SOLID WASTE MANAGEMENT PROPOSAL FOR BRAHMAVAR CHANTARU GRAM PANCHAYATH

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***Abstract*— Exponential growth in population, urbanization and economic growth are challenging the efficiency of solid waste management globally. Disproportion in solid waste generated and waste management response with years passing by are due to negligence in collecting waste from greater percentage of area and inadequate standards of transportation, storage, treatment and disposal. Indirectly a higher percentage of population is vulnerable to risk of health, environmental and social issues. Today's world confrontations are to implement efficient waste collection and transportation system, build infrastructure for solid waste disposal, scientific processing of categorized solid waste material and develop competent decision support system, which has been elucidated in municipal solid waste (Management and Handling) rules, 2000 in India.**

***Index Terms*—: solid waste management, solid waste disposal, road networking**

I. INTRODUCTION

Solid waste management may be defined as the control of generation, storage, collection, transfer and transport, processing, and disposal of solid wastes in a manner that is accord with the best principles of public health, economic, engineering, conservation, aesthetics, and other environmental consideration and that is also responsive to public attitudes. The proposal aims at starting up a decentralized solid waste management scheme in Brahmavar, Udupi district, Karnataka. The solid waste management project strives for maximum waste recovery through composting, recycling and aims to zero waste to be disposed on to dump yards and landfills. The long term waste objectives are thus to reduce the environmental degradation caused by solid waste.

II. OBJECTIVE

- Minimum waste that needs to be disposed in centralized landfills, thus extending existing landfills capacity.
- Reduce the environment impacts of disposed sites as the bio degradable waste fraction largely is blame for the polluting leachate and the methane problems.
- Benefit the soil by using organic compost instead of chemical fertilizers.
- To estimate the net quantity of waste generated per person.

III. METHODOLOGY

Brahamvar is a main Road Town located 13 kilometres north of the Udupi in Karnataka. Brahmavar is located in India at the longitude of 74.75 and latitude of 13.43. Brahamvar is surrounded by several villages such as Handadi, Baikady, Matpadi, Kunjal, in that we have taken chantar village as study area for solid waste management.

Figure 1: Karnataka map showing Udupi district.

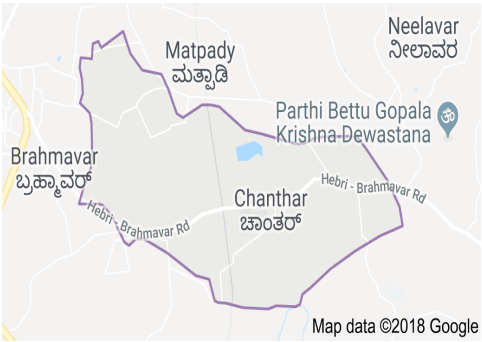
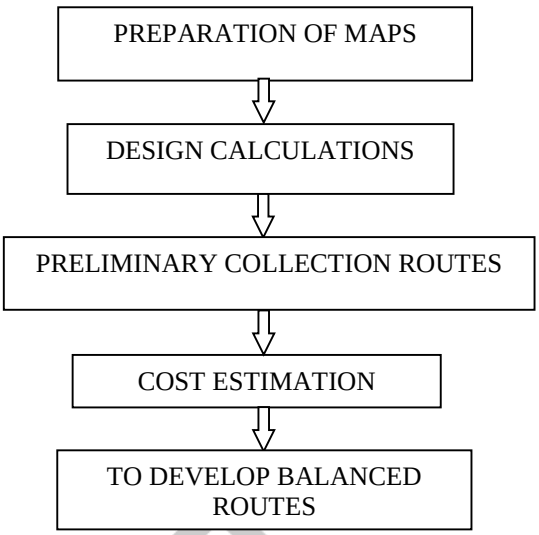


Figure 2: chantaru gram panchayath map



Flow Diagram of Proposed Work

A. Preparation of Maps

Present site condition:

Figure 3: Waste Disposed On Road Side

Figure 4: Waste Disposed On Private Land

B. Design Calculation

Based on mode of collection:

1. Hauled Container System (HCS)
2. Stationary Container System (SCS)

Solid Waste Production

Population = 5000, Growth factor = 1.5

5000 x 1.5 x 1.6kg//day =12000 kg/day

12000 x 7=84000kg/week

Density

loosely = 150-200kg/m^3

compaction = 400-500kg/m^3

Volume of solid waste to be collected per week

volume=84000/450=186.66m^3/week for compacted

volume=84000/175=480m^3/week for loosely

Collection container

Tilt frame loosely=30m^3

compactor, mechanically loaded=18m^3

No of trip/week

Volume/containersize=186.66/18=10.37/7=1.48~2 trip/day for compacted

volume/container size=480/30 = 16/7=2.28~3 trip/day

1. **Hauled container system**

1. Pickup time per trip
Phcs=pc+uc+dbc
pc+uc =0.4 h/trip [from table 11-8]
dbc =4/60 = 0.067 h/trip
phcs = 0.467 h/trip

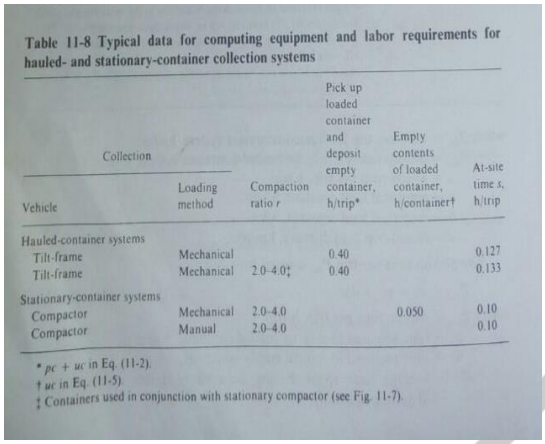


Table 11-8 Typical data for computing equipment and labor requirements for hauled- and stationary-container collection systems

Collection Vehicle	Loading method	Compaction ratio r	Pick up loaded container and deposit empty container, h/trip*	Empty contents of loaded container, h/container†	At-site time s, h/trip
Hauled-container systems					
Tilt-frame	Mechanical		0.40		0.127
Tilt-frame	Mechanical	2.0-4.0‡	0.40		0.133
Stationary-container systems					
Compactor	Mechanical	2.0-4.0		0.050	0.10
Compactor	Manual	2.0-4.0			0.10

* $pc + uc$ in Eq. (11-2).
† uc in Eq. (11-5).
‡ Containers used in conjunction with stationary compactor (see Fig. 11-7).

Figure 5: Typical data for HCS and SCS

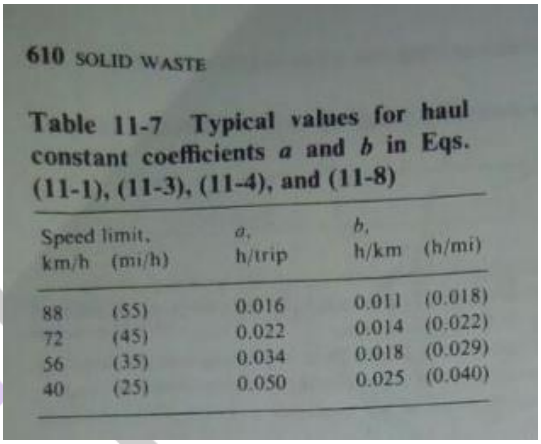


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Table 11-7 Typical values for haul constant coefficients a and b in Eqs. (11-1), (11-3), (11-4), and (11-8)

Speed limit, km/h	(mi/h)	a, h/trip	b, h/km	(h/mi)
88	(55)	0.016	0.011	(0.018)
72	(45)	0.022	0.014	(0.022)
56	(35)	0.034	0.018	(0.029)
40	(25)	0.050	0.025	(0.040)

Figure 6 : typical values for haul constant

2. Time per trip
Thcs=phcs+s+a+bx
= 1.5 h/trip for compacted
Thcs=1.9375 h/trip for loosely

3. No of trip that can be made per day
Nd=[(1-w)H-(t_1 + t_2)]/Thcs
= 3.98 ~ 4 trip/day for compacted
Nd=3.0813 trip/day
=3 trip /day for loosely

4. actual length of the work day
4 trips = (1-0.15)H – 0.58/1.5
H = (4*1.5)+0.58/(1-0.15)
= 7.74 ~ 8 hrs for compacted

