Surface Mining Technology
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Lecture 50
Inland Transportation System - II

Let me welcome you to the 50th lecture of Surface Mining Technology, NPTEL online certification course. This is the second lecture of Inland Transportation System and in this lecture, we will mainly emphasize in the inland water transportation system currently in the Indian subcontinent especially in the country.

And we will also emphasize on the slurry pipeline transportation system as is currently being practiced or attempting, attempts are being made in the country. Beforehand we have seen what are the other possible transportation system available or popularly used in different places.

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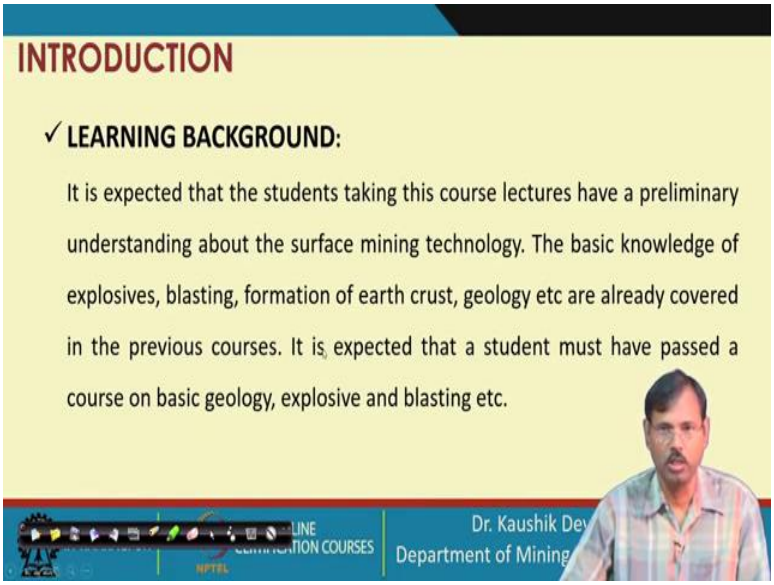

So, as we do, let us have the glimpse of the learning background for the surface mining technology course.

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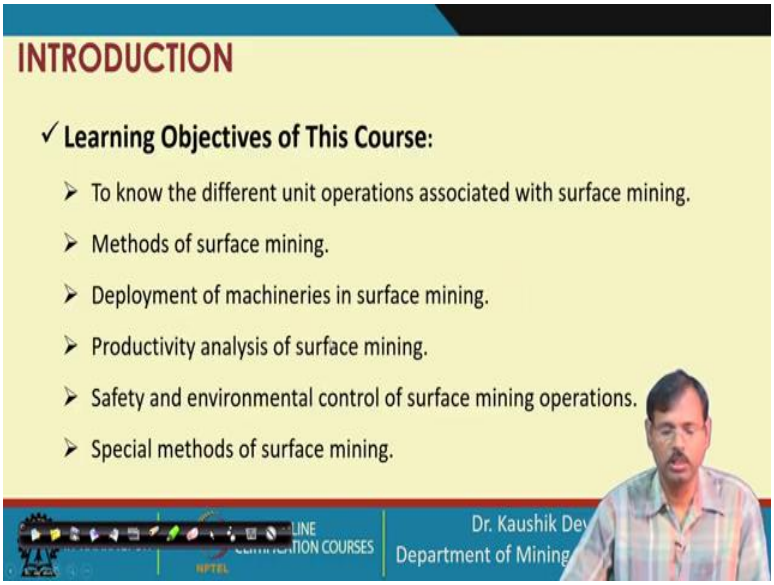

And these are the learning objectives set for the surface mining technology course.

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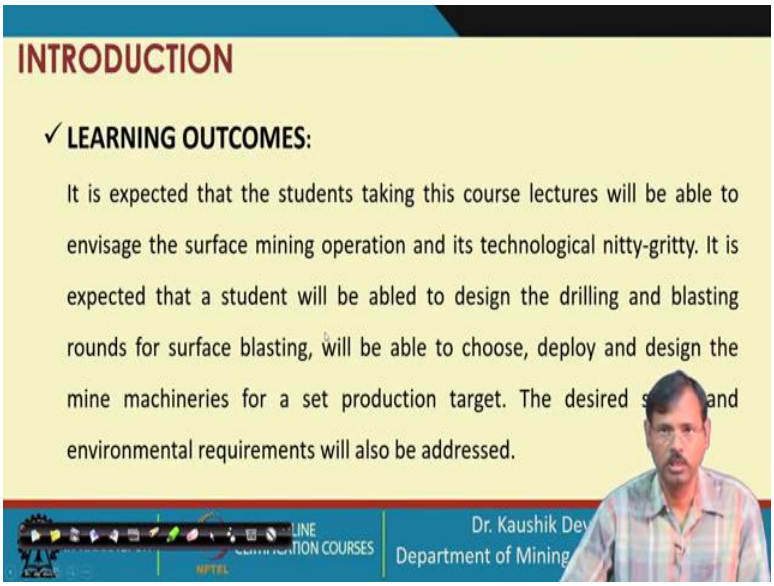

And these are the expected learning outcomes from the participants of surface mining technology course.

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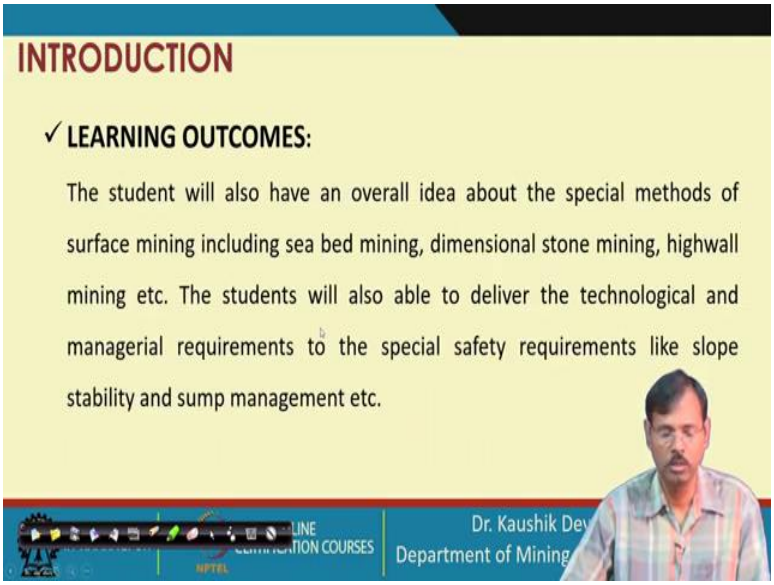

These are few more expected outcomes.

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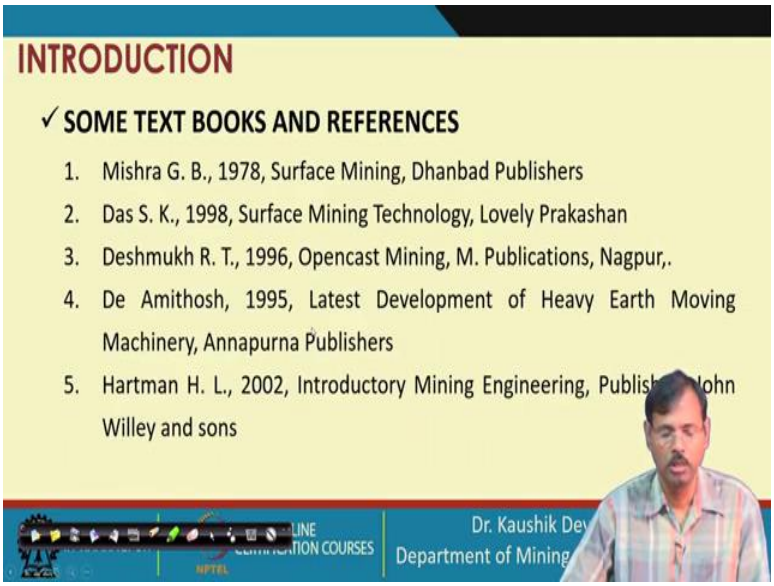

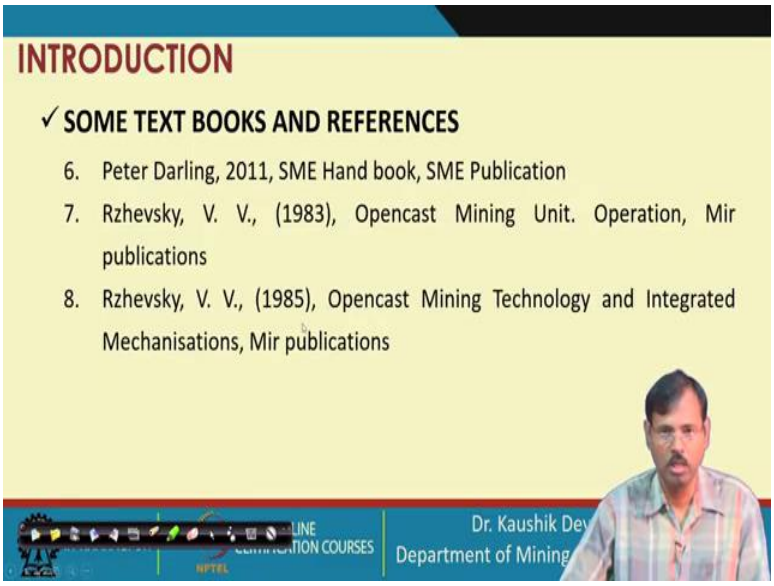

These are some of the text books and references. However, these inland transportation systems are basically these lectures are made from the website data, website resources some of the portions has been taken from the lectures of Professor Ramani also. These are basically considered in these lectures and there are good web sources are available for these lectures.

