Building Services I

Lecture 8

Refuse Disposal System

- It is the technique for the collection, treatment and disposal of the solid wastes of a community.
- So the development and operation of these systems is often called solid waste management either refuse disposable system or solid waste management
- Improper disposable can create unsanitary conditions and it can lead to pollution and it also leads to the outbreak of vector borne diseases, so it is also spread by rodents and insects. This is the very important system of any city or town or whatever.

Different types of Refuse

So you need to know what are the different types of Refuse first in order to and see how it be collected and dispose safely. So now it is the material generated from various human activities and it is disposed as useless and unwanted. Some of the major classifications like

1. Municipal Waste
2. Domestic / Residential Waste
3. Commercial Waste
4. Garbage
5. Rubbish
6. Institutional Waste
7. Ashes
8. Bulky Wastes
9. Street Sweeping
10. Dead Animals
11. Construction and Demolition Wastes
12. Industrial Wastes
13. Hazardous Wastes
14. Sewage Wastes
15. Biomedical/ Hospital Waste
16. Plastics

Food Waste (Garbage)

You need to know the sources of all these wastes so that the collection is effective. So if you take up Food waste which is the garbage it is the waste which is come from the preparation,

cooking and serving food, market refuse, waste from the handling storage and sale of meat and vegetables. So these are the sources from the households, institutions and commercials like hotels, stores, restaurants, markets, so this are the sources to produce your Garbage.

Rubbish

What we classify as rubbish are that is primarily organic, paper, cardboard, cartons, wood, boxes, plastics, rags, cloth, bedding, leather so anything that is organic and also inorganic we have tin cans, metal foils, dirt, stones, bricks, ceramics, crockery, glass bottles in these things are produced from the same source like Households, institutions, hotels, stores, restaurants anywhere like that

Ashes and Residues

So this is like the residues are from the fires we used for cooking and for heating buildings like cinders, clinkers and thermal power plants you will have ashes and residues

Bulky Wastes

They are large auto parts like large auto parts, tyres, stoves, refrigerators, other large appliances, furniture, large crates, trees, branches, palm fronts, stumps all those things they form the bulky wastes, these ashes residues and bulky wastes also the same source that is your households, institutions, commercials, hotels, restaurants, markets

Street Waste

Street waste is your street sweepings, every day you clean the street, so the street sweepings, dirst, leaves, catch basin dirt and animal droppings, contents of litter receptacles, dead animals all this things form your street waste comes from your streets, sidewalks and vacant lots

Dead animals

Small animals like cats, dogs, poultry, etc. and large animals like horses, cows, etc. even those when they die it has to be disposed safely.

Construction and demolition waste

Timber, roofing and sheathing scraps, crop residues, broken concrete, rubble, plaster anything that you find that comes out of a construction site or a demolition site or remodeling site as particular building may remodeled or refurnished repairs may be happening. So those things come under construction demolition waste.

Industrial Waste and Sludge

The solid waste resulting from industry processes, so there as various large industries manufacturing so many products and there manufacturing operations like food processing wastes, boiler house cinders, wood, plastic and metal scraps and shavings etc. and the effluent treatment plant from the sludge from the industries and the sewage treatment plant sludges and coarse screening, grit and septic tank and all this things form your Industrial waste and sludge. So this comes from factories, power plants and treatment plants etc. This is the source.

Hazardous Wastes

So the pathological wastes, explosives, radioactive materials, toxic wastes. So the sources will be like your hospitals for the pathological waste and the household institutions are will explosive and radioactive materials like when you dispose of any batteries or electromagnetic appliances like those things will come under Hazardous wastes.

Plastics

They get carry bags, bottles, containers, trash bags, disposal syringes, blood and uro bags; most of the plastics come from hospitals, hotels and air or rail travel.

