A CASE STUDY ON EXISTING SOLID WASTE COLLECTION SYSTEM IN WARD NO.53 OF BELAGAVI CITY

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Abstract -- "Municipal solid waste" (MSW) is a term usually applied to a heterogeneous collection of wastes produced in urban areas, the nature of which varies from region to region. Urban wastes can be subdivided into two major components: organic and inorganic. As per the 2011 census population of Belagavi city is six lakhs and contain 58 yards in total. Total quantity of municipal solid waste generation 160 to 180 tonne per day. The present study is carried out in ward No. 53, having a population of 7211. The area includes residential and commercial zones, with residential zone being major. For the present study 12 individual houses were selected based on occupants standard of living and are classified as high income group, Medium income group and low income group. As per the samples collected high income group generated 1.974 kg solid waste per day, similarly medium and Low income group generates 1.619 kg/day & 0.698 kg/day. Total generation from the ward No. 53 is 2.8 tonne per day and the same is collected through door to door collection system. Small collection vehicles empty their collected waste in the larger vehicle and same is taken to Turmuri disposal site, once a day.

Key words: Solid waste management, generation of solid waste, collection routes.

I. INTRODUCTION

"Municipal solid waste" (MSW) is a term usually applied to a heterogeneous collection of wastes produced in urban areas, the nature of which varies from region to region. The characteristics and quantity of the solid waste generated in a region is not only a function of the living standard and lifestyle of the region's inhabitants, but also of the abundance and type of the region's natural resources. Urban wastes can be subdivided into two major components -- organic and inorganic. In general, the organic components of urban solid waste can be classified into three broad categories: putrescible, fermentable, and non-fermentable. The primary difference between wastes generated in developing nations and those generated in industrialised countries is the higher organic content characteristic of the former. Wastes generated in countries located in humid, tropical, and semitropical areas usually are characterised by a high concentration of plant debris; whereas those generated in areas subject to seasonal changes in temperature or those in which coal or wood are used for cooking and heating may contain an abundance of ash. The concentration of ash may be substantially higher during winter [1].

Table 1 comparison of solid waste characterisation worldwide (% wet weight) [1]

Location	Putres-cibles	Paper	Metals	Glass	Plastics, Rubber, Leather	Tex-tiles	Ceramics, Dust, Stones	Wt (g)/ cap/ day
Bangalore, India [1]	75.2	1.5	0.1	0.2	0.9	3.1	19.0	400
Manila, Philippines [2]	45.5	14.5	4.9	2.7	8.6	1.3	27.5	400
Asunción, Paraguay [2]	60.8	12.2	2.3	4.6	4.4	2.5	13.2	460
Seoul, Korea [3]	22.3	16.2	4.1	10.6	9.6	3.8	33.4[a]	2,000[a]
Vienna, Austria [4]	23.3	33.6	3.7	10.4	7.0	3.1	18.9[b]	1,180
Mexico City, Mexico [5]	59.8[c]	11.9	1.1	3.3	3.5	0.4	20.0	680
Paris, France [4]	16.3	40.9	3.2	9.4	8.4	4.4	17.4	1,430
Australia [7]	23.6	39.1	6.6	10.2	9.9		9.0	1,870
Sunnyvale, California, USA [6]	39.4[d]	40.8	3.5	4.4	9.6	1.0	1.3	2,000
Bexar County, Texas, USA [6]	43.8[d]	34.0	4.3	5.5	7.5	2.0	2.9	1,816

[a] Includes briquette ash (average).
[b] Includes "all others".
[c] Includes small amounts of wood, hay, and straw.
[d] Includes garden waste.

As per the 2011 census population of Belagavi city is six lakh and contain 58 yards in total. Total quantity of municipal solid waste generation 160 to 180 tonne per day. To overcome the problem of the Belagavi city corporation has established the scientific land fill site for treatment and disposal of MSW as per Supreme Court guide lines. The disposal and treatment of Belagavi city solid waste is done in Turmuri village and it spans across 66 acres. The Belagavi city contains 58 yards in total and corporation manage the solid waste in 15 wards and remaining 43 wards are out sourced or contract based for collection of solid waste.

