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Routing and Scheduling of Solid Waste Transportation in Ahmedabad City

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ABSTRACT

This research work represents the experimental work related routing and scheduling of solid waste transportation in Ahmedabad city. With increase in population and spatial spread in urban Ahmedabad, Ahmedabad Municipal Corporation (AMC) currently covers a total geographic area of 466 sq. km and has 55.6 lakh populations which are administered in 6 Zones with 48 Election Wards. Ahmedabad generates almost 4000 Metric Tons of solid waste on a daily basis including 300 MT of construction and demolition debris. This waste is collected, transported, treated and disposed according to the Rules. Deploys more than 12,500 employees. The Vehicle Routing and Scheduling Problem (VRSP) concern the determination of routes and schedules for a fleet of vehicles to satisfy the demands of a set of customers.

Keywords: Solid waste, Geographic area, Routing, scheduling.

I. INTRODUCTION

Waste production is a global issue and its importance is increasing day by day. This is a result of two main factors which are population growth and increase in consumption. In addition to the problems of rapid population growth, increase and variety of consumer goods and products, rising trend of consuming culture, increasing use of disposable materials and uncontrolled expansion of cities caused to produces millions of tons of wastes in cities. Nowadays, complications which occurred in the urban population, caused to create dramatic changes in quality and quantity of waste, in which these variations and complexities has been followed by making problems such as handling difficulties and also how to dispose of waste. Transportation problem and the future of collection systems always has been gripped human being and forced him to look for remedy against it.The basic Capacitated Vehicle Routing Problem (CVRP) can be described in the following way. We are given a set of homogeneous vehicles each of capacity Q, located at a central depot and a set of customers with known locations and demands to be satisfied by deliveries from the central depot. Each vehicle route must start and end at the central depot and the total customer demand satisfied by deliveries on each route must not exceed the vehicle capacity Q. The objective is to determine a set of routes for the vehicles that will minimize the total cost. Waste from our homes is generally collected by our local authorities through regular waste collection, or by special collections for recycling. Within hot climates such as that of the Caribbean the waste should be collected at least twice a week to control fly breeding, and the harbouring of other pests in the community. Other factors to consider when deciding on frequency of collection are the odours caused by decomposition and the accumulated quantities. Descriptions of the main types of collection systems are given in the table below.

Objective and Scope of Study

Objectives

- To propose new alternative route for improving the service of solid waste transportation.
- To compare existing routes and propose alternative route with respect to cost, time and efficiency.

Scope

- To evaluate total collection of solid waste in Ahmedabad city.

- To evaluate the distribution network of new waste zone, Gota.
- Data collection : - Normal public opinion
  - Driver opinion survey

