Urban Services Planning
Professor Debapratim Pandit
Department of Architecture and Regional Planning
Indian Institute of Technology, Kharagpur
Lecture 43
Construction and Demolition Waste Management Part II

(Refer Slide Time: 00:28)

Welcome back in lecture 43, we will continue with Construction and Demolition Waste Management. This is part 2 of the lecture.

(Refer Slide Time: 00:32)

The different concepts that we will cover around construction and demolition waste processing, the Burari model, reuse potential of C&D waste, siting and in-situ siting of C&D

waste processing plants, environmental issues with C&D waste recycling facility, and then we will do a case study of municipal cooperation Gurugram.

(Refer Slide Time: 00:55)

So, the first we will talk about the Burari model, we have talked about this in the earlier lecture as well. So, it is a pilot project taken, initiated by Ministry of urban development now Ministry of Housing and Urban Affairs, and it is this includes crushing units at Burari, which is Jahangir Puri in Delhi. And this is a C&D waste recycling plant. So, this was initially set up by the Delhi Municipal Corporation, but now it is a part of North Delhi Municipal Corporation. And along with IL&Fs, which is the infrastructure leasing and financial services company, they have, you know, thought of setting up this in the year 2009.

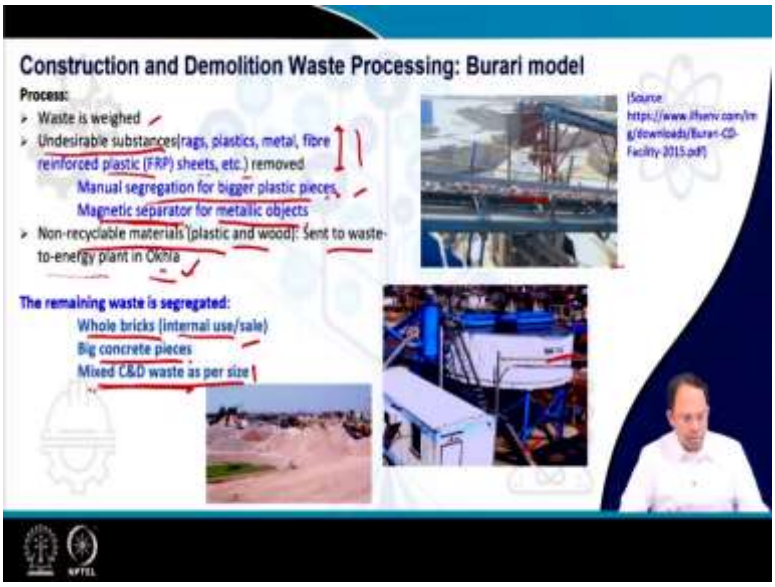
Now, the agreement was done in PPP mode and on concession basis and the agreement was for initially for 10 years and eventually it was extended. Now, the 7 acres of land was given by MCD, and the land provided was to the company ILFS to operate on. And NMDC collects and transport the materials to the plant. So that is the responsibility of the municipal corporation to collect the C&D waste and then collect and send it to the plant.

And so for that skips and bins and hauled and dumper placers or hook loaders or tipping trucks that utilise standard waste manage waste collection equipment, and then the initial plant capacity was around 500 tonnes per day and eventually it was expanded to 2000 tonnes per day and mixed waste from 28 designated points in three zones of North Delhi Municipal Corporation was taken to this particular plant.

So, as you can see, this is that plant operation, different operation going on different parts of the plant and I will gradually discuss those. Around 95 percent of the C&D waste is recovered is processed and actually we can make it into other products. And it you also uses water because some of the processes require water and in this case recycled and recycled sewage water was utilised. As zero discharge for this entire facility is a zero-discharge facility but it is and the technology they use is called a wet processing technology which involves water at the end.

So that that amount of silt and all contaminating the waste is reduced and this also reduces dust and noise pollution from the material which are being processed or prepared from the C&D waste. Now till 2016 as per estimates around 45 acres of land which would have amounted to 400 Crore saved by reducing landfill burden, because we are processing C&D waste that means, we do not have to have more land required for landfill and also it has given employment to the locals. In addition, of course, lot of money was generated by selling of this particular products.

