Waste Management

إدارة المخلفات

Prepared by

Dr. Karim Emara

Associated Professor of Heat Engines, Combustion, Energy and Environmental Science.

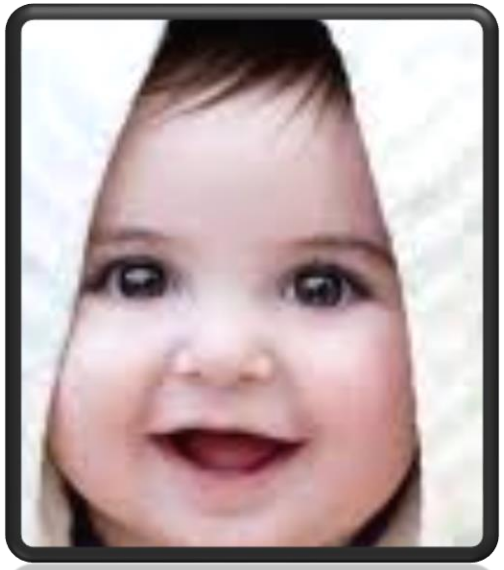
Mechanical Power Engineering Department-

Faculty of Engineering, Mataria- Cairo- Helwan University

2024

Lecture Strategy

Please



1- Smile

2- Respect the lecture time

3- Make your mobile Silent

CHAPTER (3 &4)

Collection & Transfer stations

Chapter 3

WASTE COLLECTION:

EQUIPMENT AND TRUCKS

1. Collection tools

Manually handled containers for waste are typically small bins or bags that are designed to be carried and emptied by hand

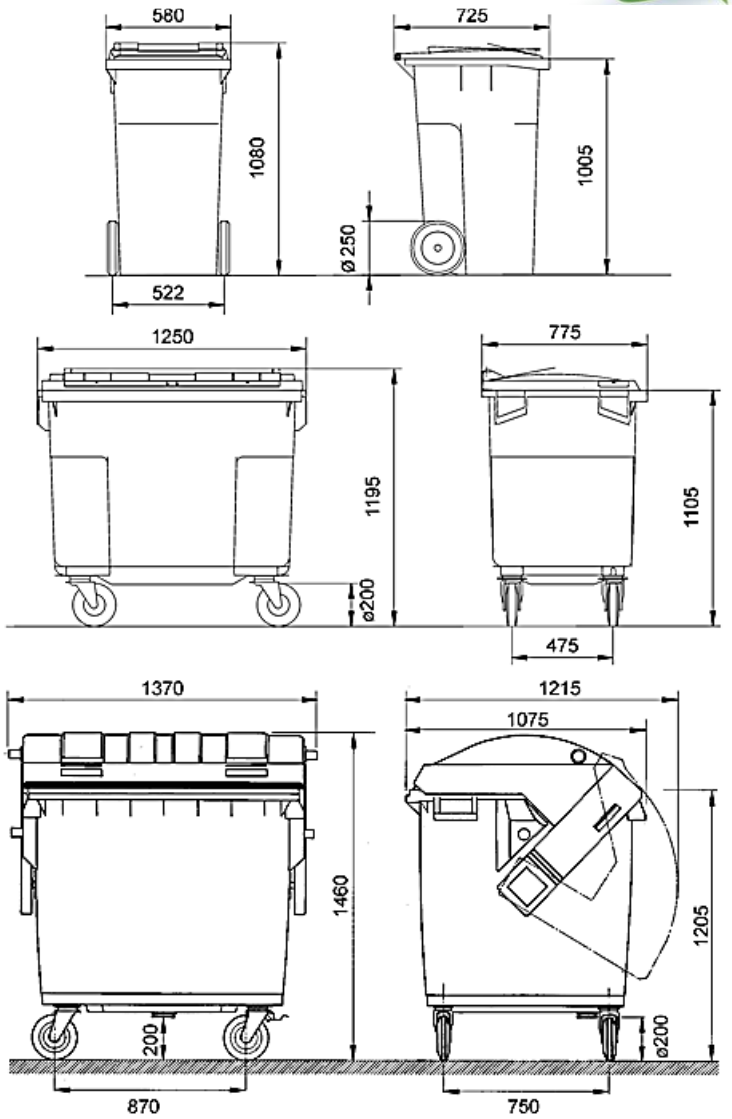
Large containers for waste are designed for larger quantities of waste and are usually placed in public spaces, such as streets or parks.