II. MATERIALS AND METHODOLOGY

Functional Elements of Municipal Solid Waste Management

The activities associated with the management of municipal solid wastes from the point of generation to final disposal can be grouped into the six functional elements: (a) waste generation; (b) waste handling and sorting, storage, and processing at the source; (c) collection; (d)

sorting, processing and transformation; (e) transfer and transport; and (f) disposal. The inter-relationship between the elements is identified in this study.

Waste Generation:

Waste generation encompasses activities in which materials are identified as no longer being of value (in their present form) and are either thrown away or gathered together for disposal. Waste generation is, at present, an activity that is not very controllable. In the future, however, more control is likely to be exercised over the generation of wastes. Reduction of waste at source, although not controlled by solid waste managers, is now included in system evaluations as a method of limiting the quantity of waste generated.

Waste Handling, Sorting, Storage, and Processing at the Source:

The second of the six functional elements in the solid waste management system is waste handling, sorting, storage, and processing at the source. Waste handling and sorting involves the activities associated with management of wastes until they are placed in storage containers for collection. Handling also encompasses the movement of loaded containers to the point of collection. Sorting of waste components is an important step in the handling and storage of solid waste at the source. For example, the best place to separate waste materials for reuse and recycling is at the source of generation. Households are becoming more aware of the importance of separating newspaper and cardboard, bottles/glass, kitchen wastes and ferrous and non-ferrous materials. On-site storage is of primary importance because of public health concerns and aesthetic consideration. Unsightly makeshift containers and even open ground storage, both of which are undesirable, are often seen at many residential and commercial sites. The cost of providing storage for solid wastes at the source is normally borne by the household in the case of individuals, or by the management of commercial and industrial properties. Processing at the source involves activities such as backyard waste composting [2].

Collection:

The functional element of collection includes not only the gathering of solid wastes and recyclable materials, but also the transport of these materials, after collection, to the location where the collection vehicle is emptied. This location may be materials processing facility, a transfer station, or a landfill disposal site.

Sorting, Processing and Transformation of Solid Waste:

The sorting, processing and transformation of solid waste materials is the fourth of the functional elements. The recovery of sorted materials, processing of solid waste and transformation of solid waste that occurs primarily in locations away from the source of waste generation are encompassed by this functional element. Sorting of commingled (mixed) wastes usually occurs at a materials recovery facility, transfer stations, combustion facilities, and disposal sites. Sorting often includes the separation of bulky items, separation of waste components by size using screens, manual separation of waste components, and separation of ferrous and non-ferrous metals. Waste processing is undertaken to recover conversion products and energy. The organic fraction of Municipal Solid Waste (MSW) can be transformed by a variety of biological and thermal processes. The most commonly used biological transformation process is aerobic composting. The most commonly used thermal transformation process is incineration. Waste transformation is undertaken to reduce the volume, weight, size. Transformation may be done by a variety of mechanical (eg shredding), thermal (e.g. incineration without energy recovery) or chemical (e.g. encapsulation) techniques.

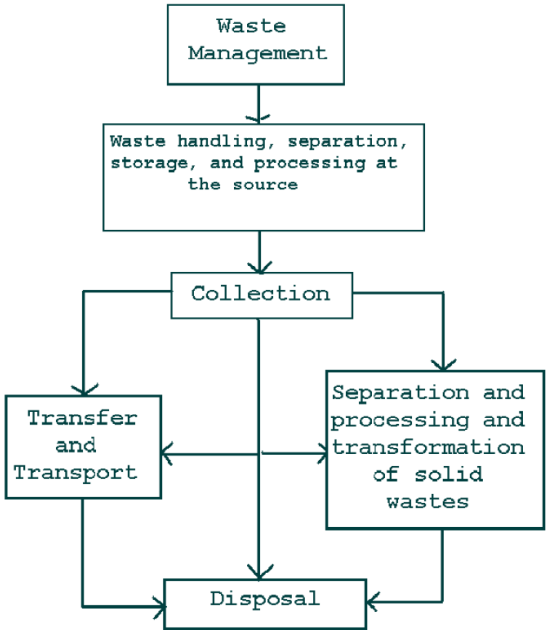
Transfer and Transport:

The functional element of transfer and transport involves two steps: (i) the transfer of wastes from the smaller collection vehicle to the larger transport equipment and (ii) the subsequent transport of the wastes, usually over long distances, to a processing or disposal site. The transfer usually takes place at a transfer station.