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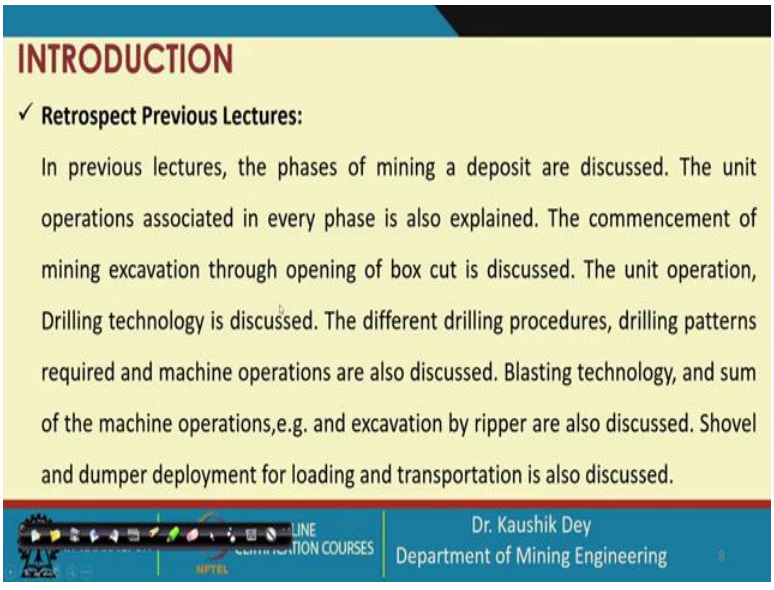

Before, as we do let us look into the retrospect of the previous lectures, in previous lecture we have completed the phases of mining and deposit. We have also seen the commencement of mining excavation, surface mining excavation through the opening of box cut; the different unit operations; drilling technology, blasting technology are discussed.

After that we have discussed the excavation of rock mass by the ripper; that is the blast free technology. After that, we have covered the excavation of the fragmented rock mass by the excavator and simultaneous loading of the same to the dumpers that is the transporting system and we have gone through the shovel dumper combinations also. After that, we have covered the excavation by surface miner and followed by excavation by drag line excavation by bucket fuel excavator then the high wall mining operations and the haul road construction maintenance, these are covered.

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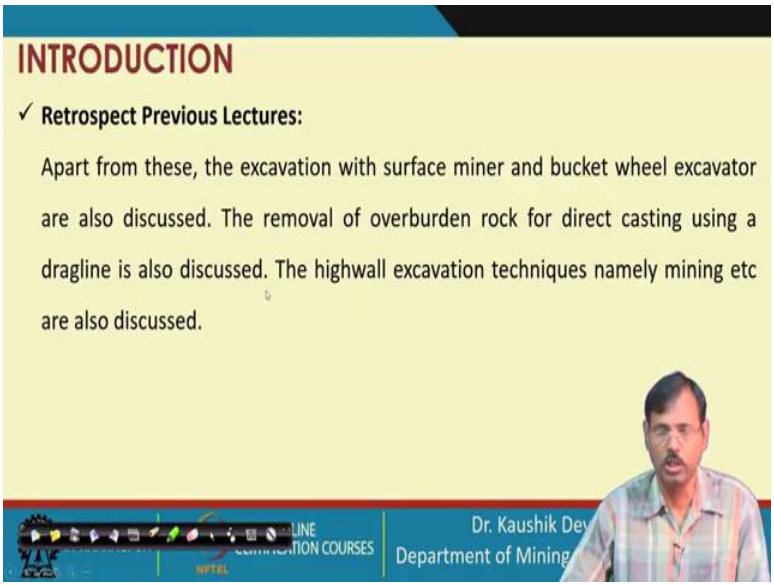

And now currently we are looking into the inland transportation system, the previous lecture is already covered, which is basically introduced you to the different types of inland transportation system, in general practiced for in different countries.

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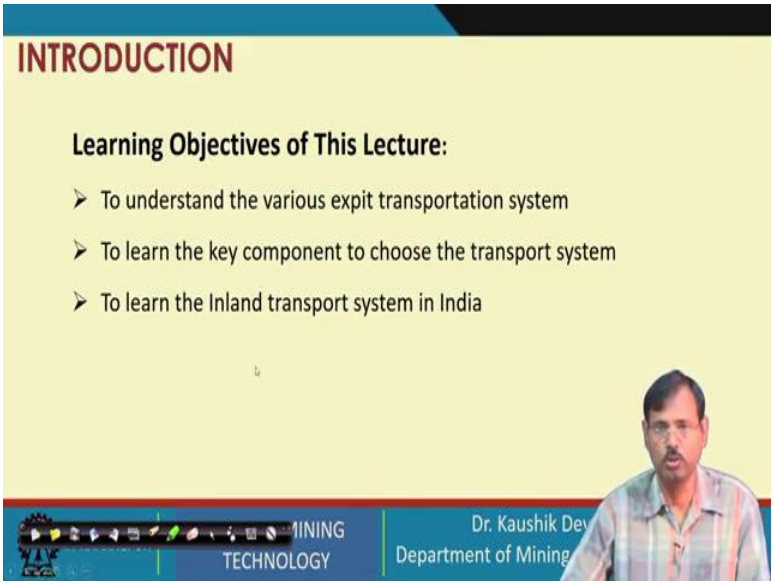

So, the objective of this inland transportation system is to understand the various expit transportation system, to learn the key component to choose the transportation systems and to learn the inland transportation system in India. So, we will emphasize the inland transportation system in India in this lecture.

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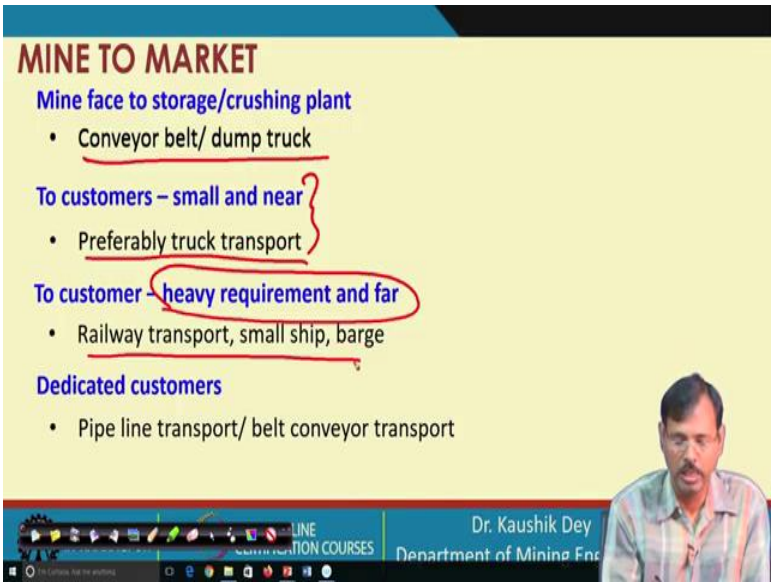

As we have seen, the most general mining face to storage transportation system is conveyor belt or dump trucks these are the most popular system and from this crushing plant or storage to the

customer is mostly either by the trucks transport, if it is small and nearby and if it is large scale requirement and away, then it is railway transport.

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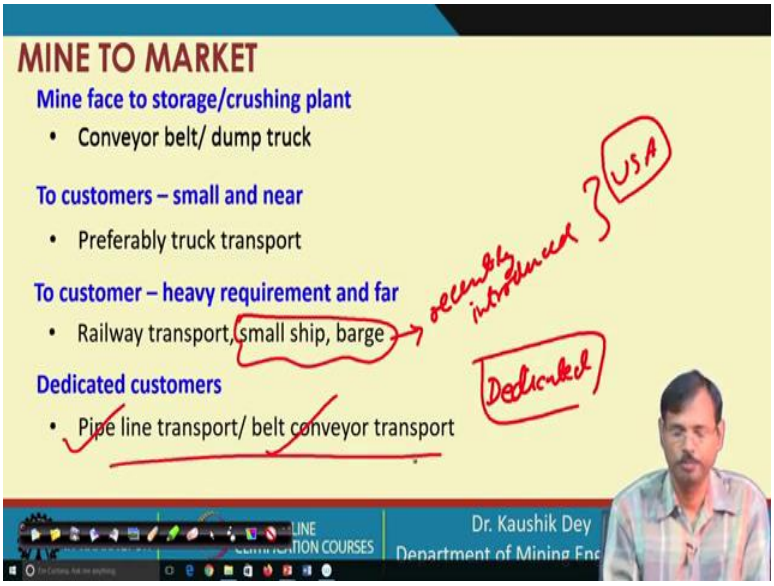

And currently for some particular segment we are using small ships and barges, this is recently introduced system. Otherwise in India, we did not have this concept but obviously in USA etcetera this was popular since long and this pipeline and belt conveyor transportation systems are also followed where the dedicated customer is there that means these systems are not applicable for the flexible customers.