Solid Waste Management

Now what is the solid waste management we have already an idea but this system refers to the combination of various functional elements associated with the management of solid wastes. So it is not a one step process it is a combination of various elements. So this system put in place, facilitates the collection and disposable of solid wastes in the community at minimal costs, so well preserving the public health you also ensure the little or minimal adverse impact on the environment like you say like I am going to preserve public health you cannot cause damage to the environment or vice versa.

So these are the functional elements that you have of you see first is your Generation that is what we saw if we know the source only we can collect so from where you get the waste that is the generation, storage now wherever it is generated everything is not putting into one place so it is stored in one place and then that is collected and once it is collected it is either you transfer it and transport is disposable site or it goes to a recovery and recycling, if possible it goes to a recovery and recycling, not only from collection from generation and storage also anything that can be recover and recycle will go there, now when you waste that cannot be directly transport or dispose it goes to the processing which is here incinerator or composting those details will be looking at the end of the lecture and finally it is disposed.

WASTE GENERATION

- Wastes are generated at the start of any process and thereafter every stage as raw materials are converted into goods for consumption.
- The source of the waste will determine the quantity, the composition and the waste characteristics
- So the most important part is identify the waste, so based on the type of waste we can decide on the disposable method then you have storage. So it is a key functioning element because collection of waste I told you doesn't take place at the source or immediately after it's generated.
- So heterogeneous wastes generated in residential areas, heterogeneous means mixture of all type of wastes, so that will be removed within 8 days because the storage space is very less when compare to the whole the ultimate storage space and the space of biodegradable material.
- Onsite storage is primary importance due to aesthetic consideration public health and economics involved. So the particular site where it is generated there itself we need to have a storage for the waste

WASTE STORAGE

Now for the storing unit for proper containers, so these containers has to be selected, so when you collect the containers

- It should save the collection energy it should increase the speed of collection and reduce crew size. So it seems very small thing but the collection of the waste and taking to the disposable places are huge process and been done by a separate crew. So the collection energy these collection people who spend energy on collection and know working on the process it helps to container selection will helps to proper container selection will help to beat more efficient.
- More importantly containers should be functional for the amount and type of materials and collection vehicles used. So depending on the collection vehicle and the materials that has been stored there the containers has to be decided.
- It should be durable, easy to handle, and economical, as well as resistant to corrosion, weather and animals. If the storage is going to be in open space then you have to consider your resistant to corrosion weather and animals.

Now what are the options for storage you have

- Plastic containers
- Conventional dustbins that we have it households
- Used oil drums can be used

- Large storage bins this are used for institutions and commercial areas or servicing deposits in public places we have large storage bins
- Now this can be classified in single family households you use small containers like residential units where there are many like your apartments. Many people are in one place and commercial units, institutions and industries requires large containers
- In residential areas, where refuse is collected manually, so there you will be standardized metal or plastic containers for this waste storage
- In for large things mechanical collection system, so the containers will be specifically designed so that it can be used in the it will be fit the truck mounted loading mechanisms.

Now they fall under either of these two characteristics, they are Stationary Containers and Hauled Containers

- Stationary Containers : The containers will be transferred to the collection vehicle at the storage of site
- Hauled Containers: Hauled Containers means the contents to be directly transferred to a processing plant, transfer station or disposable site.

This is your typical or generally what you see for waste storage. It is called as the communal or public containers, it is a compactor collection and it can fit and empty mechanically like trucks and this can fit the compactor trucks mechanism to compact and collected.

This kind of containers are placed from 100- 200m apart for economic reasons or it can be staggered so that it is more effective and it can be staggered at the distance of 100m

WASTE COLLECTION

Now coming to waste collection, so the main process is

- You have to gather the waste
- Hauled them to the location, where the collection vehicle is emptied which may be a
- Transfer station or you can have intermediate station even before the transfer station is quite a long way we will have a intermediate station where smaller vehicles will transfer there and for the bigger and larger ones will take it to the place of aggregation
- So the number of containers, frequency of collection, types of collection services and routes. So these are the main points or elements that we have to consider when we go for a waste collection method.

