

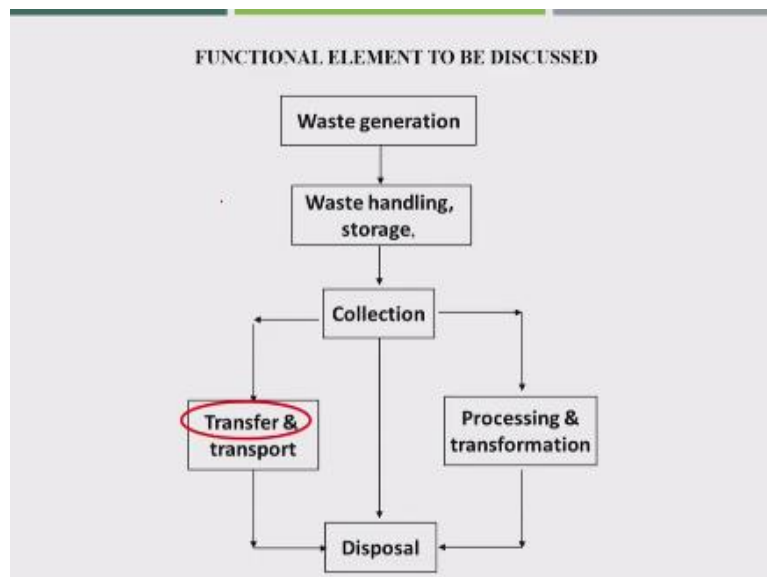
Municipal Solid Waste Management
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Lecture - 14
Need and Types of Transfer Station

So hello students. Today we will start the new module transfer and transport. So in the previous few lectures, we considered dustbin to the landfill site or recycling facility and or from the source of waste generation to the landfill site or recycling facility we consider as a collection activity. Now today again we will discuss transfer and transport.

So we will see that in between dustbin to the disposal site or source to the disposal site, where these transfer and transport activity will come up, okay.

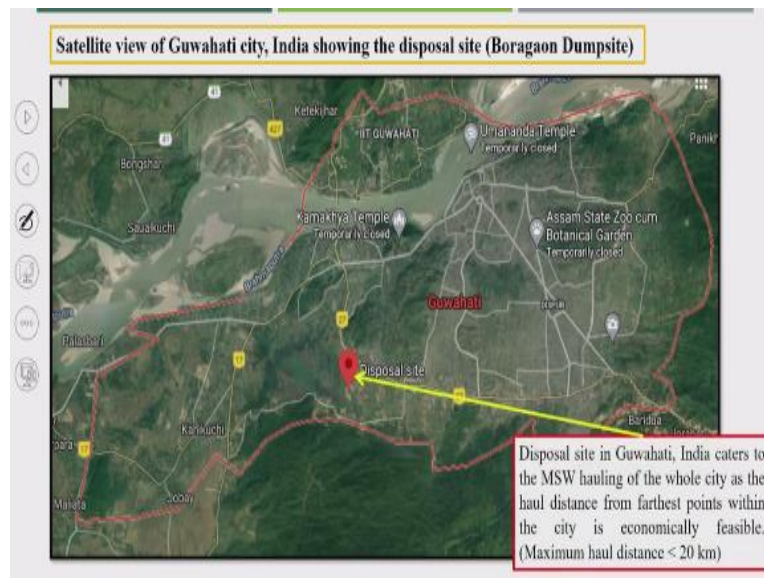
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So you will see here is the functional element. So now it is in between collection or from the source or storage facility to the disposal site. In between transfer and transport, one functional element or one activity will get considered. So this today's lecture we will talk about the need and type of transfer station.

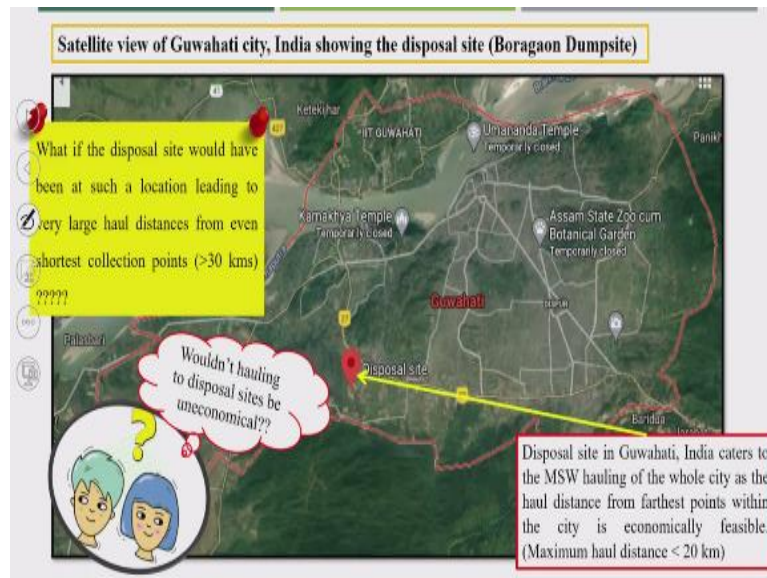
First, we will see the transfer station, what exactly is the transfer station and after that, we will see what is the need and benefit of the transfer station. And also we will discuss different types of transfer stations.

