landfills, waste segregation, plastic waste, public awareness and behavior, the effects of climate change, etc. Waste collection is insufficient. Many areas of Bangladesh do not have adequate waste collection or disposal systems, which causes improper waste disposal in streets, public areas, and water bodies or canal drains. Inadequate waste collection causes waste to accumulate more and more, which increases the risk of illness, death, and environmental pollution. Waste Segregation Done Right Effective waste management and recycling depend on the separation of waste. In Bangladesh, there is a significant lack of knowledge regarding waste segregation. Recycling becomes difficult as a result. In Bangladesh, plastic waste is a major problem because of the excessive use of plastic and the poor management of plastic waste, which causes litter to become trapped and have a negative impact on human health. Because there aren't enough effective waste management systems or liners, Bangladeshi landfills are frequently poorly run. Methane, a powerful greenhouse gas that can degrade the environment, society, and pose health risks, may be released as a result of this pollution. The truth is that people from all walks of life are the main cause of the low level of public awareness about environmental protection and waste management in many areas of Bangladesh. Encourage behavioral modification to enhance waste management and advance ethical waste disposal methods in order to achieve this. Climate Change and Its Importance Introduction Bangladesh is vulnerable to many aspects of climate change, including ocean solidification, sea-level rise, and extreme weather events. Waste management practices have the potential to exacerbate these issues by contributing to socio-environmental pollution and putting additional strain on communities. By way of practice, these need to be disposed of responsibly.

To solve these problems, Bangladesh has to adopt a comprehensive program in waste management. These include promoting waste collection and disposal, waste segregation and recycling, encouraging public awareness participation, and strengthening policy implementation and enforcement. Public-private sector on their responsibility and international and economic cooperation can also play a very important role in the waste management system in Bangladesh.

Waste production is on the rise globally, which has caused issues with the economy and the ecology. As a result, waste management needs to be evaluated and monitored. There are various challenges involved with garbage management or collection, as well as benefits and drawbacks. Garbage collection is the most expensive of them and has the greatest number of challenges. When compared to developing nations, many municipalities spend more than 70% of their budgets on solid waste management on garbage collection expenses, but many developing nations only spend 60% or less. The entire cost of managing solid waste in towns in developing nations includes the cost of a variety of waste-handling facilities, including transfer stations, landfills, temporary storage facilities, and fixed expenditures. Several of the things it undertakes, such as route optimization, are research projects with a focus on developing nations. One component of resolving the optimization problem in research involves designing a system to facilitate the growth of waste transport, and this aspect is known as route optimization.

1.2. Objective of The Study

The study's objectives are as follows:

1. To observe the quantity of waste in the study area.
2. To find out the possible waste collection route in the selected area.

1.3 Scope of The Study

First we chose the location and gave it some thought. Waste is produced from a variety of places, including homes, workplaces, schools, clinics, and mosques. On disposing of home waste, we worked. Typically, household waste is discharged outside. At a particular time, each day, employees collect all of the waste from the containers. Then he retrieved the vehicle. After that, they keep it in a designated spot. Then the employees of the city corporation load all of the waste into their drum trucks and deposit it in their designated dumping area.

1.4 Limitation

1. Due to time limitations we had to work with small areas.
2. Due to restrictions we could not enter many houses for survey.

1.5 Layout of the Report

The research is divided into five chapters with a brief description of each below:

Chapter 1 (Introduction)

In this chapter, the problem of waste management in Bangladesh is mentioned, the damage and problems caused by it, the disposal of which is very vulnerable to climate change, including extreme weather events. As a result of the increase in waste production worldwide, how will Bangladesh deal with them, how to municipalities solve the challenges has been discussed.

Chapter 2 (Literature Review)

An overview of prior research and background studies related to the use of transfer stations, waste collection, and recycling is presented.

Chapter 3 (Methodology)

This chapter describes the whole project workflow as well as the approaches taken to accomplish the objectives of the study. Discuss the many site selection methods, flow diagrams, route planning, field analysis, and site features.

Chapter 4 (Results and Discussion)

The findings from the analysis are included in this chapter along with the results and discussions.

Chapter 5 (Conclusion and Recommendations)

The primary conclusions and additions suggested by the study's results.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

A literature review is a critical and methodical synthesis and evaluation of previously published research, academic papers, books, and other pertinent materials on a particular subject or research issue. Getting a thorough grasp of the state of the art in the field, entails reading, evaluating, and synthesizing the conclusions, methodology, and main points made in the literature.

