



INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

DESIGN SOLID WASTE MANAGEMENT FOR DHULE CITY

¹Shirsale Rajeshri Vijay, ²Prof H.A. Kuwar

¹Student, Department Of Civil Engineering, Bapusaheb Shivajirao Deore College of Engineering Dhule ,Maharashtra, India,

²Assistant Professor, Department of Civil Engineering, Bapusaheb Shivajirao Deore College of Engineering Dhule, Maharashtra, India

Abstract: Solid waste is the useless & discarded material resulting from day to day activities in the community. Solid waste management could also be defined because the discipline related to the control of generation ,storage ,collection ,transfer ,processing and disposal of solid waste. According to this project carried out on solid waste management practice by Dhule municipal corporation. The solid waste generation and population and land use of the city and design the undeveloped area as MSW management. This study was also designed to study the composition of solid waste in Dhule city. The objectives of this research were to calculate solid waste generation and composition in Dhule and design the undeveloped area as MSW treatment plant.. The design of MSW treatment plant supported technical guidance of TPS 3R 2017. Based on waste generation and composition data, required area for MSW treatment plant is 2080m² of available area 3 Ha. This plant consist of waste treatment area 1504 m² and supporting facility area 576 m². Composting utilized in MSW treatment plant is hollow brick box technology.

Keywords – Municipal Solid Waste, Population, Municipal Solid Waste Treatment Plant

I. INTRODUCTION

Municipal Solid Waste (MSW) is that the trash or garbage that's discarded day to day during a human settlement. consistent with MSW Rules 2000 MSW includes commercial and residential wastes generated during a municipal or notified areas in either solid or semisolid form excluding industrial hazardous wastes but including treated biomedical wastes. Waste generation encompasses activities during which materials are identified as not being useful (being within the present form) and are either thrown away or gathered together for disposal. Municipal Solid Waste consists of the following kinds of waste.

- I. Industrial or Hazardous Waste
- II. Bio-Medical or Hospital Waste and
- III. E-Waste.

2 RESEARCH OBJECTIVES

- 1) To determine the solid waste generation & composition in Dhule city
- 2) To design the undeveloped area of MSW treatment plant
- 3) To find population & land use of Dhule city for MSW management
- 4) To determine area required of project
- 5) To introduce & aware the public to real concern of environment &it's sustainability

3. METHODOLOGY

3.1 Study Area

3.1.1 Geographical and Climatic Conditions

Dhule is largely emerging as one of the biggest upcoming hubs of textile, edible oil, and power-looms across the state and has gained a strategic advantage for being on the junction of three National Highways vi . NH-3, NH- 6, and NH-21 1 and on most anticipated Manmad - Indore Rail Project. Dhule city is a Iso a part of Delhi Mumbai Industrial Corridor Project, India's most ambitious infrastructure program, aiming to develop new industrial cities as 'Smart Cities' and converging next generation technologies across infrastructure sectors.

.Dhule is located at 20. 9°N 74.78°E.and has an average elevation of 319m and average annual rainfall in the district is 670mm.

3.2 DATA COLLECTION

3.2.1 Population Projections

Huge investment is taking place in Dhule therefore the city has good scope of growth in terms of financial as well as in population. Based on the discussion, mean of arithmetic and incremental increase method has been considered for the future population estimation.

