Integrated Waste Management for a Smart City.
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Lecture-28.
Review of MSW management in Proposed Smart Cities.

Okay, welcome back, so we will continue our discussion of week 6, this is the 3rd module of week 6, so as I told you earlier, this is now we have finished the collection system, we talked about the transportation system, before we get into the solid waste treatment and disposal part, so I just wanted to have a quick recap, not recap, a quick review of what is the status of waste management, especially the municipal solid waste management in the proposed Smart cities. Because as I said the course is focused on integrated solid waste management development for a smart city. So we want taking into Swachh Bharat mission as well as the smart city initiative..

So the goal of this course is to help the people who want to develop solid waste management system. So before we go into the treatment part or the disposal part, let us look into what is what is the status today. And so we visited few of these Smart cities in December months, December 2016 and so, this is the, these were the ones on the 1st list of 20 Smart cities and then we have, we are giving you some status of that. Again if you have happened to be from these cities, if we have made, because we were just there for a few days and trying to collect information, meeting people, looking at some reports, we may have made some errors.

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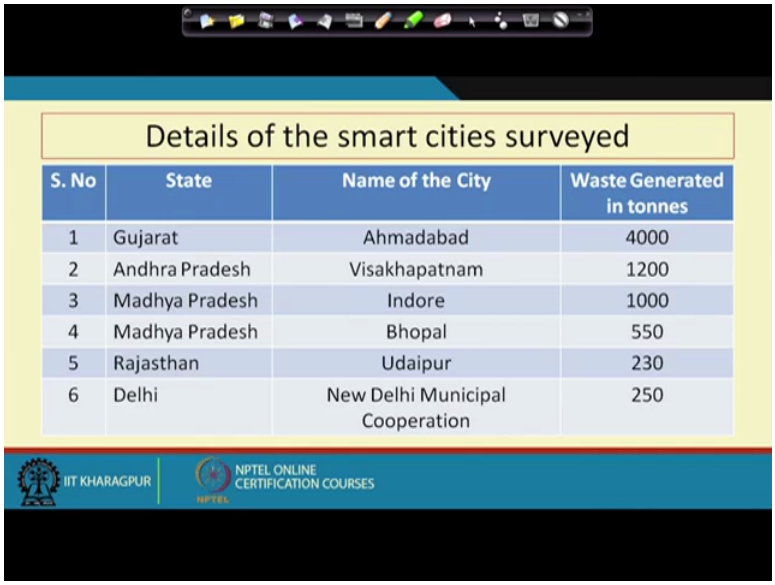

So if we have made an error, when you see any problem, feel free to correct us because that is what it should be all about. If there is some error, of course we need to get it fixed before, so please help us do that. So let us look at this, which cities we were, we will start to cover here. We had, we visited actually several more than what you see on the list. We have put, we have picked some of these because they kind of try to cover different parts in terms of the geographical region of the country. And also they have based on the waste generation rate. So as you can see over here, we have tried to follow a, from a very big city which is around 4000 tonnes per day to around a small city, although the last city is not really because we are just focusing on N DMC.

So N DMC is a smaller area, so New Delhi municipal corporation is just a smaller area, that is why you see 250 tonnes per day. And then Udaipur is actually lower than that, which is 230 tonnes per day, Madhya Pradesh 550, sorry, Bhopal is 550, Indore is around 1000 tonnes per day, Vizag 1200 and then Visakhapatnam and then Ahmedabad which is the biggest one, it is 4000. So this was a lot and then there were several others cities we visited, maybe later on we can discuss those as well if the time permits to do that. And then several States, Gujarat in the western part, Madhya Pradesh in the central part, Andhra in the South, Rajasthan again in the central North, then Delhi in the North.

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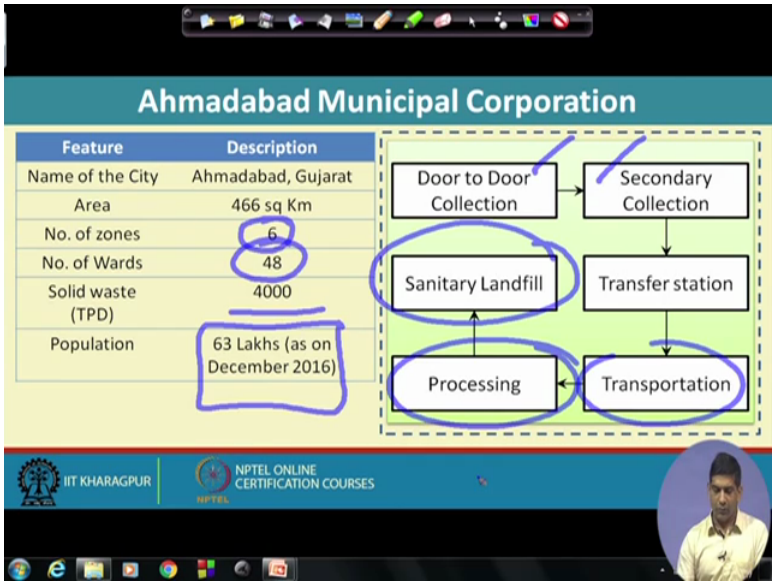

So we are looking at some, we will be visiting some more cities and then we will have some data in the northern part and as well as we are doing some work in Guwahati now. So we will be doing, we can have several information from Guwahati may be later on. So these are cities, so look at how, so what we did in each of these cities as we visited these cities and then tried to understand how the waste is managed today. Our goal was just understand how the waste is managed and try to identify what are the problems they are facing. And then try to tell them that what other solutions, the potential can be, can be done to achieve a better waste management system looking at municipal solid waste management rules and all that.

So for the Ahmedabad municipal Corporation, some basic information is provided, what is the area, number of zones, number of wards, as you know most of our cities have been divided into zones and wards and then what is the solid waste tons per day and population around 63 lakhs as on December 2016. And this is again based on the census data 2011 and then from projection which the municipality or the city does waste on the annual generation, annual growth rate. And then here we try to look at the door-to-door collection, then the 2nd collection they have, whether as a transfer station or not, whether it, and then from the transfer station other, to the task protection to the processing facility, then to the landfill facility, so we try to cover the different aspects of that particular city.