2.2 Waste Management

Every morning in Bangladesh, a large group of sweepers sweeps the cities. Apart from the street cleaners employed by the city corporation, they have cleaners to sweep the city areas. 5000 sweepers in Dhaka city are employed in three different groups at different places. The first team cleans the streets with their hand brooms and another team collects garbage from the environment with their hand-drawn carts. The collected garbage is then dumped into some intermediate reservoir, while another team cleans the roadside drains and neatly collects the silt and solid waste and dumps it at nearby dump sites or keeps it in trash cans. Although there are waste bins for collecting organic waste, the storage system is ineffective. For a city of 70 million, Dhaka has only 4000 thousand trash cans, which is less than 10%. The city corporation builds these neighborhoods at different locations along different roads, at the edge of each sector or block.[1]

Waste management plays an important role in our society. It saves our environment from the toxic effects of biodegradable elements present in waste. Wastes are unusable materials or worthless things. Waste is generated from industrial, residential and commercial activities. Waste can be classified based on fabric, such as plastic, glass, wood, paper, metal waste etc. Waste management may be a basic angle of natural cleanliness, it must be consolidated into natural arranging and development.[2]

2.3 Types of Solid Waste

There are three types of solid waste:

- Household wastes,
- Industrial wastes and
- Hazardous wastes.

2.3.1 Household wastes

Household waste is known as domestic or residential waste which is generated by households. As the populace of the world extend, so does the sum of squander create. The result of buildup waste badly affects human health.

2.3.2 Industrial Wastes

Industrial waste is produced by industrial activists. They include rubbish, ashes, demolition and construction waste. Industrial waste can be solid, liquid, or gaseous, and its composition varies depending on the industry and procedures involved. Industrial waste must be managed effectively to have the least possible impact on the environment, public health, and natural resources.

2.3.3 Hazardous wastes

Hazardous waste is a waste with properties that are harmful to human health, plant or animal life. It can be liquid, solid or gases. Types of hazardous waste: Motor oil, automobile batteries, paints, household cleaners etc.

2.4 Impact in Health Waste Management

Healthcare waste is generated as a result of different treatments conducted in hospitals, such as chemotherapy, dialysis, surgery, delivery, gangrenous organ excision, autopsy, biopsy, injections, and so on. As a result, non-hazardous trash (75-95%) and hazardous waste (10-25%) are generated, including sharps, infectious, chemical, pharmaceutical, and radioactive waste, as well as pressurized containers (e.g., inhaler cans). Improper healthcare waste disposal can result in the spread of hepatitis B, Staphylococcus aureus, and Pseudonymous oleaginous.[3]

Healthcare waste management involves the appropriate processing, collection, transportation, treatment, and disposal of waste produced by healthcare institutions. It entails the use of precise protocols and processes to guarantee the safe handling of medical waste, which may contain toxic, contagious, or potentially dangerous elements. The impact of proper healthcare waste management is critical for protecting public health, protecting the environment, and minimizing the risk of infections and other health dangers.[4]

During the pre-intervention period, the hospital lacked an HCWM Committee, a policy, a standard operating procedure, and a proper color-coding system for waste segregation, collection, transportation, and storage, as well as well-trained waste handlers. Following interventions, doctors, nurses, and waste handlers were taught HCWM practices. There were significant gains between the pre-and post-intervention periods.[5]

2.5 Hazardous Waste Management

An important issue that needs immediate attention is the management of hazardous wastes. The primary goal of any hazardous waste management plan is to ensure that waste collection, transportation, treatment, and disposal are safe, efficient, and cost-effective. It should guarantee that the system functions adequately under both current and projected future conditions. A typical hazardous waste management system is composed of components that manage waste collection, transportation, treatment, and disposal.[6]

2.6 Impact in Environment

Human effect on the environment refers to changes in biophysical settings, ecosystems, biodiversity, and natural resources caused by people, either directly or indirectly. Modifying the environment to meet the effects of solid waste on the environment include the release of damaging greenhouse gasses (GHGs), contamination of groundwater, and devastation to the natural ecosystem.

1. Air pollution is one of the most detrimental effects of hazardous waste.
2. Pollution of water.
3. Methane emissions and climate.
4. Wildlife changes, etc.

The waste management industry contributes 4% of all anthropogenic GHG emissions, and landfills are the main human-caused source of methane, accounting for 90% of the waste industry's total GHGS discharge in the US (Thornley, 2002). Methane may be a crucial component of landfill gas (LFG) and, when released into the atmosphere, a potent nursery gas. Mismanagement of hazardous waste may have serious negative impacts on the environment.

2.7 Waste Collection

Waste collection is the movement of solid waste from the place of use and disposal to the point of treatment, or land collection, and it is a step in the waste management process. Environmental preservation is the main justification for Waste collecting.

2.8 Functional Elements of SWM System

To handle solid waste effectively and responsibly, a solid waste management (SWM) system entails several functional elements and components. These are the main components of a typical SWM system:

1. Waste Creation
2. Transfer Stations
3. Waste Transportation
4. collection
5. Recycling
6. Waste-to-Energy (WTE)
7. Disposal
8. Monitoring and Enforcement

These functional components are taken into consideration by an effective and well-integrated SWM system to handle the issues brought on by rising waste volumes and to encourage sustainable waste management techniques.

CHAPTER 3

METHODOLOGY

3.1 Introduction

Waste in Dhanmondi Shukrabad area is generated from various sources like houses, offices, schools, clinics, mosques etc. Workers collect all waste from bins at a specific time during the day. Then he took the van. Then they store it in a selected location. And then the city corporation workers collect all the waste in their drum trucks and they dump the waste directly in their dumping zone. Our concern is to pave the way for proper management of that waste.

