

Municipal Solid Waste Management
Prof. Ajay Kalamdhad
Department of Civil Engineering
Indian Institute of Technology, Guwahati

Lecture – 37
Special Waste

So Hello students, today we will start the next module. Module 12 under this module is especially I had designed to talk about special waste. And see, until now, we had discussed collection treatment management issues regarding dry waste wet waste. But still, we have not talked about some special kinds of waste generated in the municipal area, like construction and demolition waste. A tremendous amount of amount is getting produced, and you know our urbanization is increasing.

So obviously, this construction work and even demolition work also is very high, though. So these kinds of inert material also are getting generated in a very high amount. We have to also talk about e-waste because this e-waste is also generated from house to house or commercial areas. This is also from the municipal area. But I think this C and D and e-waste and also the biomedical waste.

This is also the huge quantity produced and the inert waste the street sweeping waste. This is also one of the important quantity is getting generated. Still, when you see our Solid Waste Management rule 2016 or even earlier, these rules are only for municipal waste, and municipal waste does not consider the C and D waste, even e-waste biomedical waste.

And for that, there are special rules are available for C and D construction demolition waste that is also. In 2016 the special rules were available. E-waste India was the first country to come up with the e-waste management rule in 2011 also has been modified in 2016 also the biomedical we have biomedical rule also is there and specially for hazardous waste also special rules are available.

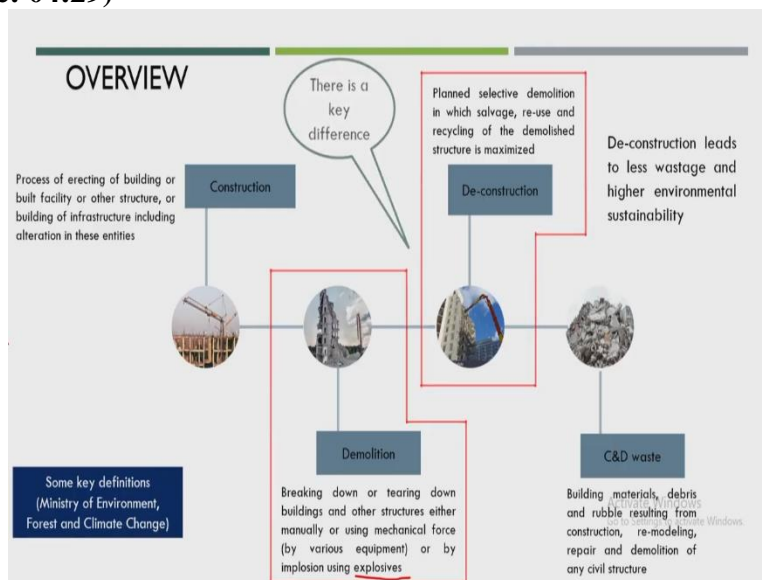
So what I thought of because these kinds of wastes like construction and demolition waste e-waste, biomedical waste and street sweeping waste are also coming under municipal waste. However, the management rules are different for that even the treatment also is different. Still, these courses are

specially for the municipal solid waste, specially for dry waste and wet waste, which we have discussed up to module 11.

So I thought of rather than giving the entire collection disposal things of these kinds of waste special waste. Still, I also thought of why not to know how this waste has been produced or how much quantity is generated and what precisely the treatment or disposal is given in the rule. And what exactly our country are working for the C and D waste e-waste or biomedical waste or inert waste.

So we will start with the first waste that is construction demolition waste. In this lecture, we will talk about only the construction demolition waste. And in the following lecture, we will talk about e-waste biomedical waste and inert waste.

(Refer Slide Time: 04:29)



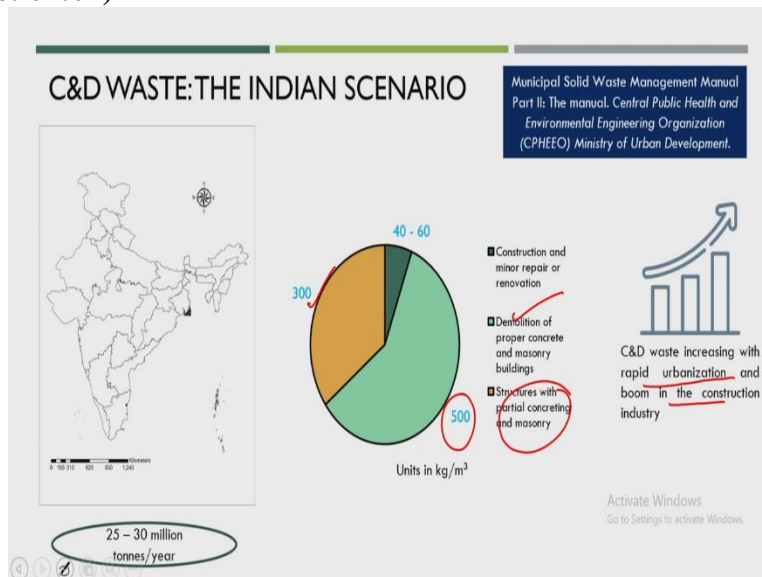
When you talk about construction demolition waste, per Ministry of Environment forest and climate change, how it has been defined like first constructing the process of buildings or other any civil structure or infrastructure in that case also the construction waste. This is the construction waste construction one. The demolition waste could be from breaking down or breaking out of the building. Some explosives mostly demolish these buildings by putting some explosives, and this entire building is getting demolished.

And the other one is that deconstruction. So deconstruction is different from demolition. See deconstruction means is a planned demolition. So properly are this demolition also could be possible to the extinction of the building and this is appropriately prepared and whatever the demolition structure the even waste amount also will be as low as possible in a while in the deconstruction process.

And another is the finally the C and D waste will come up like that will be a building material what the debris are using in the construction the while in the repairing or finally entire the demolition of any civil structure. But here, the important is that the key difference between demolition and deconstruction is that deconstruction leads to less wastage and higher environmental sustainability. So it is an adequately designed demolition.

But in India, I think both kinds of waste are usually produced or generated, even deconstruction and demolition, but the ministry for the waste generation correctly defines this.

(Refer Slide Time: 07:02)



Now, what are the Indian scenario of C and D waste so? Around 25 to 30 million tons per year of C and D waste are getting generated, and this quantity is huge is getting produced. So if you compare it with the MSW waste, this goes to 65 to 70 million tons per year. So this is also almost half of the MSW is producing C and D waste. And why the quantity is very high also because of construction material.

So obviously, the wet is very high in this case and does not have moisture; also, the wet is very high without humidity because the specific wet is also very high in this waste. So here also if you see the maximum amount of waste is generated around 500 units of demolition waste only and the structure with the partial demolition or some masonry or concreting work through that is this waste is getting produced.