Various ways of collection, what are the various ways of collection, what are the waste they collected is House-to-House collection happens in certain places like individual houses are there

so the waste collectors visit each individual house and they collect the garbage this we have seen in everyday life then you have community bin, so the uses will bring the garbage to the community bins placed at fixed points like the end of the shade or if it is a apartment in common place you will have community bins everybody will bring have a garbage and put it there, then you have curbside pickup, curbside is your sidewalks, so where the uses will leave their garbage directly outside their homes and the garbage pickup take it as per the schedule. Self-delivered there is also possibility where the generators delivered the waste directly to the disposable sites this happens for larger institutions then contracted or delegated services, municipalities they generally give a contract for this kind of waste collection, so this people the private operators they go in collect the on any of this methods will collect the waste.

- So the collection again depends on the collector and the collection crew, so they move through the collection service area with a vehicle and the collecting waste material is collected. So this Vehicle ,
- so the vehicle is the main criteria here now this vehicle it should be selected appropriate to the terrain type and density of waste generation points, terrain is the slope is going to be hill area and it going to be flat surface like that and the way it travels and the type and kind of material it is going to carry
- So these can be classified as small and simple which is a two wheeled cart which is manually pulled by the individual or large in complex and energy intensive that like a compactor trucks.

Small-Scale Collection and Muscle Powered Vehicle

- Now this is the picture you can see of a thing that is being pulled, this are the common individually small scale collection vehicle we can see we pulled by you know any animal like coarse or donkey or it can be pulled manually by person or you can see it can be fitted in a cycle kind of thing.
- So these are the common vehicles this is generally used in rural or hilly areas so this is called as a small rickshaw, carts or wagons to pulled by people or animals these are very less expensive, it is easier to build and it is very less maintenance is required compared to any other vehicles
- So it is suitable for densely populated areas where there is narrow lanes, so even if you have be compact vehicle certain wastes you cannot reach them, so they are in squatter settlements where there they don't have any proper roads at all so there also the volume of waste is also less in these areas, so these type of small scale vehicles suitable for this kinds of densely populated areas with narrow lines or squatter settlements
- The drawbacks if you see there is a disadvantage it's like a limited travel range of the vehicles you cannot ask them to go beyond the certain stage and weather exposure

also will affect if it is going to be a rain or something people cannot go and collect the thing

Non-Compactor Trucks

- This will be like something similar to your compactor trucks but without any mechanical process to take the garbage and put it inside
- So this is efficient and cost effective in small cities and waste are very dense so you have little potential for compaction
- Generally it is required to cover the trucks in order to prevent residue flying off or rain soaking the wastes we told you causes by the weather conditions. So if you have this kind of trucks even in any weather condition you can uses it can be closed so that the debris or the garbage doesn't fly
- When these are used for waste collection you need a dumping system so that the you can discharge the waste into the truck
- So the truck this capacities of 10-12m^3 are effectively you can dispose means collect the waste and the distance between the disposable site and the collection area should be less than 15km you cannot travel the long distances using this kind of Non compactor trucks for disposing the waste.
- So the distances longer the potential transfer station should be closer than 10km that's intermediate transfer station will be there if the distance is going to be more between the collection and the disposal. So you will have transfer station which is less than 10km and again these are generally used when labour cost is high we told you like the other small things will be pulled by people you know people are animals and you need manual labour for that when the labour cost is going to be very high and use this kind of trucks
- Collecting and operating cost also is a deciding factor and the collection root we have map it properly so that it is done efficiently

Compactor Truck

- These certain trucks that you would have seen every day in large cities, so these are highly mechanized in collection of the garbage, so they can effectively collect 12-15m^3 volume of waste and it is ,limited only because of the roads size, narrow roads it cannot reach that will be the only limitation and though the capacity is similar to the tougher drum truck the weight will be more like volume wise it will be less equal to most equivalent to your non compactor since you can compact it the weight will be the 2-2.5 larger than other non-compactor trucks.
- If you see it will allow the waste containers to be emptied into the from the rear from the happens by means of mechanism can also be like front or side also

- It works poorly when waste stream is very dense, wet, collected materials are gritty or abrasive or when the waste will not know fall into the compact truck easily then it is very poor in such kind of a waste.

