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# An Appraisal and Sustainability Trends of Municipal Solid Waste Management And Proposed Collection Point for Circle 8 of Hyderabad City

KEYWORDS: Geographical Information System; Solid waste management; Hyderabad urban agglomeration, Municipal wards; Greater Hyderabad Municipal Corporation

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**ABSTRACT** *Waste is a major health hazard with a very high potential to undermine people's right to life, and a threat to the environment. In India, waste is generally littered on roadsides and mostly dumped in the outskirts of the cities in areas that are low lying without compliance with the regulations. Proper and sustainable waste management can be achieved through the establishment of appropriate channels for the collection, transportation and disposal of wastes. The aim of this study was to find out the sustainability scenario of solid waste management with respect to the rising population in the city of Hyderabad. The use of Geographical Information System (GIS) was of great essence in classifying the city into sustainability classes based on the grouping of different municipal wards based on the per capita waste generated by each. It was generally found out that a bigger percentage of the municipal wards are low in sustainable waste management.*

## 1.INTRODUCTION

Before introducing solid waste management, it is prudent to begin the discussion with outlining the scope of solid waste, the material to be managed. Solid waste refers to the range of garbage arising from animal and human activities that are discarded as unwanted and useless. Solid waste is commonly generated from industrial, residential and commercial activities in a given area. As such, landfills are typically classified as sanitary, municipal, construction and demolition or industrial waste sites. Waste can be categorized based on its contents, including such materials as plastic, paper, glass, metal, and organic waste; based on its hazard potential, including categories such as radioactive, flammable, infectious, toxic, or non-toxic; or based on its origin, characterized as industrial, domestic, commercial, institutional or construction and demolition (Ohri.A 2010).

The management of municipal solid waste is a high priority issue for many communities throughout the world including India. The observed trend of waste material is a continually growing issue of concern not only at local or regional levels but also at the larger global level. The increased growth rate of the IT and electronics industry in India is propelled by increased consumption of electronic items and IT hardware, and it leads to higher generation of electronic waste (e-waste). Deciding where to locate a municipal sanitary landfill is a difficult problem in which qualitative criteria compete with quantitative, economic and engineering criteria in a process that is highly political and emotional. Site suitability analysis for resource collection and disposal requires an integrated approach and can be addressed most economically and efficiently using geospatial technology. In order to manage the Solid Waste Management properly in different aspects, GIS is a tool it provides a means of rapid data access and query based on both geographic location and attribute data (HBSHD 2011).

## 2.STUDY AREA

The present study area was chooses as Hyderabad city. Hyderabad is the 5th largest city in India. It has twin cities viz., Hyderabad and Secunderabad with its suburbs extending up to 16 miles. The Hyderabad city is situated in 17d 18'30" & 17d 28'30" North Latitude and 78d 22'30" & 78d 32'30" East Longitude. The study area covers an area of 179 Sq.Km. The total population of the district according to 2011 Census is 38,29,753 which is purely urbanised.

## 3.STUDY OBJECTIVE

- To map the population density and solid waste characteristics of the municipal wards of Hyderabad
- To determine the main sources of waste generators and waste characteristics in Hyderabad
- To determine the sustainability ratings of municipal wards of Hyderabad and the expected future waste generation trends

## 4.DATA USED

The study made use of data gathered from the Greater Hyderabad Municipal Corporation. The data included population information of Hyderabad municipal wards, volumes of waste generated and the predicted future trends in waste management. The data obtained was fed into GIS software for the generation of spatial maps to show the population distribution and the extent of waste management in various wards.

## 5.METHODOLOGY

### DATA USED

The following data was used for the study.

**Spatial Data:-**

- Topographical maps of 56k/7 and 56k/11 from Survey of India in the form of hard copy at 1: 50000 scale
- Maps of Greater Hyderabad Municipal Corporation showing different circles with ward details in the form of hard copy.
- www.ghmc.gov.in.

**Non spatial data:-**

- Census of India for Hyderabad city containing information about population of different wards, No. of households etc.,
- Hand Book of Statistics Hyderabad District 2011.

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**METHODOLOGY ADOPTED FOR ANALYSIS:-**

The study was conducted to define and understand the current problems of waste disposal in Hyderabad city and to suggest the best possible locations for Dumper bins or rearrangement of dumpers, and to suggest the best possible route from initial point of solid waste generation to the final dumping site with the use of Remote sensing and GIS techniques (Jain. A 2006).

(i) **Data base creation:** IRS-ID PAN and LISS-III satellite imageries are georeferenced using the ground control points with SOI toposheets as a reference and further merged to obtain a fused high resolution data. The study area is then delineated and sub settled from the fused data base on the latitude and longitude values and a final hard copy output prepared which is further interpreted for the generation of thematic maps.

