# Solid Waste Management and Route OptimizationBy Using GIS-A Case Study of Indapur City

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*Abstract*: In today's world solid waste management is a global environmental issue. In India this issue is not taken seriously. There is a tremendous amount of loss in terms of environmental degradation, health hazards and loss due to direct disposal of waste. There has to be appropriate planning for proper solid waste management by means of analysis of the waste situation of the area. The growth in the urban population and activity has resulted in an increased solid waste generation. In the process of solid waste management, more attention needs to be paid towards collection as it itself requires 60-70% of the total cost.

For effective management, the municipal corporation of Indapur has divided the entire region into seventeen wards which are further divided into six health units to collect the solid waste. Two alternate disposal systems are considered. In first case the entire solid waste of the city of Indapur is dumped at one dumping site. In next case there are three sites proposed at different locations in the city Indapur city.

A comparison is made considering transportation cost, site maintenance cost, labour cost, and diesel cost. This study would deal with, how Geographical Information System (GIS) can be used as a decision support tool for planning waste management and for route optimization. Hence an attempt is made in this study to second optimum route for solid waste transportation in Indapur city.

*Key words:*Solid waste,QGIS, route optimization,
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## I. INTRODUCTION

Waste management is a global environmental issue which concerns about a very significance problem in today's world. There is a considerable amount of disposal of waste without proper segregation which leads to both economy and environment sufferings. As cure is better than treatment, waste reduction and reuse of products are both methods of prevention. This project deals with the planning of solid waste management with application of as a decision support tool for optimization of routes, collection and disposal of solid waste. This study will be beneficial to the health professionals, policy makers and society. Data required for SWM in the Municipal Corporation area collected, and deficiencies in the system identified. A GIS optimal routing model based on the parameters such as population density, waste generation capacity, road network and the types of road, storage bins and collection vehicles, etc., is developed and used to trace the minimum cost/distance efficient collection paths for transporting the solid wastes to the landfill.

## II. METHOD

In a general sense, the term describes any information system that integrates stores, edits, analyzes, shares, and displays geographic information.Here are some of the reasons of using QGIS:It's free, as in l Installing and using the QGIS program costs you a grand total of zero money. No initial fee, no recurring fee, nothing. It's free, as in liberty. If you need extra functionality in QGIS, you can do more than just hope it will be included in the next release. You can sponsor the development of a feature, or add it yourself if you are familiar with programming.

## III. RESULT AND DISCUSSION

ROUTE OPTIMIZATION of Indapur city: The municipal area has been subdivided into six health units for collection purpose.

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Table No 1 – Details of Health units

| Health unit no. | Ward no. | Name of area |
|---|---|---|
| HU.1 | 1,2,5 | VP College road |
| HU.2 | 11,13,17 | Kalthan road |
| HU.3 | 12,14,15 | Shree Ram Society |
| HU.4 | 3,4,9 | Bus stand area |
| HU.5 | 6,8,10 | Main peth |
| HU.6 | 7,16 | Baramati – Akluj Chowk |

### Distance forCase I-One Dumping Site

Following Table shows the details of the first case. Table shows the total quantity of waste collected per day from each health unit in tons and distances from generation node to dumpsite in Km. In this case the collected waste from six health units is transported to ITI Indapur. It is assumed that all waste is land filled.

Table No 2- Distance for case I

| Health Units | W (ton per day) | Distance in km ITI |
|---|---|---|
| 1 | 1.5 | 1.7 |
| 2 | 1.75 | 3 |
| 3 | 1.15 | 3.4 |
| 4 | 2 | 3.5 |
| 5 | 2.6 | 2.8 |
| 6 | 1.2 | 0.5 |

Table No3- Total cost of transportation case I

| Total Waste to be transported in Tonnes/day | Cost of fuel (Rs. Lakh) | Salaries of worker (Rs. Lakh) | Cost of Maintenance (Rs. Lakh) | Total Cost (Rs. Lakh) |
|---|---|---|---|---|
| 10.2 | 4.67 | 10.92 | 3.36 | 18.95 |

### Distances for CASE II

Table No 4 – Distances for case II

| Health Units | W (ton per day) | Distance In Km | Distance In Km | Distance In Km |
|---|---|---|---|---|
| | | Akluj road dep. | Tembhurni Naka | Kalthan raod |
| 1 | 1.5 | 1.7 | - | - |
| 2 | 1.75 | - | - | 1.3 |
| 3 | 1.15 | - | - | 1.5 |
| 4 | 2 | - | 1.8 | - |
| 5 | 2.6 | - | 1.6 | - |
| 6 | 1.2 | 0.5 | - | - |
| **Total** | **10.2** | | | |

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Table No 5 – Total cost of transportation case II

| Total Waste to be Transported in Tonnes/day | Cost of fuel (Rs. Lakh) | Salaries (Rs. Lakh) | Cost of Maintenance (Rs. Lakh) | Total Cost (Rs. Lakh) |
|---|---|---|---|---|
| 1.67 | 1.30 | 10.92 | 3.36 | 15.5 |
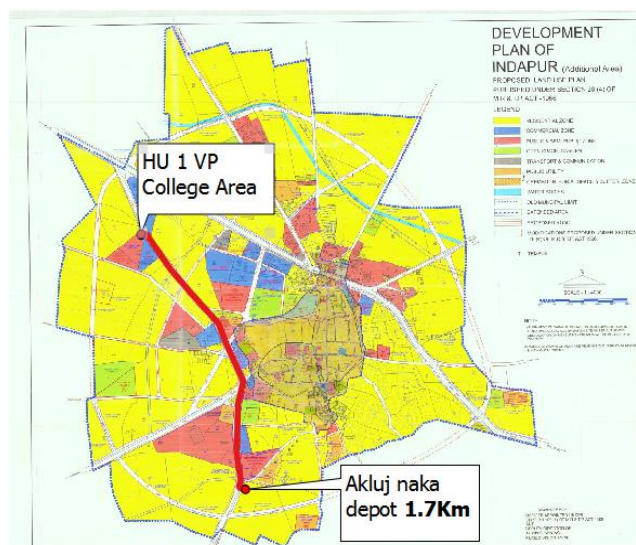


Snapshot of Optimized route for Health Unit – 1

Hence, finally from comparing above both tables as for CASE I & CASE II. We optimized the Total Cost for the Transportation (per Annum) is about Rs. 3.37 Lakh.

## IV.     CONCLUSION

In this project an attempt has been made to design and develop an appropriate collection, transportation and disposal plan of SW for the Indapur City Municipality Corporation (ICMC). Also we will done a GIS optimal model based on the parameters such as population density, waste generation capacity, road network and the type of road and collection vehicles, etc., is developed and used to trace the minimum cost/distance efficient collection path( Rs. 15.5 Lack ) for transporting the solid waste to the open dumping ground. The proposed model can be used as a decision support tool by the municipal authorities for efficient management of solid waste.

## V.     ACKNOWLEDGEMENT

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