This chapter outlines our study area, and selection of different stages of waste collection. Develop a plan for waste management routes.

3.2 Flow Chart

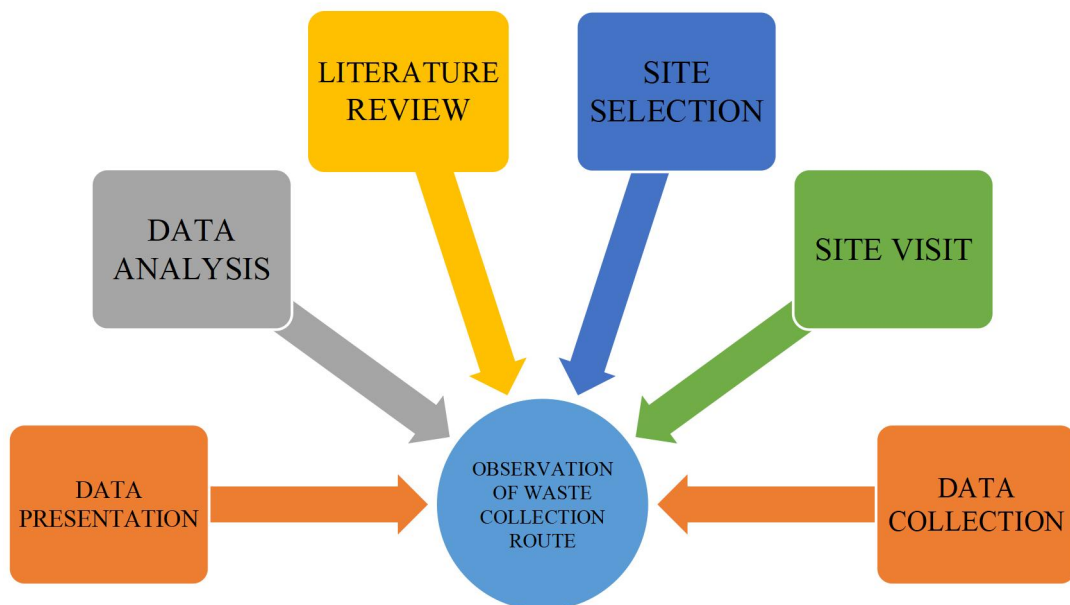


Fig 3.1: Flow chart of working process

3.2.1 Literature Review

The following themes are covered in this chapter's literature reviews: Area Selection, Site Visit, Data Collection, Data Analysis, and Presentation.

3.2.2 Site Selection

In site selection we have selected Shukrabad area. As our time limitations we have worked with small area. Shukrabad is a densely populated area, due to more waste is generated here. Considering all these aspects we have selected Shukrabad site.

3.2.3 Site Visit

We visited the site two weeks ago to facilitate data collection. And tried to learn about the place. Learned about how the local municipality people work and we visited our site.

3.2.4 Data Collection

We collected information from 10 van drivers transporting waste from different locations and 2 supervisors working at secondary stations, including how they routed their waste collection, reviewed their work and listened to it. Following the route plan, we visit each location to perform optimization. We asked from a minimum of 50 people how many times a day they collect waste. Waste is collected throughout the day from 6 am and dumped at the nearest secondary station, at 9 pm the waste is taken from the nearest secondary station by a big waste collecting truck for disposal.

3.2.5 Data Analysis

We collected data through field visits, then organized and summarized the data into verification, followed by coding and interpretation of results through Microsoft Excel program.

3.2.6 Data Presentation

Microsoft Word files were used to display data for research articles, and Microsoft PowerPoint files were used for presentations.

3.3 Density of solid waste

Table 3.1 Density of solid waste

Condition	Density (kg/m ³)
Loose MSW, no processing or compaction	90-150
In compaction truck	355-530
Baled MSW	710-825
MSW in a compacted landfill (without cover)	440-740

3.4 Primary Collection of waste from different location in the study area

Every household has a strategy in place for daily waste van. However, it is not always collected every day, and it has been observed that some households are not collected for 2-3 days. Following home rubbish collection, the waste is dumped in the open. In this picture we can see waste being collected from house to house and taken in a van. It is an important and primary step in waste management.



Fig 3.2: Primary Collection of waste from different location in the study area

3.5 Measurement of waste collecting van

Waste is collected from the region by vans. Waste collection by vans is better as a measure of area roadways. The size of waste collection van vehicles is 2.13m length, 1.22m width, 1.37 m height.



Fig 3.3: Measurement of waste collecting van

3.6 Location of the study area

In this Fig 3.4 we shown the location map of our study area. We selected Shukrabad area, which is situated nearby to the quarter Lake Circus. Shukrabad area is located between Dhanmondi 32 and Tallabagh ($23^{\circ}45'08.8''N$ $90^{\circ}22'40.4''E$). Shukrabad Area Waste Disposal Site is under Dhaka South City Corporation.