Disposal:

The final functional element in the solid waste management system is disposal. Today the disposal of wastes by land filling or uncontrolled dumping is the ultimate fate of all solid wastes, whether they are residential wastes collected and transported directly to a landfill site, residual materials from Materials Recovery Facilities (MRFs), residue from the combustion of solid waste, rejects of composting or other substances from various solid waste-processing facilities. A municipal solid waste landfill plant is an engineered facility used for disposing of solid wastes on land or within the earth's mantle without creating nuisance or hazard to public health or safety, such as breeding of rodents and insects and contamination of groundwater [2].

Figure 1 Functional elements of Solid Waste Management

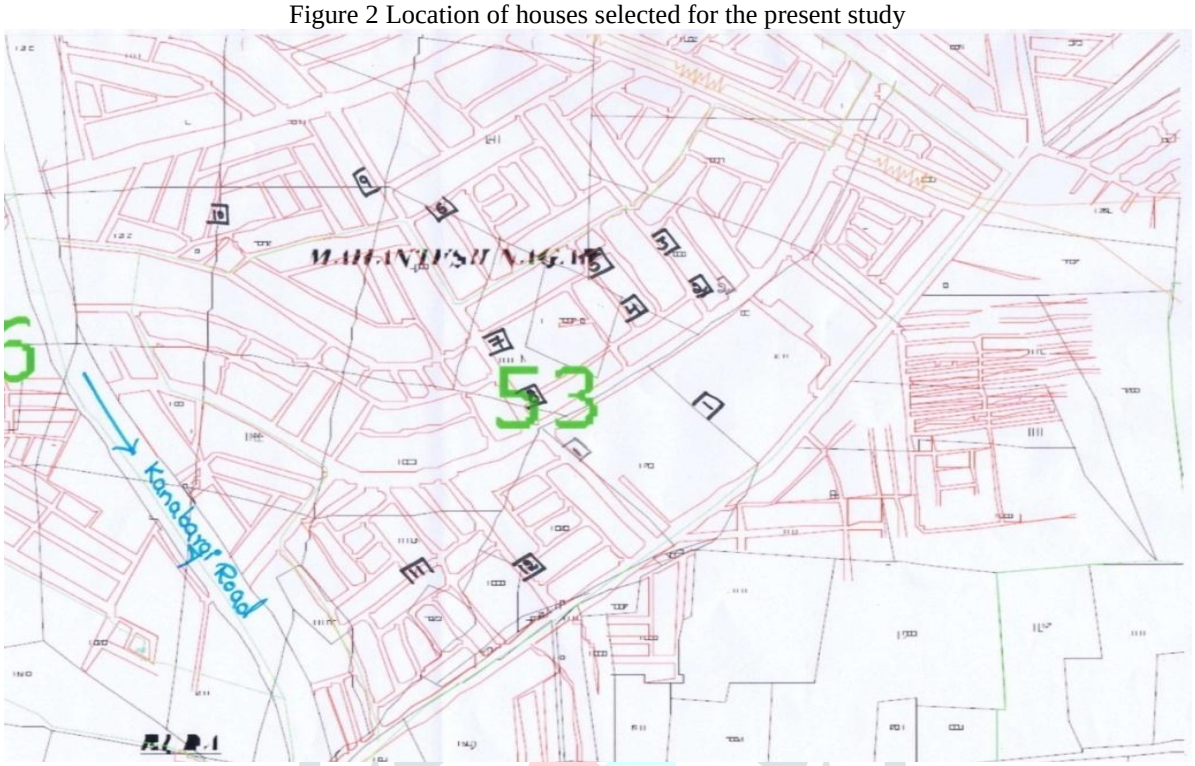


III. RESULTS AND DISCUSSION

The present study is carried out in ward No. 53, having a population of 7211. The area includes residential and commercial zones, with residential zone being major. For the present study 12 individual houses were selected based on occupants standard of living and are classified as high income group, Medium income group and low income group.