Containers for recyclables are designed to collect specific types of waste that can be recycled, such as paper, plastic, glass, or metal.

Containers for biodegradable organics are designed to collect organic waste, such as food scraps or garden waste, which can be composted

Underground bins are typically used in urban areas where space is limited

Bags for residual waste



Bins made of polyethylene (PE) for waste collection

Figure 1 :Typical roll-off containers

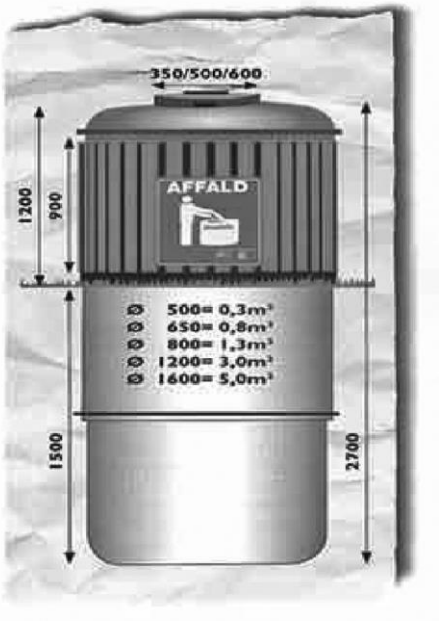


Figure 1: The underground container

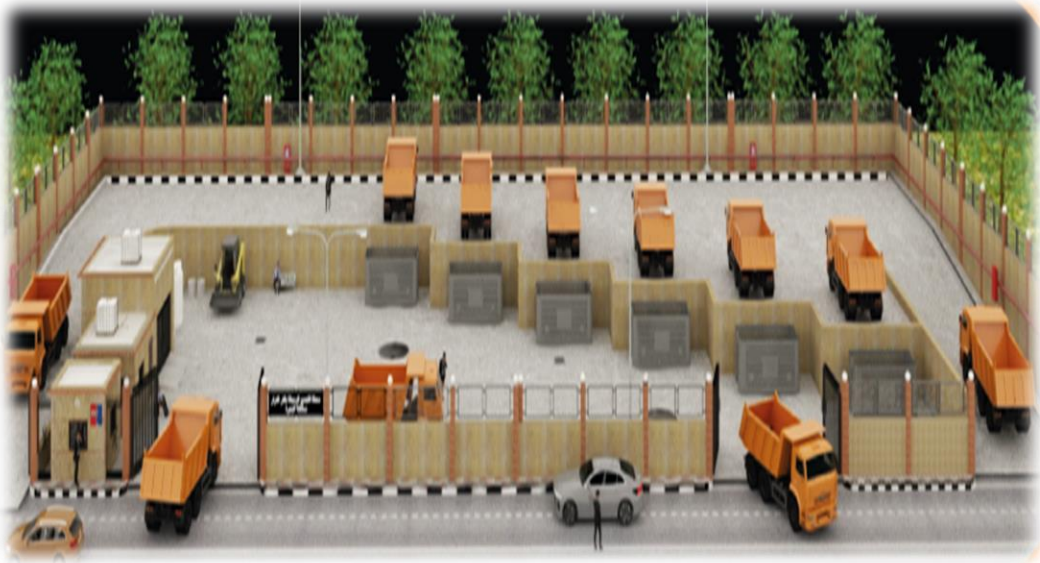
Waste collection vehicles can also contribute to air pollution and greenhouse gas emissions. Many cities are exploring alternatives, such as electric or hybrid waste collection vehicles, to reduce emissions and improve air quality. Additionally, waste reduction and recycling programs can help reduce the amount of waste that needs to be collected and transported, further reducing the environmental impact of waste collection vehicles.