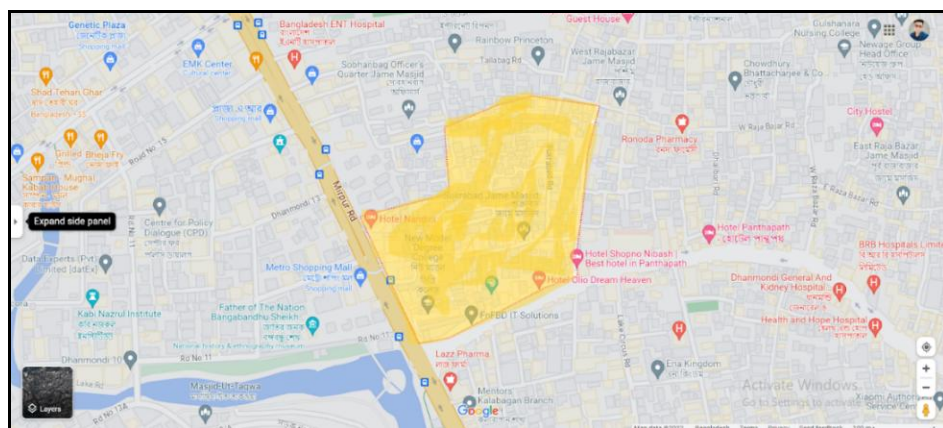


Fig 3.4: Location map of the study area

3.7 Observation of study area

It is a special type of truck that is typically used to collect municipal solid waste and transport it to a solid waste treatment facility such as a landfill, recycling center or transfer station and this is a secondary transfer station or convenient point where waste materials are stored before being sent on for further treatment or disposal. It helps to reduces collection cost by travelling shorter distance.



Fig 3.5: Vehicle which carried waste from secondary station to landfill site

Household waste also known as residential waste. This is disposable materials generated by households. This waste can be comprised of hazardous waste and non-hazardous waste. Non-hazardous waste is such as food scraps, paper, plastic bottles etc. They can be recycled or composted.



Fig 3.6: Collecting household waste

Waste is collected from house to house in Shukrabad area with the help of this types of van. Waste is collected by these vans and stored at the secondary station.



Fig 3.7: Waste Collection Vehicle

3.8 Landfill Disposal site of solid waste

According to this investigation, DCC disposes of solid wastes using unsanitary dumping techniques, endangering both the environment and human health.

According to DCC, the waste in this area Located about 12 kilometres away from Dhaka Gulistan, the Matuail landfill is a 100-acre area that serves as the disposal site for solid waste from areas under Dhaka South City Corporation. Officials claim they only have 40% of the heavy equipment required to treat 2,500 tonnes of Waste every day. Even available equipment is regularly damaged as a result of working on open waste exposed to overflowing leach ate. Apart from the complete lack of recycling facilities, another important issue is a shortage of labour.

3.9 Existing waste collection route

The location of the site that we have selected is a residential area. The population density of this area is high. There are multi storied building in front of this area. We observed that the city corporation workers first went to the back side of the area and after that they came into the front side. They collect the waste from both side of the road. Main vehicle of collecting this waste is van. Because this is enough to cover this area. The roads of this area is narrow.