(ii) **Spatial database:** Thematic maps like base map, drainage and road network maps are prepared from the SOI toposheets on 1:50000 scale. Remote sensing and GIS are effective tools for land cover mapping essential for monitoring, modelling the type of road network viz., National Highway/State highway/Major district roads/Village roads/Other district roads etc.,

(iii) **Attribute database:** Data was collected from Census of India 2001 viz., containing information about Zone-wise circle-wise population of different wards, No. of households etc., for all the individual wards

**PROCEDURAL STEPS FOR THE PROPOSED COLLECTION POINT**

1. The census book of India contains details regarding the population, households, number of workers. Waste generated in terms of M.T represents the mass of that particular ward .

From the obtained data following parameters are developed

**Table 1: Showing the Model form Development: Data collected for Circle-8.**

a. Total population of the ward
b. Waste generated in terms of M.T

S= sum of a & b.

S= a+b

2. Identify the approximate Intersecting Centroidal Axis.
3. Intersecting Centroidal Axis as origin perpendicular lines are drawn from its centre.
4. Position vector '$r_p$' is measured in 'X' and 'Y' directions, its position is represented as [ $\pm$ai $\pm$bj ].
5. The parameters obtained by the collected data is added algebraically and is represented as 'S' i.e., mass of each individual village.

**6.RESULTS AND DISCUSSION**

The waste management involves proper channels of waste collection, transportation and disposal. In order to understand waste generation and management, the number of sanitary workers (both public and private) was taken as a measure against the total waste being generated in different regions of the Hyderabad. it is evident that the central zone stands better in terms of sustainable waste management owing to the high number of workers compared to the other zones. The other regions may need to invest more on workers who will see to improved waste management

It is noticed that the source of wastes is mainly the domestic households (60 to 65%), both for the Hyderabad Municipal Corporation (HMC) and the Urban Local Boards (ULBs), which generates the MSW of 1482 and 690 tons per day. The next source of waste is streets and drains, followed by hotels and restaurants, markets, commercial establishments, industrial etc. Hospitals, clinics and construction sites are noticed as the least waste generation source

Waste disposal: At present, a total of 3063 tons per day (TPD) of municipal solid waste (MSW) is being collected, transported and disposed by the GHMC on a daily basis. The waste is being dumped at various disposable sites located mainly at Jawahar Nagar, Shamshiguda, the BHEL site near BDL and Fathullaguda. Jawahar Nagar site is the major dumping ground in Hyderabad which receives a total MSW of 2,618 tons/day from different transfer stations in the city. Apart from that Jawahar Nagar dumping yard also receives another 200 tons/day MSW from other 4 circles of the Hyderabad directly. In addition to that other dumping sites, such as, Shamshiguda, BHEL site and Fathullaguda disposable sites receive a volume of 100, 45 and 100 MSW tons/day, respectively.

The physical characteristics of wastes are categorized into bio-medical, biodegradable, recyclable and inert wastes, whereas, the chemical attributes are into pH, total moisture, fixed carbon, volatile matter and the calorific value. Transfer stations save on labour and operating costs and also reduce the number of vehicular trips to and from disposal site.In order to identify, rate and categorize the municipal wards of the Hyderabad on the basis of their sustainability levels with respect to solid waste generation, an analysis is carried out using GIS. Total per capita waste generated by the ward was taken as the basis for rating and categorizing the wards into five different groups indicating their sustainability levels

Thus , the position vector rp of the masses with respect to Intersecting Centroidal Axis is obtained as **Centre of**

| Sl.No | Circle | Election Ward No. | Name of the Ward | Population of Ward | Waste Generation (In metric tonnes) | No. Of workers | No. of Dumper Bins |
|---|---|---|---|---|---|---|---|
| 1 | VIII | 77 | Jambagh | 40798 | 34.80 | 26.37 | 89 |
| | | 78 | Gunfoundry | 22309 | 19.03 | 14.42 | |
| | | 79 | Sultan Bazar | 31267 | 26.67 | 20.21 | |
| | | | | 94374 | 80.51 | 61.00 | |

| S.N. | Ward No. | Name of the Ward | Population of Ward | Waste Generation (M.T) | % of waste generation | i (+/-) Position vector of the ward | i (+/-) Position vector of the ward | Total Mass i(+/-) | Total Mass j(+/-) |
|---|---|---|---|---|---|---|---|---|---|
| | | | A | B | C | D | E | F | G |
| 1 | 77 | Jambagh | 40798 | 34.80 | 43.22 | -1039.36 | -755.89 | -42403809.28 | -30838800.22 |
| 2 | 78 | Gunfoundry | 22309 | 19.03 | 23.64 | -223.33 | 661.41 | -4982268.97 | 14755395.69 |
| 3 | 79 | Sultan Bazar | 31267 | 26.67 | 33.13 | 687.17 | -721.56 | 21485744.39 | -22561016.52 |
| | | | 94374 | 80.51 | 100.00 | | | -25900333.86 | -38644421.05 |
| | | | | | | | | -274.4435317 | -409.481648 |