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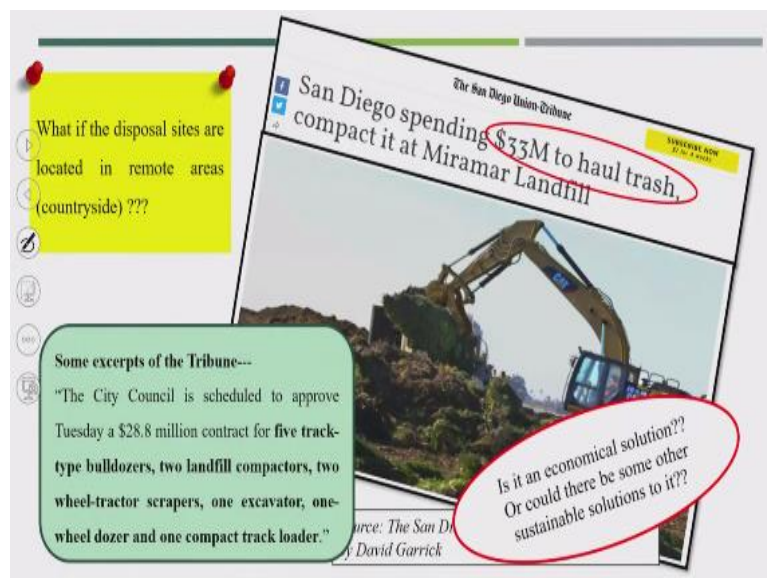
So this is one example I am going to start. So this is the Google map of Guwahati city I was just showing and this is the disposal site. So this disposal site is in Guwahati. The maximum haul distance from the entire city is less than 20 kilometers. So normally for 20 kilometers different kinds of collection systems are available in the city. So it was initially started with the stationary container system and after the JnNRUM program in 2006, haul container system has been started, and now recently mechanical stationary container system has been started with compactor vehicle. The collection cost is not that very high because haul distance is maximum is 20 kilometers. A different corner is associated with the disposal site. But the problem is the location is very close to one well-known lake. So the city corporation is looking for a different landfill site.

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But now the suppose the disposal site would have been located in such a location where the shortest collection point could be more than 20 kilometers. Suppose, because the local corporation already trying to find another location. If the location is more than 20 kilometers, the minimum haul distance or shortest haul distance is 30 kilometers, or suppose maximum hauled distance comes up with 50 kilometers or 60 kilometers. Whether that will be economical or not? That is the question. Whether hauling to the disposal site is economical or not? No, I do not think so if the haul distance goes to 40 kilometers or 50 kilometers, it would not be economical. So what will be the idea for that?

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Suppose the waste site is located in a remote area or countryside maybe 50 kilometers or 60 kilometers. You can see one example from the US. The city of San Diego is

spending around \$33 million for only the collection of waste because the disposal site is far away. Say one of the reports also has come up like 28.8 million dollars is for different collection vehicles they are spending.


If you are located far away from the disposal site, it would not be economical. This is one of the examples. You see that it is a very costly process. So what will be the economical solution for this? Such kind of cities can finalize the solution for this. Because now you see in most of the city of India also the corporation has started the disposal site very nearby.

Because their haul distance should be less and collection should be economical. But now since the population is increasing and a lot of rural people are coming to the city and staying somewhat in such areas where the prices are very low in such areas. Most of the corporation is looking for an alternate site. They are worried because no nearby location is available and wherever nearby village they are finding the location which is which could be economical. The village people are not allowing to dispose the waste near their village. So now they have to go far away which could be 40 km or 50 km away. The haul container system or stationary container system except that compaction facility is very difficult to collect the waste more than two tons, three tons of waste on a trip. And if you are especially planning for a haul container system, having waste of only two tons, three tons on a trip means I think the collection cost will be very high. The haul collection system is also difficult to accept. In that case, we have to go for a stationary container system. You know that there are lots of issues with the stationary container system. You cannot collect a large amount of waste from the haul container system.

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TRANSFER STATION

- A **transfer station** is a processing site where waste is deposited temporarily.
- In transfer stations, local waste collection vehicles deposit the waste cargo prior to their loading into larger vehicles.
- The larger vehicles then transport the waste to the treatment/recycling facilities or disposal sites.
- **Transfer and transport**, in solid waste management, refers to the means, facilities and appurtenances used to effect the transfer of wastes from one location to another.



Waste transfer station in Hong Kong, China

So now the solution is the transfer station. The photograph shows Hong Kong, China. The transfer station is a temporary disposal site which is very close to the residential area or very close to the waste generation sites. And in this transfer station, the local waste collection vehicle disposes the entire waste prior to loading into the larger vehicle. The smaller vehicle will collect the waste from the sources. These sources could be a household, could be the dustbin sites or container sites and the smaller vehicles will deposit the waste into this temporary location. And after that, it will load the larger vehicle. The larger vehicle then transports the waste to the treatment or recycling facility or disposal facility. The transport here refers to facility that affects the transfer of the waste from one proper location to another location.