(Refer Slide Time: 03:50)

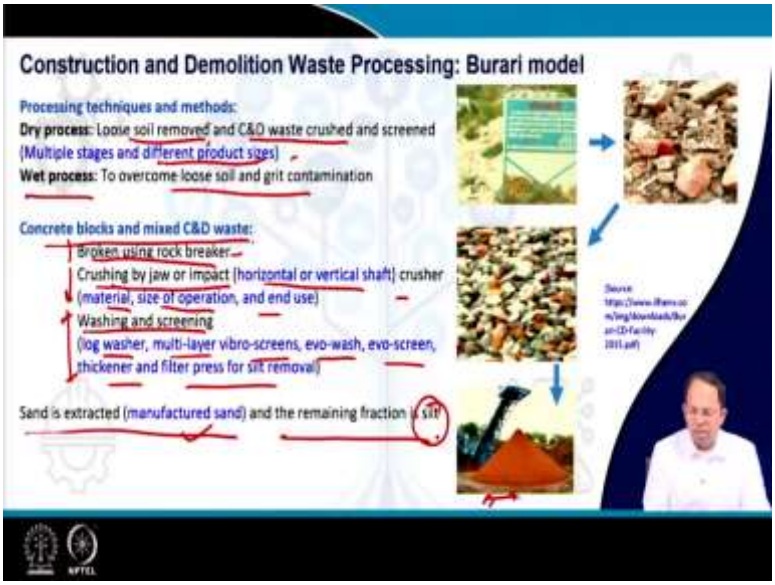


So, the process in this particular plant, you can see the different operations where the conveyor belt is carrying you know the crushed material and then there are other cleaning facilities and all, this is the echo cycle you can see over here. So, waste is first weighed, how much amount of waste is coming in, then initially undesirable substances such as racks, plastics, metal, fibre, reinforced plastic sheets, all these things are removed, then manual segregation of bigger plastic pieces. So, this segregation is either done manually and also using some amount of mechanical means as well.

So, manual segregation is done for the bigger elastic and other pieces, whereas, the metallic objects or ferrous those kind of odd even non-ferrous could be used we can use different forms of electromagnet to separate them as we have learned earlier. Non-recyclable materials such as plastic and wood that is recovered from this particular waste is sent to the waste to energy plant in Okhla, which we have also we have learned about this plant in earlier case studies. The final waste after removing all these undesired material is what it remains are three categories of waste.

One is whole bricks, which is used for internal use or some whole bricks could be also sold. The big concrete pieces and mix C7D waste as per size. So, big concrete pieces are chunks of concrete whereas, the other is a mix of bricks concrete and so, this is mix C&D waste. So, again this could be again subcategories as per the size of those particular materials.

(Refer Slide Time: 05:31)



Now, the coming to the processing technique and methods applied, so, there are usually two processes one is the dry process and the wet process. So, in both processes usually we removed the soil, the loose soil which is which comes along the C&D waste that has to be taken out and after that the C&D waste is crushed and screened, and in it is done in multiple stages and at different stages, we get different sizes of products or different rates of product.

Whereas in the weight process what we do that means, even after all this processing in the drying process, because it is a dry process, still a lot of silt and all these things are at remains in the final process products. So, to get rid of this kind of silt or you know sand even to in this particular product. So, to overcome the loose soil and grit contamination of this particular

product, the wet process is done, now how it is done? So, first for concrete blocks and mix C&D waste, for both of this broke first is a broken using rock breaker.

So this is the equipment that is used to break the waste into smaller particles, then crashing by jaw or impact which is jaw impact crusher, it could be either a horizontal or a vertical shaft crusher and it is based again on what kind of material size of operation and the final end use what we require, what kind of product will equate depending on that we will determine what sort of this jaw impact crusher that we will utilise. And finally we washed the end screen that means we washed the waste with water and then we screen the waste and these are done by log washers, multi-layer vibrio screens, vibration screens evo-wash, evo-screen, thickeners and filter press for silt removal.

So, this is where the washing happens, this is where the crushing happens and this is first breaking happens. So, after breaking we crush it to baking it into very small particles and then we wash it by so that we can remove the you know silt and other those kinds of materials. So, sand is extracted, this is manufactured sand, because we are crushing it into very small particles and the remaining fraction is silt. So, this is the final material which is coming out and then the whatever left is the silt part of it. So, eventually this becomes this could be utilised for other construction purposes.