Table 1 :- Population Projection 2011-2041

| Summary of Dhule Population Forecasts | | | | | | | | |
|---------------------------------------|--------------------------------------|---------------------------------------|---------------------------------------|---------------------------|--------------------|----------------------------|--|---|
| Year | Arithmet ic increase method | Incremen tal increase method | Geometri cal increase method | Simple Graph Method | Semi log method | Decade growth method | 2 nd order degree poly nominal method | Average of arithmetic increase and increment increase method |
| 1981 | 210759 | 210759 | 210759 | 210759 | 210759 | 210759 | 210759 | 210759 |
| 1991 | 278317 | 278317 | 278317 | 278317 | 278317 | 278317 | 278317 | 278317 |
| 2001 | 341755 | 341755 | 341755 | 341755 | 341755 | 341755 | 341755 | 341755 |
| 2011 | 375559 | 375559 | 375559 | 375559 | 375559 | 375559 | 375559 | 375559 |
| 2021 | 430892 | 429784 | 477868 | 446879 | 569696 | 493558 | 508470 | 430338 |
| 2031 | 486225 | 482901 | 608049 | 505872 | 751404 | 648631 | 599661 | 484563 |
| 2041 | 541559 | 534911 | 773693 | 564865 | 991070 | 852427 | 697186 | 538235 |

Based on the past decade trend, the average of arithmetic increase and incremental increase methods have been taken for population projections.

3.2.2 Population Density

The total area of the city is around 46.46 sq.km and the city population was around 375559(2011).Hence, the density of the city is 8083 person per Sq.km.

3.2.3 Land-Use

The city land use is divided into residential commercial, industrial public and semi-public etc. Around 48% area is developed and 52% areas is under agriculture, vacant land and barren land.

Table 2: Land-use Detail

| Land use | Area in hectare |
|---------------------------|-----------------|
| Residential | 1284.58 |
| Commercial | 77.43 |
| Industrial | 78.36 |
| Public and Semi Public | 651.28 |
| Public Utility | 48.23 |
| Recreational Activity | 136.7 |
| Transport & communication | 11.8 |
| Agricultural | 1106.47 |
| Vacant and Barren Land | 995.56 |
| Water Bodies | 255.32 |
| Total | 4646.00 |

MSWM System Process

The broad approach to the solid waste management in Dhule would be that of an integrated system. MSWM system is basically a six stage process: generation, segregation, collection, storage, transportation and disposal. A typical waste management system in a low- or middle-income country like India and Dhule would include the following elements:

1. Segregation and Storage

Source Segregation is the setting a side of inorganic and organic waste at their point of generation the generator. Separating waste at source ensures that organic and inorganic waste is less contaminated and can be collected and transported for further treatment. Segregation of waste also optimizes waste processing and treatment technologies.

2. Biodegradable Waste

The biodegradable waste includes food waste, fruits & vegetable waste, paper & pulp, paper admixture with food waste etc. food material resulting from the processing, storage, preparation, cooking, handling or consumption of food including discarded meat, scraps, egg shells, vegetable peels, and other food items from homes, stores, and restaurants etc. constitute biodegradable waste, others includes leaves, grass, twigs and other plant materials.

3. Inert & Others

This includes waste from street sweeping, hazardous waste, ash etc. which cannot be considered both in biodegradable & recyclable waste. Miscellaneous materials like textiles, leather items, rubber items, tyres, thermocol and tetrapacks are also included in this category.

4. Collection & Transportation

The system would be designed for maximum segregation and 100% collection and transportation and similar collection efficiency. Waste would be segregated into organic, inorganic and recyclable streams.

3.4 Status Of Existing Solid Waste Management In The City

Waste generation

Municipal solid waste in a typical town of India is residential waste which is around 70-80% of the total waste. Other waste generation sources are commercial units, markets, hotels & restaurants, institutions including schools, colleges, offices, street sweepings, drain silt and green area including park, gardens.

The major sources of generation of municipal solid waste in Dhule are :-

1. Households
2. Markets for fresh vegetables & fruits, meat and chicken Parks & open spaces
3. Temples Shops and commercial establishments Others

Most of the solid waste is generated by the households and then the markets and commercial areas. All kinds of waste including biomedical, E-waste and construction & demolition wastes are being mixed in the municipal stream of waste. There are no slaughterhouses in the city.

Based on the survey results, the waste generation rate, per capita waste generation considered for Dhule city is **403 GPCD** and for the floating population is **202 GPCD**.

The total waste generated in the city is estimated around **165 TPD**.