And small amount by the minor repair construction repairing is getting produced, but the major is demolition waste. And the problem is that the C and D waste increase in the rapid urbanization and boom in the construction industry that and this urbanization I think started in India from last 15 to 20 years and it believed that maybe by 2030 or almost 60 more than 60% of the population will be in the urban area.

So obviously we will be required lot of constructions. So more construction means more amount of construction demolition waste will get produce or will get generated. And because of this waste, I will not say precisely what we can call waste because it is a construction material. So we can easily recycle that recycle this kind of waste. And also can be same waste could be helpful in another construction facility for road construction.

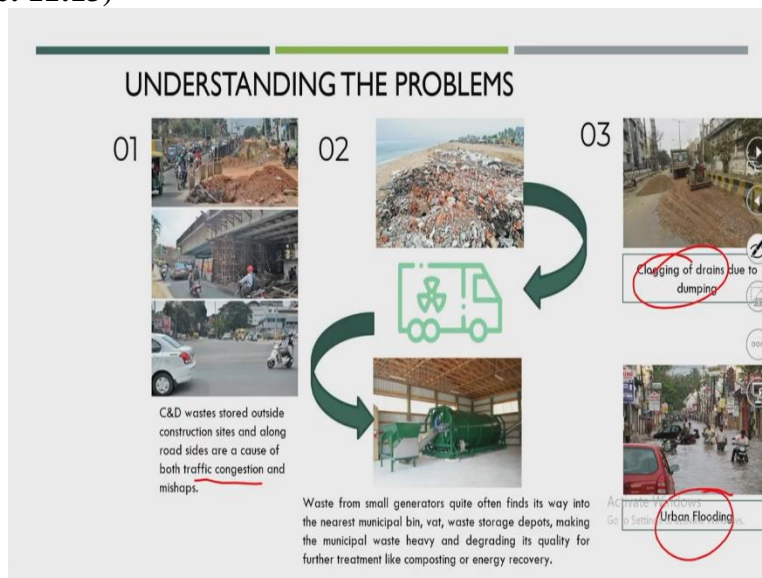
And even for the building construction itself, or maybe we can make some brick out of that, and these fired brick could be helpful for the new structure also be beneficial. Still, the problem is that proper collection and proper storage is essential for the C and D waste.

(Refer Slide Time: 10:20)



So what all is involved here is the significant components and minor components like major components are brick, cement plaster, steel or maybe stone, granite and wood or timbers. These are the essential components in the C and D waste. A few minor features like conduits like iron could be possible the pipes, electrical materials, the panels, or even glass panels could be likely. But I think this is a minor component, but major are these are the major ones.

(Refer Slide Time: 11:13)



Understanding the problem is critical first need to know why the C and D waste is becoming a significant issue in our urban areas. You can see some photographs of the C and D waste stored outside the construction site. I think you visit any construction area anywhere in your city. You will usually see this construction demolition waste stored outside your construction site.

And along the roadsides are the primary problem is traffic congestion, and this is a significant problem even it will close the drains many times you so you will see here and a problem that this kind of a waste if you dispose into the disposal site also proper wherever the even site or landfill is so if you dispose of it will take a considerable amount of area and even the transportation also is challenging in such kind of waste.

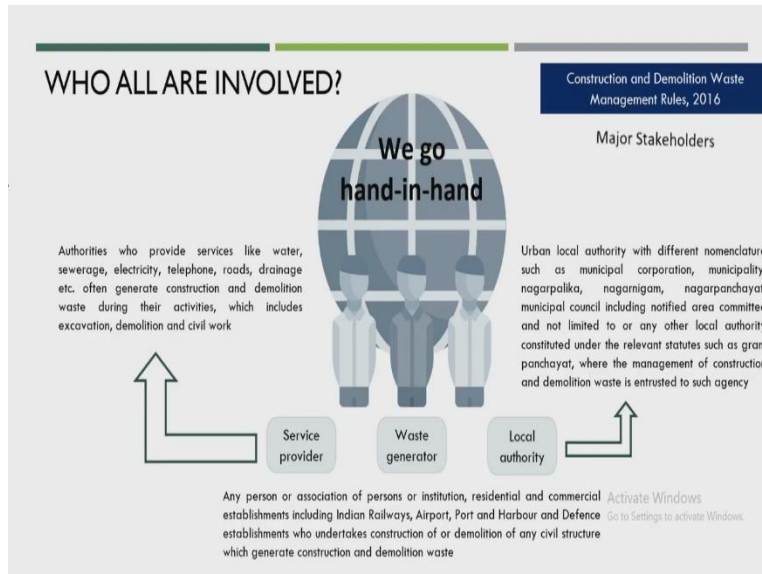
So it is an another, and the problem is that suppose if you are not storing near your construction site are and generally if you see that once the entire construction gets over the many time, we will see that this kind of waste will store the near to that construction facility until unless the local authorities or that construction company do not require to clear that particular area and mostly that this area is getting cleared.

And this entire waste is getting dispose into either nearby bin, and there also is very difficult to collect by the collection vehicle which typically contains the dry and wet waste because this concentration is very high very highly heavy materials and even the size also is sometimes very big which cannot be easily stored into the dustbin also. So these become a major issue now in most of the urban cities.

And also the many times it will clog the drains, and you know that urban flooding and every time you see in the monsoon time are most of the cities in the flooding condition even Mumbai, Delhi these are major cities. Even we have seen Chennai also once upon a time it was completely flooded. This flooding is significant because it is not that these cities do not have the proper sewage networks or stormwater collection facility.

Some cities like Mumbai are some of the oldest cities we have the stormwater or sewage collection facility or sewer network. But the problem is that these drains are getting clogged. And this clog is not only because of plastic that we are disposing of. But, these construction demolitions will also get blocked these kinds of drains, so now the issue is that you have to collect them and dispose of them to recycle them correctly.