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TRANSFER STATION

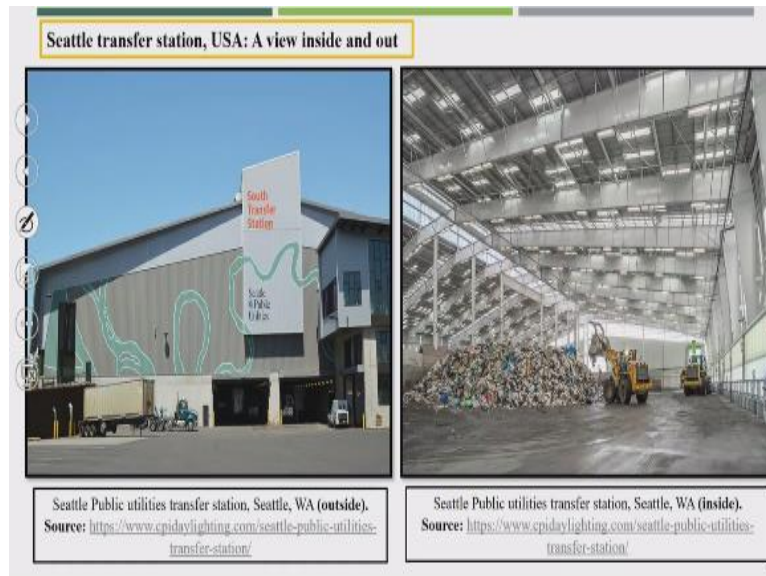
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Israel Hiriya, the largest waste transfer station in Middle East

This is another picture, you can find in Israel the transfer station

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I have found one photograph where we can see that the residential area is very close to the waste generation site. We can see here outside in Seattle, one of the cities in the US, this is the outside view and this is the inside view. See here the waste is getting temporary disposed of and from the smaller vehicle and the larger vehicle will collect the waste and transfer to the disposal site or recycling facilities.

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NEED FOR TRANSFER OPERATIONS

- Transfer operations are an integral part of all types of MRFs.
- They are necessary when-
 - ✓ The **haul distances** to available processing centres/disposal sites are **high**.
 - ✓ **Processing centres/disposal sites** are in **remote location** and cannot be reached directly from highways.

A Waste Transfer Station Tipping Floor.
Source: The simplest way to transfer waste to bulk transport. – CC BY by ACE Solid Waste

Now, what are the need for transfer operation? So the transfer station is normally is to understand the integrated part of any type of material recovery facility. So if you see in you go to any developing countries like Europe or the US everywhere you see that wherever the MRF or recycling facilities are available to transfer station is an integral part of the collection system, okay.

So this is one more photograph, transfer station. Now they are necessary when the haul distance is available for processing center disposal sites are high, if haul distance is high. You can ask this high means what? See, it again depends on city to city the distance-10 kilometers, 50 kilometers, up to 20 kilometers, even 25 kilometers traveling in a city, so is it possible?

And if you have a proper road where a larger vehicle can travel or can transport from these roads, so it will be economical. But if the haul distance is more than 30 kilometer, 40 kilometer or 50 kilometers, is very difficult to avail the simple collection facility. So in that case you will require transfer stations. And another one if the processing center or disposal site is in a remote location and cannot be reached directly by the highways.

So this is another I think is a similar kind of the point, but please both are different. Because one point we are seeing that the haul distance is very large, okay. And another case where already the local authorities or local corporation has finalized the location far away. And where is not easy to reach those locations by simple roads or simple highways.

And if it is reachable to the highways also it would not be economical to collect from the small vehicle where only two tons, three tons of waste is transporting from the roads and disposing of waste into the disposal site or recycling facility. So it is also possible that in some remote locations if you are finalizing the recycling facility or disposal facility, in that case also if you have the transfer stations inside the cities that will be very beneficial.

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Now there are a few more factors. I think apart from these two important necessities, a few more factors, which will attract the transfer stations. I think I can say, because of this transfer station some more excess benefits could be possible. So the first is the occurrence of illegal dumping due to excessive haul distance.

So it is possible that especially in India the kind of country where haul distance is very far away you will find such illegal dumping. And wherever the small area is available or wherever there is no construction or any open area is available people will try to dispose of the waste in such location. And specially in the curb services, where house owner has to be disposed of waste into the dustbin.

What these local people will do or residents will do? Rather than going to the disposal site 200 meters or 300 meters or 400 meters far away, wherever they will find a free space, they will dispose the waste. Even I think many authorities are planning for fines for disposing of the waste into such areas. But I think because of excessive haul distance very difficult to see such kind of illegal dumping.

And it is not only from the residence area, but the crew members also have to travel far away or very high haul distance. So they will also try that wherever the open area they are finding they will dispose of the waste. That is why in India most of the cases or most of the cities you will find that this vehicle is getting unloaded into the river or drains, or in the local river of the city.

And because of that this local river which is flowing through the city is highly polluted.

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See here, this is one of the photographs in Mohan agar in Nagpur, the illegal dumping of garbage. You see such locations. See this kind of location is anywhere in India, any city you can find it. This is because of the improper collection system and could be possible that if the haul distance is very high or in that case is possible to have this kind of illegal dumping.

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And see that some of the city started the CCTVs also to see that illegal dumping.

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So this is in Goa. They pay Rs. 1000 to people reporting illegal garbage dumping. So this is not only for the local household people but also for the crew member of the corporation crew members of a corporation.