Table 3.3 : Sources of Solid Waste in Dhule

| Source | Solid Waste in (TPD) |
|-----------------|----------------------|
| Household | 90 |
| Slum | 17 |
| Commercial | 16 |
| Hotels | 8 |
| Industrial | 2 |
| Street Sweeping | 24 |
| Drain Silt | 8 |

It has been assessed that 80% of the waste is generated from residential and 20% from commercial and shops including Vegetable markets and horticulture

IV. RESULTS AND DISCUSSION

Designing of MSW Treatment Plant (MSWTP)

- The design of the MSWTP was carried out to improve the waste management in Dhule and convert the location of illegal dumping into useful land which is MSWTP.
- The design has area 2080 m² of available area 3 ha.
- Before the MSWTP was built, waste in the location of illegal disposal should be cleaned up independently by the community. This waste will be sorted based on its economic value. Then the residue will be transported and disposed to the Landfill.

A) Waste Management Area:

The waste management area is divided into areas of

1. Dropping and sorting:

Dropping after collected from residential. In this area, waste will be sorted by type and economic value. The sorting is done manually. Area = 196 m²

2. The Composting Area

After sorting, the organic waste will be composted in the composting area. However, before being composted, large-sized organic waste is chopped using the chopping machine. This machine is put on 14 m² area. This area is also used to put a sieving machine for mature compost.

Composting Area : Area = 560m²

2.1 Hollow brick box technology

Composting in this MSWTP uses hollow brick box technology. Based on organic waste volume and the calculations that refer to the technical guidance of TPS 3R, the requirement of hollow brick boxes is 5 units. The dimensions of hollow brick boxes are 9 meters length, 4 meters width and 1 meter height. Organic waste in hollow brick boxes is stacked in layers with 15 cm of thickness. One brick box unit can accommodate 36 m³ of organic waste. The composting time is set at 30 days. The composting process will take 3 weeks and the maturation process of compost will take approximately 1 week. Hollow brick box design can be seen in Fig.

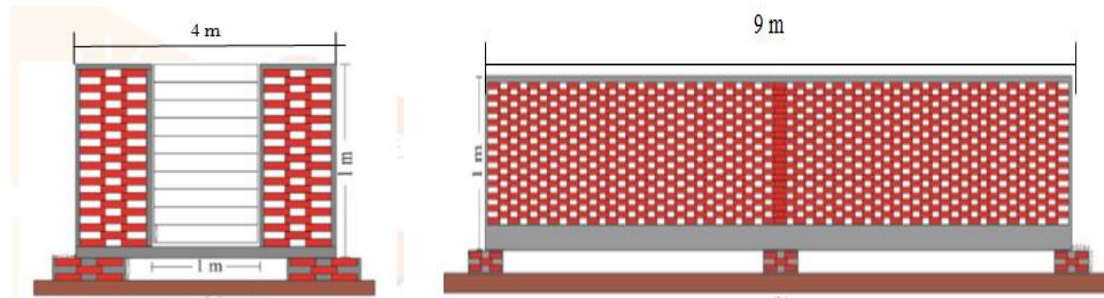


Figure Hollow brick box design

3. Compost Storage

After the composting process is completed, compost is used for fertilizing plants around the MSWTP area and the rest is packed for sale. Area = 12m²

4. Inorganic Storage :

Inorganic waste is sorted according to its specific type such as paper, plastic, glass, metal, etc. Inorganic waste such as plastic and paper should be compacted or pressed to reduce the dimensions. Sorted plastic waste can be chopped by chopping machine to produce a small size. This small size can save space and increase its economic value for recycling. Furthermore chopped plastics are packaged and sold to recycling factory. Paper waste can be put into a press machine to compress its size. Compressed paper will be stored in inorganic storage before sold to recycling factory. Area = 196 m²

5. Residual and Hazardous waste room

Has a function as storage for residue. Whereas hazardous waste room has a function as storage for waste contains toxic substances. The residue and hazardous waste will be transported to the Landfill for further treatment. The residual room has same size these rooms are designed as a closed room in order to reduce odors, enhance aesthetics and isolate the uneconomical waste. Area = 35 m²

6 .Rest corner

For the workers to take a rest. Area = 168 m²

Total space for waste management area is 1504 m².