(Refer Slide Time: 14:58)



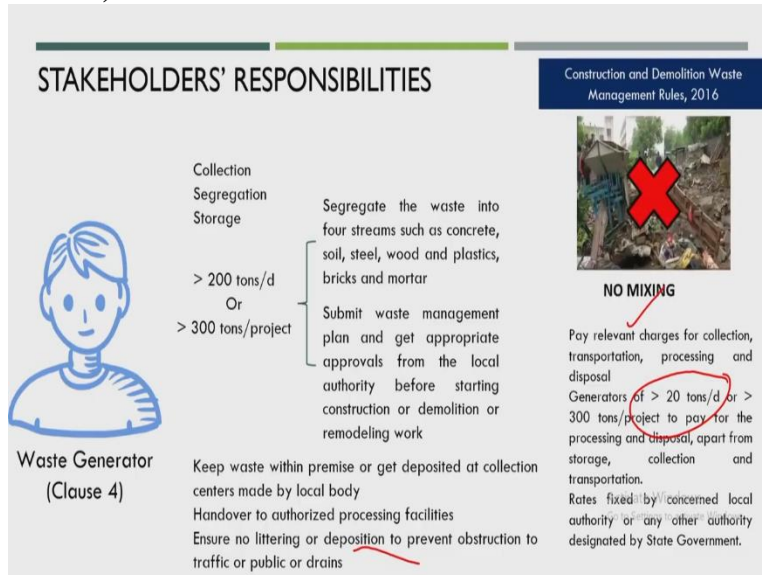
So who all is involved? So if you talk about the significant stakeholders, the first is the waste generator. So, waste generators could be any person or association of persons or institutions or even residential area commercial establishments like railway and airport defence establishments. These are all the waste generators. They are the major stakeholders of this C and D waste generation. Next is the service provider.

So service providers could like the water supply, sewer network, electrical, telephone, road, drainage these facilities means I think these authorities will provide the services. Those are the stakeholders, and others are the local authority. So local authority could be your municipal corporations. These are the primary stakeholders or the municipals for class 1 cities or even nagarpalika for class 2 cities; panchayat is for rural areas.

And because the why these become a major stockholder here because this authority has to come up with particular by law particular rule although we have the C and D waste is waste rule is available with us but to have those rules in that specific city the local authority has to come up with their particular facilities like if they are asking to store or get collect this C&D waste, so they have to provide one specific facility.

And somebody supposes some Kawadiwala can collect those particular ways. So you have to provide a specific facility for that. So that is the primary task or significant stakeholders in the C and D waste.

(Refer Slide Time: 17:18)



Now, if you talk one by one waste generator their responsibility of waste generator if you talk about construction demolition waste management rule 2016 in class 4, the duties are given for the waste generator for the collection of C and D waste, segregation of C and D waste and even the storage also the responsibility is shared, and usually, this waste generator typically is generated around more than 200 tons per day or 300 tons per project.

And what is their other responsibility, like segregate the waste into a four-stream such as concrete, soil, steel, wood, and plastic brick and mortars. Likewise, the four streams have to segregate the waste submit the waste management plan to get appropriate approval from the local authority before starting construction or demolition or remodelling work. This waste generator could be some construction industry.

One particular private company could be a waste generator or even one specific household whether they can ask one or the other authority to segregate the waste and also specific storage they have to the local authority should provide to those particular household people and also the one special responsibilities given for that keep debris within the premises or get disposed of deposited at

collection centre made by the local body handover to the authority processing facility ensure no littering or deposition to prevent no obstruction to the traffic or public or drain.

This is also one crucial point is or essential responsibilities given to the waste generator. So why transportation such wastes the littering of that waste should not be there onto the road. And also you have to pay relevant charges. Based on whatever orders are applied or asked by the local authorities and the generators of more than 20 tons per day or more than 300 tons per project to pay for the processing and disposal apart from storage, collection, and transportation.

So they say it is only the payment is typically for 20 tons per day or 300 tons per project. So mainly, in this case, the giant construction industries only involved so obviously because they have to dispose of the waste, so they have to pay some charges also and rate fixed by the consent of the local authority and any other authority designated by the state government. So no mixing is the particular guideline is given for the waste generator. The waste should not be get mixed with the MSW.

(Refer Slide Time: 21:03)

The slide is titled "STAKEHOLDERS' RESPONSIBILITIES" and is part of a presentation on "Construction and Demolition Waste Management Rules, 2016". It lists responsibilities for "Service provider and their contractors (Clause 5)". The text is crossed out with a large red 'X'. The responsibilities listed are: "Prepare within six months from the date of notification, a comprehensive waste management plan covering segregation, storage, collection, reuse, recycling, transportation and disposal of construction and demolition waste generated within their jurisdiction." and "Remove all construction and demolition waste and clean the area every day." Below the text, it says "IF NOT POSSIBLE". There is also a small "Activate Windows" watermark in the bottom right corner.

Now the next is a service provider or their contractor in class 5. I had been asked to prepare the prepare within six months from the date of notification or a comprehensive waste management plan covering segregation, storage, collection, reuse, recycling, transportation, and disposal of construction demolition waste generated within their jurisdiction. So within preparing the six months, the plan has to become up from the service providers.

And also had been asked that remove all construction demolition waste and clean the area every day. Suppose if it is not possible by the service providers. So what they can do they can tie up with the authorized agency for removal of construction demolition waste and pay the relevant charges. Suppose they cannot come up with a particular plan, and they cannot provide one specific facility so they can tie up with another authority. They can pay whatever the charges relevant charges for those facilities.

(Refer Slide Time: 22:26)

STAKEHOLDERS' RESPONSIBILITIES

Construction and Demolition Waste Management Rules, 2016

Local authority (Clause 6)

- Issue detailed directions and seek detailed plan or undertaking (from generator) with regard to proper management of construction and demolition waste within its jurisdiction.
- Chalk out stages, methodology and equipment, material and final clean up after completion of the construction and demolition.
- Seek assistance from concerned authorities for safe disposal.
- Make arrangements and place appropriate containers for collection of waste and shall remove at regular intervals or when they are filled, either through own resources or by appointing private operators.

Generator

- Transport waste to appropriate sites for processing and disposal either through own resources or by appointing private operators.
- Give appropriate incentives to generator for salvaging, processing and or recycling preferably in-situ.
- Examine and sanction the waste management plan of generators within a period of one month or from the date of approval of building plan, whichever is earlier from the date of its submission.
- Keep track of the generation of C&D waste within its jurisdiction and establish a data base and update once in a year.

Expert institutions

- Device appropriate measures in consultation with expert institutions for management of C&D waste generated including processing facility and for using the recycled products in the best possible manner.
- Create a sustained system of information, education and communication for C&D waste through collaboration with expert institutions and civil societies and also disseminate through their own website.
- Provision for giving incentives for use of material made of C&D waste in construction activity including non-structural concrete, paving blocks, lower layers of road pavements, and rural roads.

Now the next is local authority is another stakeholder, and the responsibility is given in class 6. I had been asked to detail directions and sought a detailed plan or undertaking regarding the proper management of construction demolition waste within their jurisdiction, chalk out stages, methodology and equipment, material, and final clean up after completing C and D waste. And they can take the assistance from the concerned authority and make arrangements and place the appropriate containers for the collection of waste shall remove at regular intervals.