(Refer Slide Time: 07:52)

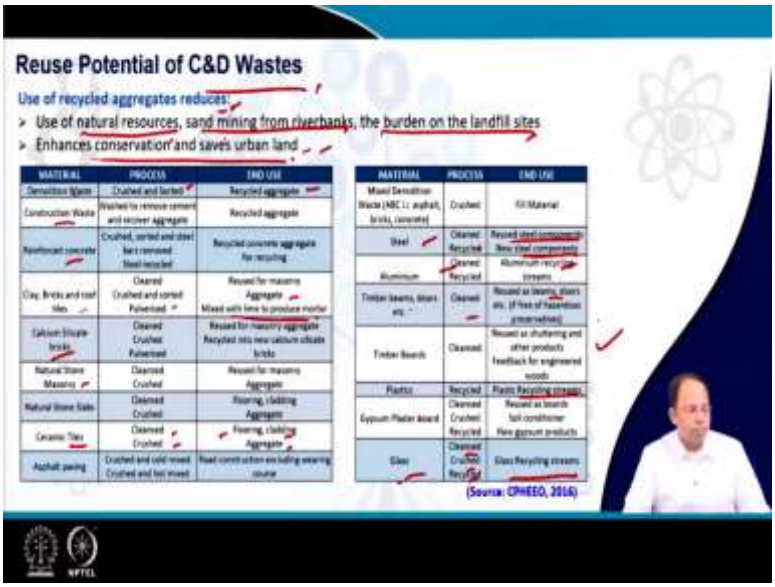
So, what are the final products coming out of this plant. So, there could be road sub-base, granular sub-base, pre-cast products such as kerb stones, cement bricks, pavement blocks, hollow bricks, square tiles, some of these you can see in this particular images. So, they

manufactured sand. So, ultimately this is the manufactured sand, which is very you know, small green particles whereas this is aggregates which could be used as granular sub-base. So, in addition after cleaning, we are also getting rid of the soils, but the soil is there which is also sold lose this loose soil that we generate after greening is can be also sold. So, this is that different kinds of products that are generated from this particular plant.

Now, coming to the final outcome of this project, because of this project, illegal dumping in Yamuna River and in the surrounding eco-sensitive areas were stopped and the Supreme Court building and some M you know a Member of Parliament, apartment buildings blocks were created using this kind of material. So, 20 like tonnes of this material was utilised there. 4 kilometres of expressway by DDA was also constructed where 2.6 lakh tonnes of this material was utilised.

Then Delhi State Industrial and Infrastructure Development Corporation utilise 3.2 lakh tonnes of screened soil for further development of unauthorised colonies. So, this is how this project has turned out to be a very good example which could be repeated in other parts of the country.

(Refer Slide Time: 09:29)



So, use of recycled aggregates could be the use of this particular material. Definitely when we make aggregates out of the C&D waste, we reduce the natural resources that would have been otherwise used for creating these aggregates. One problem is sand mining from riverbanks which is leading to erosion and flooding in certain areas. So, this kind of practice will reduce the demand for sand mining, it will reduce the burden on the landfill site the

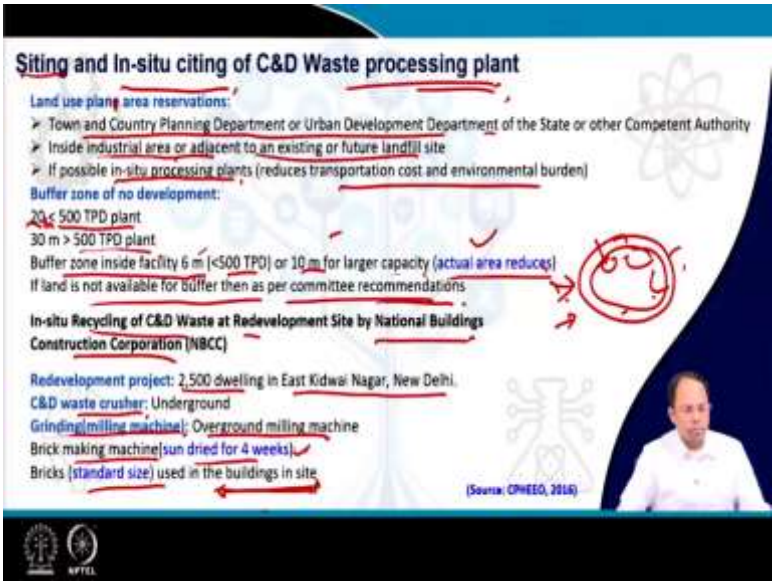
landfill area requirement and finally it will enhance the conservation and saves overall urban land.