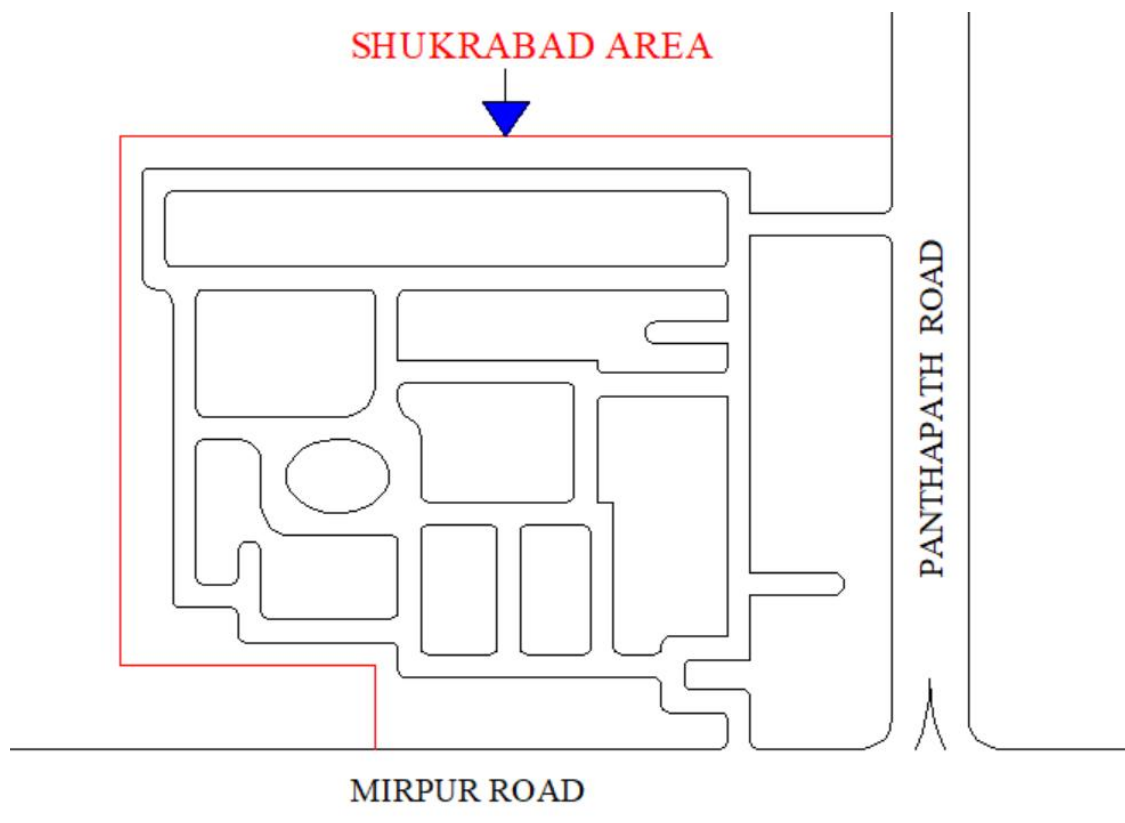


Fig 3.8: Existing waste collection route

3.10 Google map of the study area to transfer station

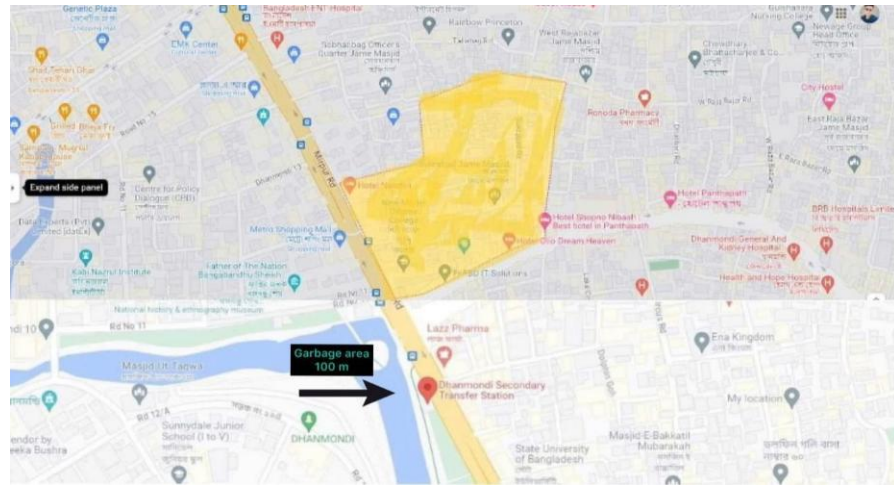


Fig 3.9 : Google map of the study area to transfer station

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Introduction

The importance of outcomes in making a difficult decision cannot be overstated. We acquire a result by merging the data collected via Results, and these generated results aid in the completion of a survey activity.

4.2 Citizens' Opinion of Waste Collection

Solid waste management is one of the world's primary issues, with its creation increasing dramatically every year in lockstep with population expansion. Because of its distinct population and socioeconomic, each country creates a varying quantity of waste. Municipal solid waste management is a major challenge in terms of environmental pollution, exclusivity, and economic sustainability, and it necessitates both comprehensive evaluation and holistic planning.

Residents can find the location of waste containers and file requests, claims and complaints. One of the most effective strategies to reduce waste is recycling wherever possible. Some permanent residents believe that our community should have a proper waste collection system. They believed that delaying the final verdict on the matter would be harmful to our environment and health. But they don't know that the government has already developed a system to clean the city. Cleaners collect the waste and recycle it for a small fee. It is convenient for both parties. Workers are paid for their efforts, while residents are rewarded with a cleaner city.

4.3 Waste Separation

It was found during the survey that no house has a waste segregation system. All waste is deposited in a single barrel or bucket, and waste pickers remove the rubbish from that shared area.

4.4 Questionnaire for Supervisor

Table 4.1: Questionnaire for Supervisor

Questions	Total Survey on 2 no's of Supervisor	
1. What type of waste is generated from your secondary transfer station?	Mostly are food, plastic, paper waste etc.	
2. What type of transportation do you have for the transfer of generated waste?	Different types of vehicle such as van, truck.	
3. How much waste is generated from Shukrabad area every day?	7-8 ton per day.	
4. What are your future plans to improve your waste management?	i) Manpower can be increased. ii) Vehicle can be increased. iii) Proper maintenance can be done by the authorities.	
5. How many people collect waste in Shukrabad area?	16 people.	
6. How much waste is collected from households and market?	Market	Households
	60%	40%

4.5 Questionnaire survey report

Question no. 06: How much waste is collected from households and market?

