



* **Set out - set back** - containers are set out from the homeowner's property and set back after being emptied by additional crews that work in conjunction with the collection crew responsible for loading the collection vehicle.

* **Set out** - essentially the same as set out - set back service, except that the house owner is responsible for returning the containers to their storage location.

Manual methods used for the collection of residential wastes include

* the direct lifting and carrying of loaded containers to the collection vehicle for emptying

* the rolling of loaded containers on their ends to the collection vehicle for emptying

* the use of small lifts for rolling loaded containers to the collection vehicle.

From Low and Medium Rise Apartments.

Curbside collection service is common for most low and medium rise apartments. Typically, the maintenance staff is responsible for transporting the containers to the street for curbside collection by manual or mechanical means. Where large containers are used, the containers are emptied mechanically using collection vehicles equipped with unloading mechanisms.

From High-Rise Apartments:

Typically, large containers are used to collect wastes from large apartment buildings. Depending on the size and type of container used, the contents of the containers may be emptied mechanically using collection vehicles equipped with unloading mechanisms or the loaded containers may be hauled to an off-site location where the contents are unloaded.

From Commercial - Industrial facilities:

Both manual and mechanical means are used to collect wastes from commercial facilities. Where manual collection is used, wastes from commercial establishments are put into plastic bags, cardboard boxes and other disposable containers that are placed at the curb for collection.

Collection of wastes separated at the source:

Waste materials that have been separated at the source must be collected or gathered together before they can be recycled. The principal methods now used for the collection of these materials include curbside collection using conventional and specially designed collection vehicles, incidental curbside collection by charitable organizations and delivery by homeowners to drop-off and buy-back centers.

Residential curbside collection:

In a curbside system, source separated recyclables are collected separately from commingled waste at the curbside, alley, or commercial facility. The principal types of collection vehicles used for the collection of separated wastes are

- * standard collection vehicle and
- * specialized collection vehicle → including closed body recycling trucks, recycling trailers, modified flatbed trucks, open-bin recycling trucks and compartmentalized trailers.

Commercial facilities:

Source separated materials from commercial establishments are usually collected by private haulers. The wastes to be recycled are stored in separate containers.

3.2 Types of collection systems, Equipment And Personnel Requirements.

Over the past 10 years a wide variety of systems & equipment has been used for the collection of solid wastes. These systems may be classified from several points of view, such as the mode of operation, the equipment used, and the types of waste collected. According to the mode of operation, collection systems have been classified into two categories.

* Hauled container systems (HCS)

* Stationary container systems (SCS)

Hauled container systems:

Hauled container systems are ideally suited for the removal of wastes from sources where the rate of generation is high. Because relatively large containers are used. The use of large containers reduces handling time as well as the unsightly accumulations and unsanitary conditions. Another advantage of this system is their flexibility in container size and shape.

Containers used in the system must be filled with manually. This often leads to low volume utilization in very large containers.

Advantages:

- Required only one truck
- a driver to accomplish the collection cycle
- each container picked up requires a round trip to the disposal site

Disadvantage:

- container size and utilization are of great economic importance.
- when highly compressible wastes are to be collected and hauled over considerable distances the economic advantages are obvious.

Types of Hauled Container System:

- * Hoist truck system
- * Tilt-frame container system
- * Trash trailer system.

Hoist truck system:

Hoist trucks were widely used with containers varying in size from 2-12 yd^3 . With the advent of large capacity mechanically loaded collection vehicles, this system is applicable at a certain places and they are as follows:

- For the collection of wastes by a collector who has a small operation and collects from only a few pickup points where considerable amounts of waste generated.
- For the collection of bulky items and industrial rubbish such as scrap metal and construction debris.

Tilt-frame container system:

This system used large containers often called drop or debris boxes, which are ideally suited for the collection of all types of solid waste and rubbish. The generation rate warrants the use of large containers.

Large containers, in conjunction with stationary compactors, are common at apartment, complex, commercial services and transfer stations.

Trash - Trailer System:

The application of trash trailer is similar to that for tilt frame container system. Trash trailers are better for the collection of especially heavy rubbish, such as sand, timber and metal scrap, and often are used for the collection of demolition wastes at construction sites.

Personnel Requirements for the Hauled container System:

In most hauled container systems used a single collector driver. This ^{collection driver} person is responsible for driving the vehicle, loading full containers onto the collection vehicle, emptying the contents of the containers at the disposal site and repositioning the empty containers.

In some cases, for safety reasons both a driver and helper are used. The helper usually is responsible for attaching and detaching any chains or cables used used in collection vehicle.

The driver is responsible for the operation of the vehicle. A driver and helper should always be used where hazardous wastes are to be handled.