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So it is that you will see that for most of our, for most of these information, they have been, we have tried to provide you with some photographs. So I will just show how the things are working in that particular city. So as you can see, this is again the generation of waste on , again, if you look at this is totally mixed waste, it is not source separated. As you can see from those pictures, a lot of things like paper, plastic, everything is mixed up over here. So it is a totally mixed waste and the goal nowadays is to have a source separation, so there is a, many, some of these restaurants, some of these eating places, they have these kinds of bins now where you have the green bean and the blue bin, those things are there.

Then in the residential areas you see these kinds of primary collection where things are predominantly actually it is getting mixed up where it is it is a primary collection and then you have some secondary waste of the industry and other places coming in, then they can go to the transfer station where it gets processed a little bit and then from the transfer station, further processing it can go for a treatment, like a compost plant, it is usually compost plant and then finally to disposal to a landfill. So this is how the, these all these pictures were taken in the month of December of last year in Ahmedabad.

So you can see how the things are happening on the ground. So just, just basically you can think about, just like a ground report before we, so of course the source separation, it is already started but again it is, that is one area where we need to put a lot of emphasis in case of Ahmedabad, that is why, so that we can come and look at this. If you look at this treatment of waste right now, as you can, if you look at closely, although the picture is, if you can zoom into the picture, you can, if you are familiar with the waste photographs, you can see, you are

seeing a lot of plastics there, all those white white white pieces, there is a good chance of those film plastics that are shown up there.

Essentially it is a compost plant, so we should, we should have mostly food waste and some yard waste, kitchen waste and your garden waste. But since this most of the food items these days come in a packaging material, lots of plastics are used, lots of papers are used, paper to certain extent is okay, it will be treated in the compost plant, not something with a high lignin content. There is something with a lower lignin content will be really good, but high lignin content, it will not degrade, but still it is a biodegradable material, so it is okay.

But specially the plastics, the film plastics, the different types of plastics, the packaging, the Styrofoam, those actually make the compost quality really bad. So that is the one area where we need to do a lot of work in Ahmedabad in this particular area to have a good source separate garbage, so that the compost quality will be better. And they can get good value for the compost.

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So, in terms of the waste collection and storage, they do included a concept of door to door and gate to dump since July 2009. And then waste from these vehicles are transferred to the transfer station in each ward to the treatment plants. And then the project is successfully covering 100 percent of all residential and commercial units on all 365 days of the year. So again this information has been provided to us by the municipal Corporation people there, who were talking with us and we were there for just a few days. Again if there is some any information which is not covered, we may have understood it wrong, we may have made

some mistakes in terms of noting down the values, so we have tried our best not to but in case there is something is wrong, do let us know, if you know better information from there.

So, project is successfully covering 100 percent of the residential areas, more than 600 vehicles have been deployed and they start working from 7 AM and as you can see, some more pictures , the cart that is used, the small vehicles, so this is like a cart kind of system that is also used, we have smaller vehicles, then we have the primary collection that is, this kind of dump trucks, maybe haul container, again things which is going to haul, transfer station, so things are being built up. Ahmedabad actually has one of the, has been working on ways management for quite some time. And they have a decent waste management system in place but still, every place needs, always have some room for improvement. So that is another thing that is happen.

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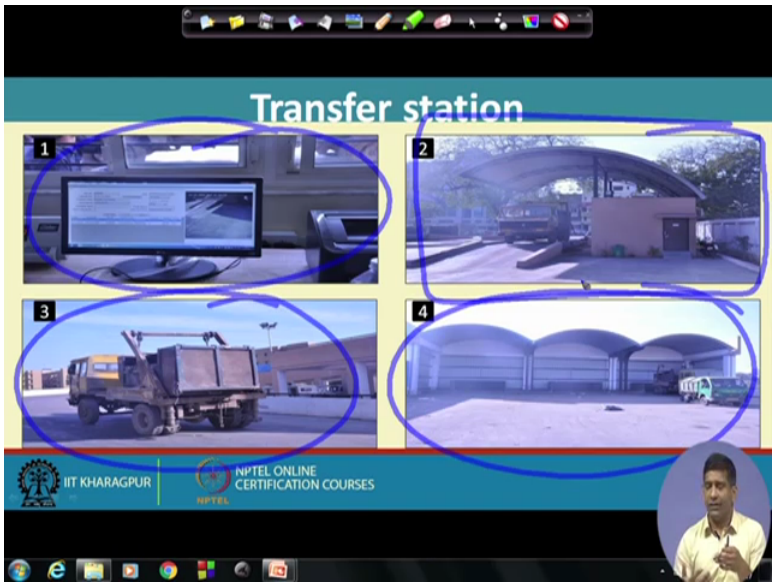

So this is some pictures of the transfer station, you have if if I can ask you question like what is this, it is UC at many of the transfer stations or at a landfill site, that is your scale house, that is where you can see a truck and the trucks are getting weighed. So even at the landfill site once the truck comes in, it will get weighed and then when the truck comes out, it will be weighed against. So the difference of the 2 weights gives us the weight of the garbage. So truck full going in, it is weighed, truck coming out empty, it is weighed again and the difference will give you the weight of the material in the truck.

So that is in terms of how the weight is calculated and how they will be billed for billing purposes. Some other pictures of the transfer station, things are being monitored on the

computer these days a lot of automation as well, so things are done using the Scada system and other systems. Then some truck pictures, the vehicle pictures and the transfer station, how it looks like from outside, so it is getting towards a modern facility, it is again, it is work in progress, a lot of work needs to be done but things are improving for a modern facility.