Chapter 4

Transfer Stations

Transfer Stations

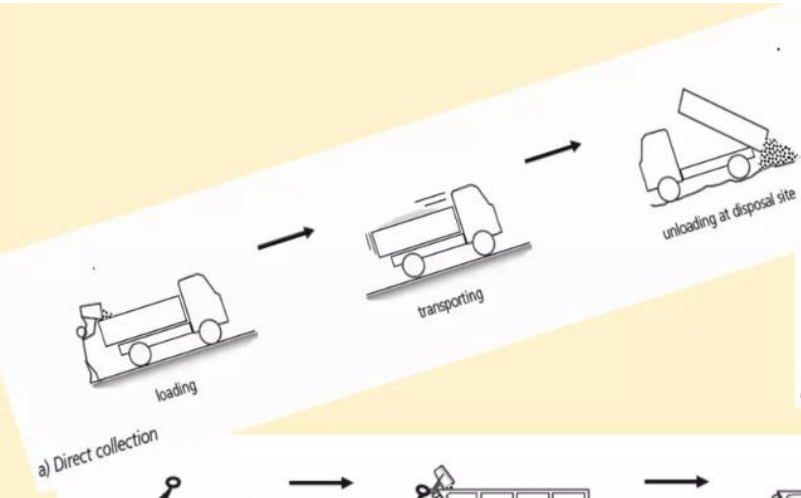
- What is a transfer station
- Functions of transfer station
- Types of transfer station



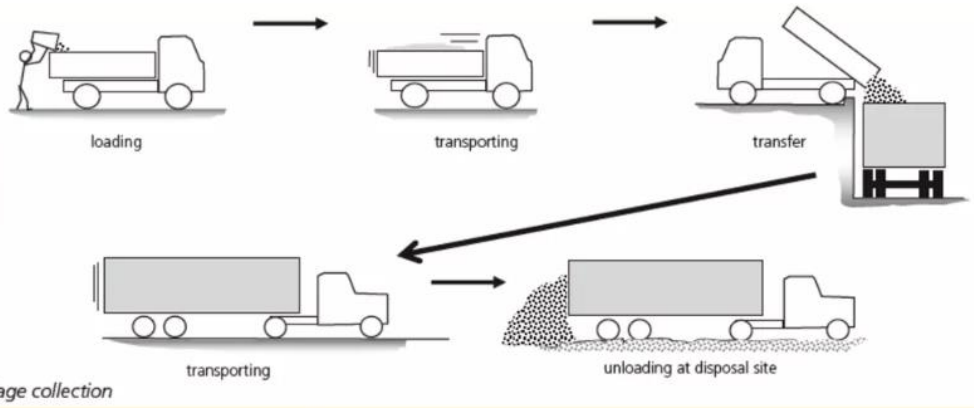
Transfer Stations

- Waste transportation costs will be substantial if the distance between a collection zone and the final destination (e.g., landfill, incinerator) is significant.
- In the interest of economics, many municipalities choose to transfer waste from neighborhood collection trucks or stationary containers to larger vehicles before transporting it to the disposal site.
- A transfer station may be established between the waste collection sources and the final destination to serve in this capacity.
- At a transfer station, waste is transferred from smaller collection vehicles to larger transfer vehicles, such as a tractor and trailer, a barge, or a railroad car.

