

CHAPTER 13

TRANSPORTATION OF WASTE

13.1. INTRODUCTION

Transportation of the waste stored at waste storage depots at regular intervals is essential to ensure that no garbage bins/containers overflow and waste is not seen littered on streets. Hygienic conditions can be maintained in cities/towns only if regular clearance of waste from temporary waste storage depots (bins) is ensured.

Transportation system has to be so designed that it is efficient, yet cost effective. The system should synchronize with the system of waste storage depot and should be easily maintainable.

13.2. THE PRESENT SCENARIO

13.2.1 Inefficient and Unscientific Manual Loading of Waste

In most of the cities/towns there is no synchronization between waste storage depots and transportation of waste. Waste stored in open spaces is either loaded manually or with the help of loaders in traditional trucks. Manual loading takes time and reduces the productivity of the vehicles and manpower deployed. Besides, manual handling of waste poses a threat to the health of the sanitation workers as the waste is highly contaminated. (See Photographs in Fig.13.1)

Fig. 13. 1 MANUAL LOADING OF WASTE

Loading through loading machine necessitates large quantities of waste collected in open, as could be seen from the photograph below.

Fig. 13.2 LOADING OF WASTE THROUGH FRONT END LOADER & TRUCKS

Here the loading operation is cheap but the loaders can not clean waste storage depots fully, besides loading machine damage the flooring and screen walls very often necessitating frequent repairs. If repairs are not carried out on time, the damaged flooring becomes a source of nuisance.

In cities where Dhalavs or large masonry bins are used, waste is not regularly removed from inside of such structures and loaders can not effectively function for removal of waste from the corners of such structures. Leftover (uncollected) waste putrefies and emanates foul smell causing nuisance and insanitary conditions.

13.2.2 Irregular Transportation

Cities and towns generally have limited fleet of vehicles and most of them are old necessitating frequent repairs with the result the transportation of waste does not take place regularly. The waste is generally seen lying in heaps or scattered at the unscientifically designed dust bins giving unsightly appearance besides causing nuisance and unhygienic conditions.

13.2.3 Underutilization of Fleet of Vehicles

Most of the vehicles are manually loaded and the lorries which can easily take 5 to 6 tonnes of solid waste in one trip, carry only 1-3 tonnes of waste as strict monitoring system does not exist. In several cities, small vehicles and even bullock carts are taken directly to landfill sites located at long distances. This makes the transportation operation very inefficient and uneconomical.

13.2.4 Open Trucks Cause Nuisance

Open trucks loaded with garbage wade through cities and towns as shown in Fig.13.3(a) & (b) below. They emanate fowl smell and cause nuisance to people. At places where cover material is arranged, covering of trucks is done half-heartedly and nuisance continues.

Fig. 13.3(a) GRABAGE LOADED IN OPEN TRUCKS CAUSING NUISANCE

Fig. 13.3(b) GARBAGE LOADED IN OPEN TRUCKS CAUSING NUISANCE.

13.2.5 Non-Routing of Vehicles

In cities and towns, by and large, transportation net work is illdesigned. Waste storage depots are not cleared at regular intervals and more or less fire fighting operations are carried out by local bodies. These sites are attended to more on the basis of the complaints received or pressure brought on local staff rather than following a system of regular removal of waste from waste storage depots. The system of routing of the vehicles and the clearance of the bins on day to day basis thus generally breaks down.

13.2.6 Transportation of Waste from Hotels, Restaurants, Hospitals, Construction Sites, Etc.

In many cities there is no separate system of collection and transportation of such wastes and waste from the above sites is not cleaned regularly.

13.3. MEASURES TO BE TAKEN TO IMPROVE THE SYSTEM

Looking to the present situation, transportation of waste has to be planned scientifically to bring about a total change in the existing system.

System of transportation should be such that it can be easily maintained departmentally or through private garages and the system should appropriately match with the system adopted for the storage of waste at the waste storage depots. Manual loading should be discouraged and phased out expeditiously and replaced by direct lifting of containers through hydraulic system or non-hydraulic devices or direct loading of waste into transport vehicles.