Advantages

- Uniform large cover completely and it is visually it is enough ensue
- It is set out in containers so that the crew can pick them up quickly, so the speed of the collection is so here
- Health risk to the collectors and the odour also is minimized
- In this relatively inaccessible to waste packers. So the waste packers tend to know the crew and the garbage outside, so they will not able to pick this trucks

Movement of Collection Crew

We have this different types of storage things and collection vehicles, now we have put together the collection crew so that it is very efficient, so for a efficient operation the team has to be first completely trained, generally we say like it is only a garbage collection crew, what training they needs but there are so many factors here, a collection crew is the driver of the collection vehicle first work as a team like the driver of the thing and people were going to know hall in the waste. So the container location vehicle stopping point the distance the collection crew will have to move know it is going to be very far off, so all those things will affect this collection system.

Advantages

- The crew is familiar with the locality where they are going to collect it, so that it will also improve efficiency because they know where it is located and what is the better way to you know position the truck and collect the waste.
- So if the crew is aware of the location, the containers and the vehicle stops it will be an efficient collection system.
- So we have to assign each crew specific areas of responsibility, if you give them one particular area not put the all crews in every area, if you put them in one particular area, they will be familiar with the area now say within a day or two then the collection system will be effective.

Now the collection route is determined now that also determined planned previously, so we have two types of routing macro routing and micro routing.

Macro-routing will be like consists of dividing the total collection area, you have specific collection area it divided into various routes, how the various routes how they go into come out and size in such a way to represent the day's collection for each crew. So when you know mark the zones for each crew they should be able to collect the entire thing in one go they cannot keep going and coming back for a day so one day how much they can collect that has to be mapped for them correctly.

Micro routing is from the micro routing analysis, micro routing is another detailed scale where the specific path where they have to take that will be given to them they have to go this route they have to come out this way, so that is more important to be the system to be effective.

Transfer Station

Transfer station is the centralized facility where

- All the waste is unloaded from smaller collection vehicles and
- Is reloaded into larger vehicles for transport to a disposal or processing site.

So I told you isa intermediate place where the waste are disposed. So the smaller vehicles they unload here and the larger vehicles will reload and it will be taken to a disposable site. The transfer of waste is frequently accompanied by removal, separation or handling of waste. So here they it also like in separation of waste like organic or inorganic or recycling that also will happen here

Need for Transfer station:

- In areas, where wastes are not already dense, they can be compacted at a transfer station. It is not dense it is very very migor so you know need to take directly to the disposable site. This will save time and effort. So it taken to transfer station where it will compacted and larger trucks will take it off. Then the technical limitations of smaller collection vehicle on the low handling of hauling cost, hauling cost is carrying cost of solid waste using larger vehicles. So if it is going to be smaller vehicles will have limitations thatthey cannot carrying more than that and the larger vehicles will have limitations like cannot go into those space those places where smaller vehicles are going, so this things will be like balance if you have a transfer station.
- When there is a need for vehicles servicing a collection route to travel shorter distances, unload and return quickly to their primary task so when they have a smaller vehicles you cannot collect the entire day's garbage in one slot, so what they do is they collect it and it has to be placed very near so they can disposed of there again comeback and start there and continue their collection.

Waste Disposal

Now we have collected, generated, stored, and collected. Now how are we going to dispose it

- This is the final element in the SWM is Solid waste management system.
- So an efficient system it has to provide environmentally sound disposal should not affect the environment. So that also it can be reduced, recycled, composted, combusted or processed further.