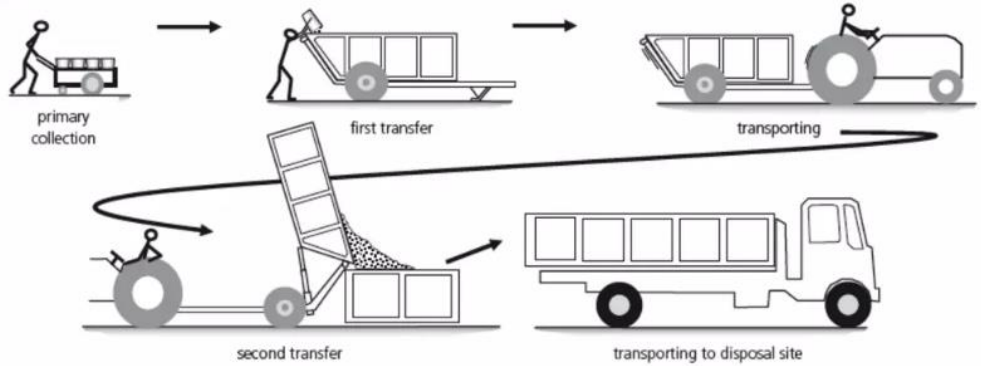
Transfer Stations



a) Direct collection



b) Two stage collection



c) Three stage collection

Transfer Stations

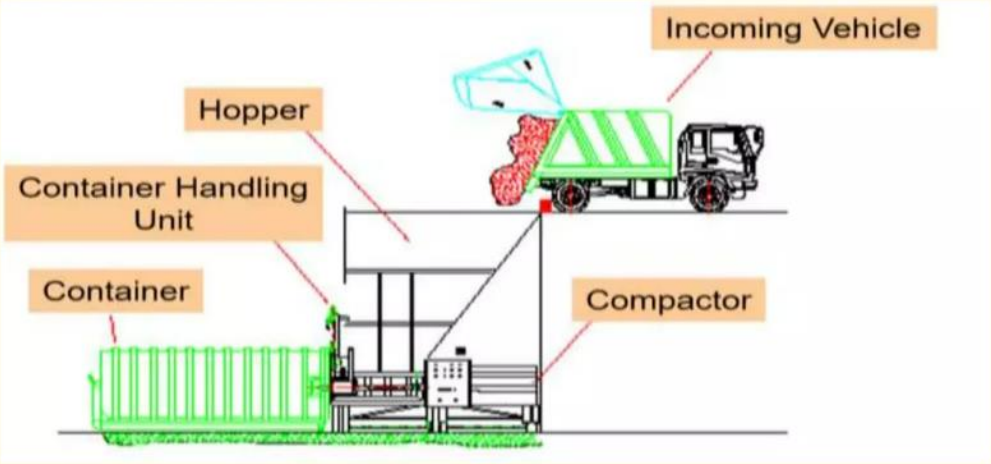
- The primary objective in using a transfer station is to reduce the traffic of smaller vehicles to the disposal site, ultimately resulting in reduced transport costs including labor (crews spend less time traveling to the disposal site) and fuel.
- In addition to lower collection costs, transfer stations offer benefits including
  - Reduced maintenance costs for collection vehicles
  - Increased flexibility in the selection of disposal facilities
  - The opportunity to recover recyclable materials at the transfer site
  - The opportunity to process wastes (shred or bale) prior to disposal

Transfer Stations

- In determining whether a transfer station is appropriate, municipal decision makers should compare the costs and savings associated with the construction and operation of the facility with costs for the direct shipping of the wastes from local neighborhoods to the landfill.
- Transfer stations are often difficult to site and permit, particularly in urban areas.
- The farther the ultimate disposal site is from the collection area, the greater the savings attained from the use of a transfer station.

Transfer Stations

- Sometimes a transfer station is required regardless of distance to a landfill.
- To minimize the traffic and air pollution impacts at a landfill, a permit may limit the landfill to only receiving waste from transfer stations.
- This significantly reduces the number of vehicles travelling to a landfill.



Types of Transfer Stations

- The type of station that would be most appropriate for a community depends on several design variables, for example (U.S. EPA, 2003):
  - Capacity for waste storage
  - Types of wastes received
  - Processes necessary to recover material from wastes
  - Types of collection vehicles using the facility
  - Types of transfer vehicles to be accommodated
  - Site access

Types of Transfer Stations

[1] Small to Medium Transfer Stations (capacity of less than 100 to 500 tons/day)

1) Small to medium transfer stations are usually “direct-discharge” facilities that provide little area for interim waste storage.
2) Such stations are equipped with operating areas for waste collection trucks and are often provided with drop-off areas for use by the public.
3) Direct-discharge stations are often constructed with two operating floors.
4) A compactor or open-top container is located on the lower level. Users enter the upper level and dump wastes into hoppers attached to these containers.
5) Some smaller transfer stations used in rural areas may use simple drop-off collection, in which a series of open-top containers are filled by users.
6) The containers are then emptied into a larger vehicle at the station or hauled directly to the disposal site.
7) The number and size of containers at the facility depends on the size and population density of the area served and the frequency of collection.