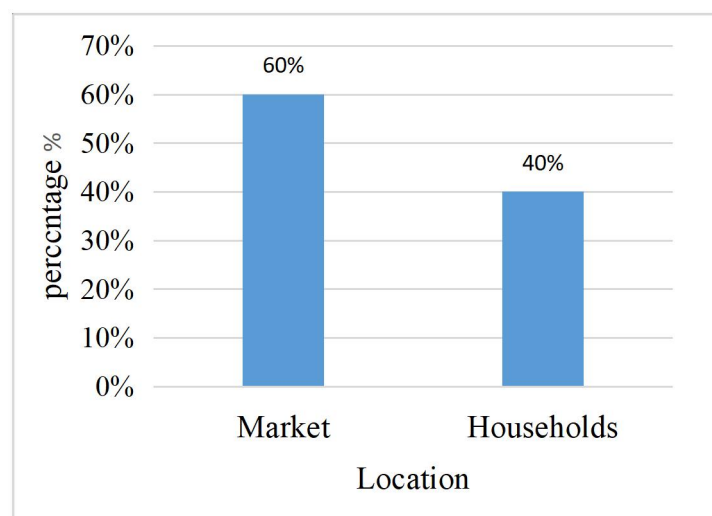


Fig 4.1: survey report question number 6

4.6 Type of Waste

During the survey, we asked the supervisor of the secondary transfer station to know how many types of waste are received here. He told us, food, plastic, paper waste is high, rubber-leather-textile and glass relatively less. He gave us an approximate table of how many types of waste and how much waste is available.

Table 4.2: Types of waste in the study area

Type of Waste	Quantity	percentage
FOOD	4.67 ton	58.50%
PLASTIC & PAPER	1.1 ton	13.78%
OTHER	2.013 ton	25.22%
RUBBER	0.2 ton	2.50%

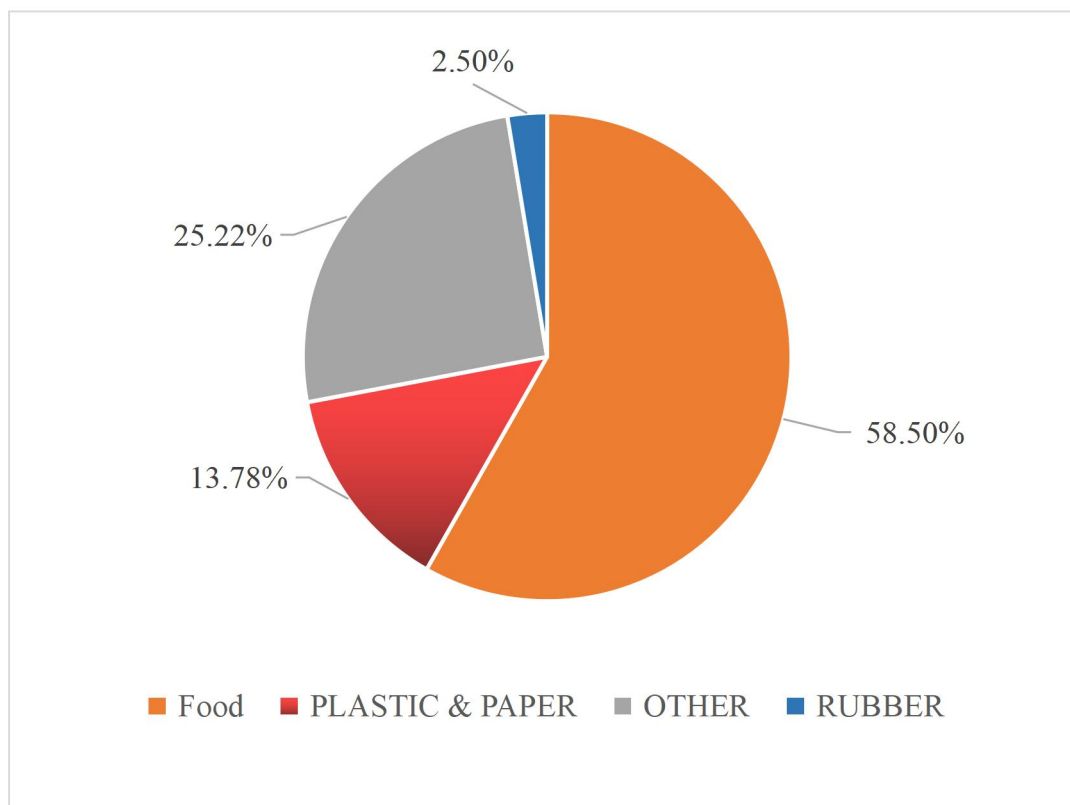


Fig 4.2: Percentage of waste

Our neighborhood is primarily residential. As a result, municipal garbage output is very high in this area. The majority of the localities create a significant amount of household garbage. They only retain it in one location before handing it on to City Corporation personnel.

4.7 Estimated Waste Collection

There are many buildings in this area. These buildings have about 6 to 8 flats. 4 to 5 family members live in each flat.

Item Name	Quantity
Number of building	153
Number of flat in every building	8
Number of family Member (per flat)	4
Solid-waste generation (per member)	0.65 kg (2018-2019 and 2017-2018 respectively)
Office, Bazaar, Shop waste generate (Per day)	4800 kg/day
Capacity of the track	7000 kg/day

The size of the waste collection van is 2.13 m length, 1.22 m width, 0.793 m height. Then a van collects 2.06 m³ of waste at a time.