Or when they are failed and either through their resources or by appointing private operators. So they have to arrange the particular containers in such facilities or select one private contractor. This private contractor will collect the waste and properly dispose of the waste, and transport that particular waste particular incentive to the generator for processing and recycling incentive.

So they can also ask that one of the construction companies if you can reuse the proper incentive and give it to them. Examine and sanction the waste management plan for the generator within one month from the building plan's approval. Please keep track of the generation of C and D waste within their jurisdiction. And appropriate device major in consultation with the expert institution for management of C and D waste.

This expert institution could be academic institutes also or whoever is using or recycling such kind of C and D waste and create a sustained system for information education and communication for C and D waste through the collaboration with expert Institute and provision for giving incentives for the use of material made by C and D waste in construction activity. This is one of the critical points they can have they can start the different awareness, and also they can begin to some incentives.

Whatever waste you generate, you can reuse in your construction or construction material for new construction if any particular construction industry uses recycled material for its unique structure. So obviously, you pay some incentives to them so that the maximum amount of waste get a waste will get utilized.

(Refer Slide Time: 25:35)



Now the management of C and D waste through sustainable solutions how the sustainable solutions could be possible like for from proper storage collection transportation disposal and unique is processing if you do adequate processing assessing the potential for reuse and recycle

and propose reuse and recycle of the process to C and D waste again is not only the utilization of that recycled material that is also the critical part and finally the environmental considerations. So this will be a significant or proper sustainability solution for the management of C and D waste.

(Refer Slide Time: 26:24)

I. STORAGE, COLLECTION, PROCESSING AND RECYCLING FACILITIES

Construction and Demolition Waste Management Rules, 2016

Land allotted by State Govt or setting up of storage, processing and recycling facilities and handed over to local competent authorities for development, operation and maintenance.

Local authorities + Dept. of Urban Development of the State/UT provide necessary clearances to operators.

Activate Windows
Go to Settings to activate Windows.

So we will go one by one. We will start with the storage collection transportation. So there should be a good land should be allotted by the state government of setting up for storage processing and recycling facility and handed over to the competent local authority for development operation and maintenance. And the local police, plus the department of urban development of the state, provided necessary clearance for operation.

(Refer Slide Time: 26:57)

I. STORAGE, COLLECTION, PROCESSING AND RECYCLING FACILITIES

Construction and Demolition Waste Management Rules, 2016

Vegetative boundary to strengthen the buffer zone

Fencing

Drinking water, sanitary, and lighting facilities at site

Stormwater drains to prevent stagnation of surface water

Water Bodies

NO DEVELOPMENT ZONE

Monitoring ambient air quality at the vicinity

GATEWAY

Approach roads

Waste disposed in a Sanitary Landfill (Design life of 20-25 years)

Local authorities + Dept. of Urban Development of the State/UT provide necessary clearances to operators.

Forests

Far off from the landfill site

Clusters

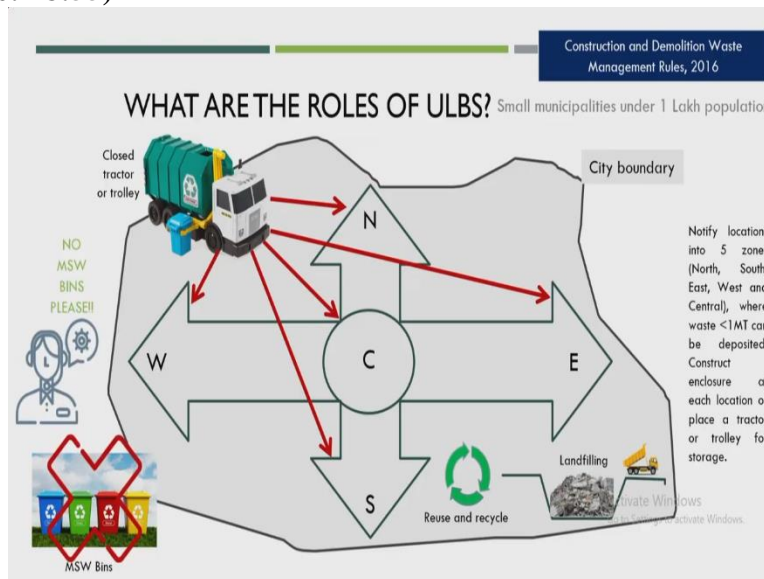
Habitations

Activate Windows
Go to Settings to activate Windows.

So suppose one particular location will finalize where we can have the proper storage or processing or disposal of C and D waste. So and these designs should be 20 to 25 years properly designed and far from the landfill site, far from the forest, far from the water bodies or far from the clusters or habitations you can locate such kind of which should not be close to the water body should not be close to the forest. It should not be close to the habitations.

And see that the nearby area there should not be development go for proper fencing proper approach road weighing bridge so that how much amount of waste is entering into those facilities and provide the adequate facility like water, sanitation and hygiene facilities see that the stormwater drains to prevent into that particular area and also to provide monitoring of ambient air quality at the vicinity and go for proper plantations in the nearby area. So this was the complete thought about the entire facility of storage collection and processing and even disposal facilities or landfilling facility in this particular area.

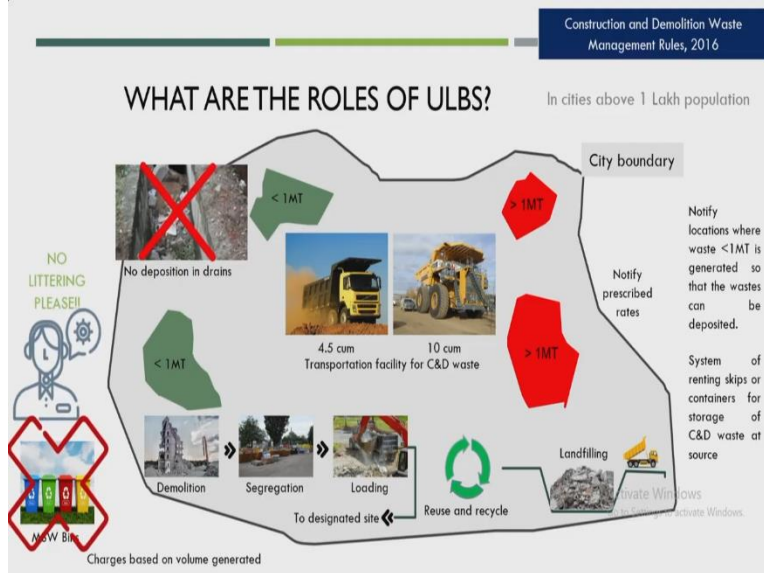
(Refer Slide Time: 28:55)



So what is the role of ULBS here? Now it has been notified this is for mainly this role is explained for the small municipalities under 1 lakh population the small habitations where it has been reported that the entire city has been segregated in 5 zones north south east west and central where waste less than one metric ton can be deposited and construct an enclosure to each location or place a tractor or trolley for the storage.