Types of Transfer Stations

[2] Large Transfer Stations

- Transfer vehicles are weighed after loading to just under maximum legal weights; this maximizes payloads and minimizes weight violations.
- Several different designs for larger transfer operations are common depending on the transfer distance and vehicle type.
- Most designs fall into one of three categories (U.S.EPA, 2003):

  (1) Direct-discharge non-compaction stations

  (2) platform/pit noncompaction stations

  (3) compaction stations

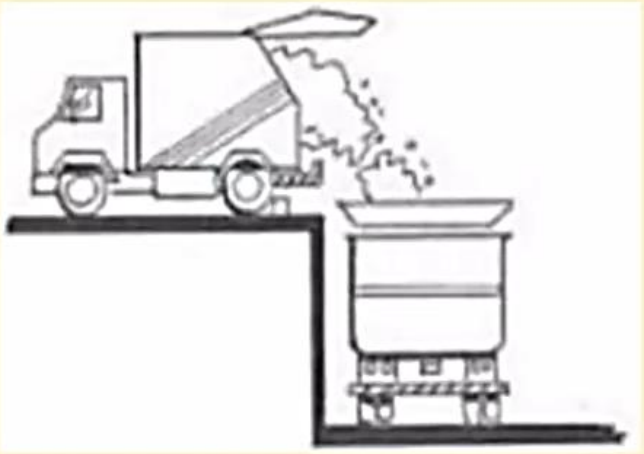
Types of Transfer Stations

[a] Direct-discharge non-compaction stations

- These stations are generally designed with two operating floors.
- In the transfer operation, wastes are dumped directly from collection vehicles on the top floor through a hopper and into open-top trailers on the lower floor.
- The trailers are often positioned on scales so that dumping is halted when the maximum payload is reached.
- These stations are efficient because waste is handled only once.
- However, some provision for waste storage must be provided at peak drop-off times or during system interruptions.

Types of Transfer Stations

[a] Direct-discharge non-compaction stations



Types of Transfer Stations

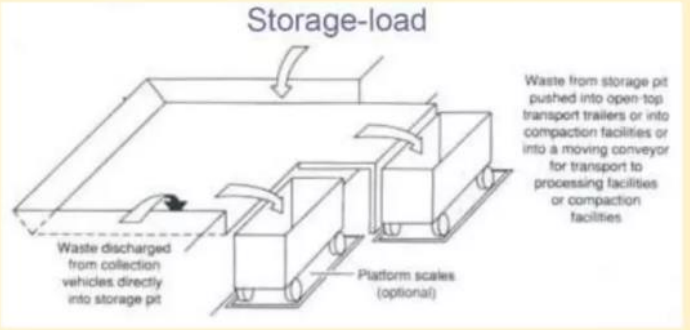
[b] Platform or Pit noncompaction Stations

- In platform or pit stations, collection vehicles dump their wastes onto an area where wastes are temporarily stored and sorted for recyclables or unacceptable materials.
- The waste is then pushed into open-top trailers by front-end loaders (Figure 5.8).
- Platform stations are also constructed with two levels.
- Temporary storage is provided that can accommodate peak inflow of wastes.
- Construction costs may be higher with this type of station because of the increased floor space; however, the ability to temporarily store wastes results in a need for fewer trucks and trailers.

Types of Transfer Stations

[b] Platform or Pit noncompaction Stations

- Also, facility operators can haul wastes at night or during other slow traffic periods (U.S. EPA, 2003).