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Now at the dump site, where they do have a dump site which they are planning to actually close it down, if I remember correctly, that is called piranha dump site, again, they are trying to close this downward header dump site as you can see that is, they are trying to control the methane gas, that is another issue they have when you can even see fire kind of situation where things are, things do catch fire. And so let us see, you can see some fire like situation, so that the fires is the being tried to be controlled and then again they are trying to control the fire, dust and smoke and all that. So again people working on this particular landfill has to have a proper air pollution control like a mask and all that which in sometimes we do not see that happening.

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But they are, there are cases of they have to try to control this methane which is catches fire from time to time. Then in terms of disposal of waste, still at the old landfill, you can see the garbage here, it is basically everywhere, it is totally mix, totally heterogeneous and this is such a beautiful picture, you can see some birds, you can see the sun but here if you, come here, you see kind of garbage. So that is we have like a natural scenery has been, this garbage makes that picture look bad actually. But that is the smell of money, is not it, garbage business is a very profitable business.

If you come here, if you look at this particular teacher, here in this you see some people sitting there trying to collect, basically they are there to collect some recyclables, so that is what the rag pickers, those, they need to be incorporated as well in terms of waste management decision, waste management plan because this is their livelihood. And we have to somehow get them from these informal sector sto a formal sector, maybe they could be the workers at the transfer station, they could be workers at the material recycling facility. As part of Skill India Mission, the government is working on right now, they, their skills can be upgraded, they can be and they need to have knowledge, specially, why this waste management needs to go from this informal sector to the formal sector.

That is because the informal sector as well, they are working with the garbage, there is no pollution, there is no personal protection, there is environmental health and safety regulation therefore living and they are getting sick and many of them actually die very young or they are sick most of their life. So we have to educate them, once we get them on board, they could be able to work in it because they have been working with this kind of material for

quite some time. So there will be a good, once with the Skill India, another similar program, I have they are skilled enough, they have made them skilled enough, they can work at the transfer station or at the MRF material recycling facility. So this is where you see the social angle as well. There is a social angle of the waste management which you see in the picture here.

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And then they are trying to have a green waste processing, where green waste is collected separately, if you can take this food waste separately or the yard waste, or the waste from temples and other stuffs, then it is basically buses are compost, so it is like a mini compost plant, just looking at the green waste, again it is a source separated waste, so they are trying to take the waste, work through different processes, makes it do some curing, let the waste degrade, finally they screen and then after screening, the good product is being sold off, the product is being sold off and they can make money out of that as well. So that is another thing that is going at Ahmedabad.

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So, then in terms of the several companies who are working on it, there is Excel industries, Bharuch Eviro Engineers Ltd, Creative Eco recycle private Ltd and they work with different tons, different amount of tonnage. They are making some compost, they are also making (()) (15:53). And they have this mode of no tipping fee, so that is the, I would say where we need to work on, we need to have some tipping fee, so but they have no tipping fee, it works on design build, operate and transfer later on, that particular mode. And it has been working for last several years. So this is a kind of, it has been working for last 6-7, nearly 7 years, more than 7 years now. So that is how the waste processing is done using composting for organic fraction of the waste, for organic fraction of the waste, this is what is being done in Ahmedabad.

But this is again not, if you think about 4000 tonnes per day and if you take around 50 to 60 percent as the food with or the organic waste and if you just pick even 50 percent, 4000, 50 percent is 2000 tonnes per day, if you add capacity of the 3, that is why we have what 300-250, is 400, so it is 950 tonnes per day, so it is still 50 percent, less than 50 percent. So we need more than, double the capacity of what they, these 3 are providing in terms of just manage the compost or manage the compostable material. It does not have to be compost, it can be another waste digester or whatever depending on what will work for that city. But again this is, more investment is needed in this side to make it, to take care of entire organic fraction that is produced in the city.

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Sanitary landfill is being developed, it will be a land facility with a leeched collection system, gas collection system and all that and then leeched treatment system as well. So for in air disposal, as per MSW management rules 2016, anything which can be treated or which is biodegradable should not go to the landfill, landfill is for inert material and also if something could be combusted, if the city has a combustible, if the city has a waste-to-energy plants, it should essentially go there and maybe there are several from the combustion plants make up to the landfill.

But there is, when it comes to the landfill, we do need an inert, we do need a sanitary landfills. When we say sanitary landfill, we talk about landfill towards, towards maybe 8 week and towards the end of 8 week but landfill is essentially highly engineered structure where it has a leeched control, it has the gas control and all those things need to happen in the landfill here as well.

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So action plans, what the city is thinking in terms of future, they have a 0 waste Ahmedabad by 2031. When we say 0 waste, that does not really mean 00, it means reduction in the waste quantity, because you cannot have no waste being produced because there will always be some waste which needs be treated, sorry which needs to be disposed. So think about, if we set up a compost plant, even in the compost plant you will have some rejects, if you set up a waste-to-energy plant, even at the waste-to-energy plant you will have the fly ash, the bottom match that is coming up. If you manage the fly ash in bricks or cement and other stuffs, I say 100 percent of the fly ash is gone, then you have the bottom ash.

Even if you take the different fractions of bottom ash and then try to use it as a personal substitute for road concession, still you will have some fraction which needs disposal in a landfill. That is where those of the Western European countries are, they have actually brought of the landfilling to some places, even to down to even less than 10 percent. But still they do need a landfill, so we do need a landfill for our inerts to go. Initially it will be a big volume but gradually our goal would be to reduce the volume going into the landfill. Then there are Swachhata Jan model, waste segregation at source is being taught, inclusion of waste pickers in mainstream that we talked about.

Setting up of solid waste recycling centre which is essentially material recycling facility and scientific closure of existing piranha dump site, that is what they are trying to do as well and then they are trying to implement waste to energy technique for the treatment of waste where those things they are trying to do. So that is a kind of summary of what is being done in Ahmedabad. So again in Ahmedabad context, it is one of the actually I would say the better

examples, one of the good waste management systems in the country. Although still I think in the collection sites and other stuffs, it needs improvement because I go to Ahmedabad quite frequently and then I have seen garbages on the side of the road and all that.