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Because of this, we can reduce illegal dumping by having a transfer station. So another factor is possible to use a small collection vehicle. So it is possible that if very close, any transfer stations are available so why to use the very big vehicles. Like you see in most of the cities are now under Swachh Bharat Mission. Is hauling around 7 tons, 8 ton or 10 tons of waste in the same vehicle and if such kind of vehicle is traveling from the smaller road is very difficult for their transportation into such roads. So and nobody likes such kind of vehicles in their nearby area or a neighboring

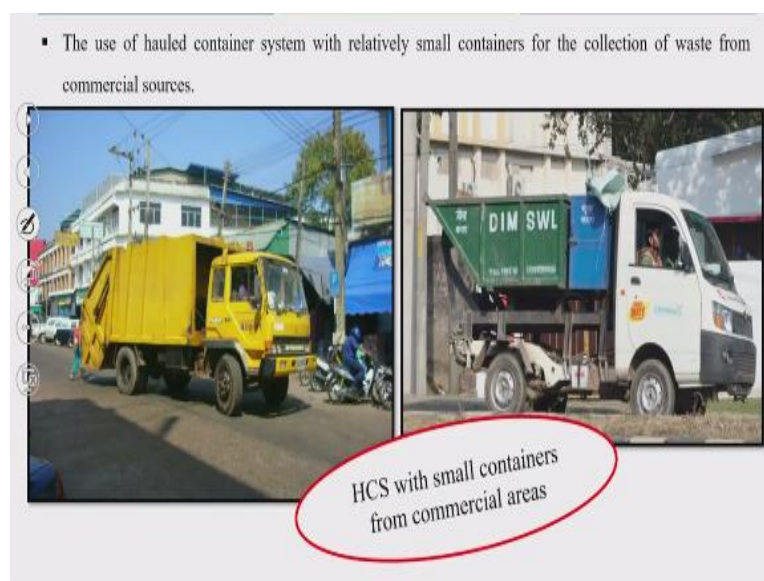
area, nobody will like to have such kind of big vehicles. So why not I think if there are transfer station very close, we can have this kind of smaller vehicles.

And these smaller vehicles directly can go to the transfer station, need not go to the storage area or dustbins area. So because of this transfer station, you can avoid the dustbins in the city. I think one of the lectures I was sharing that is it possible that small city without dustbins or dustbin free cities? Yeah, it is possible. If you are planning transfer stations very close to the residential area.

But there are some issues which I will discuss in further slides. But because of these transfer stations, it is possible that you can plan for a smaller vehicle and this smaller vehicle collect the waste directly from the households and it will go to the transfer stations facility and deposit the waste in those locations.

Also for primary collection rather than using the tricycle rickshaw, we can use the auto tippers, the mechanical vehicle, where the waste can be collected from each household and will go to the transfer stations. So the small capacity of the vehicle in the Surat. This is one of the photographs. This is for primary collection. So now here primary collection and secondary collection are together.

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Now, this another benefit that the use of haul container system with relatively small containers for the collection of waste from the commercial sources. Now normally in the commercial areas normally we have to use the stationary container system and the

quantity is very large and very difficult to have haul container system because the size of the vehicle will be somewhat large.

So why not we can have these kinds of vehicle. And this could be a haul container system we can plan or we can have the stationary container system also with the smaller containers and collection frequency we can increase in that case. So the haul container system is a smaller container from the commercial areas.

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Also possible that the use of a hydraulic or pneumatic collection system. If the size of the vehicle is small, we can have a pneumatic system. So a lesser number of crew members will be required. So you see in this photograph, these are two types of waste. This is from the Jaipur where the wet garbage and dry garbage has been collected from the residential area for the primary collection and now is disposing of is getting unloaded into the dustbins area. So now here a photograph is showing this kind of dustbins. This will go to the transfer stations, not to the disposal site.

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Is another hydraulic system could be possible.

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Now the use of transfer stations this another one more attraction of transfer station. These transfer stations can be used as recycling centers that can be more sustainable. Here I will discuss a few points. Now I think one small transfer station is getting wet waste and dry waste. So maybe wet waste we cannot store for a longer period.

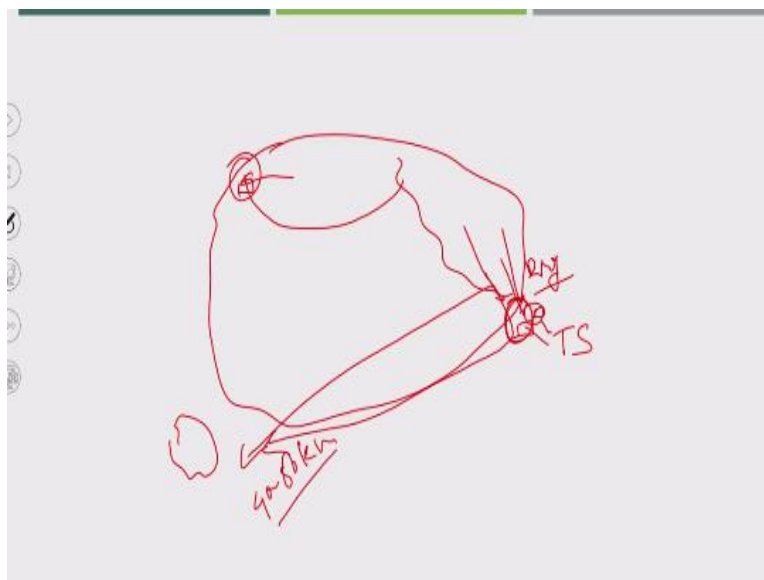
The wet waste will go directly to the composting facility or treatment facility. At least this dry waste could be possible that it gets recycled. Maybe some small recycling facility is possible. If not the recycling facility at least the component separation facility. At least that can be started into these transfer stations.

