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**Storage and primary collection of urban solid waste**

**INTRODUCTION**

Ten million people living in an area of 1500 Sq.K.M in and around the city of Calcutta, known as Calcutta Metropolitan District, are fighting a battle, yet to be won, for improved environment in respect of adequate safe water supply, drainage, sewerage, housing, solid waste management and a lot more. Inefficient management of any one of the facilities may cause serious health hazards in the community.

Solid waste management has proved itself to be a very important constituent of environmental pollution in large, small and medium towns.

In the year 1976, a study was initiated to assess the deficiencies in, and recommend remedial measures for, solid waste management systems of thirty odd small and medium towns of Calcutta Metropolitan Districts. The population of these towns ranges between 50,000 to 5,00,000.

The study team has made the following general statement regarding SWM in small and medium towns :

" Inadequate and inefficient collection and disposal of municipal solid waste has become a serious health hazard for the urban community in most of the cities and towns in India by way of soil, water and air pollution, contamination of food, propagation of flies, rats and other disease causing pests, flooding, water logging and mosquito breeding. In the small and medium towns of India, the problem is worse due to the presence of unlined open drains used for the disposal of rain and sullage water. These drains are often used for defecation and urination. Uncollected solid wastes find their way into these drains, blocking their flow and fouling the overall urban environment. Putrifying heaps of garbage and rubbish on the streets and stagnant and septic sullage water in the open drains are two distinct

and disagreeable features of urban environment, the inhabitants of small and medium towns in India have learnt to live with it ".

**THE DEFICIENCIES IN THE PRESENT SYSTEM**

- a) At present there is no house collection system. Also adequate number of community containers are not provided. As a result collection is made from open road side dumps. The wastes are scattered by scavengers and animals. Rats contaminate food. Fly larva migrate and pupate in the vicinity. The water sources are contaminated through percolation of leachates from decomposing and putrifying garbage. The resultant contamination of food, water and soil spreads cholera, jaundice, typhoid and other pest borne diseases.
- b) If solid waste is not cleared regularly it ultimately clogs the road side open drains meant for rain and sullage water. The stagnant water in the drains favours mosquito breeding. Moreover the wastes from the drains are to be cleared at a much higher cost.
- c) At present waste is collected from road side dumps into ill designed hand carts and again dumped into bigger heaps to be picked up with rakes and baskets into trucks. This system entails wastage of labour and time for the vehicle. Over and above, the labour -s are exposed to health hazards.
- d) The transport vehicles used in the municipalities are not suitable in respect of labour and vehicle productivity. The skilled man power and workshop facilities are not available in the smaller municipalities. Consequently about 30 to 60 percent vehicles remain out of order at any instant of time.

e) The method of disposal of Solid Waste in municipal towns is by filling up privately owned low lands in a hapazard insanitary manner with potential health risks to the community.

Though many of the municipal towns need additional resources in the solid waste management sector yet it has been observed that due to the use of inappropriate primary collection and transport vehicles the quantity of solid waste collection is not commensurate with the current expenditure for the purpose.

#### PROPOSED SYSTEM

Stress will have to be given on the following four points for the improvement of the system :

- a) The road side dumps and double handling will have to be eliminated by introducing house to house collection or at least collection from community containers in pedal tricycles carrying 6 to 8 numbers of 40 litre G.I.Bins. This change will minimise health risk of the labourers and increase per capita waste collection to 350 to 400 gms.
- b) Simple type of transfer stations will have to be introduced for the purpose of transfer of refuse from the bins of the pedal tricycle into the waiting skips or trailers which will eliminate the chance of contact of refuse with the ground and improve vehicle and labour productivity.
- c) Introduction of carrier container system will separate out the prime mover from the carrier. It has been found that the carrier container system of transport can make much more trips/day with an optimal combination of pedal tricycle containing bins as primary collection vehicle, than that of trucks. This can reduce transportation cost by about 50 percent.
- d) A low cost labour intensive, manually operated, 'Wind Row' composting method, in addition to sanitary land filling, is proposed. This will reduce the load on valuable lands required for dumping solid waste.

The system outlined above is not a rigid one. The design of community containers, house hold bins, transfer stations, transport vehicles as well as frequency of collection may be suitably changed within the broad frame work outlined above.

#### PRIMARY COLLECTION VEHICLE

A brief outline of the existing condition and the proposed system have been given. Now, we shall restrict our discussion to only primary collection vehicles, which play a vital role in SWM.

Different types of primary collection vehicles are in use for solid waste management. Most common amongst those are the following :-

- a) Conventional box type hand carts carrying no refuse bins.
- b) Box type hand carts with three wheels.
- c) Hand Carts for carrying 2/4/6 numbers of bins.
- d) Tricycle with box vans.
- e) Framed tricycle vans for carrying 4/6/8 numbers of bins of 100/50 /35 litre capacity.
- f) Light weight motor vehicles.
- g) Animal Carts.

Among the above mentioned primary collection vehicles the following were tried in different pilot study areas for the purpose of collection of solid wastes from houses/community bins.