So that needs to improve, things are improving but things have to even improve further to make it really a smart city. And then they should look at, since the compost, I am not really, personally I have always have very much worried about the compost market because if the compost you are not able to sell, then the compost plant actually becomes defunct. So it is very very critical for us to do that market assessment before we go for big compost plant.

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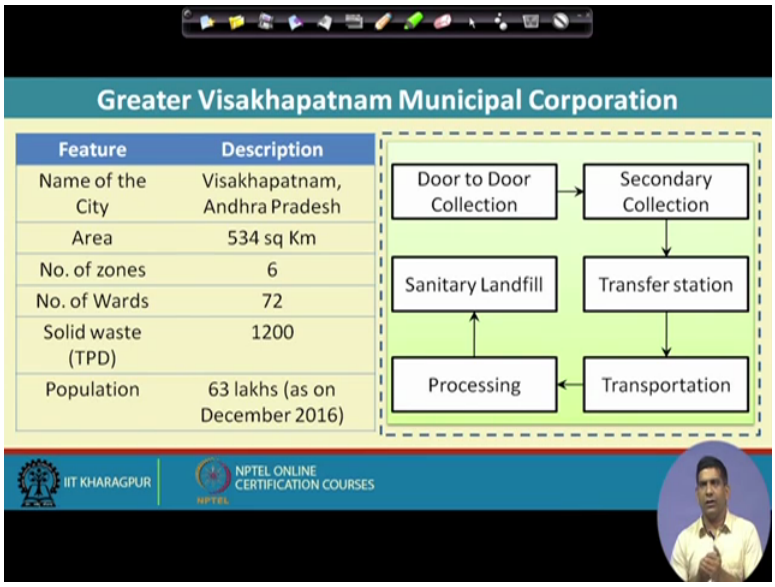

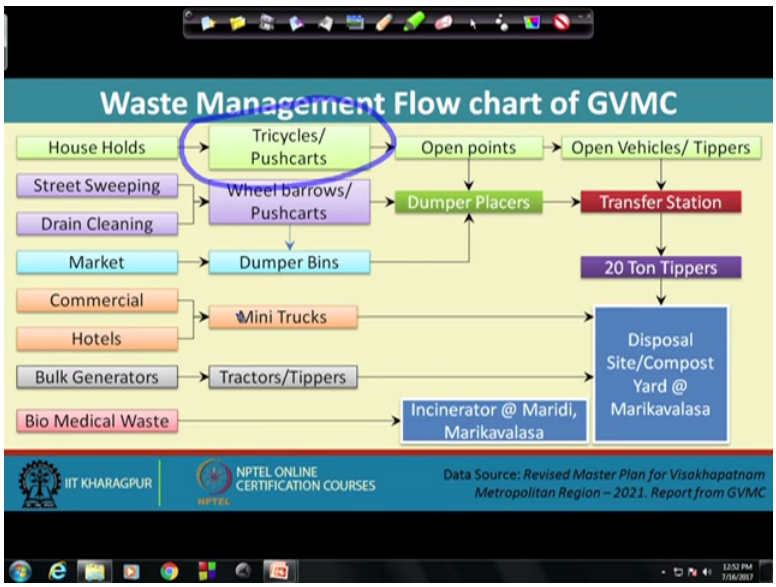

So okay, so that is from the top, from Ahmedabad now let us now moved to Vizag, so Visakhapatnam. So again Visakhapatnam area is 534 square metre, number of zones is 6,

wards is 72, solid waste they produce is around 1200 tonnes per day, population is around 63 lakhs as on December 2016. The here again we have tried to look at all these different aspects. So door to door, secondary collection, transfer station and all that, so if you look at waste management flow for the G VMC which is for the Vizag municipal Corporation. So you have the households where things are mostly done using tricycles from the households.

It is tricycles or pushcarts which carry that, it takes to the open points which is essentially the secondary like a primary collection Centre or the secondary collection Centre. And then you have the street sweeping, and the drain cleaning, the wheelbarrows and pushcarts, they took it to the dumper place, market, we have the dumper bins, commercial and hotels, you have the many trucks, many bulky generators, you have tractors, tippers and all that and then biomedical waste. Biomedical waste is not part of the miscible solid waste, so we will not worry too much about that. But biomedical waste is incinerated at Maridi which is that Marikawalasa and then, so this is and this is at the same place where they have the disposal site or the compost yard.

So all the facility seems to be at one particular a particular location. So from this primary collection points it goes to a, like a vehicles where it gets collected and then it goes to transfer stations, and then from the transfer station it can go to the big landfill, big waste disposal centre. So this is how links works in the Vizag city in terms of the waste management.

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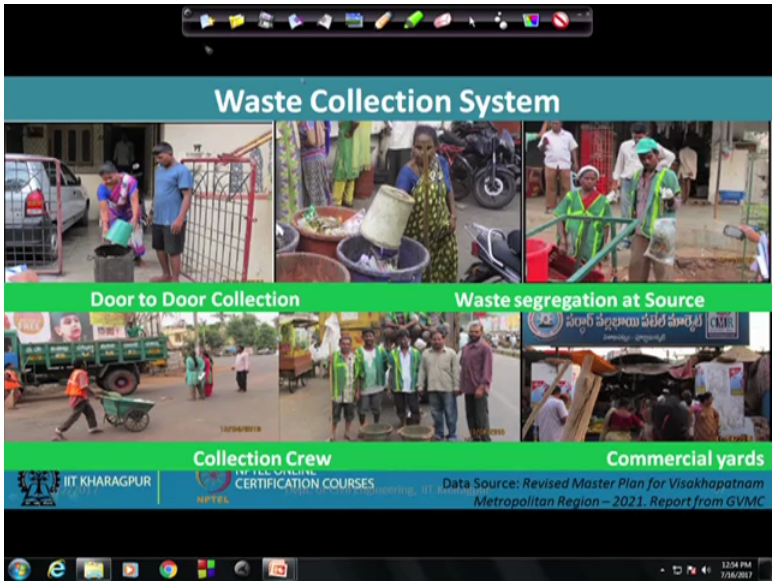

These are the different components that they have, so there are some pictures of the waste being collected in a Vizag. As you can see there is some door to door collection, there are

waste segregation at source, there is some, you see some collection crew going around and trying to collect the garbage and then you have the commercial yard. So there has you can see, there are, this is how the waste is being collected, of course some of these beans and other stuff probably need improvement where it can be made look little bit more modern. And same thing with over here , what happens as part of the garbage just fills up on the road, we responsible for that, so those things should be sorted out a bit because there is always some sort of issue going on for that. So there is always data that actually came from the master plan for Vizag which is done for 2011 it was done for 2021.