B) Supporting facility area like office, parking lot and garden.

1. Office

A part of MSWTP is the office. Office is the operational center in MSWTP. This office has an area of 96 m² with 12 meters in length and 8 meter width.

2. Toilets

In the west of the office there are 4 toilets for sanitary facility for the workers in 3 m² of each.

3. Garden.

In the north of the office there is a 108 m² garden for enhancing aesthetics and improving the air quality of MSWTP.

4. Parking Lot

The south of garden there is a parking lot.

Total Supporting Facility Area Like Office, Parking Lot And Garden = 576 m².

Total Area of MSWTP = Waste Management Area + Total Supporting Facility Area

$$= 1504 + 576$$

$$= 2080 \text{ m}^2$$

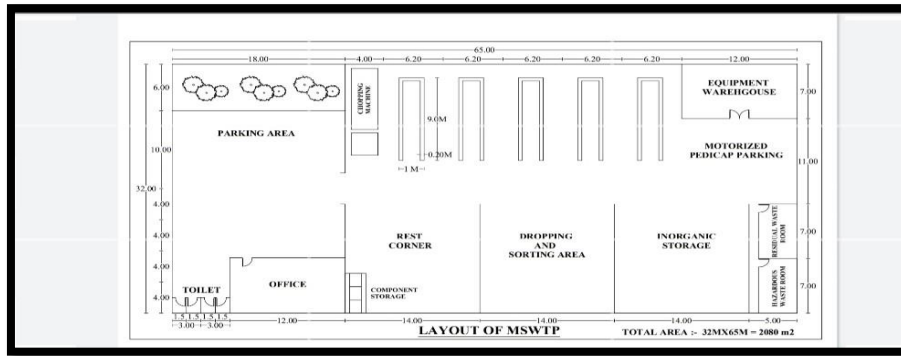


Figure Line Plan of MSWP



Figure Top view of MSWP



Figure Front view of MSWTP

CONCLUSION

1. Studies have shown that SWM for city increase day to day Its average waste generation for city is 0.403 kg/capita/day
2. The MSW is that Public awareness, and public participation as essential for the successful implementation of the legal provisions and to have an integrated approach towards sustainable management of municipal solid wastes.
3. Design the MSWTP is 2080 m² include waste management area 1504 m² and supporting facility area 576 m². Waste management area consist of dropping and sorting area 36 m², composting area 90 m², compost storage 12 m², inorganic storage 36 m², residual waste room 6 m², hazardous waste room 6 m², motorized pedicab parking 25 m², equipment warehouse 15 m² and rest corner 24 m². Supporting facility consist of office 16 m², toilets 6 m², garden 14 m², and parking lot 62 m²

References

1. GK Singh ,K Gupta, et.al.,(2014),Urban Solid Waste Management ,It's Sources Collection, Transportation & Recycling- International Journal Of Environmental
2. S A Ismail, P Singh (2018) Urban Solid Waste Management Developing World With Erraphasis Of India Challenges & Apportunities
3. L. Zaccariello, R Cremiato (2015) Evaluation Of Muncipal Solid Waste Management Performances By Material Flow Analysis, Theoretical Approach
4. M .Mian, A,Narry ,et.al(2017) Muncipal Solid Waste Management For Content Sustainable Society:A Comparative Analysis
5. Ashish R Mishra , Shweta A Mishra , Anurag Tiwari (2013)
6. Solid Waste Management –Case StudyW Widuarti & M R Sugiarto et.al.(2018)Design of Muncial solid waste (MSW) treatment plant in Onggomertan village,Yogyakarta