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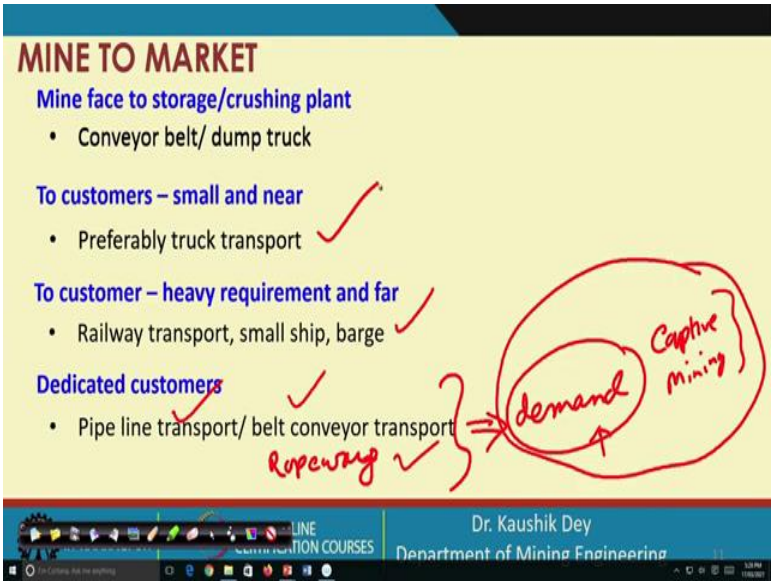

So, if these customers are known and there is no change in their demand, so dedicated customer with fixed demand in that case only these things are used and same is for ropeway also, a real ropeway also or cableway, ropeway or cableway; so, these transportation systems are followed where in general the captive mining, captive mining is carried out that means the production point is fixed, the destination point is fixed and the demand is also fixed in those cases.

Because there is no change in the capacity of the system, belt conveyor system capacity, slurry pipeline system capacity, rope way system capacity; as there is no changes in those cases these systems are utilized but these are having the flexible demand system where this can be used very easily and our customers are also not fixed. So, in those cases, these systems are basically utilized.

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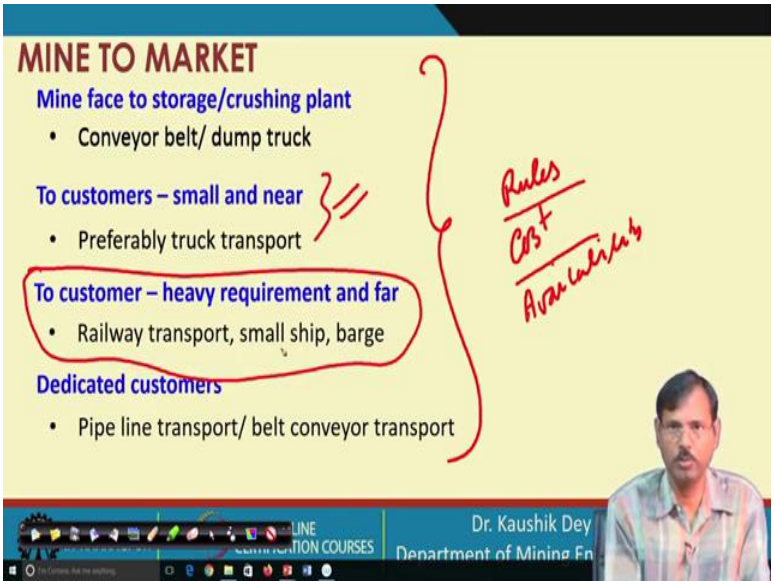

However, the adaptation of these are also depending on the country's rules, cost and availability. This is particularly important for this region, this is very-very flexible system whenever anyone is willing to have this one, they can have a truck transportation system there is no compromise on this but whenever it is a question of railway transportation system or ship transportation system.

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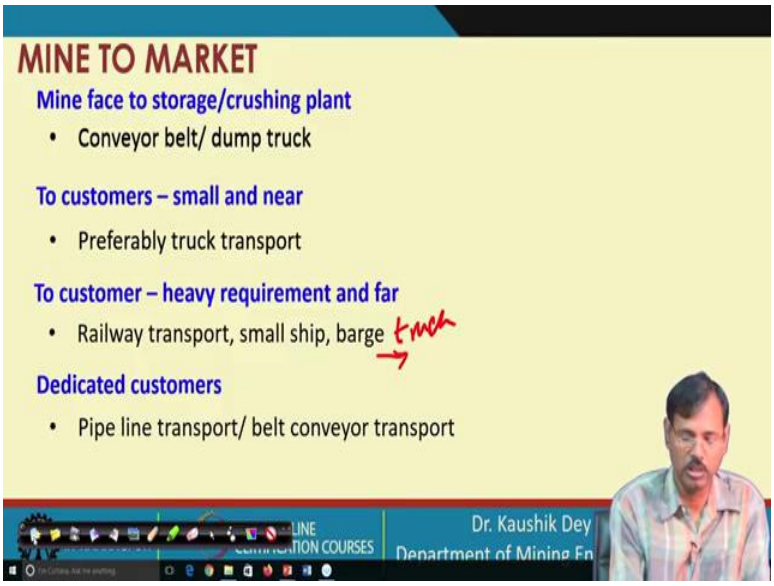

Then the problem arises with the number of availability, number of available rail or ship. Because these are not sufficiently available or the sufficient routes are not available that means if someone is willing to have a railway rack for transporting coal from a particular point to a particular point say consider that you are transporting the coal from the BCCL to you are transporting that to some point of the Gujarat.

Then it may be possible if they are willing then also that rail rack is not available to take that material from that particular point to that particular point. So, these systems are very-very problematic and that is why it is not always possible to have this one. Similarly, this ship that means this connectivity between this BCCL to the Gujarat, this ship connectivity is not there, so these things are very-very important: that the availability of the system and its allocation system country's rule.

Especially countries like India we are having a rule that the railway racks are being booked depending on the distances and that is why always the dedicated racks may not be available for the particular transportation of that one and that basically forcing the companies to go for truck transportation system even for a long-distance transportation system, may be from BCCL to Gujarat.

So, that is, a more than 1000 or 1500 kilometer distance is being traveled by the trucks because of the dearth of railway racks in those cases, so there may be the possibilities and that is why this is very-very important or sometimes racks are available but the tracks are heavily loaded if once

it is loaded that is taking long time to reach to the destination, so these are the problems and those problems are very-very important and should be addressed or should be considered while the decision of the inland transportation system is made.

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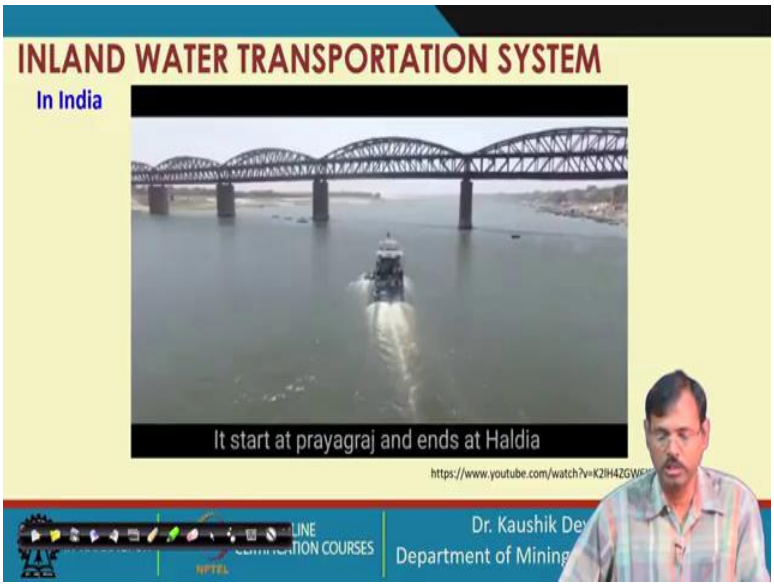

Now this is one very-very important video that is the country's attempt to adopt the inland water transportation system basically shown in this figure, this is the national waterway one termed as national waterway one. And this national water one is basically the water connections through the river ganga, 1620-kilometer-long waterway is constructed from the Prayagaraj to Haldia port.

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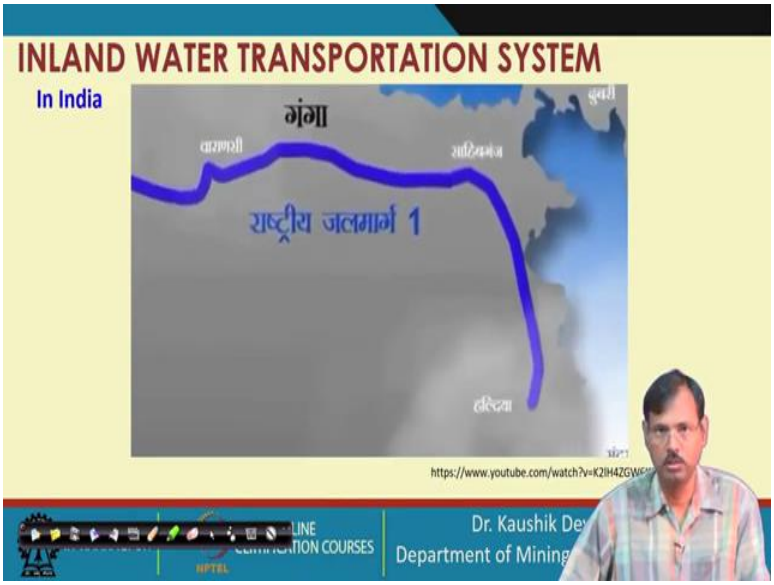

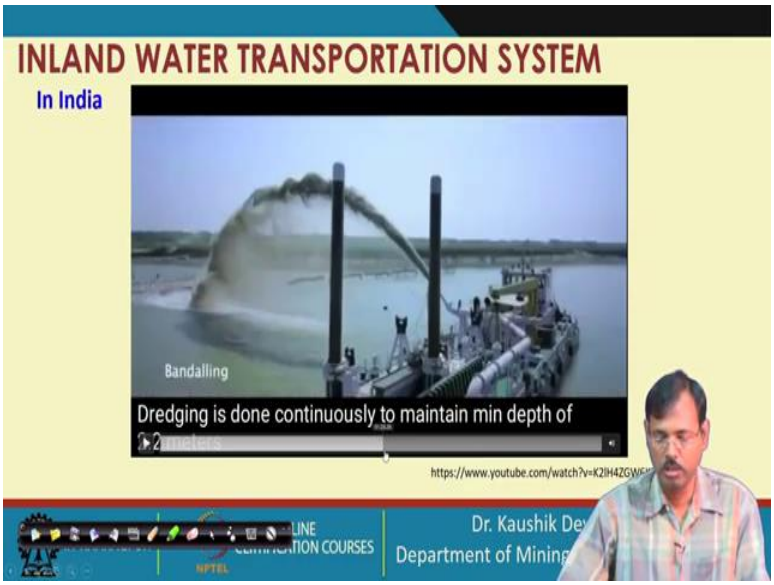

So it is from Allahabad, you can say Allahabad almost close to Allahabad to the Haldia port and this is the port which is constructed in the Haldia, Haldia is adjacent to the Bay of Bengal and that port is basically constructed to transfer the material through the ships or barges through the river ganga.