There are approximately 153 buildings here. Each building has an average of 8 flats so, $153 \times 8 = 1224$ flats. Each flat has an average of 4 members. Each member produces an average of 0.65 kg of waste per day.

The discarded density of solid wastes in collecting vehicles is 320 kg/m³.

So, the daily amount of waste generated in this area -

Total number of residences = $1224 \times 4 = 4896$ person

Amount of waste daily produces = $(4896 \times 0.65) + 4800 = 7983$ kg/day

Capacity of the van = $2.06 \times 320 = 659.42$ kg

Determine the Number of trip/day = $7983 / 7000 = 1.14 = 2$ [Capacity of the track = 7000kg/day]

4.8 Planned Route for Waste Collection in Shukrabad area

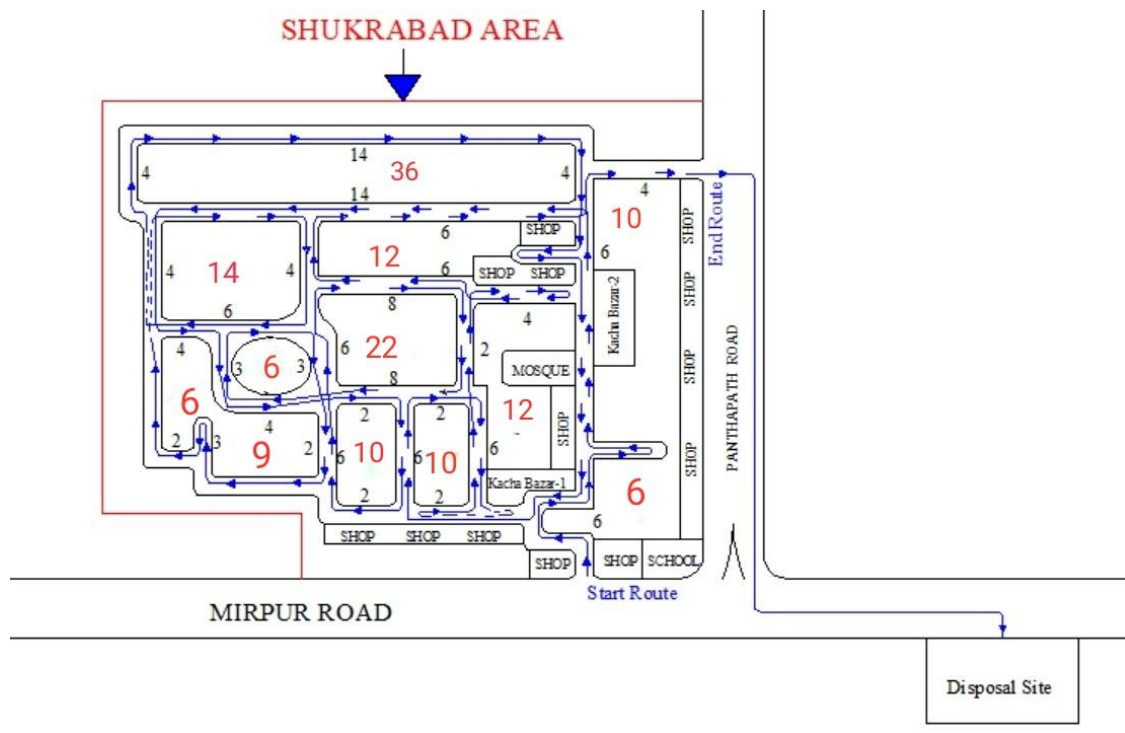


Fig 4.3: Planned Route for Waste Collection in shukrabad

So, we see that a waste collecting van can collect a day's waste in $(7983/659.42)=12.10$ Approximately 13 trips from this very particular area.

We think the plan will be the best for waste collection in this method, because in and out will be the different way and it will be much easier to collect waste.

4.9 Route map of transfer station to landfill

The waste from the area we worked with is taken to Dhanmondi secondary transfer station for management. Which is located 100 meters away from our chosen place. Here the disposal site or landfill has been taken out from Dhanmondi transfer station. The route from Dhanmondi transfer station to the landfill site (red color) is shown by the municipality. Which has to cover a distance of 12 km through waste and takes more time due to road crossing. Here we have shown a route (blue color) which takes much less distance and time than planned municipal roads. The two planned roads meet at the Matsya Bhavan crossing road for the landfill site, after which vehicles are diverted to the landfill via Gulistan and Jatrabari Maur. Our planned route covers a distance of 10 km and takes less time.