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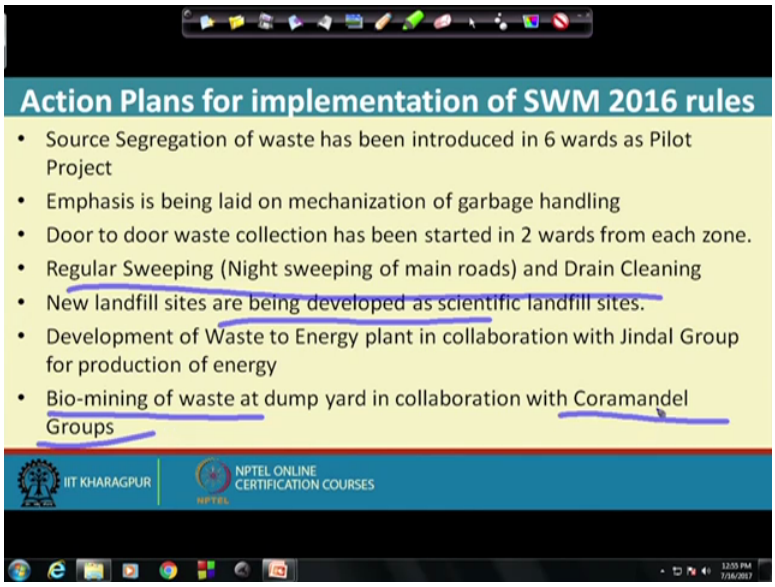

Okay, let us go to the next slide. Okay. So in terms of the action plan for what they were trying to do, they are trying to do source separation of waste in 6 parts as pilot project. Emphasis is on mechanism of garbage handling, how to handle the garbage in terms of source separation. Door to door waste collection was started in 2 wards from each zone. Regular sweeping like night sipping of main roads and drain cleaning, new landfill is being done, they do not have a scientific landfill and that is why their new landfill sites are being developed, there are still the sites are being developed and then they need to have landfill , engineer landfill facilities.

Then they have development of waste-to-energy plant is being talked of talked about as well in calibration with Jindal group. Bio mining is a being kind of talked around as well with Coromandel group is interested, recently we have heard I think they have backed out now but I am not 100 percent sure. So but there are, these are some of the stuffs that they are thinking about in terms of solid waste management 2016 rules and also as part of the smart city

initiatives that they are, they are working on. So it is lot of lot of activity that needs to happen in Vizag in the coming years.

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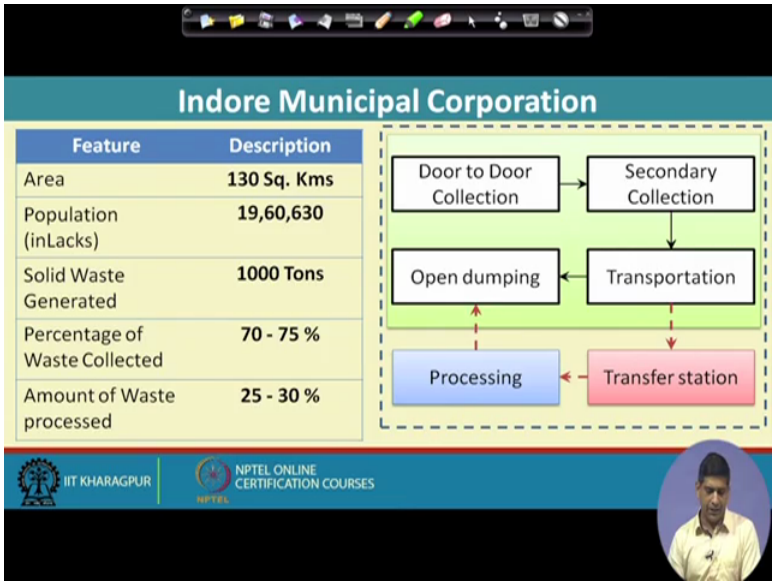

So you have like a different action plan and other things going around for the city. So, so next is, let us look at Indore, Indore again has got, I think it has got a prize recently, the Swachhata Puraskar. What I have heard and while we were discussing with people in Indore, Indore had some really tough situations in terms of waste management until a few years back. So if you look at although Indore got the award because people, it was people driven award, so Indore had improved a lot, since this equation was really not that good at all. So even that little bit of improvement, the improvement looks much substantial because you can see the improvement.

Once you are already at 90 percent, going from 90 to 100 percent is always very difficult. And then if you make those incremental improvements from 90 to 92, 94 percent, it is not visible as well. But once you are at the lower, say if, then you kind of make a jump by doing something which is really good, then people do appreciate and people do, that registers people's mind very quickly. So that is kind of something similar situation of Indore. So here in Indore, there is again, around 19 lakhs population, 1000 tonnes per day, 70 to 75 percent is the waste collection, so around 30 percent waste is not collected.

And then out of the waste collected, around 25 to 30 percent is processed, rest is just going to open dump. So there is a door to door collection, secondary collection, transportation, there are transfer station processing and open dumping of the landfill. Open dumping at the landfill

or so-called liquid open dumping at that site, we should basically say it… So this is how the things work in Indore in terms of the waste management based on our trip over there.