And these are the views of those ships, as those are moving, this is through the river Ganga, the proper depth of the river is very-very important, controlling the depth of the river is very-very important. In fact, the sufficient water supply in the canal must be placed so that the depth and the water height can be maintained and the ship can move through those cases.

In fact, the tide effect initially is the advantage for the ship but at the upper side of the river ganga the tidal effect is not that much significant, so sufficient water supply has to be controlled in that particular case.

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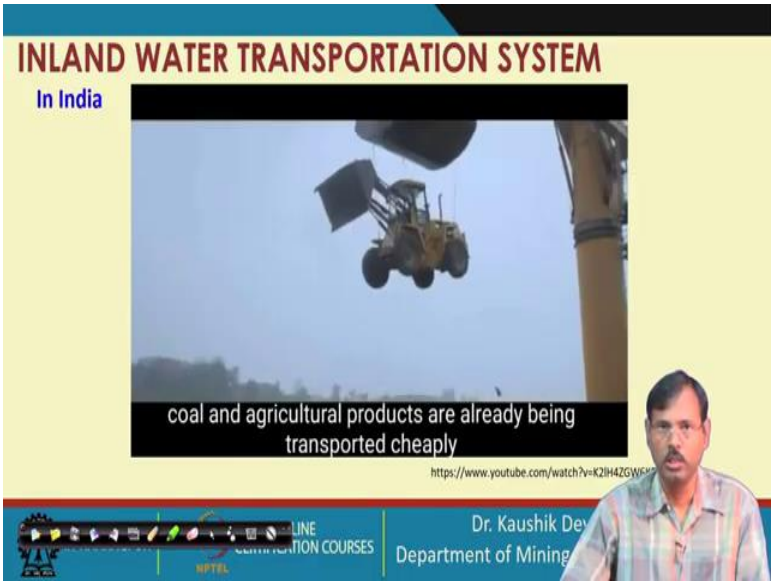

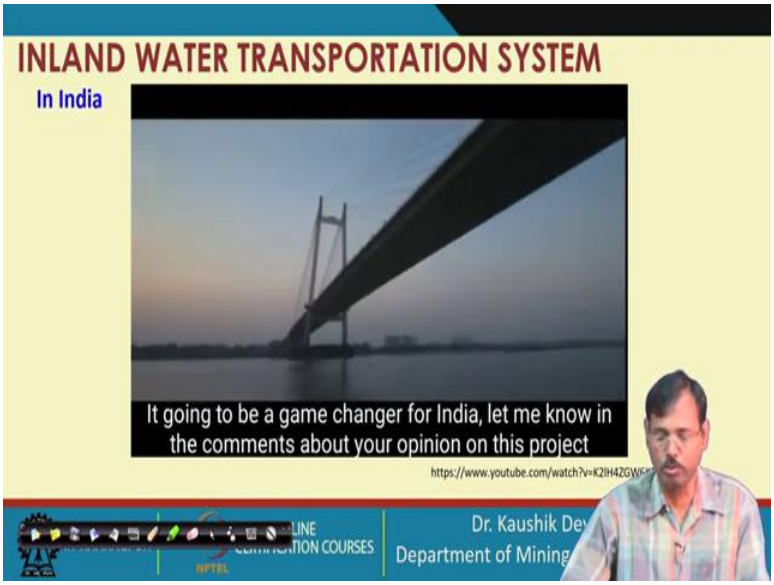

In fact, with the development of this one, it is having facilities that the Syndrolic coals are suitably transferred through this channel. As well as the coal which are basically received in the Haldia port; Indonesian coals and Australian coals are also able to be shifted, transferred through this inland water system to the up to the Varanasi. So that is the benefit of this water system; inland water transport system

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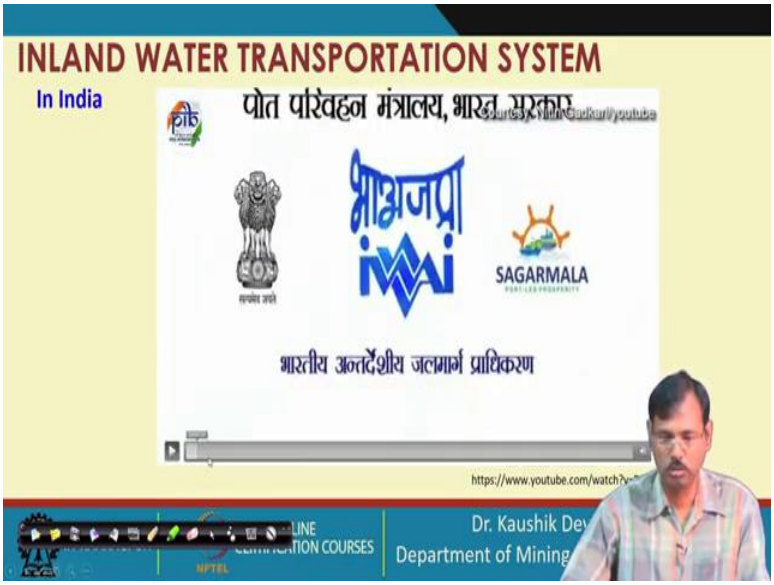