So if you look at this picture there is explain you have SOLID WASTE here Primary segregation is happening at the Household level, if you take for residences so there you have Biodegradable waste, Non-biodegradable waste and Hazardous waste. So we based on the sources of waste we had a separate classification so based on the nature of the waste or the way they can be disposed they have three major classification, so based on the way you can dispose it, so biodegradable waste is a wet waste where you have a vegetable peels, fruits, flowers, egg shells, tea leaves, leftover food and garden waste all this things come under biodegradable waste and that can be disposed by compost or vermin compost that is one method. Then Non-biodegradable that is dry waste which will be the secondary segregation in there where it can be taken to whatever can be recycle will be taken to recyclable plant. So here it will includes plastics, papers, card boards, milk covers, oil covers, glass bottles, pet bottles and metals. So these are soul to the merchants deal in the recyclable things then you have Hazardous waste, hazardous waste here is household chemicals, fused bulbs, ceramic items, indoor and form particles, grease, spray cans, old medicines, syringes, blades and rusted tins all this comes under Hazardous waste. Now this hazardous waste and your non-recyclable this will send to your sanitary land bill, so the non-recyclable what we called as glass ware, mirror, paint tins, batteries and non-recyclable polythene bags. So this kind of segregation has to happen initially before we move onto the disposal method, so this is what we say about an solid waste management look like

Now when we look at various methods available to dispose off waste. We have like

- Sanitary landfills
- Incineration
- Waste Compaction
- Bio-gas generation
- Composting
- Vermi Composting

These are various methods you can dispose the waste

SANITARY LANDFILL

This is actually like your Garbage, know you will have the separate area where they will take the garbage and the layers like this so you will have belayed and there will be a liner and the daily refuse you know placed above the other end layers, then it is like compacted and covered with clay or plastic foam like every layer will be covered like that, so it is like bottom also nowadays put an impermeable liner because this waste when they composed it should not go inside you know the ground surface and disturb the ground water table. So the usually cover it with in impermeable liner like a several layers of clay, plastic and sand will be there and above that your garbage is filled. So these liner will protects the ground water from being contaminated. Now when the landfill is full it is covered with clay, sand, gravel and top soil to prevent seepage of water. Several wells are drilled near the landfill site to monitor if any leakage because even though you provide all the safety precautions it is still that is the procedure you know drill like small small bores and check how much the soil has been contaminated is it contaminated or not this is the monitoring process.

Sanitary landfills site selection

Sanitary landfills you have to select proper site to do this you cannot do the sanitary landfills in any place

- It as to be above the water table, should minimize the interaction to ground water, so the difference between the surface and the ground water table as high as possible it should be maximum
- It should located in clay or silt soil because in the clay or silt soil possibility of sweeping will be very less
- Do not want in a place in a rock quarry or water can leech through the cracks, so if it is going to be in a rock quarry you know the stone area the water can leech though the crocks in to the water fracture system.
- So you do not want to locate in a sand or gravel pit.
- You do not want to locate in a flood plain also because they going to be frequent floods that will be a problem for it again, so large number of adverse impacts can happen when you do this landfill does not best of the option.
- The impact can be fatal accidents can happen like scavengers know if they try to come and pick ways they can be buried under that
- Infrastructure damage will happen like damage to access roads by heavy vehicles.
- If heavy vehicles have to you know go on you know put on the garbage or dispose of that infrastructure can be damaged
- Pollution of the local environment is possible because if there is a sea page and the groundwater table is affected then the pollution happens there. So of gassing of methane if it is going to be disposed obviously it is going to give more methane gas

organic will definitely will give you harmful gases, so these gases will you know pollute the atmosphere also

- Harbouring of disease vectors such as rats and flies you cannot help them from reaching this sites they might spread vector diseases also, so the landfills has to be properly taken care of and it has to be properly operated.