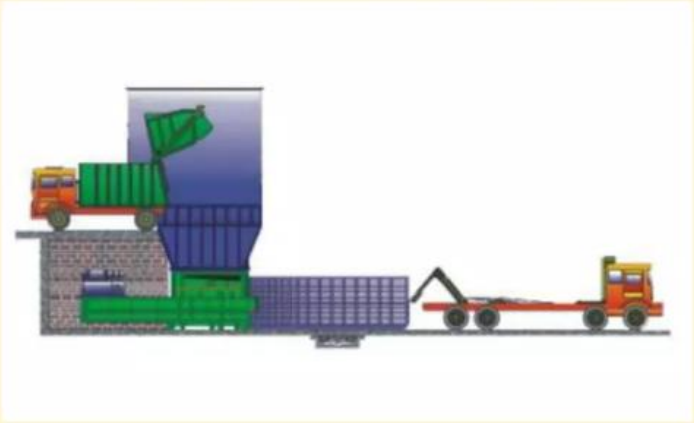
Types of Transfer Stations

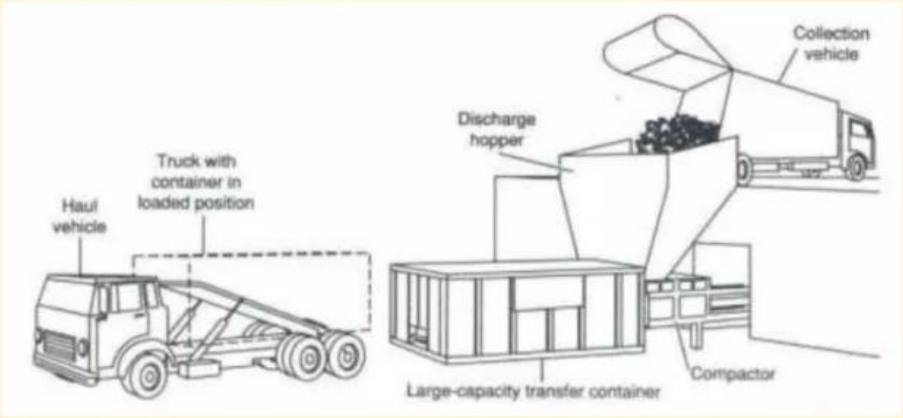
[c] Compaction Stations

- Compaction transfer stations use mechanical equipment to compact wastes before they are transferred.
- A hydraulically powered compactor is commonly used to compress wastes.
- Wastes are fed into the compactor through a chute either directly from collection trucks or after storage in a pit.
- The hydraulic ram pushes waste into the transfer trailer, which is mechanically linked to the compactor.

Types of Transfer Stations

[c] Compaction Stations





Types of Transfer Stations

[c] Compaction Stations

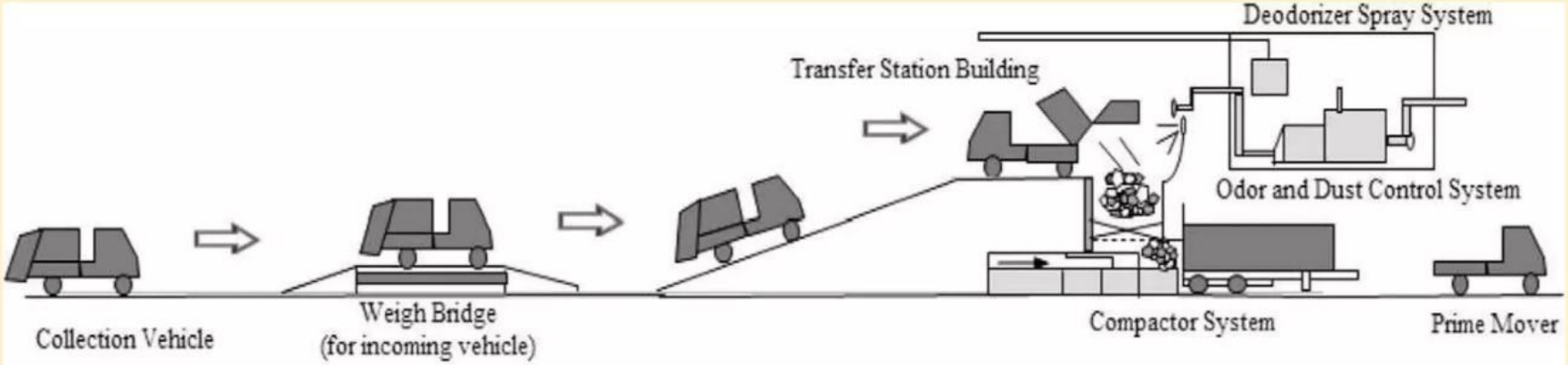


Fig. 1. Horizontal Compact Transfer Station.

Types of Transfer Stations

Types of Transfer Stations

Types of Transfer Stations

Types of Transfer Stations

Thank you