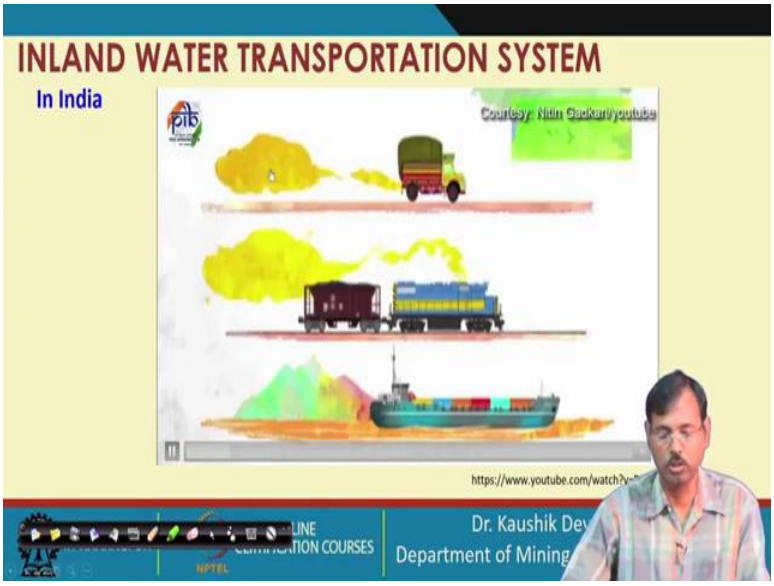

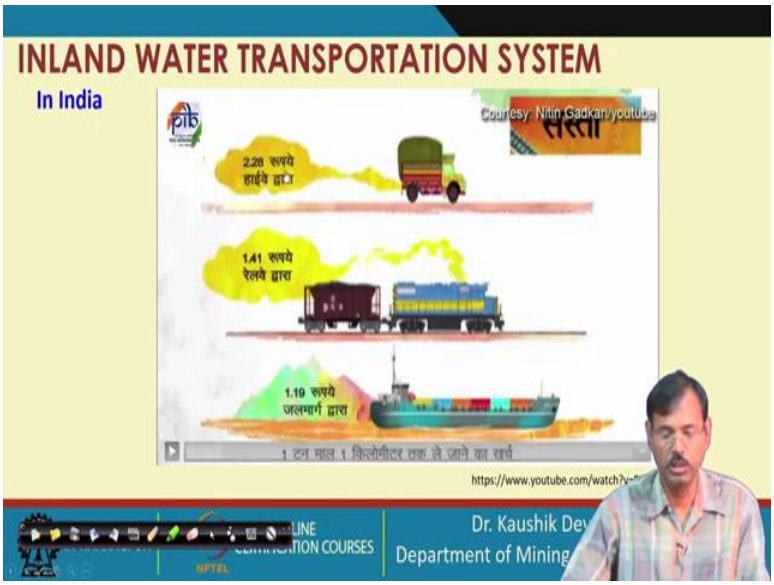

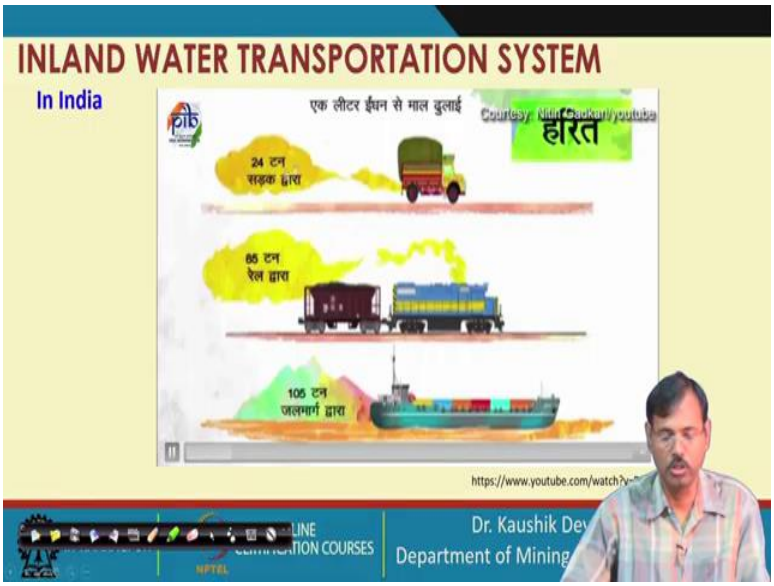

This is another video; this is for the same, on the inauguration of the same and this is showing that the transportation cost, 2.28 rupees, the transportation ton per kilometer is the truck transportation cost; 1.41 rupees is the ton kilometer transportation cost. Whereas one; close to 1 rupee is the cost for water transportation system and whereas this can be seen for a truck which can take in and around 24 ton, the rail is single rack is carrying around 85 ton and 105 ton can be carried by the water way. Because of the buoyancy, the actual load which is taken out by the ship or propelled by the ship is not that much significant.

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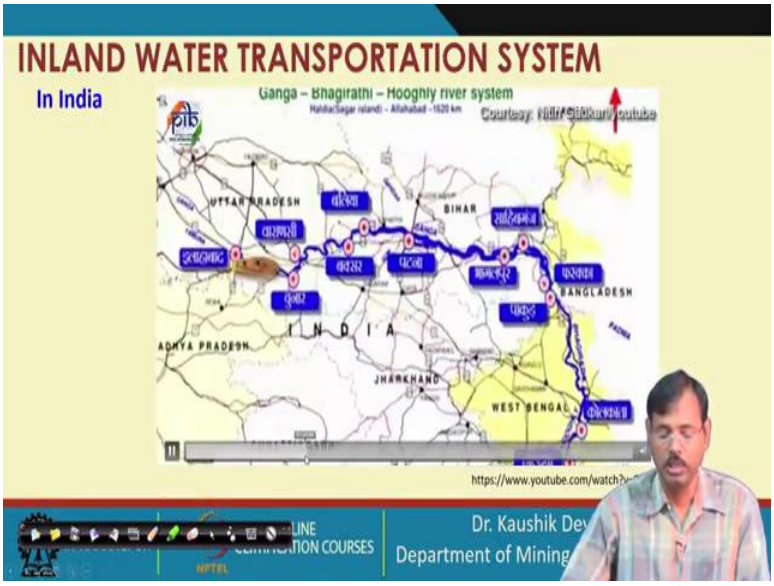

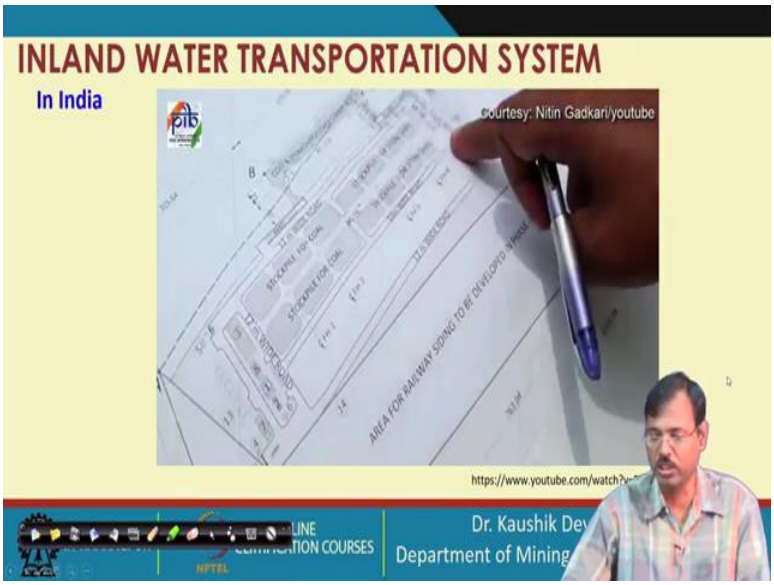

A little bit problem is there, if in consideration of the transportation system loading and unloading systems generally in that in the case of truck, a dumper can be loaded by the excavators and can be taken out by the dumper itself; similarly the dumping system can be made for the railways also but tippling system, tippling system can be made for the wagons.

However, for the water transportation system; the grab etcetera which are utilized for the loading and unloading is not that much efficient system that is a little bit problem with the transfer loading and transportation system in this case but that problem may be overcome because of the cheapest transportation system for this inland water system here.

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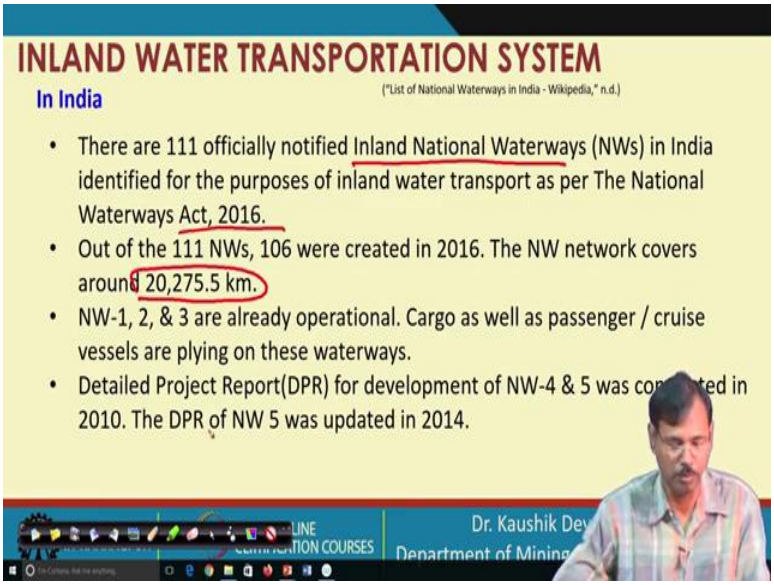

So, now in the inland national waterways; Act 2016; has been made and around 20,000-kilometer waterways are to be developed and for that attempt are being made in the country.

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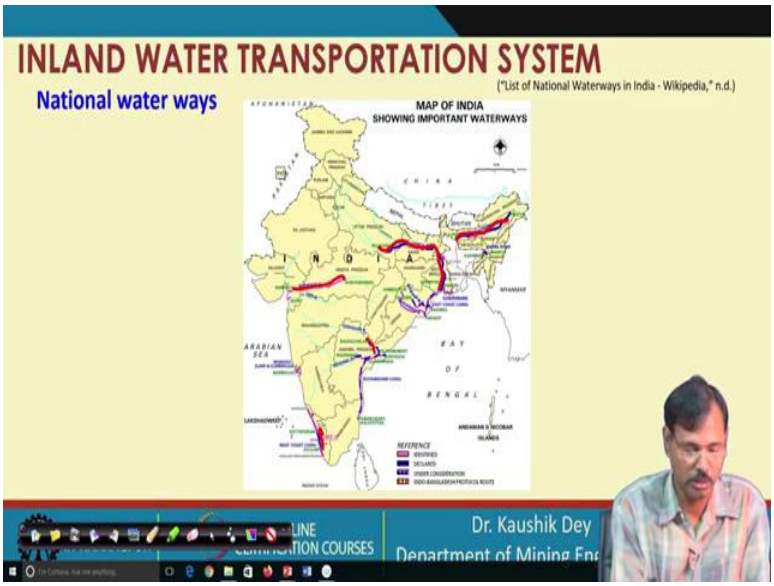

This will change significantly the water ways; these are the proposed water way which is already completed. This is almost in the finishing stage and these are some of the other waterways which are proposed and can be developed in the future.

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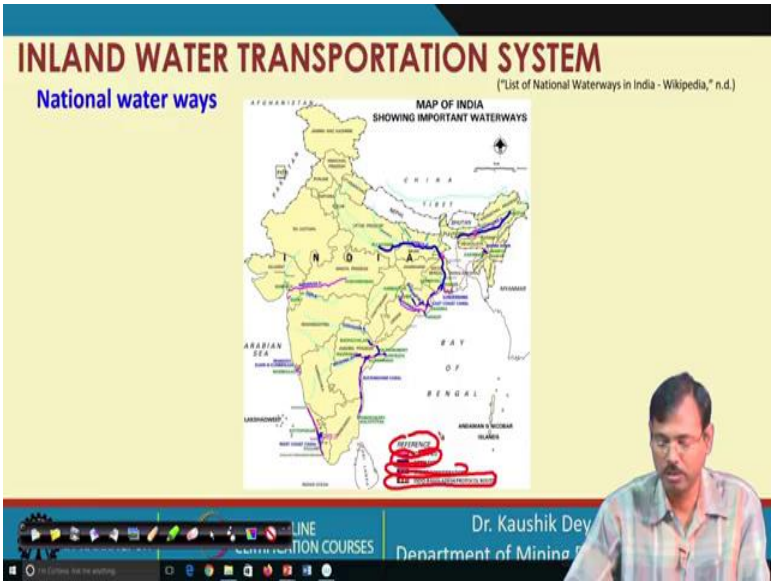

As per the proposal, these are the identified, so these are the identified, these are declared, these are under construction and these are the international route is under construction again.