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So here one example I will give. This is another one more photograph of the recycling center in the transfer station.

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Here I will give one example. Like this is one city suppose and your disposal site is somewhere here. The distance from this location especially from this location to the disposal site is around 40 to 50 kilometers. And is very difficult, is not economical to haul the waste from such a location to the disposal site or recycling facility. So what could possible that here somewhere here we can plan one transfer station, okay.

So from this transfer station, so whatever the dry waste and wet waste segregated way will come to the transfer station. So what we can do is here the wet waste can directly haul to the disposal facility with the larger vehicle and remaining this dry waste we

can have the proper segregation facility. We can make it here some segregation facility and from here itself is going for the recycling facility, not to any bigger recycling facility.

Or at least some kind of recycling could be possible here itself. So that is what one another benefit of the transfer station. The waste is getting transported properly but also this kind of facility can be used as one of the recycling facility. Suppose, the dry waste recycling facility is not possible.

And if you are in such location, suppose if you are getting the proper area and it is somewhat out from the city or somewhat far from the city area can have one composting facility here. Maybe the wet waste is getting composted here itself. So only the dry waste will get hauled off to the disposal site or recycling facility followed.

So similar way maybe from some other areas also like in other cases, also if you plan one transfer station here itself. It is possible that if you plan one composting plant here, in one location or another location. So at least this wet waste would not come to the disposal site or any recycling facility. So that is what one benefit we can do it by transfer stations.

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TYPES OF TRANSFER STATIONS

- Transfer stations are used to accomplish transfer of solid wastes from collection and other small vehicles to larger transport equipment.
- Depending on the **method used to load the transport vehicles**, they are classified as:
 - ✓ Direct-load
 - ✓ Storage load
 - ✓ Combined direct-load and discharge load

Now I think once we understand the transfer station and the importance of the transfer station now we will talk about the types of the transfer station. There are different

types of transfer stations and based on that, we can get the benefit of these transfer stations. So depending upon the method used to load the transport vehicle they are classified as a direct load transfer station or storage load transfer station.

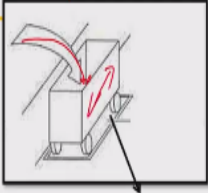
And combined with the direct load and storage load. I think here we will see that based on a load of the transport vehicle and what kind of benefits we are planning to get it, especially the whether recycling facilities or any composting facility could be possible in transfer station, based on that we can classify it in three different ways the transfer station.

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Direct-Load Transfer Station

- At direct-load transfer station, the wastes in the collection vehicles are emptied directly into the vehicles to be used to transport them-
 - ✓ to a place of final disposition.
 - ✓ into facilities such as MRFs.
 - ✓ to compact the wastes into transport vehicles into waste bales that are transported to the disposal site.
- Waste may be emptied onto an unloading platform and then pushed into collection vehicles after recovery of recyclable materials.

Waste discharged directly into an open top trailer, into compaction facilities or onto a moving conveyor for transport to processing facilities or compaction facilities



Platform scales (optional)

First, we will see the direct load transfer station. So at the direct load transfer station, the waste in the collection vehicles are emptied directly into the vehicle to be used to transport them to a place of final deposition directly emptied directly into the vehicle and transferred to place of final deposition into facilities such as MRF facilities it will go. Or to compact the waste into transport vehicles, the waste bales are transported to the disposal site.

A waste may be emptied onto an unloading platform and then pushed into a collection vehicle after recovery of recycling matter. So it is possible one way we can say the emptied directly into the vehicle and another way the waste may be emptied into an unloading platform and after that, it will push into the collection vehicle.

So here we can plan for if it is possible to get some kind of recycling material that we can get it and then it will push to the larger size collection vehicle. So here the one platform and this is the smaller vehicle will get unloaded into the larger vehicle. So waste discharged directly into an open top trailer into a compaction facility. So this could have one compaction facility okay.