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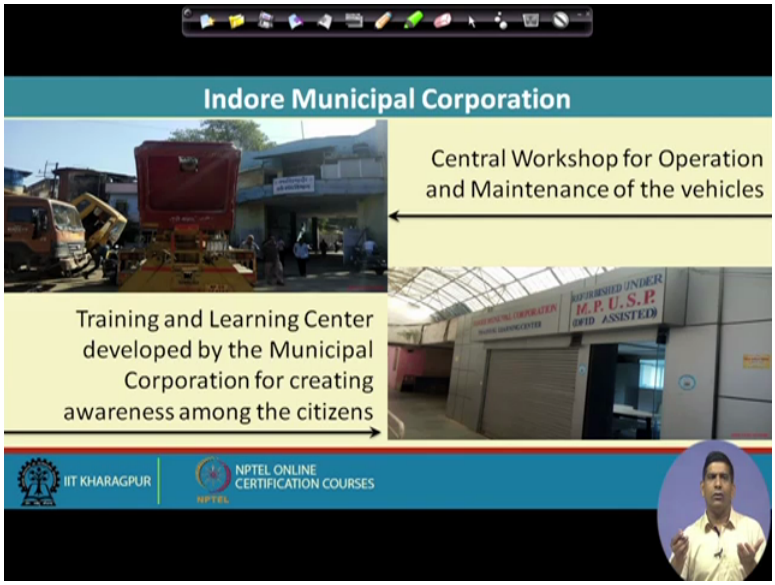

So Indore municipal Corporation, they do have a central workshop for operation and maintenance of the vehicles, they also have a training and learning Centre by municipal Corporation for creating awareness among the citizens. So that is kind of a good initiative I would say. As, I think I have mentioned this earlier as well, most of the western cities, even a city as small as 200 to 1000 people, they do have a small team, like people with 2 members or 3 members dedicated to waste management education for the common people. If you really want to get the source separation done in a realistic, in a good way, then you need to invest money in terms of learning that you need to provide to all these house owners, household owners in terms of separating the garbage and all that.

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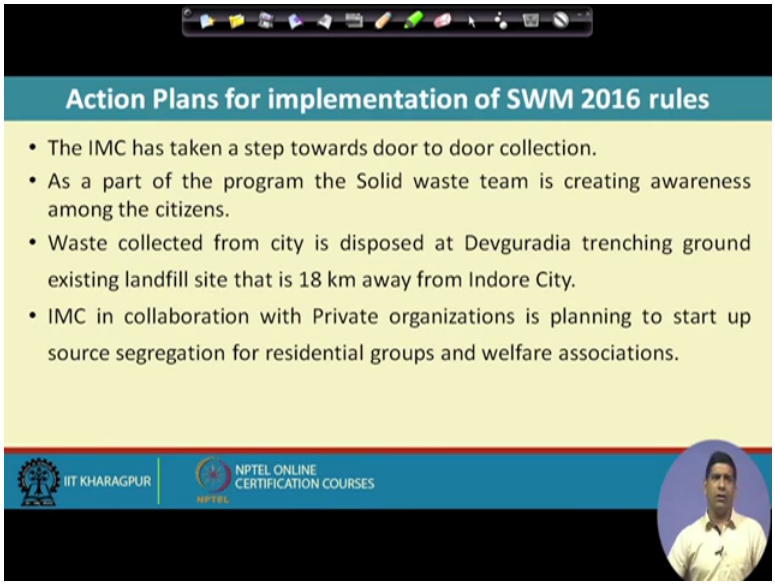

So that is, they have invested in training and learning system and then they do have workshop for, for the maintenance of vehicles. And they also took a step towards door-to-door collection. So as part of the program, solid waste is creating awareness among the citizens. And right now the waste collected is disposed at Devguradia drenching ground which is 18 kilometre away from the Indore city. But there are, they are in collaboration with some private organisation planning to start-up source segregation for residential groups and welfare associations. So that is there trying to do some sort of waste collection. So they have to do a lot of education and all that in all these places, in all these residential areas and welfare association areas. But they are working on these aspects in terms of implementing solid waste Management rule.

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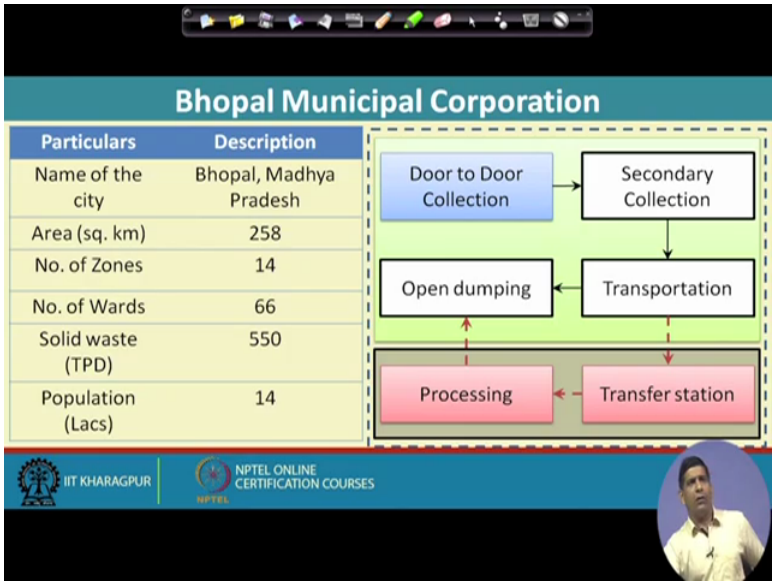

So that is in terms of Indore municipal Corporation, then Bhopal, Bhopal again, it is in Madhya Pradesh, area is 258 square metres, number of zones is 14, wards is 66, solid waste is 550 tonnes per day, population is 14 lakhs. So here again if you look at, again it is open dumping which is happening in most of the places. So waste management system you have these different trucks have come in, trucks with different compartments have also come in and then some older dustbins are still being used, then some in terms of treatment systems are being proposed.