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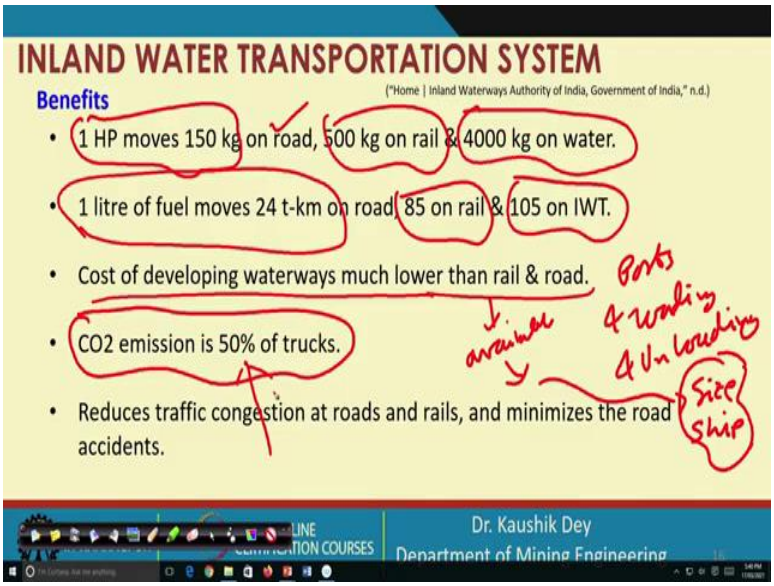

Now, let us look into the technical details where 1 horsepower load can take 150 Kgs on road, 500 kgs on rail; it takes 4000 kgs on water because of the benefit of the buoyancy and 1 liter fuel; 24-ton kilometer on road; 85 on rail and 105 on water transportation system. And cost of developing waterways are much lower than the rail and road because you do not have any cost for the construction, only the ports and loading unloading system has to be developed.

Ports and loading unloading system are required to be developed otherwise there is no construction cost on the road. And another important part is that the availability of the water is very-very important, availability of the water is important and depending on that your size of your ship is also basically depending on the availability of the water. If we are considering the emission of the greenhouse gases, this is almost for the water transportation system, 50 percent of the truck, so that is why this is also very-very efficient one.

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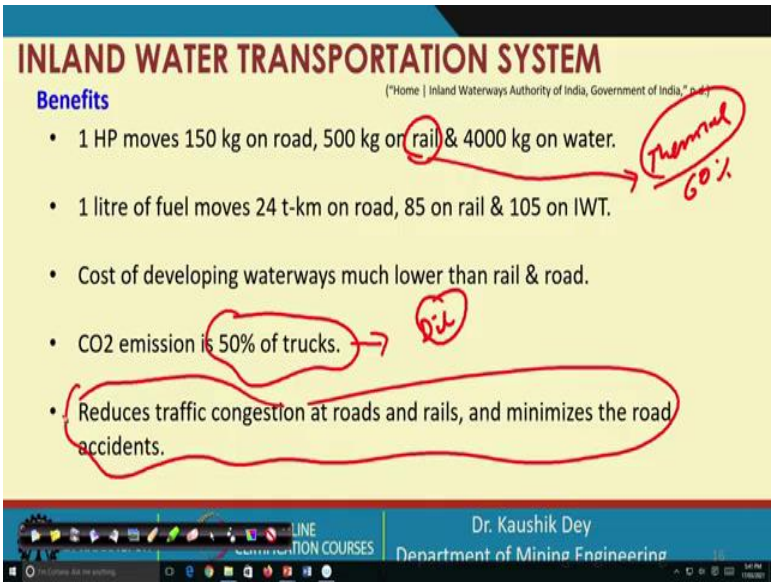

Rail in India mostly travels, rail in India mostly travels on electricity, however, electricity is basically coming out from the thermal power plants, most of the Indian power source almost 60 percent, more than 60 percent is from the thermal power plant, so that is why, these two are generating more carbon dioxide and that is why but in the inland waterway transportation system only 50 percent CO_2 are coming though these, are mostly diesel operated or you can say oil is used, diesel oil is used for the as the motive power for the running of the engines.

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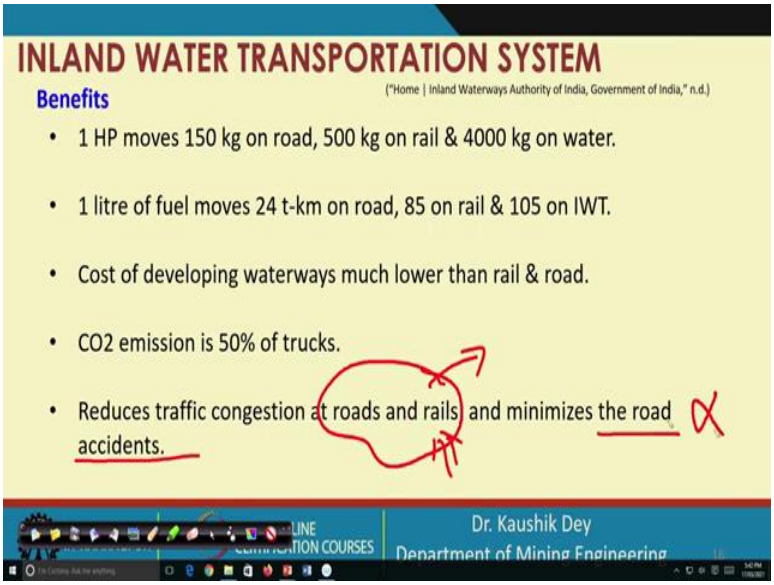

And traffic congestions all these are not that much and most significant part is that the question of road accident is almost zero, so when the inland water transportation system is there unless and until the ship crews are facing any problems, the accident is almost zero in the case of inland water transportation system.

But if it is a road traffic then there is significant accidents and often in rails also occasionally we found because of the problems in the tracks etcetera because huge human interference are there, so that is why the problems are associated, accidents are associated with the rails and roads these are creating the problem, hindrance in the normal transportation of the people, so these are creating problems but the inland water transportation system does not have this type of difficulties. So that is why inland water supply water transportation system is very-very important and popular one.

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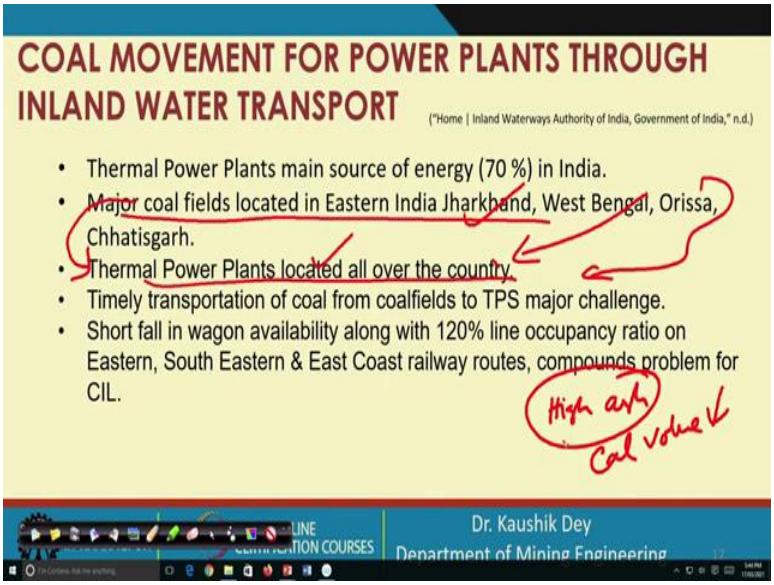

Most of the coal fields are located in the Eastern India, thermal power plants are located in the all over the country, so there is a huge mismatch in these coal sources, thermal power plants are in the other places because the power loss is unwanted transmission loss so coals are required to be transferred a long distance and another problem is that Indian coals are having very high as percentage.

So that is why calorific values are reduced, so whenever a coal is being transported a significant energy loss there because that is containing high ash, that unwanted material has to be travelled a lot and that is why the energy utilization is not that much significant.

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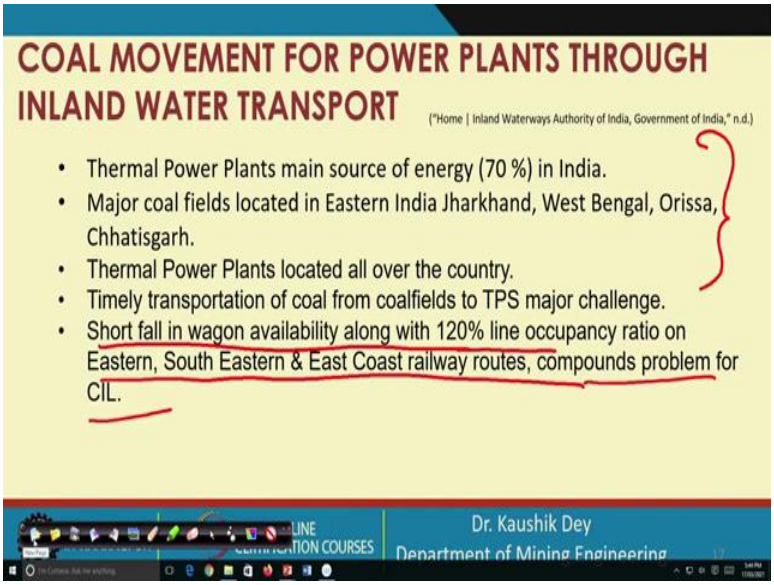

So, transportation of this coal up to a long distance is very-very problematic, shortfall of in wagon availability is 120 percent in this case. And that is why eastern rail south eastern rail and east coastal is having huge problem for allocating the racks for the coal India limited, so that is a significant problem.