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Direct-Load Transfer Station

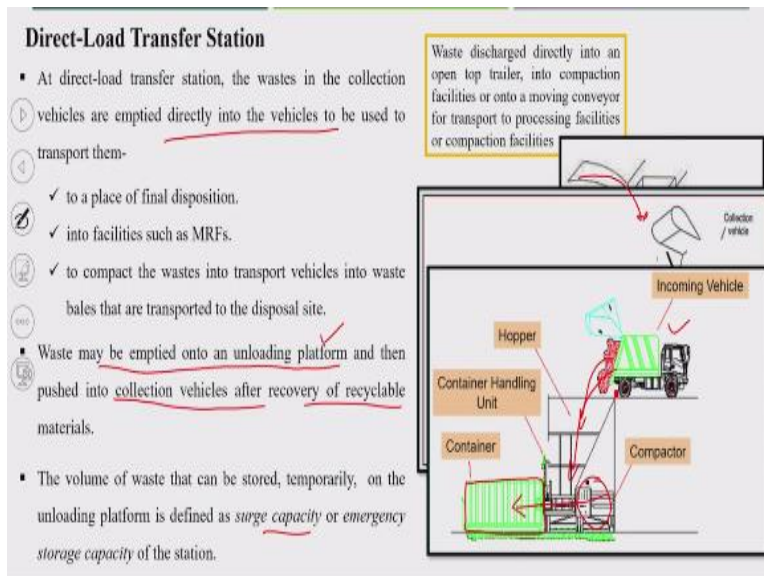
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- Waste may be emptied onto an unloading platform and then pushed into collection vehicles after recovery of recyclable materials.
- The volume of waste that can be stored, temporarily, on the unloading platform is defined as *surge capacity* or *emergency storage capacity* of the station.

Waste discharged directly into an open top trailer, into compaction facilities or onto a moving conveyor for transport to processing facilities or compaction facilities

Direct-load transfer station with stationary compactor

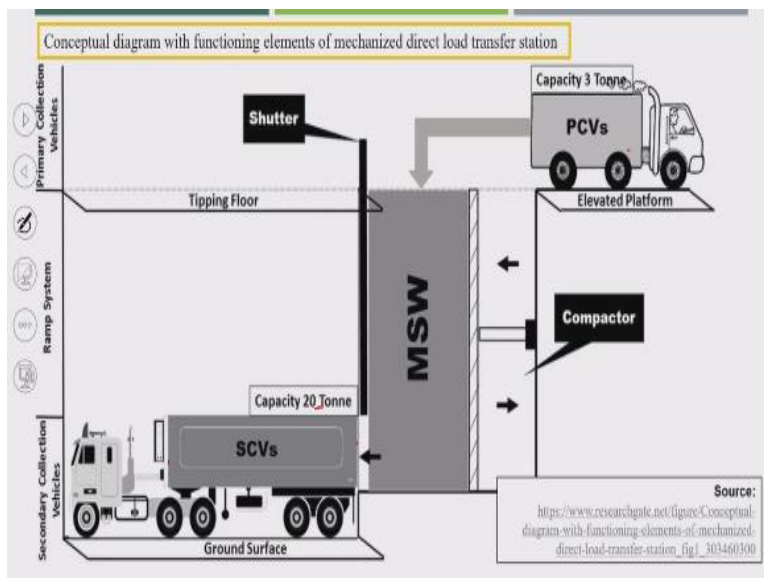
So here you can see this is the truck from waste is getting collected and here is getting unloaded and here maybe here one compaction facility also could be possible and this is the large container transfer station. This will get hauled to the disposal site or recycling facility. So the volume of waste that can be stored temporarily on the unloading platform is defined as surge capacity or the emergency storage capacity of the station, whatever the maximum capacity of that particular station.

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So here you can see here, this is the incoming vehicle, the smaller size of the vehicle is getting unloaded into the larger container. This is the container of large vehicle and it is having one facility of compaction. The waste is getting unloaded, it is getting compacted and this compacted waste is going to the larger container. So this kind of facility could be possible.

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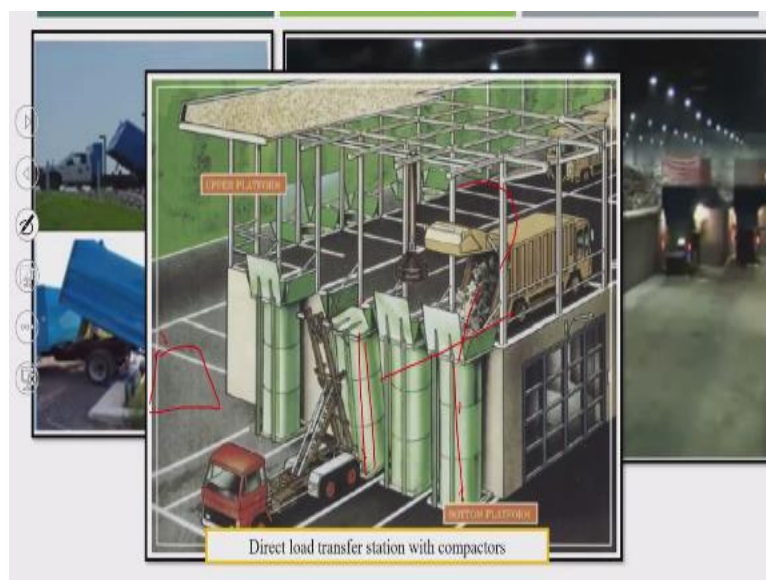
So this is another one more photograph, simple. So here are 3 tons capacity of one vehicle. The MSW is unloading, here the compaction facility and another vehicle having the larger container which can take 20 tons of waste in one trip.

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So you can see here this is very simple facility. Waste is getting hauled and this is the bigger container is here, okay. This is another facility. So here waste is getting first deposited into the floor and after that is getting unloaded into the larger container.