And then you have big trucks carrying around the garbage from one location to another location, this drug as you can see on the back has that compactor as well. So that this

compactor the garbage while it is, while it does the collection system. So that is in terms of some pictures of things which is happening in Bhopal.

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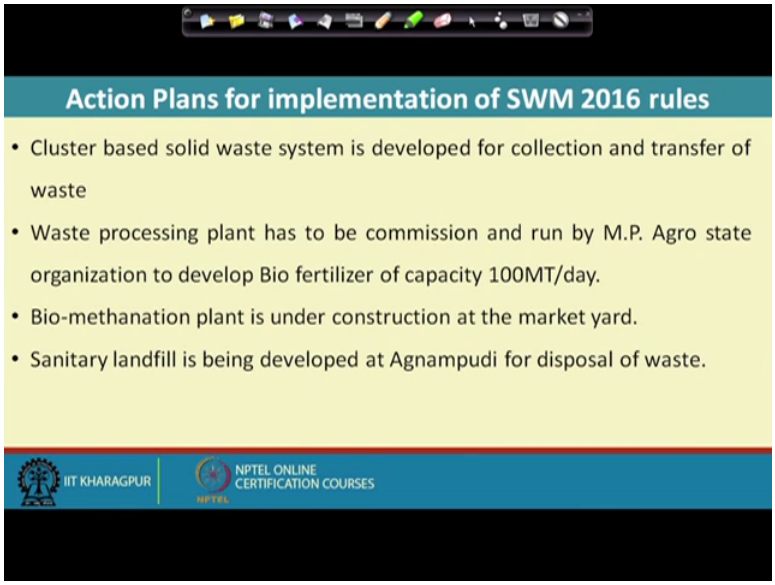

So in terms of what they are trying to do for solid waste management rule 2016, they are looking at cluster-based solid waste management system and development of collection and transfer of waste. So they have to do all those maths calculations that we have talked about in the last video and the video before that. Then waste processing plant has to be commissioned and run by MP agro state organisation to develop bio fertiliser, so that is, many people are going for that, especially that has new subsidy. So they are trying to have a bio fertiliser with around 100 metric tons per day.

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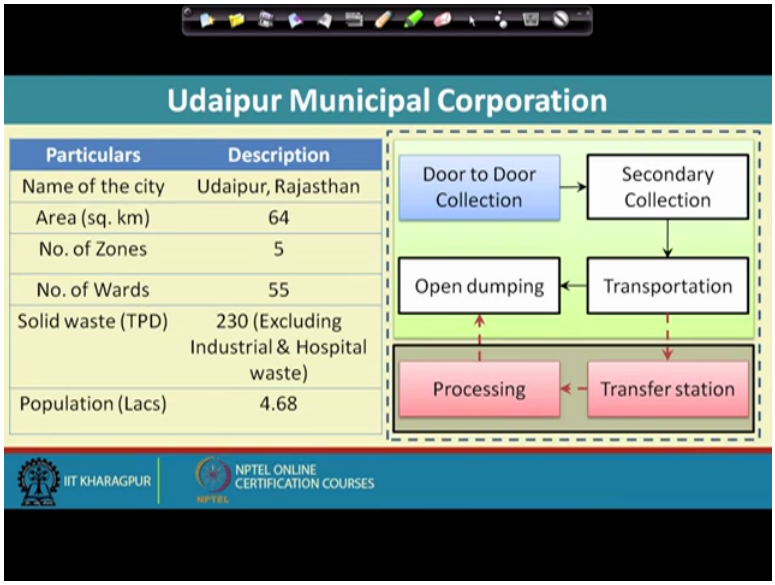

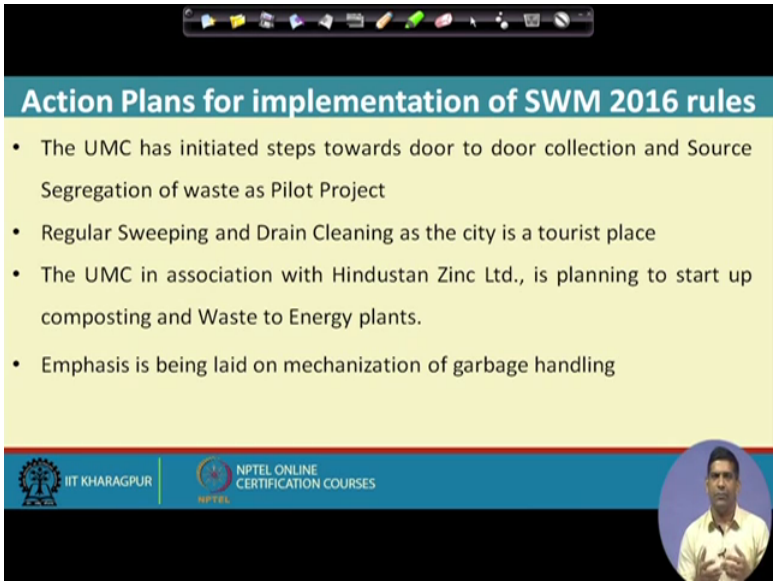

So this bio-methanation is under construction at the market yard, so they are working on it, then there is stationary landfill is being developed, so again, sanitary landfill is being developed here as well. So that is so that is in terms of Bhopal. The next we have is Udaipur, again similar scenario, when we have certain zones, number of wards, population is given, we have looked at all these door to door collection. Here also there is an open dumping, street sweeping, secondary collection, secondary bins, you can see the bins conditions as well, dump yard, compactor truck, double been lifters and all those things are there.

So here is, they are trying to do door-to-door collection and source separation, they have regular sweeping and drain cleaning is done in the city as the city the tourists place. UMC has association with Hindustan Zinc Ltd is trying to start-up composting and waste to energy plant, emphasis is being laid on mechanisation of garbage handling, so make it more and

more mechanised, so that is they are emphasising on. So again depends on where you are, different cities have different priorities.