- a) A light motor vehicle (Dumper)
- b) Pedal tricycles - container carrying type.
- c) Pedal tricycles - box type.
- d) Hand Carts - Container carrying type.

The feasibility of (1) Power Hauler ( 8 to 10 H.P) and (2) Animal Carts which are being used in some municipal towns under C.M.D.A were also examined, for a comparative evaluation.

The dumpers, with a carrying capacity of 2 M<sup>3</sup> (1 to 1.2 ton refuse) were operated for house to house collection in two wards of Rajpur, a rural municipal town, where the density of population is less than 10,000 per Sq. K.M. It was found that for house to house collection the optimum crew size would be 2. However, it was found that 3 to 4 pedal tricycles would cover the same area and collect the same amount of refuse, as the dumper, in a relatively lesser time. Capital cost of dumper being more than six times than that of four pedal tricycles, the system will be counter productive.

It has been observed that the box type hand carts, now in use, would not fit in any model of urban solid waste management system, which aims at achieving better standards of environmental sanitation and higher productivity. In case of existing box type of hand carts there is no other alternative than to dump the refuse on the road prior to its transfer into the transport vehicles, which results in double handling. This fouls the environment, creates health hazards, significantly reduces system efficiency and vehicle and labour productivity.

In the pilot project modified hand carts for carrying six to eight containers were tried. It was observed that such carts would not be effective unless population density is too high, more than 30,000/Sq.km and roads are too narrow. Animal carts would add to the management problems of the municipal authorities apart from polluting the streets with animal dung. Time of clearance by animal carts are also higher than that with pedal tricycles.

In different pilot study areas in the CMD, pedal tricycles, box and container carrying type, were used for primary collection. Container carrying type were found to be by far the most cost effective and efficient mode of primary collection. Box type pedal tricycles could be used only in cases where there is no need of transfer into secondary vehicles. Here refuse is used for filling local low lying areas within the city. Only under such conditions box types would function better than container carrier type. It has been found that pedal tricycles

carrying 6 to 8 containers of 40 to 60 litres capacity, are the most optimum for house to house collection as well as collection from community bins, for urban situations typical of Calcutta Metropolitan District (CMD) area. Introduction of pedal tricycles with containers will be appropriate for the following reasons :

- a) They will enlarge the command area of transfer stations, thereby reducing secondary transport by motor vehicles. This will result in considerable reduction in cost of vehicles, fuel, oil etc.
- b) They will eliminate double handling and open dumping and increase vehicle and labour productivity further by reducing trip time by 300%.
- c) They can be manufactured locally and do not require skilled manpower for operation and maintenance.
- d) Most municipal towns lack workshop, and garaging facilities and cannot maintain sophisticated motorised transport vehicles and hence non-motorised, non fuel consuming and non-polluting tricycles should be an ideal choice.

Use of power hauler or dumper can be thought of only if individual routes leading to a transfer station, contribute more than one ton of refuse. Such situations may arise only for a very high density of population, with high rise buildings and each transfer stations serving more than 30,000 population. For municipal towns in CMD area, primary collecting vehicles for serving one transfer zone of 10,000 to 15,000 people, carrying capacities above 500 Kgs. were found to be counter productive.

#### TRANSFER STATIONS :

Optimal and appropriate combination of primary collection vehicles and crew and secondary transport vehicles, depends primarily on appropriate selection of primary transfer stations. For every urban situation in respect of density of population, vehicle routing, land use characteristics, there is an optimal size of transfer station which will optimise total cost. Based on the

experiences of pilot studies in CMD area, it was found out that one primary transfer station would be required for every 10,000 to 20,000 people, for population densities varying between 10,000 to 30,000 per Km<sup>2</sup> .

Larger transfer stations would require a larger fleet of primary collectors, while smaller ones would increase secondary vehicle requirement. When pedal tricycles are used as primary collectors, the area under one transfer station should be limited to 0.1 Km<sup>2</sup> . Hence, for areas with higher densities of population, optimal size of transfer station is likely to be somewhat larger.

Primary transfer-stations proposed for municipal towns are essentially a ramp, by the side of which a large container/skip/trailer could be placed, so that primary collectors (pedal tricycles) would directly deliver the wastes into the skips, without dumping them onto the ground. This is also the point, where prime movers (Tractors) would exchange the trailers/containers/skips.

For optimal transport economics primary transfer stations must be located, as far as possible, centrally in respect of the collection areas and primary collection vehicles routes. Routing of the collection crew should also be done, so that amount of garbage collected per Km travelled be maximised. However, in more cases than not, adequate areas may not be available at best of locations, and compromises on this account has to be accommodated in the design by adjusting and altering primary collection vehicle routes.

This must be noted, that by Primary Transfer Station we mean locations where primary collection crew would transfer their wastes into transport vehicle, as distinguished from Transfer Stations, which are required when the disposal ground is too far away (10/15 km) from the towns. Even primary transfer stations may not be required in small towns, where the disposal ground is within 3/5 Kms. In bigger towns also wastes from wards closer to the disposal ground may be carried direct to the disposal ground by primary collection vehicles themselves.