**Table 2:Showing the population and waste generation with reference to total mass**

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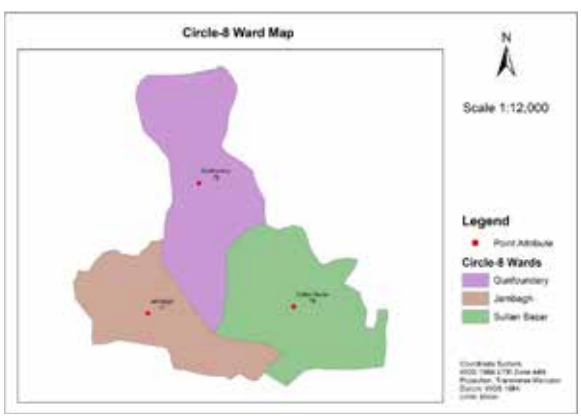
**Mass = -274.44 i - 409.48 j, where ai = -274.44 and bj = - 409.48.** The Proposed collection point for the Circle 8 was fallen in third quardrant. Position vector ($r_p$) of the masses with respect to Intersecting Centroidal Axis for Circle VIII is explained in detail below.

ICA : Intersecting Centroidal Axis
$m_{p1}$ : Mass of the ward with code number '1'
$m_{p2}$ : Mass of the wards with code number '2'
$m_{p3}$ : Mass of the wards with code number '3'
$m_{p4}$ : Mass of the ward with code number '4'
ai : Distance in mm/cm in 'x' direction.
bj : Distance in mm/cm in 'y' direction.
$r_{p1}$ : $(ai_1 \pm bj_1)$ with respect to $mp_1$
$r_{p2}$ : $(ai_2 \pm bj_1)$ with respect to $mp_2$

$$\text{Center of mass } (r_m) = \frac{m_{p1}[r_{p1}]+ m_{p2}[r_{p2}]+ m_{p3}[r_{p3}]+\ldots.}{m_{p1}+m_{p2}+m_{p3}+\ldots.}$$

Centre of Mass = -274.44 i - 409.48 j, where ai = -274.44 and bj = - 409.48.



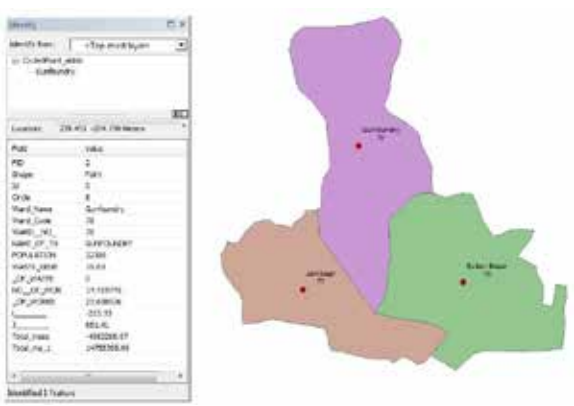



**Figure 1: Showing the circle 8 ward map and Attribute linkage in ArcGIS Software**

## 7.CONCLUSION AND RECOMMENDATIONS

The issue of waste generation and management needs to be taken with weight due to the health hazard that wastes pose to human, animals and plants. In the city of Hyderabad, increase in population has in turn increased the quantities of wastes generated, a phenomenon that needs to be taken care of by increasing the number of workers and the systems of collection, transportation and disposal of the wastes. The main sources of waste are domestic households while least amount is produced at the hospitals, clinics and construction sites. Collected wastes are taken to transfer stations then to disposal sites such as in Jawahar Nagar, which is one of the largest sites. The future trends of waste generation are expected to rise just as the population trends are raising. Measures should be put in place for sustainable waste management (SWM). So far, SWM has been rated 'very good' in wards such as I.S. Sadan, Kishanbagh and Lalithabagh, while wards such as Defence Colony and Old Malkajgiri have been rated 'bad' due to the observed poor waste management

For the future SWM it would be recommended that disposal sites be located at a reasonable distance from the collection areas in order to check the financial issues related to high transfer costs and additional investment in road infrastructure. Adequate waste disposal can be taken care of by compliance with guidelines for the siting, design and operation of especially the new landfills. Existing dump sites need to be upgraded through the establishment of sanitary landfills. There also needs well-trained sanitary personnel for waste management and the provision of adequate financial and physical support for a rational operational standard

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