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Stationary Container Systems:

These systems may be used for the collection of all types of wastes. According to the type & quantity of wastes to be handled, as well as the number of generation points, the systems may vary. For the economic advantages, almost all the collection vehicles are equipped with internal compaction mechanism.

There are two main types.

- * Systems in which mechanically loaded collection vehicles are used
- * Systems in which manually loaded collection vehicles are used.

Systems with mechanically loaded collection vehicles:

Container size and utilization are not so critical in stationary container systems using collection vehicles equipped with a compaction system.

After the contents of containers have been collected and compacted, and the collection is full, trips to the material recovery facility (MRF), transfer station or disposal site. For this reason, the quantity of waste hauled is considerably greater than hauled container systems.

A variety of container sizes is available for use which are relatively small (bogie) compared with a hot truck

Smaller containers offer greater flexibility in terms of shape, ease of loading, and special features available and lead to considerable increased utilization.

These systems can also be used for the collection of residential wastes, substituting one large container for a number of small containers.

Because of difficult maintenance and weight involved, these systems are not well suited for the collection of heavy industrial wastes and bulky rubbish. And service is difficult at locations where high volumes of rubbish are produced.

Systems with Manually loaded collection vehicles:

The major application of manual loading methods is in the collection of residential wastes and litter.

Manual loading is effective where than mechanical loading in residential areas. Because the quantity picked up at each location is small and loading time is short. And individual pickup points are inaccessible to mechanized self-loading collection vehicles.

Special attention must be given to a single collector, driver. At present, these vehicles appear with side loaded compactors, which is best suited for curb and alley collection.

Personnel Requirements for Stationary Container System:

The personnel requirements will vary depending on whether the collection vehicle is loaded mechanically or manually. Labour requirements for mechanically loaded stationary container systems are same as for hauled container systems. The driver often assists the helper in bringing loaded containers and returning the empty containers. Occasionally, a driver and two helpers are used, where the containers must be transferred to the collection vehicle from inaccessible locations, such as in congested downtown commercial areas.

In stationary container systems where the collection vehicle is loaded manually, the number of collectors varies from one to three, depending on the type of service and the collection equipment. Typically, a driver and a collector, are used for curb and alley service. A multiperson crew is used for backyard carry service.

In satellite vehicle collection systems, one collector driver is used for collection vehicle. While the satellite vehicles are being loaded, driver of main vehicle

pickup wastes from curb locations.

3.3 Collection Routes

Once equipment and labor requirements have been determined, collection routes must be laid out. In general, the layout of collection routes involves a series of trials.

Some common guidelines that should be taken into consideration when laying out routes are as follows:

- * Existing policies and regulation related to the point of collection and frequency of collection must be identified.
- * Existing system characteristics such as crew size and vehicle types must be coordinated.
- * Whenever possible, routes should be laid out that they begin and end near arterial streets, using topographical and physical barriers as route boundaries.
- * In hilly area, routes should start at the top and proceed down hill as the vehicle becomes loaded.
- * Routes should be laid out that the last container to be collected is located nearest to the disposal site.
- * Wastes generated at traffic congested locations should be collected as early in the day as possible.

* Sources at which extremely large quantities of wastes are generated should be serviced during the first part of the day.

* Scattered pickup points that receive the same collection frequency should be serviced during one trip or on the same day.

Layout of Collection Routes:

The general steps involved in establishing collection routes include

- (i) preparation of location maps
- (ii) data analysis
- (iii) preliminary layout of routes
- (iv) evaluation of the preliminary routes and the development of balanced routes by successive trials.

Step 1 is essentially the same for all types of collection systems. The application of step 2, 3 and 4 is different for the hauled and stationary container system.

Collection Route Layout - Step 1:

On a large scale map of the commercial, industrial or residential area to be served, the following data should be plotted for each pickup point: location, collection frequency, no. of containers.

If a mechanically loaded stationary container system is used, the estimated quantity of

wastes at each pickup location should be entered on the map. For residential sources it is assumed that approximately the same average quantity of waste will be collected from each source.

Because the layout of collection routes involves a series of successive trials tracing paper should be used. For locations with less than 20-30 pickup points, this step is not necessary. For larger areas it may be necessary to subdivide further each of the similar areas into smaller areas.

Collection Route layout - Step 2, 3 & 4 for Hauled container System:

Step-2:

On a spread sheet program first enter the following headings: collection frequency, times/week; no. of pickup locations; total no. of containers; no. of trips trips/week, and a separate column for each day of the week during which wastes will be collected.

Determine the no. of pickup locations requiring multiple pickups during the week and enter start the listing with the locations requiring the highest no. of pickups per week.