3 trip =(1-0.15)H-0.58/1.5
H=(3*1.9705)+0.58/(1-0.15)
=7.637~8 hrs for loosely

2. **Stationary container system**

For compacted
1. H=[(t1+t2)+Nd(Tscs)] / (1-W)
Tscs=[(1-0.15)8-(0.33+0.25)] / 1
=6.22 hr

2. Pick up time per trip
Tscs = (Pscs+S+a+bx)
Pscs = Tscs-(S+a+bx)
=4.07 h/trip

3. No of containers that can be emptied/trip
Pscs = Ct x uc+(np-1)dbc
Ct x 0.2+(0.25ct-1)0.1=4.07
Ct0.225=4.17
Ct=18.53~19

4. Capacity of the collection truck

Ct=Vr/cf
V=19*8*0.75/2.5
=43.2m^3~44m^3

For Loosely

Number of trips = 3
Tscs=6.22 hr Pscs=3.07h/trip
Ct=14.08~15 V=36m^3

C. Preliminary Collection Routes

1. Primary collection
2. Secondary collection

Figure 7 : layout of routes

1. <u>Primary collection:</u>

Primary collection is the collection of waste from the point where it is placed by the person or organisation that has produced it. These collection points could be located outside each individual household and business, communal containers serving a number of households, or waste skips taking waste from households and businesses in the surrounding area. Depending on the collection vehicle and the distance to the waste treatment/disposal site, the waste at this stage may be taken to the final disposal site or to a transfer station. Primary collection system is necessary to ensure that waste stored at source is collected regularly and it is not disposed of on the streets, drains, water bodies, etc

1. Door to door collection through tricycles/push carts using segregated bins.
2. Containers placed on streets and will be collected through autos, tipper, lorries, dumper places and compactors.

<u>Tools and equipment used for primary collection</u>

I. Hand carts/push carts:

The use of traditional hand carts should be discontinued and instead, hand carts having 4 to 6 detachable containers of capacity ranging from 30-40 litres i.e. 0.03 to 0.04 cu.m each should be used. The containers should be of sturdy material preferably strong polyethylene/plastic with a handle on the top and rim at the bottom for easy handling of the container. The handcarts should have preferably three wheels and sealed ball bearing. There should be locking arrangement with a chain and a lock.

Fig.4.3.1 Hand Cart

II. Tricycles:

Local bodies can use tri-cycles in the areas which are spread out, and distances are long. The tricycles could have eight containers of 0.04 cu.m. (40 litres) capacity each. These containers should also be detachable from the tricycle and should have a locking arrangement.

Fig.4.3.2 Cycle Cart

III. Community bin carrier

A community bin carrier having a capacity to carry 40 containers (bins) in a two tier arrangement may be used to pick up community bins from residential areas and slums in the cities and towns where direct transfer of waste into the hand carts or tricycles is not found suitable. These vehicles with two-member crew should pick up filled community bins and replace empty ones and take the vehicle, when 40 filled containers are picked up, to the nearest temporary waste storage depot (large container for transfer of waste).

Fig.4.3.3 Bin Carrier

Primary collection of waste is done by following aspects,

- For slums and BPL settlements
- Collection from bulk waste generators
- Recyclable waste collection from houses
- Collection of solid waste from community

2. Secondary collection:

Secondary collections are where the waste from a number of primary collections is taken from the transfer station to the final disposal site.

Tools and equipment used for secondary collection

I. Compactor trucks

The waste is compacted hydraulically the weight of solid waste per trip is 2-2.5 times larger. It allows the waste containers to be emptied into vehicles from rare. The capacity of this vehicle is 12-15 m^3.

Fig.4.3.4 Compactor Truck

II. Tipper

This is a common type of vehicle used for the materials transfer in construction sector. With respect to integrated solid waste these kind of vehicles are preferred when the waste is not subjected to compaction. The size of the container is 8.5 m^3.