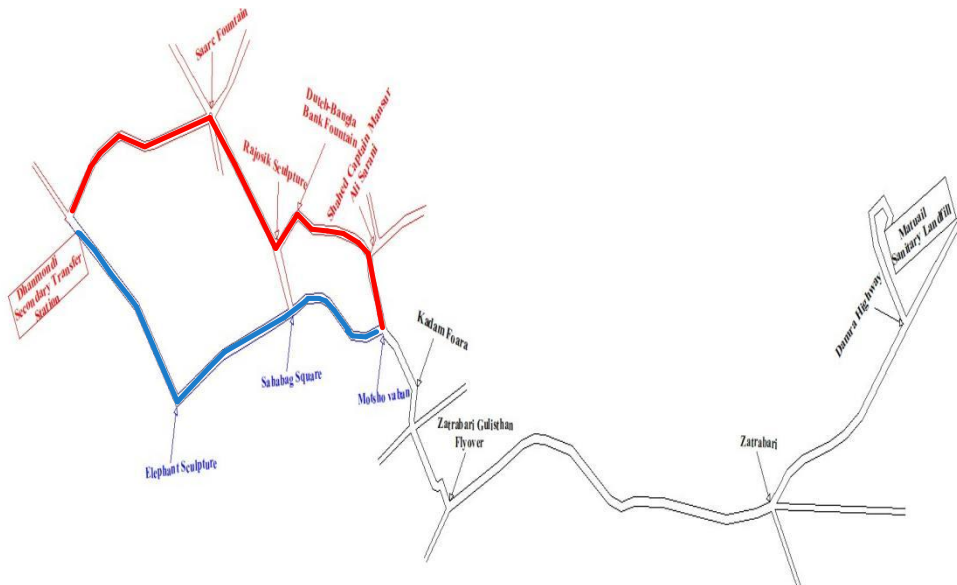


Fig 4.4: Route map of transfer station to landfill

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

In the investigation of our survey we found that in this area 58.50% of waste collected are food. There are two raw markets in Shukrabad area. A large number of waste are produced from there. Such as food waste, plastic, cow dung etc. Total waste generation in this area is around 7983 kg/day. Within these amount 60% market waste and 40% household waste. Plastic waste, food waste, cow dung are the main types of waste produced from different sources. There are more residential buildings than commercial ones. Our study area was inside the Dhaka south city Corporation and the waste was disposed of the prescribed land of Dhaka south City Corporation. Waste from mostly all areas under south City Corporation is disposed on that land. There were two kinds of landfill approaches. In one part, the plastic products obtained from the waste were sorted and kept for recycling and in the other part, all types of wastes mainly food waste were dumped. The authority of Dhaka south City Corporation maintains the landfill and such arranged required facilities to level and fill the ground. The target of our study is to optimize the route for waste collection. For making the collection route we considered the number of apartments, population, quantity of waste, people thinking and the opinion of waste collectors. We proposed the most suitable route for the study area based on the roads and collection vehicles size. We are confident that if the proposed route is followed, it would be beneficial for us and the next generation.

5.2 Recommendation

We have discovered problems with our current routes or waste collection techniques. There are some limitations such as the population of cities is growing and will continue to grow, the generation of waste will also increase with the population. So, we want to use the proposed system -.

- Because of time limitations we worked in a small area or only one area (Shukrabad). If we work in the large area we may get more accurate result.
- If we conduct questionnaires survey with more people we might get more information regarding this study.

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Appendix

C.1: Photo taken during questioning to the supervisor



Talking with supervisor



Visiting the transfer station

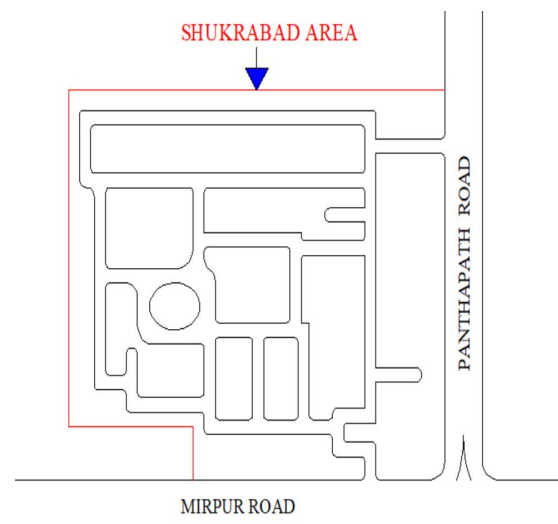
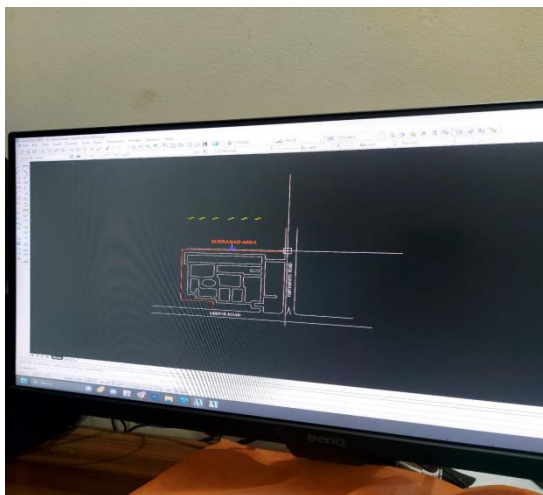


Collected waste and taken to secondary transfer station

C.2: Photograph during the site visit



Waste is stored here



Designing waste collection route map in auto cad



Survey of waste collection information