Transportation of waste should be done regularly to ensure that the containers /trolleys and dustbin sites are cleared before they start overflowing. The frequency of transportation should be arranged accordingly. The system of transportation of waste must synchronize with bulk storage of waste at the temporary waste storage depots. multiple and manual handling of waste should be avoided.

13.4. STEPS TO BE TAKEN TO MEET THE ABOVE OBJECTIVES

13.4.1. Domestic/Trade/Institutional Waste

Transportation of waste from temporary waste storage depots/sites may be planned in accordance with the frequency of containers becoming full. The locations where the containers are placed may be grouped into four categories as under:

- Containers which are required to be cleared more than once a day.
- Containers which are required to be cleared once a day.
- Containers to be cleared on alternate days.
- Containers, which take longer, time to fill and need clearance twice a week.

It may be ensured that vegetable, fruits, meat, fish market waste is removed at least once in a day.

13.4.2 Routing of Vehicles

Depending on the containers to be cleared each day, the route for lifting containers may be worked out avoiding zigzag movement of vehicles to the extent possible. This will save a lot of fuel and time.

13.4.3 Use of Vehicles in Two Shifts

All the vehicles may be utilized in two shifts to lift containers, to ensure full utilization of the fleet of vehicles and to reduce the requirement of new vehicles.

Transportation of waste during night time may be done in areas where there is serious traffic congestion during the day and it hampers solid waste management operations. Work at night will increase the productivity and reduce the cost of such service.

13.4.4 Type of Vehicles to be Used

Vehicles which can synchronize well with containers placed at temporary waste storage depots should be utilized for transportation to prevent multiple handling of waste. The selection of the type of vehicles should also be done keeping in mind the quantity of waste to be transported, the distances to be travelled, the road widths, road conditions, work shop facilities, etc.

In cities above 5 lac population, hydraulic vehicles could be used. Following type of vehicles or similar vehicles could be used for transportation of waste.

- (i) Container lifting devices such as Dumper placers/skip lifters or similar other vehicles may be used for transportation of large size containers to transfer stations or to disposal sites as illustrated in Fig.13.4.
- (ii) At places where small size containers of 0.5 to 1.0 cu.m. may have been placed, the refuse collector machine without compaction devices of 6 to 15 cu.m. capacity having top or back loading facility may be used. This vehicle, instead of transporting the container as shown in Fig.13.4 above lifts and unloads the contents of the small container into the body of the vehicle through a hydraulic system and puts the empty container back in place as shown in Fig.13.5.

Fig. 13.4 TRANSPORTATION OF LARGE CLOSED-BODY CONTAINER

FIG. 13.5 LIFTING OF SMALL CONTAINER FOR EMPTYING THE CONTENTS

(iii) *Transportation from Congested Areas*

Local bodies should provide facility of direct loading of waste in small vehicles in the congested areas where small vehicles may be parked at suitable locations during primary collection and sweepers may be directed to transfer the waste from the hand carts directly into vehicles, as shown in Fig. 13.6 below.

Fig. 13.6 PRIMARY COLLECTION OF WASTE THROUGH A SMALL VEHICLE

The waste so collected in small vehicles may be taken to the nearest transfer station to transfer the contents into a large container by using a ramp to reduce the cost of transportation.

- (iv) In small cities with poor repairs and maintenance facility, where hi-tech vehicles may not work efficiently, tractor-trolley combination or lifting of containers or toeing of containers by tractors may be utilized. Simple hydraulic tipping-trailers are recommended to avoid manual unloading at Processing Plants or disposal sites.

13.4.5 Bio-Medical Waste From Hospitals, Nursing Homes, Health Care Establishments Etc.

Transportation of bio medical waste has to be arranged by waste producers or their associations. The instructions contained in the Biomedical Waste (Management and Handling) Rules 1998 may be followed. The recommendations made in the Chapter-7 on biomedical waste may be followed. Adequate protective clothing must be used by the staff handling biomedical waste as illustrated in the photograph in Fig. 13.7:

Fig. 13.7 STAFF ENGAGED IN TRANSPORTATION OF BIOMEDICAL WASTE

13.4.6 Transportation of Waste From Hotels & Restaurants

Hotels and restaurants waste should be collected once or twice daily through a contract given by the associations of hotels and restaurants, or at their request by local bodies on cost recovery basis. Doorstep collection system may be introduced for collection of such waste. Either refuse collector with back loading facility or motor vehicle with close body may be used. The entire collection and transport system could be privatized and rates may be prescribed by the associations or local bodies. 33% spare vehicles may be kept in reserve to ensure reliable service.