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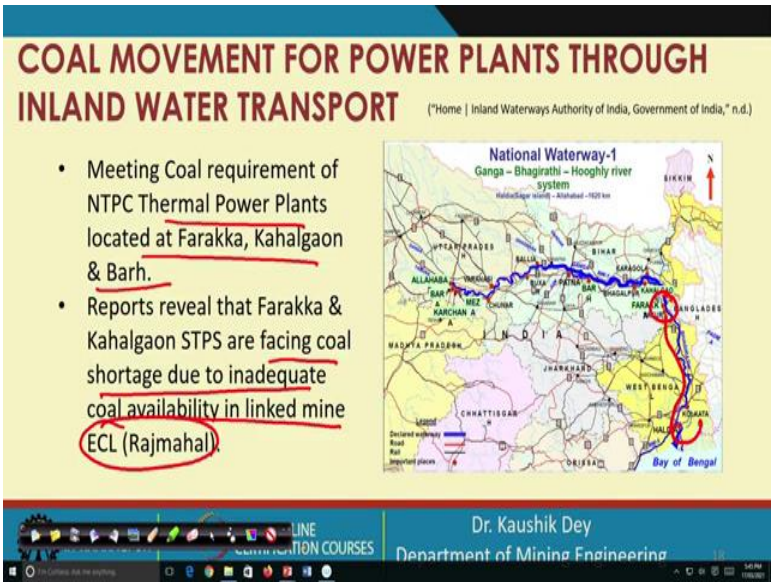

And that is why inland water transportation system may solve some problems in this, so this is currently the available inland network which is allowing the NTPC plant at Farakka and this can be seen that the linked mine ECL Rajmahal facing coal shortage due to the inadequate coal

availability in this mine and that is why the Farakka located at this facing the problems of the availability of the coal which can be solved through this the Indonesian coal can be taken and then transported to this easily and can has the benefit of this of inland water, inland water ways can be utilized for this transportation system.

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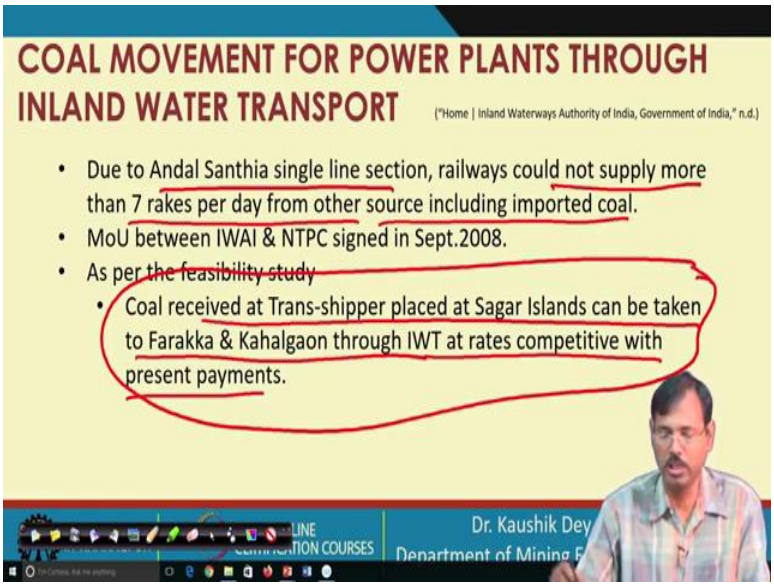

And Andal Santhia single line section, railway could not supply more than 7 racks per day from other source including the imported coal from the Indonesia. So, that is why this ship transportation system, Sagar Island can be taken to Farakka through inland water supply system at a competitive with present payments.

So, because of this transportation requirement a separate dock is created in the Haldia port and that is why that is becoming popular transportation system nowadays in which the coal is being transferred.

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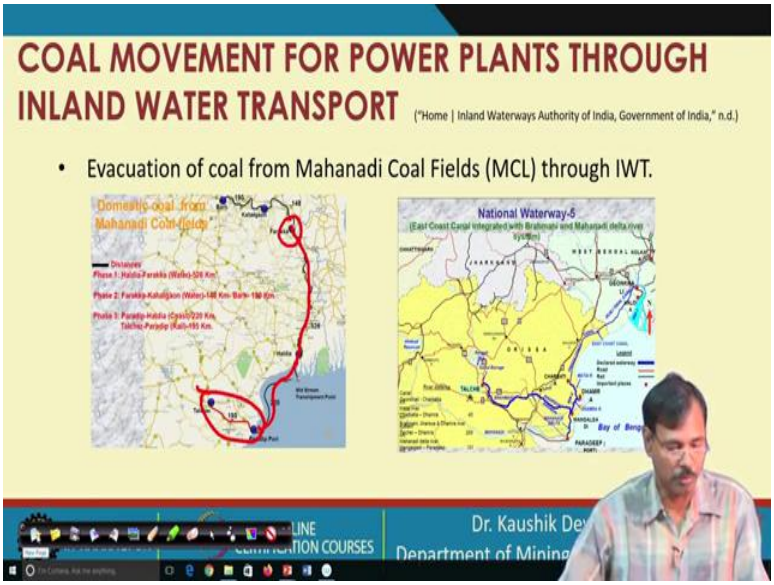

Similarly, for Mahanadi also, the Talcher coal is transferred to the Paradip port, then from Paradip port the inland water way is used to transfer the coal to the Farakka, so that is also another very-very important one, route of transfer of coal from Mahanadi coal field to the Farakka thermal power plant.

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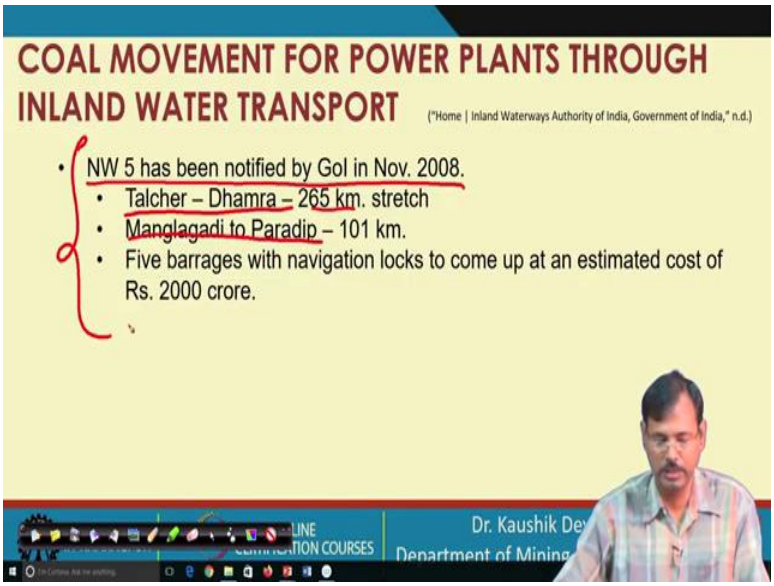

National waterway 5 has been notified by government in 2008 which is having Talcher to Dhamra, 265 kilometer stretch. Then Mangladi to Paradip; 101 kilometer and this is basically

designed in this way, these are yet to come out, these are in the proposed stage. And there are many proposed networks there which will gradually come in later one.

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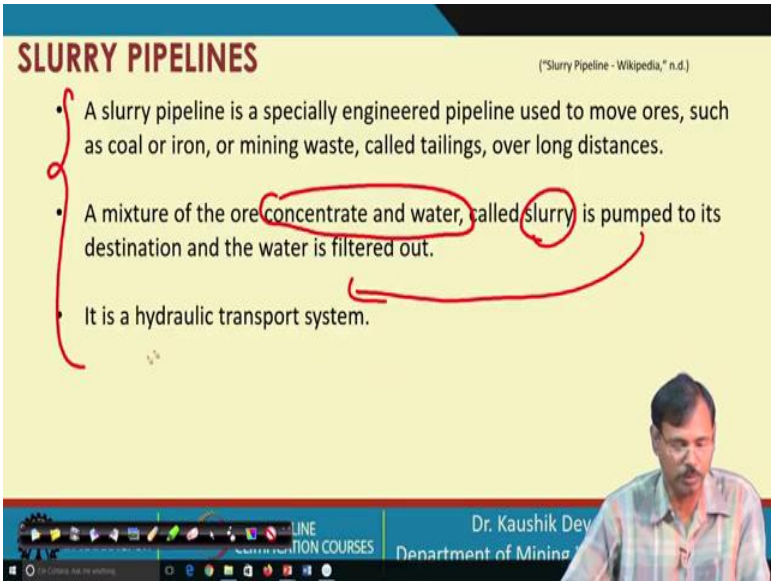

Next part is the slurry pipeline transportation system, the slurry pipeline is a special case the Essar is doing on this, this is a hydraulic transportation system in which the ore concentrator water is mixed to make a slurry which is pumped through the pipeline and that is transferred to a long distance and time to time the head is being maintained so that the transportation of the same can be continuously carried out without any hindrance.