So all 5 locations so compact tractor or trolley you provide into those locations and this kind of waste should not be disposed into MSW bins. Remember that and try whatever is waste is getting stored try reuse recycling. If not can go for landfills.

(Refer Slide Time: 30:04)



And now, for the city above 1 lakh population, it has been notified that the location where waste less than one metric ton is generated. So that the waste can be deposited and some of the sites are waste could be stored more than one metric tons should find out and notify the prescribed rates and again the no MSW storage and provide the proper transportation facilities like the small 4.5 cubic meter and ten cubic meters in the case of waste storage more than one metric ton and also reuse recycle and go for finally landfilling.

So and also had been asked no deposition in the drain. Whatever the demolition waste goes for segregation and loading and put it into the designated site and whatever charge will be required for volume generator, ask them to pay for those charges.

(Refer Slide Time: 31:29)

2. PROCESSING CONSTRUCTION AND DEMOLITION WASTE

C&D waste can be put to a profitable use, given the scarcity of sand and stone for construction, thereby saving natural resources.

1



Prevents public nuisance and traffic congestion issues arising from indiscriminate dumping of C&D waste.

2



BENEFITS ACCRUED

Reduces cost of bulk transportation if recycled close to source of generation.

4



Saves valuable space at landfill sites.

3



Activate Windows
Go to Settings to activate Windows.

Now the processing of construction and demolition waste, what benefits we can get if the C and D waste can be put to can be used in sandstone for the construction can be effortlessly reusable. Also, it will prevent public nuisance or traffic congestion because of storing waste very close to their construction facility, which will save valuable space in a landfill site. If you are going for reusing of such kind of material and finally reduce the cost of bulk transportation or recycling floor if that kind of waste is getting generated getting reused in the generation facility itself.

(Refer Slide Time: 32:31)

3. REUSE AND RECYCLING POTENTIAL

Municipal Solid Waste Management Manual
Part II: The manual, Central Public Health and
Environmental Engineering Organization
(CPHEEO) Ministry of Urban Development.

1



Demolition waste
Process: Crushed and sorted
End use: Recycled aggregate

2



Construction waste
Process: Washed to remove cement and recover aggregate
End use: Recycled aggregate

3




Reinforced concrete waste
Process: Crushed, sorted and steel bars removed; Steel recycled
End use: Recycled concrete aggregate; For recycling

4



Clay bricks and roof tiles
Process: Cleaned; Crushed and sorted; Pulverized
End use: Reused for masonry; Aggregate; Mixed with lime to produce mortar

5



Calcium silicate bricks
Process: Cleaned; Crushed and sorted; Pulverized
End use: Reused for masonry; Aggregate; Mixed into new calcium silicate bricks

6



Natural stone masonry
Process: Cleaned; Crushed
End use: Reused for masonry; Aggregate

So now reuse and recycling potentials like I had come up with around 12 to 14 different waste and their end-use. First, you take the demolition waste that can be end use could be recycled aggregates like construction waste end use could be again the recycler aggregates. This is reinforced concrete

waste end use could be recycled concrete aggregate for recycling clay bricks and roof tiles end use could be reused for masonry aggregates are mixed with lime to produce mortar calcium silicate bricks also could reuse for masonry or can be another brick we can prepare up that natural stone masonry that also you can reuse for same for masonry and aggregate.

(Refer Slide Time: 33:31)

REUSE AND RECYCLING POTENTIAL

Municipal Solid Waste Management Manual
Part II: The manual. Central Public Health and
Environmental Engineering Organization
(CPHEEO) Ministry of Urban Development.

7 Aluminium
Process: Cleaned; Recycled
End use: Aluminium recycling streams

8 Steel
Process: Cleaned; Recycled
End use: Reused steel components;
New steel components

9 Mixed demolition waste
Process: Crushed
End use: Fill material

10 Asphalt paving
Process: Crushed and cold mixed; Crushed and hot mixed
End use: Road construction excluding wearing course

11 Ceramic tiles
Process: Cleaned; Crushed
End use: Flooring, cladding; Aggregate

12 Natural stone slabs
Process: Cleaned; Crushed
End use: Flooring, cladding; Aggregate

Like aluminium is a recyclable matter, see all steel components are recyclable. We can create new steel components from the aluminium like mixed demolition waste that can be used for the resin-filled material like asphalt paving can also be used for road construction and ceramic tiles that can be used for flooring and aggregate production also can be used. Natural stone slabs also can be used for flooring or aggregate productions.

(Refer Slide Time: 34:05)



Like timber beams, doors can be reused as in beam or entry if it is not hazardous. Timber boards also can be used for shuttering or other engineering wood we can create out of the plastic that is recycled completely. And even the gypsum plasterboard that can also be end-use is very good. Glass is an entirely recyclable one. So and also the use of construction demolition waste for road works is prevalent.

So there is one report submitted by Central Road Research Institute CRRRI in Delhi that is possible to use the construction demolition waste for the road in embankment construction. So like for sub-grade building, sub-base construction, even for rigid pavement, also could be possible to utilize. So means I think I had come up with 17 different waste materials that could be easily recyclable and could be utilizable for other purposes.


So Government of National Capital Territory Delhi has recorded exemption of VAT also for tiles and curbstone made from the C and D waste or (())(FL: 35:48) this is the Hindi we call is a (())(FL: 35:51). So they will not ask for the VAT for that. So this is also good by law from the local authorities.

(Refer Slide Time: 36:00)


Municipal Solid Waste Management Manual
Part II: The manual, Central Public Health and
Environmental Engineering Organization
(CPHEEO) Ministry of Urban Development.

4. PROPOSED USE OF PROCESSED C&D WASTE


Primarily mixed aggregates or recycled aggregates (RA) as well as recycled concrete aggregates (RCA).



Demolished concrete block



Recycled coarse aggregate



Recycled fine aggregate

Deleterious material, such as organic content, vegetable matter, coal, clay lumps, external substances such as soft fragments like pieces of plastics, paper

Chemicals, known to be detrimental for the strength or durability of concrete or steel reinforcement, such as chlorides, etc. beyond the threshold value.

RCA should be pre-wetted near to SSD (saturated surface dry) conditions before use to avoid rapid slump loss due to its high water absorption rate. Admixtures with better slump retention effect would be useful.