13.4.7 Transportation of Construction Waste and Debris

Disposal of construction and demolition waste and debris is the liability of waste producers. If such waste is not promptly removed within a reasonable time prescribed by the local body, it may be removed by the local bodies themselves on full-cost-recovery basis. One of the following methods may be adopted for transportation of construction waste and debris:

- In very large cities where a skip-renting system can be introduced, the skips may be transported by hydraulic system at a time mutually agreed upon between the local body and waste producer. See photograph in Fig. 13.8.

Fig.13.8 SKIP UTILIZED FOR TRANSPORTATION OF CONSTRUCTION WASTE/DEBRIS.

- When sufficient cost-recovery fee is deposited in advance by waste producer for removal of construction waste, such waste may be loaded mechanically into skips or vehicles using front-end-loaders. One front-end-loader and 3 to 4 trucks can transport 100 to 150 tonnes of construction waste in one shift.
- In small cities under 5 lac population, construction waste may be manually loaded into trucks/ or tractor trolleys and transferred to disposal sites.

Since all such waste must be cleared sooner or later, the more promptly this is done, the cleaner the city will be and there will be less traffic obstruction.

13.4.8 Transportation of Waste from Narrow Lanes

Quite often small quantities of waste are disposed of in narrow lanes, which cannot be removed by sending out the usual transport vehicles. Loading rickshaws or traditional carts or animals may be used for removal of such waste manually but very promptly.

13.5. SETTING UP OF TRANSFER STATIONS

In large cities where disposal sites are more than 10 km. away from the city boundary and smaller vehicles are used for transportation of waste, it may prove economical to set up transfer stations to save transportation time and fuel provided such cities have a good performance record of vehicle maintenance and adequate facilities to maintain large size vehicles and containers. Large size 15 to 20 cu. m. containers could be kept at transfer stations to receive waste from small vehicles. A ramp facility may be provided to facilitate unloading of vehicles or dumper places containers, directly into large containers at transfer station. Construction of complicated and expensive transfer stations must be avoided.

The requirements of large containers and vehicles may be worked out on the basis of the total quantity of waste expected to be brought to the transfer station and the number of trips the vehicles will be able to make in two shifts each day.

13.6 LIFTING OF WASTE FROM TRANSFER STATION

In cities where transfer stations have been provided, to economize the cost of transportation of waste, large containers of 15 to 20 cu.m. may be used and lifted by specially designed vehicles which can carry big size containers duly cleared by regional transport authorities.

13.7 WORKSHOP FACILITY FOR VEHICLES MAINTENANCE

All local bodies must have adequate workshop facilities for the maintenance of their fleet of vehicles and containers, handcarts etc. Such facilities may be created by local bodies departmentally or through a contractual arrangement. The workshop, public or private, should have adequate technical staff, spares and preventive maintenance schedules to ensure that at least 80% of the vehicles remain on the road each day and the down time of repair/maintenance is minimised to the extent possible. Spare assemblies should be kept available

which could be given as replacements until necessary repairs are carried out. The workshop should be preferably headed by an automobile or mechanical engineer.

Cities which use hydraulic equipments such as dumper placers, refuse collectors, etc., should as far as possible give contract to the manufacturers of the equipment or to their, authorized agents or to reliable workshops in the city for the repairs and maintenance of vehicles to keep the fleet of vehicles in a good working condition. In such cases, daily checking, 15 days checking, checking after 2000 Kms and 4000 Kms. may be carried out departmentally and checking after 20,000 Kms could be got done through a private garrage which has been given contract. Generally this will take about an year when some major repairs would be required in the vehicles, which could be done through a contractor.