Distribute the no. of containers requiring once per week service so that the no. of containers emptied per day is balanced. Preliminary collection routes can be laid out once this information is known.

Step - 3 :

Using the information from step 2, the layout of collection routes can be outlined as follows. Starting from the dispatch station, a route should be laid out that connects all pickup points. The next step is to modify the basic route to include the additional containers. Each daily route should be laid out so it begins and ends near the dispatch station.

Step - 4 :

When preliminary routes have been laid out, the average distance to be traveled between containers should be computed. If the routes are unbalanced with respect to the distance traveled, they should be redesigned. A no. of collection routes must be tried before the final ones are selected. When more than one collection vehicle is required, collection routes for each area must be laid out and work loads for each driver must be balanced.

Collection Route layout - Steps 2, 3 and 4 for Stationary container system with mechanically loaded collection vehicle:

Step - 2 :

On a spread sheet program first enter the following heads: collection frequency times/week, no. of pickup locations, total waste yd^3/week and a separate column for each day of the week.

Determine the amount of waste to be collected from pickup locations requiring multiple pickups during the week. Start the listing with the locations requiring the highest no. of pickups per week.

Using the effective volume of the collection vehicle, determine the amount of additional waste that can be collected each day from locations receiving once per week service.

The amount of waste collected per trip is balanced for each collection route. Preliminary collection routes can be laid out once this information is known.

Step - 3 :

The layout of collection routes can proceed as follows.

Starting from the dispatch station, a route should be laid out that connects all the pickup points during each collection day. Depending on the quantity of waste to be collected, several basic routes may have to be laid out.

The next step is to modify the basic route to include the additional pickup locations to complete the load. These modifications should be made so that the same general area is serviced with each collection route.

Step - 4:

When the collection routes have been laid out, the quantity of waste to be collected and the haul distance for each route should be determined.

In some cases it may be necessary to readjust the collection routes to balance the work load.

After the routes have been established, they should be drawn on the master map.

Route
Collection layout - Step 2, 3 and 4 for Stationary
Container Systems with manually loaded collection vehicles:

Step - 2:

Estimate the total quantity of wastes to be collected from pickup locations serviced each day.

Using the effective volume of the collection vehicle, determine the average no. of residences from which wastes are to be collected during each collection trip.

Step - 3:

Once these data are known, the layout of collection routes can proceed as follows.

Starting from the dispatch station lay out collection routes that include all of the pickup locations to be serviced during each collection route.

These routes should be laid out so that the last of these locations is nearest the disposal site.

Step - 4 :

When the collection routes have been laid out, the actual container density and haul distance for each route should be determined.

Using these data, the labor requirements per day should be checked against the available work time per day.

In some cases it may be necessary to readjust the collection routes to balance the work load.

After the routes have been established, they should be drawn on the master map.

Effective Volume of the collection vehicle :

Effective volume of the collection vehicle is defined as the volume of waste ^{collected and} compacted in the nominal volume of the collection vehicle.

$$\text{Effective volume} = \text{nominal} \underset{\text{collection}}{\text{volume}} \times \text{compaction ratio}$$

Transfer Stations:

Transfer stations are integral part of the large integrated waste collection route system.

Transfer operations attractive include

- * the occurrence of illegal dumping due to excessive haul distances
- * the location of disposal sites relatively far from collection routes
- * the use of small capacity collection vehicles
- * the existence of low-density collection areas
- * the use of small containers in commercial routes
- * the use of hydraulic and pneumatic collection systems.

Types of Transfer Stations:

Transfer stations are used to accomplish transfer of solid wastes from collection and other small vehicles to large transport equipment.

Transfer stations may be generally classified into three types:

- * direct - load
- * storage - load
- * combined direct - load and discharge - load.

With respect to throughput capacity of transfer station, it may be classified into

- * Small < 100 ton/d
- * medium 100 - 500 ton/d
- * large > 500 ton/d.

Direct - Load Transfer Stations:

At direct - load transfer stations, the wastes in the collection vehicles are emptied directly into the vehicle to be used to transport them to a place of final disposition or into facilities to compact the wastes into transport vehicles or into waste bales that are transported to the disposal site.

Storage - Load Transfer Stations:

In the storage load transfer station, wastes are emptied directly into a storage pit from which they are loaded into transport vehicles by various types of auxiliary equipment.

The difference between a direct load and a storage load transfer station is that the latter is designed with a capacity to store waste (typically 1-3 days).

Combined Direct - Load and Discharge - Load Transfer Station:

In some transfer stations, both direct - load and discharge - load methods are used. Usually these are multipurpose facilities that service a broader range of users than a single purpose facility.

A multipurpose transfer station can also do