Fine washed aggregates in the range of 4.75 mm to 0.075 mm (75 μ) separated from C&D waste using 'wet' process may be used as 'manufactured sand' for non-load bearing structures.

Now the proposed use of process C and D waste primarily mixed aggregates are recycled aggregates as well as recycled concrete aggregates like this is the demolition concrete block can come up with the recycle coarse aggregate and even for fine aggregates and can be used for supposing the this will not be possible to use the other material we can use this kind of material very quickly. So like fine washed aggregating range of 4.75 mm to 0.075 mm can be utilized for different construction purpose.


(Refer Slide Time: 36:48)

Municipal Solid Waste Management Manual
Part II: The manual, Central Public Health and
Environmental Engineering Organization
(CPHEEO) Ministry of Urban Development.

PROPOSED USE OF PROCESSED C&D WASTE



Recycled coarse aggregate



Recycled fine aggregate

Making concrete for non-structural purposes. The extent of use would be limited to non-load bearing structures only, for e.g. wall between two RCC load bearing members, filling walls between RCC frame, non-industrial flooring, etc.

All grades of PCC (non structural and structural).

Percentage of replacement of natural aggregates by RA can be up to 20% for any type of plain concrete works; up to 30% for road sub-base / base / other road related applications except wearing course.

Making kerb stones, paving blocks, concrete blocks and bricks, road sub-base, pathways for pedestrian use, rural roads

Activate Windows
Go to Settings to activate Windows.

So again, these kinds of coarse aggregates and fine aggregates to make concrete for nonstructural purposes. Also, all grades of PCC could be made out of these aggregates percentage replacement

of totals around 20% we can replace by this kind of aggregates. And also now we can make paving blocks or concrete blocks or bricks also we can use of such type of coarse and fine aggregates.

(Refer Slide Time: 37:27)

Construction and Demolition Waste Management Rules, 2016

PROPOSED USE OF PROCESSED C&D WASTE

Sl. No.	Parameters	Compliance Criteria
1	Drainage layer in leachate collection system at bottom of Sanitary Landfill Gas Collection Layer above the waste at top of Sanitary Landfill and Drainage Layer in top Cover System above Gas Collection Layer of Sanitary Landfill For capping of sanitary landfill or dumpsite, drainage layer at the top	Only crushed and graded hard material (stone, concrete etc.) shall be used having coarse sand size graded material (2mm - 4.75mm standard sieve size). Since the coarse sand particles will be angular in shape (and not rounded as for riverbed sand), protection layers of non-woven geo-textiles may be provided, wherever required, to prevent puncturing of adjacent layers or components.
2	Daily cover	Fines from construction and demolition processed waste having size up to 2 mm shall be used for daily cover over the fresh waste. Use of construction and demolition fines as landfill cover shall be mandatory where such material is available. Fresh soil (sweet earth) shall not be used for such places and borrow-pits shall not be allowed. Exception - soil excavated during construction of the same landfill. During hot windy days in summer months, some fugitive dust problems may arise. These can be minimised by mixing with local soil wherever available for limited period.
3	Civil construction in a sanitary landfill	Non-structural applications, such as kerb stones, drain covers, paving blocks in pedestrian areas.

Schedule II: Application of materials made from construction and demolition waste and its products

Activate Windows
Go to Settings to activate Windows.

And here also you can see that it can be used for different purposes. The use of process material like for drainage layer in the leachate collection system even for daily cover we can utilize for civil construction in a sanitary landfill.

(Refer Slide Time: 37:48)

Construction and Demolition Waste Management Rules, 2016

PROPOSED USE OF PROCESSED C&D WASTE

Sl. No.	Compliance Criteria	Cities with population of 01 million and above	Cities with population of 0.5-01 million	Cities with population of less than 0.5 million
1	Formulation of policy by State Government	12 months	12 months	12 months
2	Identification of sites for collection and processing facility	18 months	18 months	18 months
3	Commissioning and implementation of the facility	18 months	24 months	36 months
4	Monitoring by SPCBs	3 times a year - once in 4 months	2 times a year - once in 6 months	2 times a year - once in 6 months

Schedule III: Timeframe for Planning and Implementation

Activate Windows
Go to Settings to activate Windows.

We can use and if you see the compliance criteria from the local authorities like the city and the monitoring also will be done by a State Pollution Control Board and these under the construction demolition waste management rule to 2016. This was the timeline given for each city of a different

population to develop particular policy identified sites for the collection processing and the commissioning of those facilities. For 12 months and 18 months, even for the larger population of 36 months, they have to develop the particular facilities.

(Refer Slide Time: 38:41)



Now last is the environmental consideration.

(Refer Slide Time: 38:45)



So the central issue is a because of this construction material, a lot of dust is getting generated, and a lot of noise is also getting developed in the construction facilities.

(Refer Slide Time: 39:02)

Municipal Solid Waste Management Manual
Part II: The manual, Central Public Health and
Environmental Engineering Organization
(CPHEEO) Ministry of Urban Development.

POTENTIAL ENVIRONMENTAL ISSUES WITH SITING AND
MANAGING A CONSTRUCTION AND DEMOLITION RECYCLING
FACILITY

Activity	Potential Issue	Impacts
Site clearing	<ul style="list-style-type: none"> Dust and noise Loss of biodiversity 	<ul style="list-style-type: none"> Health Air pollution Ambience or visual impact Flora and fauna habitat
Site operations or contouring that permits water to pond onsite	<ul style="list-style-type: none"> Odour 	<ul style="list-style-type: none"> Health Ambience or visual impact
Uncontrolled or poorly managed site run-off	<ul style="list-style-type: none"> Surface water runoff resulting in transportation of sediments (i.e. erosion) 	<ul style="list-style-type: none"> Water pollution Soil erosion
Transporting materials to or from site or stockpiling of wastes or recycled products on site. Crushing, grinding or screening operations	<ul style="list-style-type: none"> Dust Noise 	<ul style="list-style-type: none"> Health Air pollution Ambience
Asbestos contamination in waste loads	<ul style="list-style-type: none"> Asbestos pieces pass through crushing operations Asbestos from stockpiled material remains in soil 	<ul style="list-style-type: none"> Health Air pollution Land contamination
Sorting of C&D waste	<ul style="list-style-type: none"> Hazardous waste components of C&D waste 	<ul style="list-style-type: none"> Health Air pollution Land contamination
Litter	<ul style="list-style-type: none"> Litter from operations or during transportation to or from site 	<ul style="list-style-type: none"> Littering, choking of drains

So this was another thought is given in the CPHEEO manual, like the construction site activities like site clearing, site operation or transporting materials, or sorting of C and D waste. So what could be the potential uses the primary potential use of or potential problems of those activities like dust and noise odour these are the primary and many health issues are also the well aware of the potential issues of the all the activities.