In cities where such an arrangement is not possible or local bodies desire to maintain the fleet of vehicles departmentally, they should appoint adequate technical staff, in the workshop for maintenance of the fleet of vehicles as shown in Table 13.1 below and should have a schedule of preventive maintenance for the vehicles as shown in Annexure-13.1. This Annexure shows the items to be checked daily, fortnightly/ after 2000 Kms., after the 4000 kms, etc., in case of hydraulic mounted vehicles. Similar schedule of maintenance for the trucks utilized for handling garbage is given in Annexure-13.2, which also shows the preventive maintenance schedule after running 24000 Kms.

Table-13.1

STAFF REQUIREMENT FOR MAINTENANCE OF VEHICLES

SR. NO	DESIGNATION	VEHICLES	VEHICLES	VEHICLES	VEHICLES
		5	10	25	50
1.	Fitters	1	1	4	6
2.	Electricians	1	1	2	2
3.	Tyre fitters	-	-	1	2
4.	Body smith	-	-	1	1
5.	Welder	-	-	1	1
6.	Supervisors	-	1	2	2
7.	Mechanics	1	1	2	2
8.	Helpers/Cleaners	1	2	4	6
9.	Store clerks	-	-	-	1
10.	Maintenance Incharge	-	-	-	1

Team incentives should be introduced in departmental workshops to ensure that more than 80% of vehicles remain on the road throughout the month.

Type of standard tools required in the workshop.

If local bodies decide to maintain the fleet of vehicles departmentally, the minimum tools required in the workshops are given in Annexure-13.3

The workshops should preferably be run in more than one shift. Technical staff as per the requirement may be kept in the second or third shift to ensure optimum utilization of the fleet of vehicles of local bodies.

Since waste-transport vehicles have a useful life of 8-10 years, financial planning must ensure timely replacement of vehicles to minimise down time and repair costs.

13.8 FLEET OF VEHICLES TO BE MAINTAINED

Every local body should work out the need of vehicles as under.

- (i) No. of containers placed in the city.
- (ii) No. of containers to be removed on day to day basis.
- (iii) No. of containers to be lifted 1st, 2nd and/or 3rd shift.
- (iv) Distance to be travelled.
- (v) No. of containers a vehicle can lift in one shift.

Normally during the busy day time 4 to 5 containers can be transported from the city to the processing or disposal site if distance to be travelled is within 5 to 9 Kms. The no. of trips could be more if the distance to be travelled is less than 5 Kms. And could be less if distance to be travelled is more than 9 Kms. More trips could be made if transportation is carried during night time when the roads are free from traffic flow.

- (vi) No. of vehicles required to lift the required No. of containers in two shifts.
- (vii) Stand by vehicles required @ 30% of the total vehicles to be used each day.
- (viii) Total no. of vehicles required on the fleet.

It must be ensured that local bodies remove daily quantities of waste equal to the total quantity of waste produced each day to avoid any backlog, which can be estimated by taking all the vehicles small or big, carrying waste to the waste treatment/disposal site through a public weigh bridge for at least 3 days

continuously or correctly estimate the quantities of waste transported each day taking into consideration the volume and density of the waste being transported on day-to-day basis. Some studies, conducted by NEERI, Nagpur in past have estimated waste generation rates as per Table 13.2.

TABLE 13.2

POPULATION RANGE	AVERAGE PER CAPITA WASTE GENERATION (IN GRAMS.)
1,00,000 to 5,00,000	210
5,00,000 to 10,00,000	250
10,00,000 to 20,00,000	270
20,00,000 to 50,00,000	350
50,00,000 and above	500*

Source : NEERI. Strategy. Report on SWM in India

* Presently 600 gm.

13.9 PARKING OF WORKSHOP VEHICLES

Small cities having a few vehicles can have parking in the workshop itself; but in big cities where large distances are to be travelled, it is desirable to have parking depots in different parts of the city to reduce dead mileage of vehicles. Cities above 5 lacs population should think of having more than one depot for parking of vehicles in different directions of the city. Cities above 2 million should think of having at least 3 to 4 such depots to reduce the congestion in the workshop and also to cater the needs of the different sectors of the city from the depot close by. The arrangements for putting fuel in such vehicles could also be made locally either by having fuel filling station at each depot or having a working arrangement with a private petrol pump to provide fuel on contractual basis to municipal vehicles. This will save lot of dead mileage and add to the efficiency of transport system.