This map shows the location of houses that we have selected for the collection of solid waste:

Figure 2 Location of houses selected for the present study



Followings are the details of houses selected for the present study:

Table 2 Details of houses sleeted for the study

S.l No.	Owner of the house
1	Shashidhar Chiniwar
2	Vijay Hedduurshetti
3	Shashidhar kumar Hogarti
4	Jayshankar Sunkadmath
5	Mahantesh Sobarad
6	Appasaheb Vibhuti
7	Mustak Khan
8	Narendra Bhamki
9	Vivek Kokatnar
10	Virappa Bidari
11	Dayanand Sanadi
12	Hema Kotagi

Figure 3 Solid waste collected from selected houses.

Composition of solid waste generated we have collected

For the collection and segregation of solid waste, each house was provided with three boxes and plastic bags. The residents were instructed to dispose the solid waste based on its category as (i) Kitchen waste (ii) Paper & Plastic (iii) Other waste. Every day the waste was collected from plastic carry bags and replaced with new ones. The collection of solid waste was carried out at 7:00 pm every day and the waste collected was weighed immediately. The details of the solid waste collected from selected houses are as follows:

Table 3 Details of solid waste from High Income class

Kitchen waste	1.483 kg
Papers and plastics	0.345 kg
Others	0.146 kg

Table 4 Details of solid waste from Medium Income class

Kitchen waste	1.247 kg
Papers and plastics	0.248 kg
Others	0.124 kg

Table 5 Details of solid waste from High Income class

Kitchen waste	0.458 kg
Papers and plastics	0.122 kg
Others	0.118 kg

Table 6 Comparison of solid waste in different income groups.

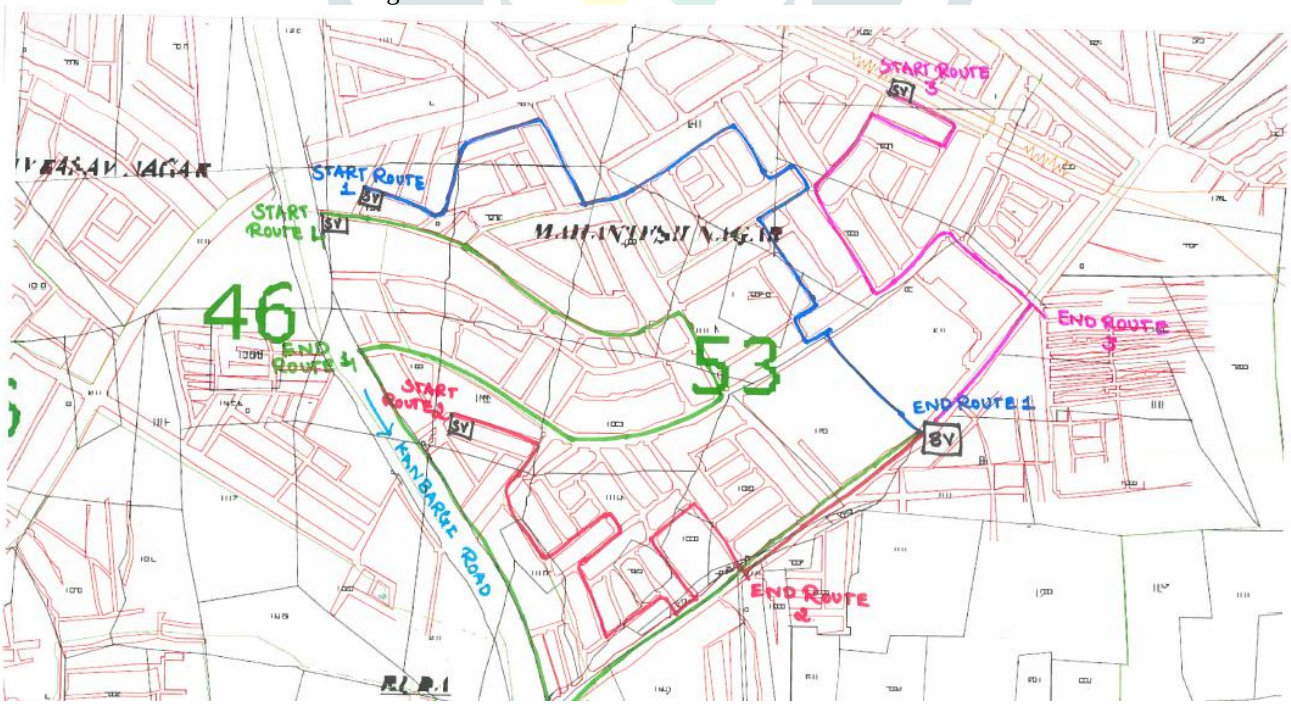
Type of waste	High income houses	Medium income houses	Low income houses
Kitchen waste	1.483 kg	1.247 kg	0.458 kg
Paper & plastics	0.345 kg	0.248 kg	0.122 kg
Others	0.146 kg	0.124 kg	0.118 kg