(Refer Slide Time: 39:56)

Municipal Solid Waste Management Manual
Part II: The manual, Central Public Health and
Environmental Engineering Organization
(CPHEEO) Ministry of Urban Development.

AMBIENT AIR QUALITY AND NOISE LEVELS AT THE PROCESSING OR
RECYCLING SITE AND IN THE VICINITY

Parameters	Acceptable levels
Suspended Particulate Matter	500 µg/m ³ (24 hours)
Respirable Suspended Particulate Matter (RSPM) or Particulate Matter (PM ₁₀)	<ul style="list-style-type: none"> 100 µg/m³ (24 hourly) 60 µg/m³ (annual)
Particulate Matter ≥ size (PM _{2.5})	<ul style="list-style-type: none"> 60 µg/m³ (24 Hourly) 40 µg/m³ (Annual)

For redevelopment of colonies and markets, where in-situ recycling is carried out, provided (a) the project is completed within 5 years, (b) minimum 80% of the C&D waste generated at the site is recycled or reused within the same site, and (c) sufficient buffer area is available to protect the surrounding habitation from any adverse impact In-situ recycling at large construction sites (minimum 1 hectare so that some buffer area is available), provided (a) the project is completed within 3 years, and (b) minimum 50% of the C&D waste generated at the site is reused or recycled within the same site.

Schedule for carrying out ambient air quality monitoring by the concerned authority:

- Six times a year for cities having a population of more than 5 million;
- Four times a year for cities having a population between 1 million and 5 million;
- Two times a year for town or cities having a population between 100,000 and 1 million; or
- Once a year for all towns (including census towns) having a population below 100,000.

For noise levels, the noise standards recommended by Central Pollution Control Board (CPCB) and notified in the Environment (Protection) Rules, 1986 for industrial area shall be applicable (daytime 75 dB ALeq and night time 70 dB ALeq). The measurement would be done at the interface of the facility with the surrounding area, i.e., at plant boundary.

And ambient air quality has to be monitored appropriately, especially for suspended particular matters and PM 2.5 and PM 10. This monitoring has to be done in that specific local construction site. So suppose in the city there are new construction facilities are coming up. So, a proper

monitoring station has to be provided by the State Pollution Control Board. They have to follow the particular acceptability level of suspended particle matters and PM 10 and PM 2.5.

So proper schedule has to be carried out by the local authority and also State Pollution Control Board like six times in a year for cities having a population of more than 5 million, four times in a year for cities having a population between 1 million to 5 million and two times in a year for town or cities having a population between 1 lakh and 10 lakh or 1 million and also once in a year for all cities having the population below 1 lakh.

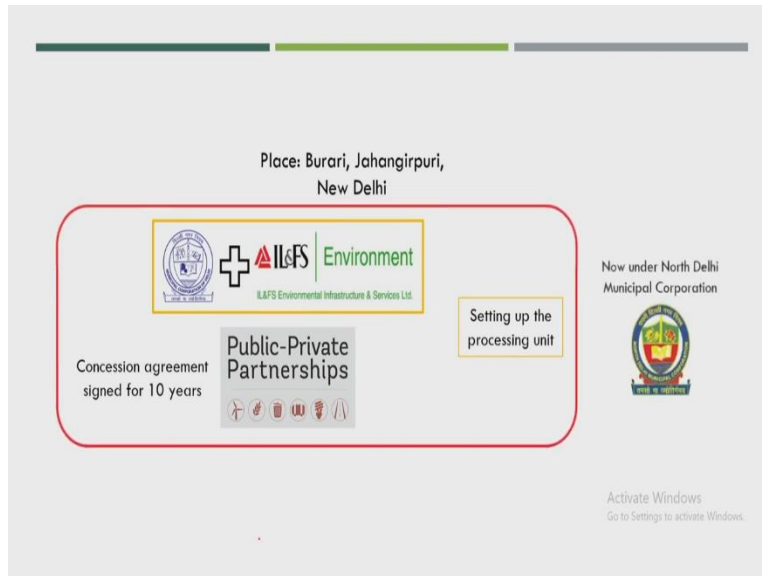
So likewise they have to monitor and for noise level also one noise standard recommended by Central Pollution Control Board and notified the environment under 1986 for the industrial area shall be applicable that also time to time need to be checked. And also the recycling wherever the recycling facilities provided the or recycling carried out should be completed within the 5 years minimum 80% of C and D waste generated at the site is recycled and reused within the same site and provide the buffer area to store the waste.

(Refer Slide Time: 42:05)



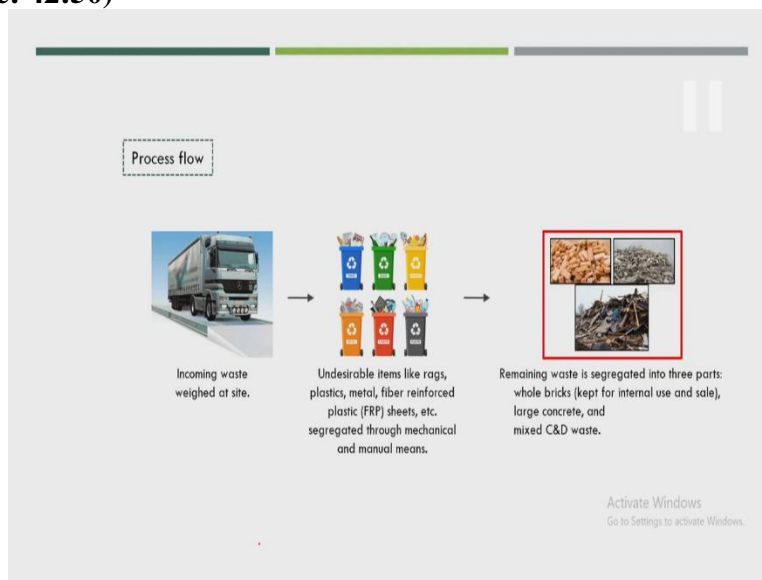
So if you find few new examples for India, like the first pilot project of construction demolition waste management.