Fig.4.3.5 Tipper

Solid waste production
Population=5000
Growth factor=1.5
5000 X 1.5 x 1.6=12000kg/day
Density
Compacted=450kg/m^3
Loosely=175kg/m^3
Compacted:
100% overflow = 12000 X 2
= 24000kg/day
= 24t/day
Volume = 24/0.45 = 53.3 ~ 54m^3/day

Loosely:
Volume = 24/0.175 = 137.14 ~ 138m^3/day

Primary collections
For compacted
1. Pushcart (1100lt~1.1m^3)
= 54/1.1 = 49.09~50No's
2. Tipper (8.5m^3)
= 54/8.5 = 6.3~7No's
For loosely
1. Pushcart (1100lt~1.1m^3)
= 138/1.1 = 125.45~126No's
2. Tipper (8.5m^3)
= 138/8.5 = 16.2~17No's

Secondary collection
For compacted
1. Compactor truck (12m^3)
= 54/12 = 4.5~5No
For loosely
1. Tipper (8.5m^3)
= 138/8.5 = 16.2~17No's

1Trip= 16 No's
2Trip= 8 No's
3Trip= 4 No's

Route 1
Tipper= 24 X 1.1=26.4 m^3 = 26.4/8.5 = 3times
1trip = 9bins

Route 2
yellow (35-24) = 11
11 X 1.1 = 12.1m^3
Option1:
Bolero = 12.1/3 = 4.03 ~ 5trips
Option 2:
Tipper= 12.1/8.5 = 1.42~2trips

Route 3
49-35 = 14bins
14 X 1.1 = 15.4 m^3
Tipper = 15.4/8.5 = 1.81 ~ 2

Option 2
Bolero = 15.4/3 = 5.13 ~ 6trips

IV. COST ESTIMATION

PRIMARY COLLECTIONS			
For Loosely			
TYPE OF VEHICLE	NO's	RATE	AMOUNT
1. Pushcart	126	12000	1512000
2. Tipper	3	1700000	5100000
		TOTAL=	6612000
For Compacted			
TYPE OF VEHICLE	NO's	RATE	AMOUNT
1. Pushcart	50	12000	600000
2. Tipper	2	1700000	3400000
		TOTAL=	4000000
SECONDARY COLLECTION			
For Compacted			
TYPE OF VEHICLE	NO's	RATE	AMOUNT
1.Compactor	5	2300000	11500000
		SUM=	15500000

FOR 50 PERCENT			
For Loosely			
TYPE OF VEHICLE	NO's	RATE	AMOUNT
1. Pushcart	63	12000	756000
2. Tipper	3	1700000	5100000
		TOTAL=	5856000
For Compacted			
TYPE OF VEHICLE	NO's	RATE	AMOUNT
1. Pushcart	25	12000	300000
2. Tipper	1	1700000	1700000
		TOTAL=	2000000
SECONDARY COLLECTION			
For Compacted			
TYPE OF VEHICLE	NO's	RATE	AMOUNT
1.Compactor	2	2300000	4600000
		SUM=	6600000

Table.1 rate analysis for primary and secondary collection

Table 2. rate analysis for 50 percent of primary and secondary collection

SECONDARY COLLECTION			
For Compacted			
TYPE OF VEHICLE	NO's	RATE	AMOUNT
1.Compactor	5	2300000	11500000
		SUM=	15500000
With around three shifts per day approximate amount			5115000

Table 3. rate analysis of solid waste for three shifts per day

V. ADVANTAGES

- It is a hygienic system. There will be no disposal of waste on the road side or any other residential areas.
- The wastes are collected systematically and separated according to their characteristics.
- These waste are recycled or reused. The wastes that cannot be recycled or reused those wastes are dumped into a landfill.
- The waste which are organic those are used for the composting purpose and many other useful purpose.
- This system gives many employment opportunities for the people who are unemployed.
- This system improves the aesthetic view of the city. As there will be no wastes present in the city the city looks clean.

VI. CONCLUSION

Integrated solid waste management results in the minimal disposal of waste on land or complete elimination. This systematic way of collecting the wastes helps the people of chantaru gram panchayat and production of toxic gases from the open burning of wastes can be reduced. In this study significance is given only for the waste management. In future organic composting plant can be proposed depending on the quantity of only organic waste which can overcome the negative impacts of chemical fertilizers. In overall the premises of chantaru looks clean and hygienic with which aesthetic view of the city also improves.

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