So, this is what are the general benefits of C&D waste, but now coming to specific kinds of C&D waste like construction waste, demolition waste, reinforced concrete, calcium silicate bricks, natural stone masonry, you can see that these are the different processes which are erupted from that, for example, for ceramic tiles, we have to clean it and crush it and then it could be used for flooring, cladding or aggregates, for demolition waste, of course, we have to crash and then sorted then it can be used as recycled aggregate, then clay bricks and roof tiles, this could be cleaned, crushed, sorted and pulverised, then it will be used for masonry or used as aggregate or mixed with lime to produce mortar.

And then coming to this site where we have steel, we can recycle it and then we can clean and recycle it and then reuse steel components and new steel components can be prepared from that. Aluminium exactly same, we can recycle it completely. Then this reuse beams doors and this timber wooden beams and doors this could be cleaned and they could be reused directly and then some plastics could be put into the plastic recycling streams of that particular elv, the glass could be clean, crushed, recycled and then we can have glass recycling streams as well.

So, you can see that a lot of material that is generated could be utilised in different ways and not only the concrete and all these blocks, but also metals, glass and all whatever is generated from this kind of demolition sites or construction activities, we can actually utilise it for other recycling as we have discussed earlier.

(Refer Slide Time: 11:48)



So, then coming to siting of this kind of waste processing plants. So, along with siting we will also talk about in-situ citing that is wherever they are demolition is happening we can set up our processing plant over there or in general terms where we will site. Now then this plan so, usually the Town and Country Planning Department or the Urban Development Department of the state government is the one which is authority, which is department which is responsible for allocating land for this processing plants.

Now, usually the location choice you know, depends on many things, it depends on logistics, it depends on land area available, it depends on what kind of you know emissions are coming out from the site is that dust emission, noise emission and so on. So, those rules remain same for setting up any kind of recycling facility. Whereas in general, we will set up this kind of plants in industrial area and at least it should be adjusted to a landfill site. So that whatever the reuse could be directly taken to the landfill site. And if possible, we have to also go for in-situ processing plants, this will reduce transportation costs and also the overall environmental burden.

Now, one rule that is there in the management has the C&D waste management rules is that we have to create certain buffer zones around these kind of processing facilities. For example, when plants are less than 500 tonnes per day, then the buffer zone should be 20 metres. Whereas, if it is more than 500 tonnes per day, then we have to have a buffer zone of 30 metres around this particular plant. Now, inside the zone, we should also require a buffer zone that is around 6 metre for a small plant which is 6 500 tone plant and 10 metres for a

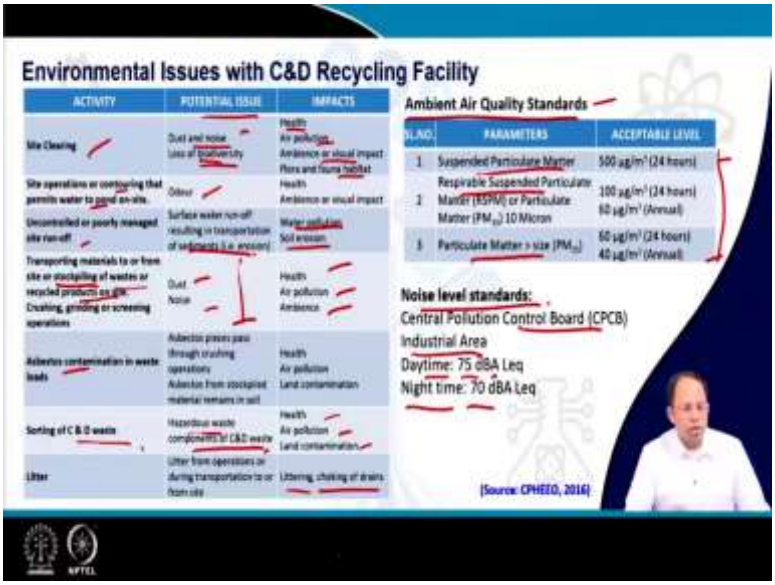
larger capacity plant. So, the actual area that is available for operation or setting up sub buildings is lesser than the site area that you will choose.