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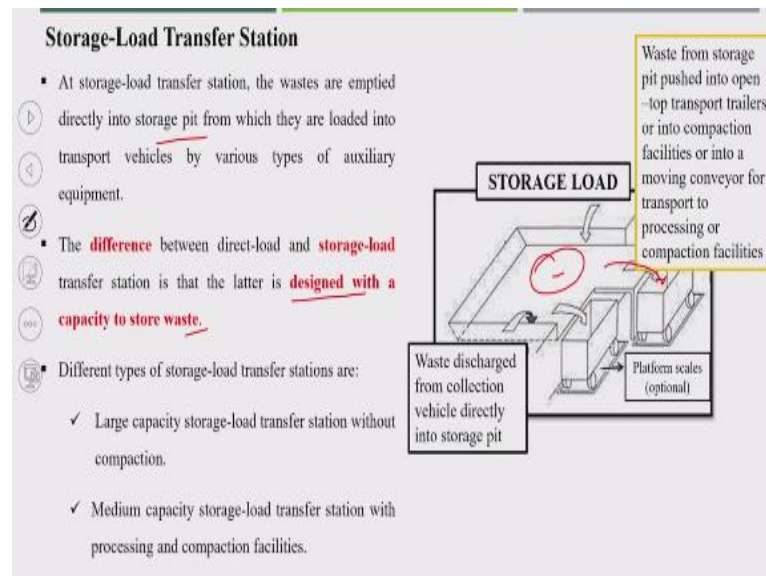


Or here you can see these are the different units. So this is the vehicle and these are the these the big chambers. So waste is getting unloaded into these chambers and these chambers are loading onto the vehicle. Suppose these chambers are filled completely this will be loaded onto this vehicle, okay.

So in the direct load facility, suppose if you are not planning to say any segregation or any recyclable matter so directly this waste will get deposited into the larger vehicle directly. If you are not planning for compaction facility need not go for compaction

also. Specially the wet waste, if wet waste is getting disposed or getting deposited into this container, so do not require any compaction facility. That is also possible.

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Now next is the storage-load transfer station. So here the name just signifies storage facility. Means waste is getting stored and then it is getting loaded onto the larger vehicle. So at storage-load transfer station, wastes are emptied directly into a storage pit. So it is getting unloaded into a storage pit which they are loaded into the transport vehicle by various types of some different auxiliary equipment.

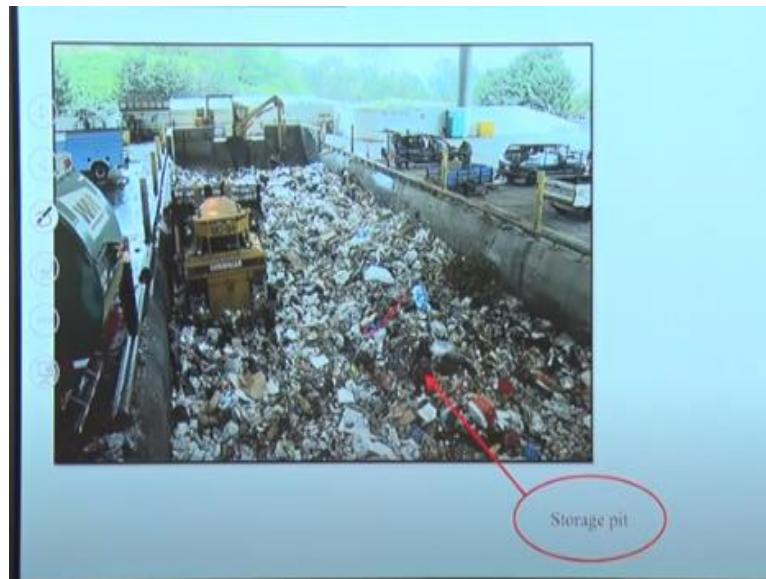
So this is the storage platform and by different ways it will get feed into the larger container. Now the difference between the direct load and storage load transfer station is that latter is the designed with a capacity to store waste. Only change is, it is designed to store the waste, okay. So different types of storage-load containers are large capacity storage-load transfer station without compaction is possible.

There is no compaction facility and also along with the processing or compaction facility. So here the benefit of this storage-load could possible that initially waste is getting stored into the storage pit or wherever you are planning for collection of recyclable matter that you can plan it whether mechanically or even mechanically also some unit could be possible that the recyclable matter will get segregated.

And remaining, which is not able to segregate, that will be loaded into the larger vehicle. That kind of facility we can plan into the storage load transfer station. So is

not only the transfer station but also we can plan the recycling facility also in such locations.

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So you see here this is the waste is getting into the storage pit. This is the storage pit. Now I think if you will see here difficult to have a collection of segregation of recyclable matter but manually could be possible in such locations.

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So you see here the waste is unloaded into the storage pit. There are different vehicles that are coming and disposing of the waste. And by different vehicles, waste is getting pushed into different areas or to the larger vehicle facility. Compaction truck unloading waste into the storage pit. So these are the compactor vehicles.

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So here are also the this is one of the photographs from the US. The waste is getting unloaded into the storage pit.