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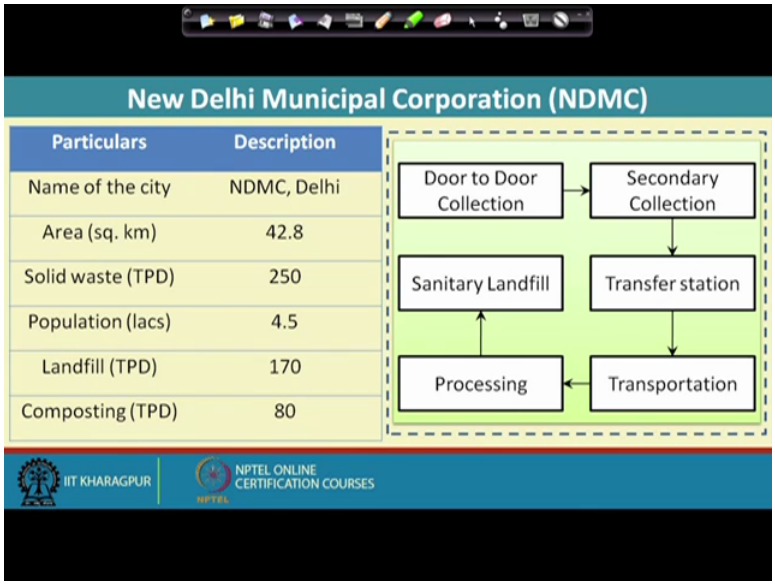

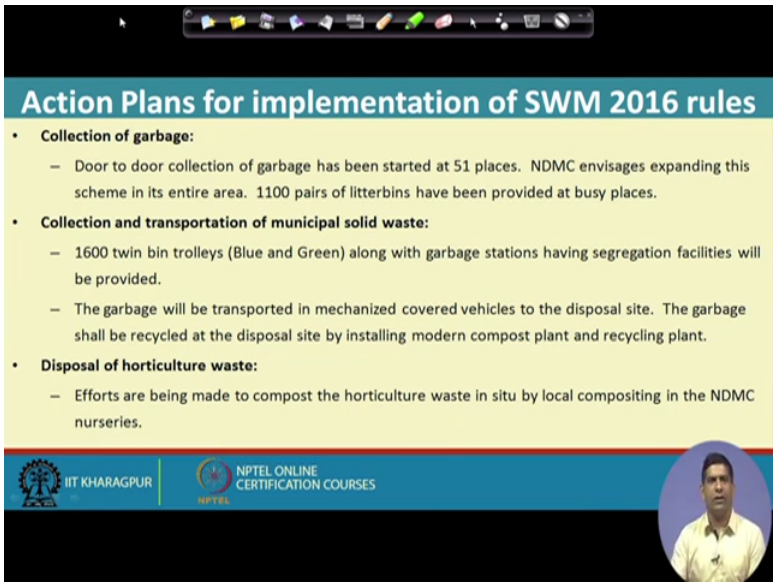

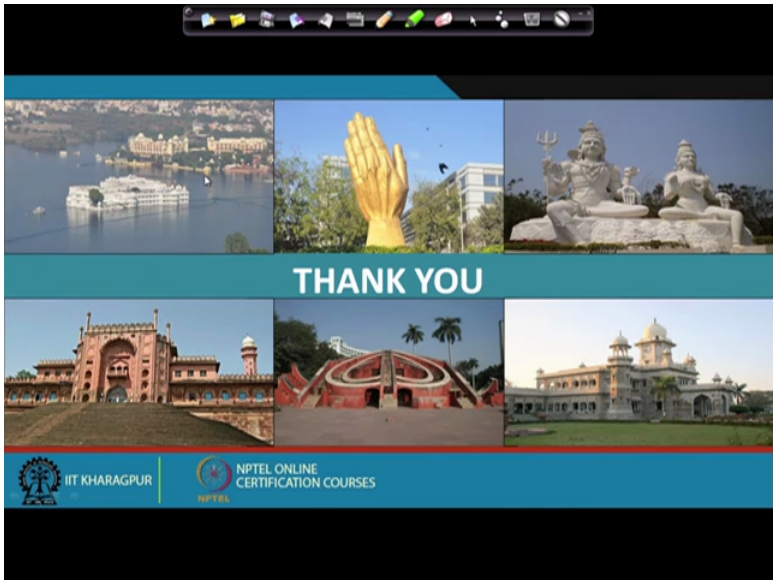

So last but not the least, this is our NDMC, New Delhi municipal Corporation, again population is 250 tonnes per day, 5 lakhs operation, so we are just looking at the very central point of the land of Delhi, landfill is around 170 tonnes per day goes to the landfill, composting is done for the remaining 80 tonnes per day. So that is how things are being done in Delhi. Garbage is collected from door-to-door N DMC, they started with 51 places, they make, they want to spread in entire area, 1100 pairs of litter bins have big provided. Collection and transportation is being done by trolleys along with garbage stations having segregation facility and then garbage will be transported in a mechanised covered vehicle to the disposal side, that garbage shall be recycled at the disposal side by soaring modern compost plant and recycling plant.

So basically solid waste roles this requires composting and waste-to-energy plant, they are also looking at that. Disposal of horticultural waste is through compost, that is what, then they use compost in NDMC nurseries, that is where it goes back to. So that is kind of in a nutshell is the summary of these 6 cities , these are going to be the smart city. So as you can, as you saw, there are certain good things happening in many of the cities, there are certain challenges that we have, open dumping is still being practised, composting is being developed, compost also struggles because of the lack of source separated garbage.

So all those factors are there, so in the next video onwards, what you will see when we start from now, from this point onward we will start getting into the treatment system and finally to the landfill chapter. So the treatment system when we start discussing, we will like to highlight again from time to time of the different cities that we talked about, what are the problem the city has in terms of trying to make a compost plant or trying to make anaerobic

digester, what they should do so that digester will be working, it will not become a dead after a couple of years. So those things we will discuss in subsequent videos. So with this let us close this video and then thank you very much, and I will look forward to seeing you in the next video. Thank you.