So, if I have a site here like this, actually we have to keep a buffer of 6 metre or 10 metre accordingly and then create everything else inside this particular facility. So that is how you should determine what amount of area should be required to reserve to be reserved for this kind of setting over this kind of processing plants. So if land is not available for buffer, because maybe it is a very densely packed area or maybe there are other land uses surrounding where we there are other industries also which is not a problem in terms of emission and all this in that case that you know the committee is formed, including committee people from PCP, the Pollution Control Board, pollution control committee who usually give recommendations on the final application approval for setting up this kind of plants.

Now, as we have discussed in-situ is always better because of reduction in transportation costs. So National Building Construction Company NBCC has developed in-situ recycling C&D waste plant in one of its redevelopment site. This site is at East Kidwai Nagar in New Delhi. It includes 2500 dwellings which needs to be redeveloped. So, there is a lot of C&D waste is generated because first you have to demolish and for a waste crusher is set up underground so that you know dust and all these things does not spread too much. And then there is grinding and milling machines which you are making it into smaller particles and all which is overground setup in this particular area.

Now, there is also a brick machine making machine which makes 100 brick which takes around 4 weeks for the bricks to mature and standard size bricks are prepared and these are used in the same buildings for development. That means in the same site, they are doing a lot of development, where your new buildings are being constructed. So, all these are utilising the bricks which are generated over here.

(Refer Slide Time: 15:58)



So, some of the environmental issues of C&D recycling facilities, this issues also remain for in-situ plants as well. So, we have to be very careful. Now, some of these activities, there are different activities like site clearing, site operations, or contouring operations that permit water to be pounded on the site or uncontrolled or poorly management site runoff asbestos contamination. So, these are different aspects and each of them results in certain potential issues like site clearing results in dust and noise, loss of biodiversity maybe. Then site operations result in some you know, this ponding operations may result in some order. Then uncontrolled or poorly managed site runoff results in a transportation of sediments or erosion, which leads to water pollution and soil erosion.

Similarly, dust and noise leads to healthy air pollution ambience or visual impact flora and fauna based on loss of biodiversity they are impacted. So, transportation of materials to and flow from site and stockpiling of waste recycle or recycling product that leads to dust and noise. This is the primary concern; this leads to health problems air pollution ambience is also lost and so on. So, sorting of C&D waste hazardous waste components of C&D waste may cause health, air pollution and land contamination and litre is spreading of the dust by wind and so on.

So, it could lead to choking up drains and general littering of sight which is not aesthetically pleasing. Now, for this we have to regularly monitor this kind of sites both in-situ sites as well as separate sites. So, the air ambient air quality monitoring standards has to be followed these are again as per you know, this suspended particulate matter RSPM then particulate

matter different kinds of matters are being measured and you can see these are the values acceptable levels.

And similarly, for noise level standards we have it is similar for industrial areas and as given by CPCB during daytime, the maximum noise allowed is 75 DBA leq. So, this is the acceptable average decibel levels and this this for night-time it is 70 DBA. So, this is what we have to be careful about when we are setting up this kind of facilities.

(Refer Slide Time: 18:25)

And now, we will do a case study of municipal corporation Gurugram. So, as you can see in this particular image, this yellow are the real estate and infrastructure development projects that are going on in this particular area, Gurugram is a developing fast developing area. So, we have got a lot of projects and but people the waste that is generated from this projects are illegally dumped in nearby areas as you can see from survey, these are the illegal dumping site that has been observed. These are empty sites, not probably there are not too many people over there. So, people are dumping waste there. So, this sort of practices has to be definitely stop.

So, it is not only making facilities for processing and all these things for C&D waste processing, but at the same point of time, we have to deter people. So that means there has to be some amount of you know penalty for this kind of you know, activities and also in cases people are doing construction, they are not informing the government, then there has to be definitely penalties. So usually for non-disclosure, the penalties are 25,000 or 25 percent of the overall assessment of that property which whichever is lower. And night patrolling and

on-call complaints are registered. That means people can complain about if they see something. And night patrolling is taken up intensively so that people are deterred to generate this kind of C&D waste and then throw it away, just like that. So that has been done in Gurugram. So, it is not really the positive thing, but also some amount of you know strictness has to be there to prevent this kind of disposal activities.

Now coming to the you know the processing plant that has been developed approximately 1200 tonnes per day of C&D waste is generated in the Gurugram Municipal Corporation. And usually earlier private contractors used to dump this waste in private properties, they used to sell it even for you know making those properties higher, then illegal dump the rest of the waste was illegally dumped along roads, public lands and even isolated areas in the Aravallis. So, all these were done earlier. Then, initially a C&D waste processing facility was proposed by the corporation along with ILFS, environmental infrastructure and service limited which is IEISL.