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Combined Direct-load and Discharge-load Transfer Station

- Some transfer stations use both direct-load and discharge-load methods.
- These are multipurpose facilities meant to service a broader range of users than just a single purpose facility.
- These facilities can be used by various waste collection agencies and by general public (who will have to pay a certain amount of discharging fee)
- It can also house a materials recovery operation.

Waste discharged onto unloading platform. After recyclable materials have been removed, the remaining waste is loaded into transport trailers with the front-end loaders

Now the third type is combined direct-load and discharge-load transfer station facility. So is a combination of both direct-load and discharge-load. So these are multipurpose facilities meant to service a broader range of users that just is a single-purpose facility. So now here there are two different facilities. So, I personally believe that this kind of transfer station is always beneficial for India.

So what we can plan here is that we know that segregation is one of the important activities. So already under the Swachh Bharat Mission segregation have started with dry waste and wet waste. Now see here, if you are planning for transfer station so this

wet waste I would not accept that could have the composting facility nearby because is very close to the residential area.

So difficult to have biological degradation facilities, okay. So what we can plan here, the wet waste will get direct-load. So there is no storage of wet waste. But dry waste, we can have storage into the storage pit. Whatever the recyclable matters will get segregated we will do it and which is not recyclable like inert content or some other materials which are not possible to get recycled, that will go to the larger container.

So we can plan in such a way that the wet waste will directly get loaded into the larger vehicle without compaction facility and the dry waste after segregation of recyclable matter will go to the larger container with compaction facility. So because of that, we can increase our collection efficiency. Okay, so these are very highly beneficial for material recycling facilities.

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Now you see here are a few direct-load and discharge-load transfer facilities. So here direct-load some and somewhere we can plan for storage facility also along with that.

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SOME ADVANTAGES AND DISADVANTAGES OF A TRANSFER FACILITY

Advantages

- ✓ Lower collection costs.
- ✓ Reduced fuel and maintenance costs for collection vehicles.
- ✓ Increased flexibility in selecting disposal facilities.
- ✓ Option to separate and recover recyclables or compostables at the transfer site.
- ✓ Opportunity to shred or bale wastes before disposal.

Disadvantages

- ✓ Difficulty with siting and permitting, particularly in urban areas.
- ✓ Construction and operation costs may make them undesirable for some communities.

We will see some advantages and disadvantages of transfer station. So the advantages are lower collection cost obviously, because haul cost has been reduced now since you are hauling 20 tons, 30 tons in one trip itself. So maybe in small cities like Guwahati, around 700 to 800 tons of waste is generated. So in that case, you will require only a few trips.

If you have a plan for 4-5 vehicles, that means each vehicle has to do maybe around 5 to 6 trips in a day. So always that will be economical. Because of that, the fuel and maintenance cost of the collection vehicle will be reduced. This is one of the very important issues in India or the Indian waste collection system because we are using a separate number of vehicles for the primary collection and secondary collection.

So obviously, the maintenance cost is very high. So by reducing the hauling, we can reduce the maintenance cost. Increased flexibility in a selected disposal facility. Yeah, is also possible that if you are using the transfer station, we have always the flexibility of choosing our location of the disposal site. Maybe in such cases, you can go far away 50 kilometers, 60 kilometers, or is possible that few cities close maybe there are two ULBs which distance could be 100 kilometers.

So maybe is possible that somewhere in the middle we can plan one disposal site or recycling facility and there the waste from both the ULB's will come together. So that is also possible that we have the flexibility if we have the proper transfer station. So the option to separate recover material or compostable at the transfer station. So as I

said, composting could be difficult but at least separation of the recyclable matter could be possible because of that.

Opportunity to shred or bale waste into them before disposal, maybe compaction or shredding is also possible. That also we can get the benefit of the transfer station. These are the few advantages. And other advantages like difficulty with the sighting, permitting, and particularly in the urban city. This is one of the important issues, which I am going to discuss in the next class, location.

Because every time I am saying that is very close to the recycling facility, very close to the residential facility. So obviously, finding such a location itself is a very difficult task. And construction and operation costs may make the undesirable for some community. So this is also one of the issues in this related one. Because is close to the residential area.

So obviously the local people will they would not allow having the transfer station near their locations. And finding that kind of location also is somewhat difficult. But I think apart from these advantages or disadvantages also I talked a few points like which is attracting the transfer station that especially it can reduce the illegal dumping.

That is one very important issue, especially for the Indian kind of country where illegal dumping is very most of the cases you are finding the illegal dumping, most of the cities. Also, we need the mechanical collection system with a smaller vehicle with a hydraulic or pneumatic collection facility.

I think now the time has come up to have such kind of collection system in India where the smaller vehicle will reach to the source waste generation areas and directly waste is getting hauled to the transfer stations facility. And obviously, I think we need to increase our recycling facility. So rather than the one centralized recycling facility can plan the transfer small recycling facility at the transport station. That always will be highly beneficial, okay.

So now I think one issue is which we are going to discuss important to discuss citing their location. And also the mean of transportation, because every time we are thinking about transportation by road or transportation only. But is not only the road transportations, there could be water transportation or air transportation could be also possible.

So that we will discuss in the next lecture and the location also we will see that. And also some design parameter is very important to know before planning for a transfer station. That we are going to discuss in the next lecture. So thank you for this lecture.