(Refer Slide Time: 42:16)



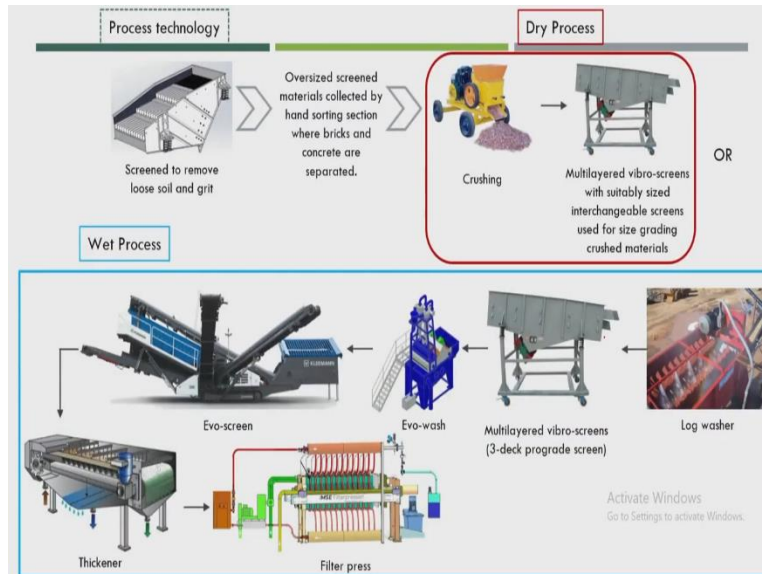
I was in the Burari in the Jahangirpuri, New Delhi. So that was one PPP project along with the one private company named as an ILFS. So that was a PPP project, and that was a concession agreement signed for ten years. So the idea was to set up the processing unit under the North Delhi Municipal Corporation.

(Refer Slide Time: 42:50)



So what was their idea to process flow so incoming waste will be weighted first and undesirable items like racks, plastic, metal, and fibre are segregated by mechanical and manual means? Whatever remained, waste is again segregated into three parts. The whole brick large concrete and mix C and D waste. So likewise, you will see here three different segregated materials.

(Refer Slide Time: 43:26)



And the process technology was screened to remove the loose soil and grit oversize material, and whatever the materials should get crushed properly and get screen under the dry process, in the wet process, the log washer and followed by multilayer screen and again wash. And finally, we can come up with a filter press, and a good product will come up.

(Refer Slide Time: 44:05)

Final Products

Used for making road sub-base; granular sub-base (GSB); and making pavement blocks and pre-cast products like curbstones, paver blocks, and square tiles. The loose soil separated by the grizzly is sold. The manufactured sand is used for making ready-mix concrete for nonstructural application and lean concrete.

In order to test the application of the recovered GSB from the plant, the roads within the plant as well as the access road to the plant (about 150 meter in length) were made with the recycled C&D aggregates.

You can see here this is the 1 product they had come up with, the brick from the C and D waste. So these are used for making roads sub-base granular sub-base and making payment block and precast product like curbstones, paver block, and square tiles in the city area. So that was one of the perfect projects. So, all the C and D waste is converted into the brick having the dry process followed by the wet process, and come up with an excellent product.

And can be utilized for the other infrastructure facilities and loose soil separated by that get sold and manufacturers and is used for making ready mixed concrete for non-structure applications and for testing the application of record that particular plant the road within the plants as well as the access road to the plant about 150 meters were made from the recycled C and D waste.

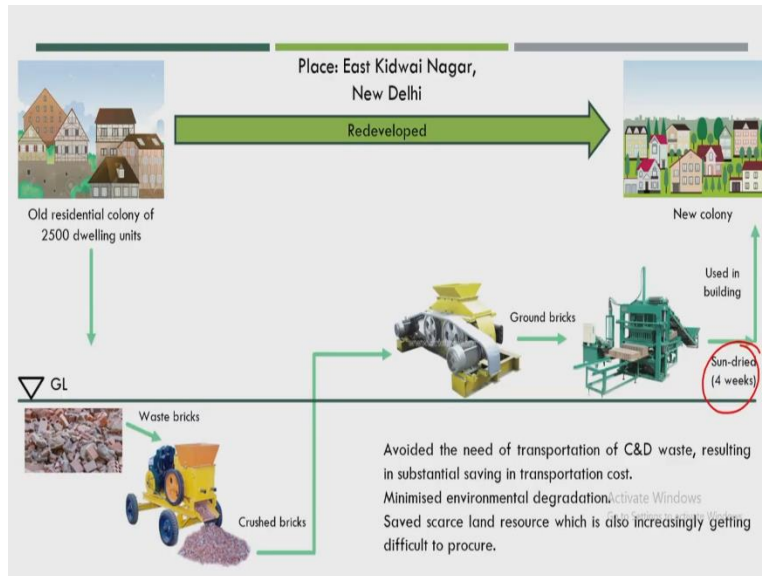
So I think that was a good idea from these particular PPP projects. They constructed their own facilities forms recycled C and D waste to propose to the other construction company to utilize this specific material.

(Refer Slide Time: 45:47)



So another example is the In-situ recycling of C and D waste at the redevelopment side by the National Building Construction Corporation in BCC.

(Refer Slide Time: 45:48)



That was placed in East Kidwai Nagar, New Delhi. So earlier, there was a one-world residential colony of 2500 dwelling units that were demolished, and after demolition, they got waste bricks. Bricks got crushed and grounded again, and whatever the product they come out, the new brick they come up with is the sun dried for 4 weeks and used for the new building. So this was developed by the same material.

So that this was a perfect project where all the entire demolition waste is getting collected, crushed, and made into another product. Another construction facility has been created. So, avoid the; need to transport C and D waste, resulting in substantial saving in transportation costs because the location was the same. So, even the recycling facility was also created in the same place.

So the waste was same location recycling facility was the exact location and new construction location also was the same. So there was no transportation cost. So the minimize the environmental degradation and save the scarce land resource, increasing getting challenging to procure. So here we saw that the quantity is enormous even though storage handling and transportation are somewhat tricky. But now we saw the 2 case studies in Delhi where the same demolition waste has been utilized for the new construction facilities.

So similar way and is not only for the building construction only we can use for road construction you will be required a different kind of base materials. And sometimes, these base materials do

not require that kind of compressive strength like the brick also has been constructed. Like whatever bricks are needed for the building construction, comprehensive states are different for road construction; other complete states are required. So whatever the product will come up that can be used for the additional construction facilities.

I believe that 100 per cent of the C and D waste should get utilize the only problem is that the small towns, especially the towns where population less than 1 lakh are less than 1 million they do not have that kind of facility because getting space in the city area for the storage and recycling that itself is a difficult task. Now but because that rule was come up in 2016. So likewise in the Swatch Bharat Mission.

Most of the city is trying to follow the waste management facilities proper management of solid waste. Similar to these kinds of urban locations also have to develop particular policies and facilities to provide to the developing construction industries. So, these industries can also benefit from their construction cost by reutilizing or reusing similar kinds of recycled material. So thank you.