II. METHODS AND MATERIAL

Methodology

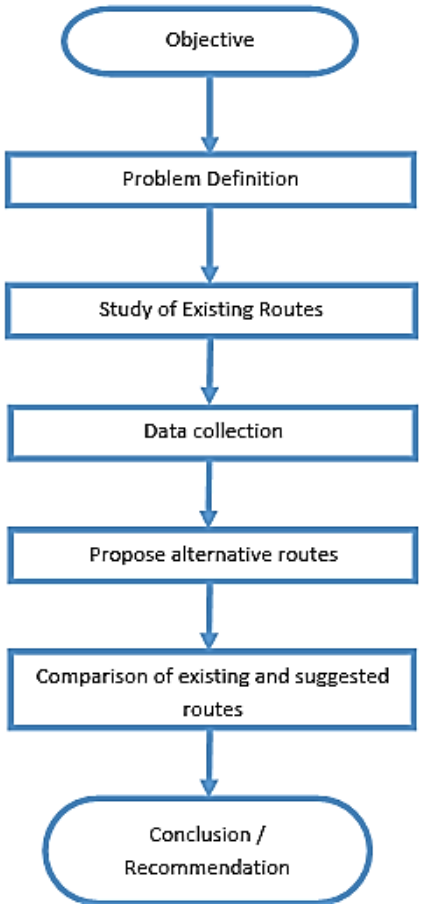


Figure 1. Methodology of Work

Existing Route

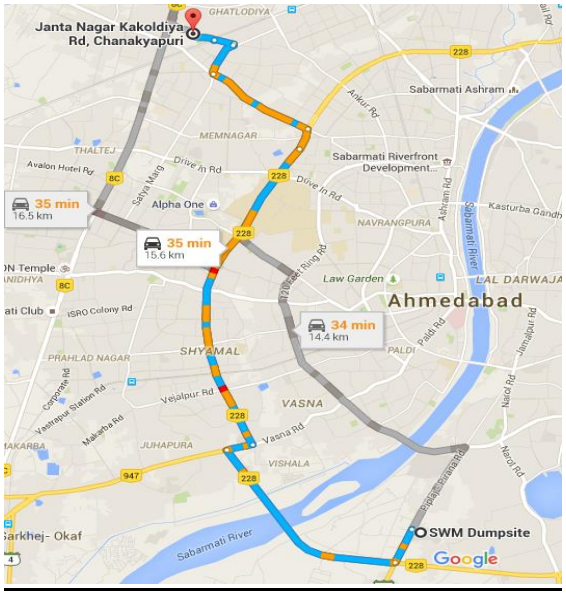


Figure 2. Existing Route

- On this route 25 to 30 trips daily trips made by hook loader from New west zone to SWM pirana dump site.
- Daily around 400MT. solid waste collection is done at the new west zone site.
- At this zone 9 wards collection is done which are: Chandlodia, Bodakdev, Gota, Maktampura, Thaltej, Ghatlodia, Jodhpur, Vejalpur, Sarkhej.
- There are 15 hook loader vehicle available for this particular site.
- Load carrying capacity of each hook loader vehicle 15 Tonne.

Alternate Route

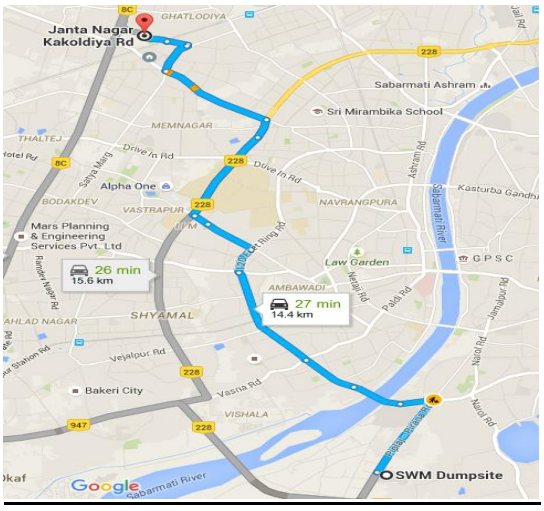
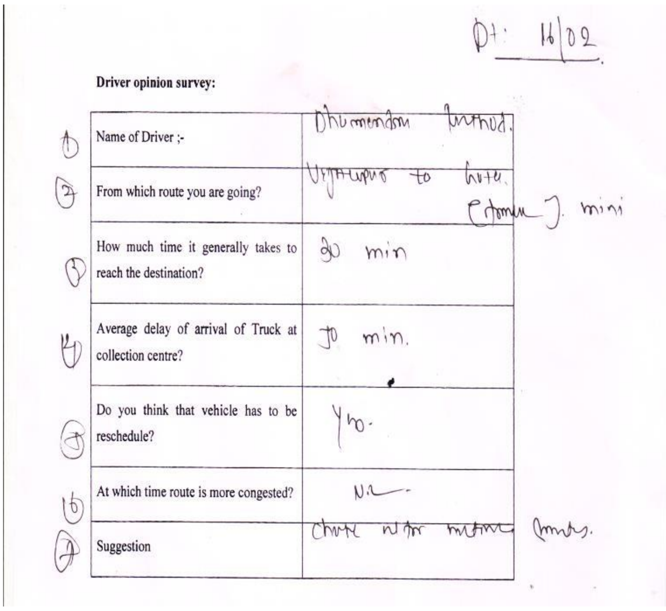


Figure 3. Alternate Route

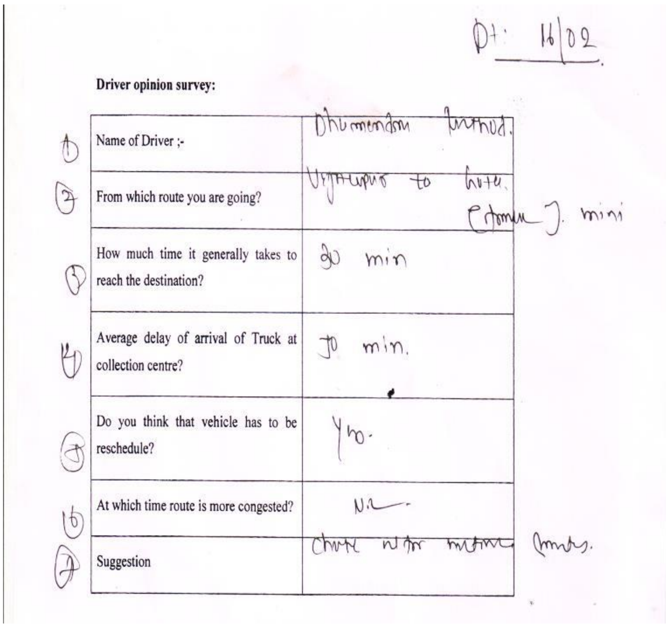
Driver Opinion Survey


Driver opinion survey:

Name of Driver :-	
From which route you are going?	
How much time it generally takes to reach the destination?	
Average delay of arrival of Truck at collection centre?	
Do you think that vehicle has to be reschedule?	
At which time route is more congested?	
Suggestion	

Figure 4. Driver Opinion Survey

Public Opinion Survey


Driver opinion survey:

Name of Driver :-	
From which route you are going?	
How much time it generally takes to reach the destination?	
Average delay of arrival of Truck at collection centre?	
Do you think that vehicle has to be reschedule?	
At which time route is more congested?	
Suggestion	

Figure 5. Public Opinion Survey

Ahmedabad Zone wise collection centre

Table 1. Daily Waste Collection

Sr. No.	Collection Centre	Daily Waste collection(MT)
1	Gota	475
2	Ranip	700
3	Rakhiyal	650
4	Naroda Patia	650
5	Vatva	755
6	Vastral	770
Total		**4000**

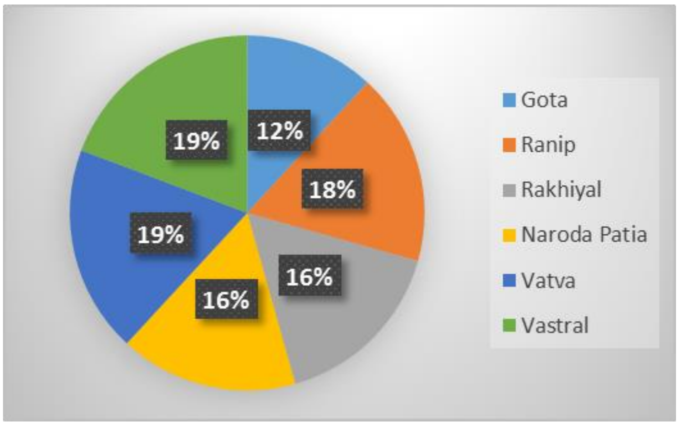


Figure 5. Graph of Distribution Network

Figure 6. Image of Swm Dumpsite Pirana

III. RESULTS AND DISCUSSION

Time Scheduling Noticed at Junction

At sattadhar cross road

Table 2. Vehicle Noticed Time

Sr. No.	Time	New west zone to SWM	SWM to New west zone
1.	07:30 am to 11:00 am	07:28	-
		08:03	-
		08:31	-
		09:01	09:23
		09:49	09:54
		10:20	10:24
		10:54	10:55
2.	11:30 am to 02:00 pm	11:21	11:26
		11:53	11:57
		12:22	12:27
		01:20	12:58
		01:44	01:29
3.	02:00 pm to 05:00 pm	02:11	02:00
		02:31	03:00
		02:53	03:21
		03:15	03:41
		03:22	04:01
		03:44	04:22
		04:16	04:43
		04:37	05:04
		05:02	05:25
		05:23	05:46
4.	05:30 pm to 08:00 pm	05:54	06:06
		06:25	06:27
		06:56	06:58
		07:27	07:28
		07:58	07:59
		08:29	08:30
5.	09:00 pm to 10:00 pm	09:03	09:00
		10:09	09:31
		-	10:02
		-	10:59
		-	12:05

Observations:

1. It takes generally 1 to 5 minutes to reach Sattadhar cross road from new west zone.
2. It takes generally 10 to 20 minutes to reach IIM cross road from Sattadhar cross road.
3. It takes generally 10 to 20 minutes to Jivraj park cross road from IIM junction.
4. It takes generally 15 to 25 minutes to SWM dump site cross road from Jivraj park junction.
5. At every cross road it takes minimum 3 to 5 minutes of time consumption.

Accident data on existing route

Table 3. Accident Data on Existing Route

Year	No. of Accidents occurred	
	Major	Minor
2009	23	55
2010	35	54
2011	27	42
2012	38	55
2013	46	76
2014	59	77
2015	67	79

Accident data on existing route

Table 4. Accident Data on Alternate Route

Year	No. of Accidents occurred	
	Major	Minor
2009	17	28
2010	23	34
2011	28	38
2012	33	45
2013	39	53
2014	45	68

IV. CONCLUSION

In this research routing and scheduling transportation for solid waste in Ahmedabad, study of existing route which is from New West Zone Gota to SWG pirana dump site will be carried out with respect to the time, cost, number of vehicles passing daily existing route and various environmental problem due to dumping of solid waste. For this purpose, various data related to existing route condition for dumping solid waste will be carried out i.e., time consumption by vehicle, cost, rental cost for dumping vehicles. After the proposal of an alternative route comparison has been carried out between the existing route and proposed route with respect to cost, time rental vehicle cost an on environmental issues. Route which will be selected is eco-friendly, economical and also reduces the travel time hence cost.

V. WEB REFERENCES

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