So, this is a subsidiary of the ILFS company and into the year 2016, they had a Build Operate Transfer Agreement, this is one form of PPP mode agreement that you have learnt earlier, they have done a 20 year agreement for you know, this kind of waste prosy and waste processing and initially they started with a 4 acre plot and the plant was constructed and the plant started operating from 2019 and the design capacity was of the plant was made around 1800 tonnes per day. So, they started with 300 tonnes per day capacity initially and then eventually they were able to increase that to the full amount of waste that has been generated in the municipal area.

So, one of the main problems with this kind of projects is the collection and the primary and the secondary collection system for C&D waste, because C&D waste is bulky, it is heavy, it is difficult to transfer you plus it has to be done as per real time requirement that means somebody will you know, book that I have my C&D has to be picked up from that site and then we have to send vehicles. So, all this detailed planning needs to be done. So, Pragati Natural Resources Private Limited. So, this was a company which was again taken under a concessional contract and there they were paid around 360 rupees per tonne for segregated C&D waste and rupees 720 per tonne for non-segregated waste to transfer collect and transfer this waste to the processing facility.

Total they employ deployed around 92 vehicles and 23 machines and total number of intermediate storage points that was used in the city was 5 initially it was planned to be around 13 but ultimately 5 became operational. Total manpower deployed was more than 300 and total percentage of C&D waste that got processed is 100 percent, that means the entire 1200 tonnes per day of waste was actually processed.

(Refer Slide Time: 22:54)

The process and method employed as you can see, this is a crusher for the C&D waste plant, this is the Basai plant and the processing method they employed was a waste was initially inspected and weighed and then computerised billing and vehicle tracking system so that you can pay deferred payments and all this stuff you have to measure how much amount of weight of waste is coming and so on. Then the plant is unloading area where the waste was unloaded and then from that waste wood, steel, plastic and bituminous materials are manually segregated. And these are sold to recyclers. So, this is the first waste stream.

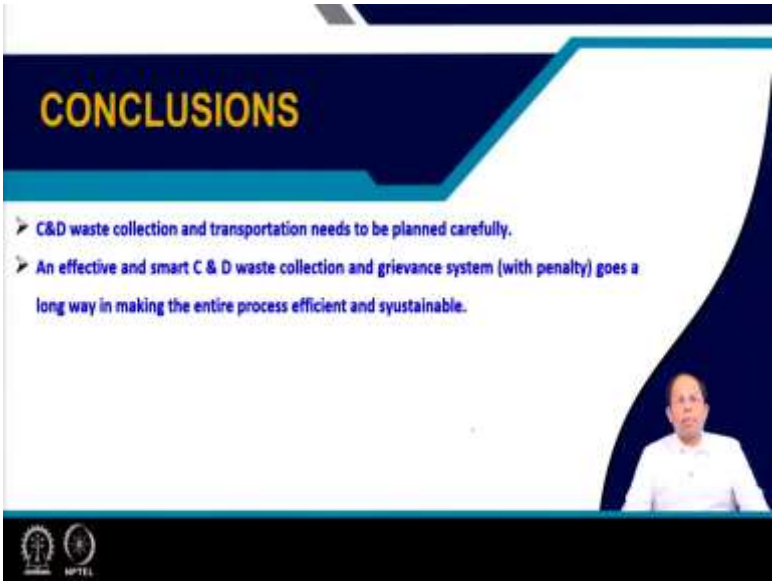
The three other waste streams that were there because we have now segregated all these other materials, where whole bricks, big concrete pieces and mix C&D west. So, this is almost same as the previous this Burari plant, then crashes were utilised where the concrete were broken into pieces, conveyors were utilised for screening of this particular broken material. And then wet processing technique was utilised even similar to the Burari plant for cleaning the waste, so that we can separate silt from the actual different aggregates and the finer materials.

So finally, bulk contracts were done with bulk buyers to sell up this kind of material. So this is how these are two successful examples of C&D waste and this could be repeated in many parts of the country.

(Refer Slide Time: 24:13)

So, these are some of the references you can follow.

(Refer Slide Time: 24:17)



So, to conclude, C&D waste collection and transportation needs to be planned carefully and effective and smart C&D waste collection and driven system with penalty goes a long way in making the entire process efficient and sustainable. Thank you.