From the study conducted, generation of solid waste varies with respect to the standard of living of the occupants. High income group generated 1.974 kg solid waste per day, similarly medium and Low income group generates 1.619 kg/day & 0.698 kg/day. Main cause for the increase in generation of solid waste may be due to the increased usage of packaged food or increased consumption of luxurious resources.

The existing collection route for solid waste

The collection of solid waste is carried out with the help of tippers, lorries with compactors. Belagavi Municipal corporation has 10 dumper vehicles, 280 steel containers, 2 lorries with compactors and 1 street sweeping machine. The selected study area contain around 2000 houses and collection of solid waste start from 6:00 am to 2:00 pm. There are four collection routes for the collection of solid waste from the selected area. The detailed route of collection is shown in the figure below.

Figure 4 Solid waste collection route in ward no. 53.



Collection of solid waste is carried out through door to door collection system and four small vehicles of capacity 2.50 m^3 are used for the collection. These small vehicles collect and transport the solid waste to a larger vehicle, which is located at a prefixed location. Some of the residences opt for disposal of solid waste directly into the larger vehicle located in the area. Four collection route have been identified and length of route 1 is 8 kms, similarly length of 2nd, 3rd and 4th route are 12, 10.50, 9.50 kms respectively. The segregation of solid waste

takes around 2 hours and another one hour for processing waste during dumping of solid waste in disposal site. Total collection route for the smaller vehicle is around 40.00 kms and Turmuri disposal site is at a distance of 10km from the selected area.

IV. CONCLUSION

Belagavi is one of the major city in Karnataka state and contains 58 wards. The present study is carried out in ward No. 53 and has a population of 7211. Selected area comprise of residential area and commercial area. Population in ward No. 53 have varying standard of living with different economic conditions. 12 houses were carefully selected for the study and the occupants are instructed to collect the solid waste generated in the given boxes and plastic bags as (i) Kitchen waste (ii) Paper & Plastic (iii) Other waste. As per the samples collected an average of 0.2655 kg of kitchen waste per person per day is generated, similarly 0.050 kg of papers and plastic waste and 0.072 kg of other waste is generated per person per day. As the living standard varies even the rate of solid waste generation varies and the same is evident from the results. High income group produced 1.974 kg solid waste per day, similarly medium and Low income group generates 1.619 kg/day & 0.698 kg/day. Total generation from the ward No. 53 is 2.8 tonne per day and the same is collected through door to door collection system. There are 4 small vehicles having a capacity of 2.5 m^3, which collect the solid waste from the entire study area. There are 4 existing collection route for the collection of solid waste and they cover most of the study area. The segregation of solid waste takes around 2 hours and another one hour for processing waste during dumping of solid waste in disposal site. Small collection vehicles empty their collected waste in the larger vehicle and same is taken to Turmuri disposal site, once a day.

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