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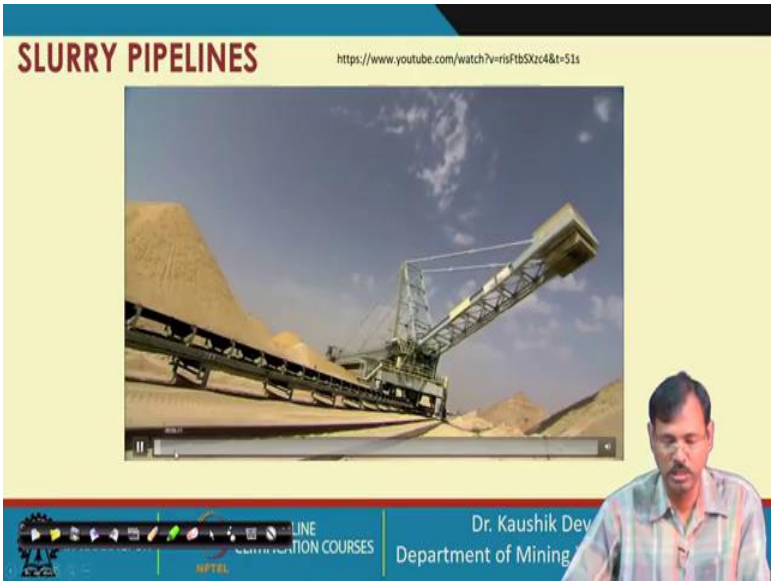

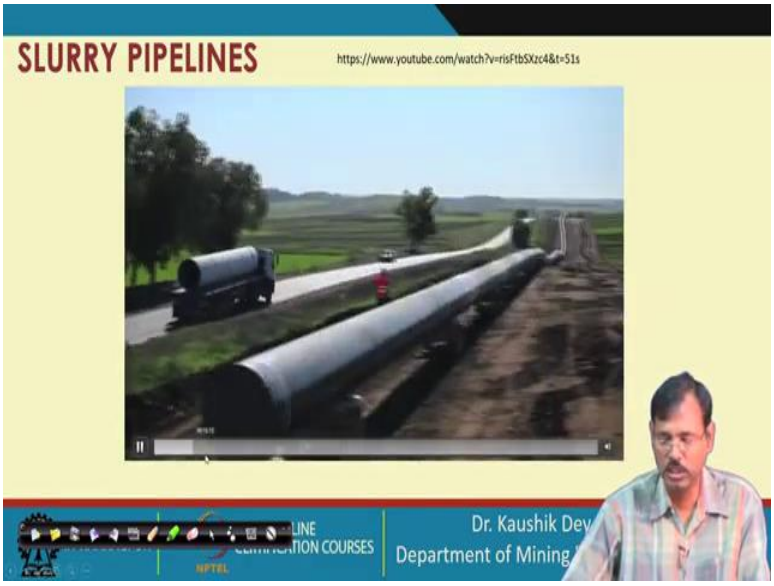

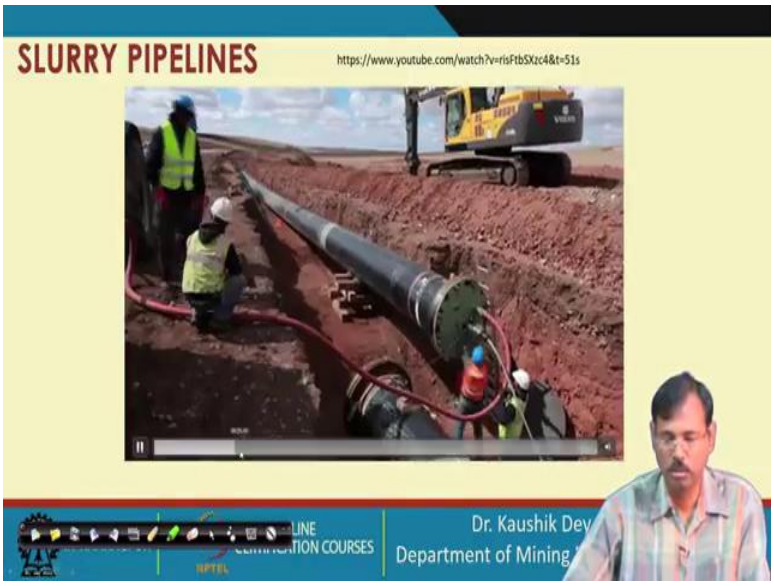

This is the video of this slurry transportation system, so this is the pipeline how the pipelines are led in general most of the cases the pipelines are made underground. So this is the underground trench is made, then the pipeline is laid.

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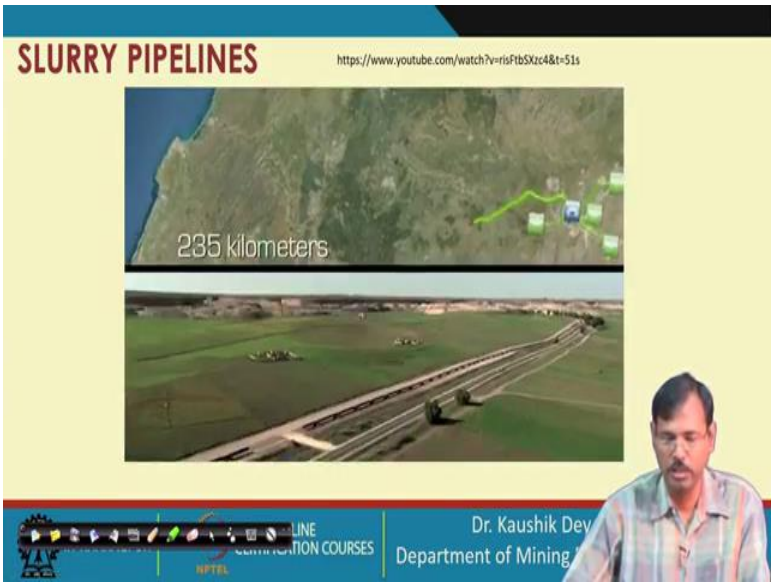

SLURRY PIPELINES

https://www.youtube.com/watch?v=risFtbSXzc4&t=51s

SLURRY PIPELINES

https://www.youtube.com/watch?v=risFtbSXzc4&t=51s

Then again it is filled back. So, 235 kilometer this is made through this terrain and this is the how the slurry is prepared, this is the way the slurry is prepared. Then the pipeline is utilized to pump them. So, this is the pipeline is utilized to pump them up to a long distance, so this is the pipeline led and at the receiving end of the pipeline the dewatering is carried out and the material is again reused there. So, this is the laying of the pipes and this is the dewatering system.

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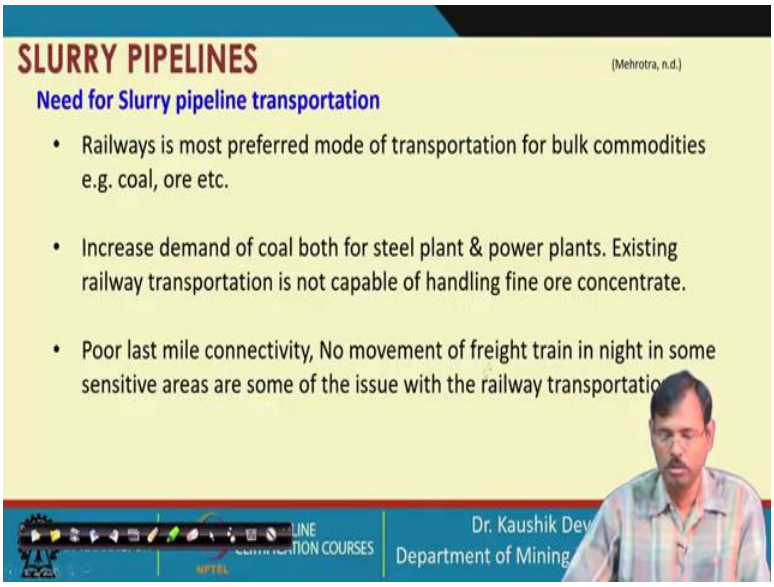

In India earlier from Kudremukh we had a slurry pipeline system but after the kudremukh mine was closed then there was nothing after that, currently Essar has set up.

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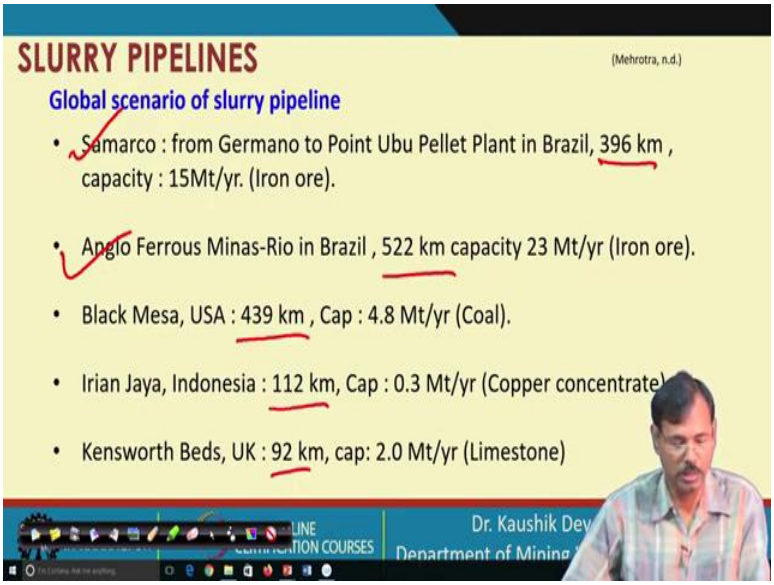

Apart from that there are few notable slurry pipeline systems are there; 396 kilometer, 522 kilometer, 439 kilometer, 112 kilometer so these are the very big slurry pipeline systems available throughout the world.

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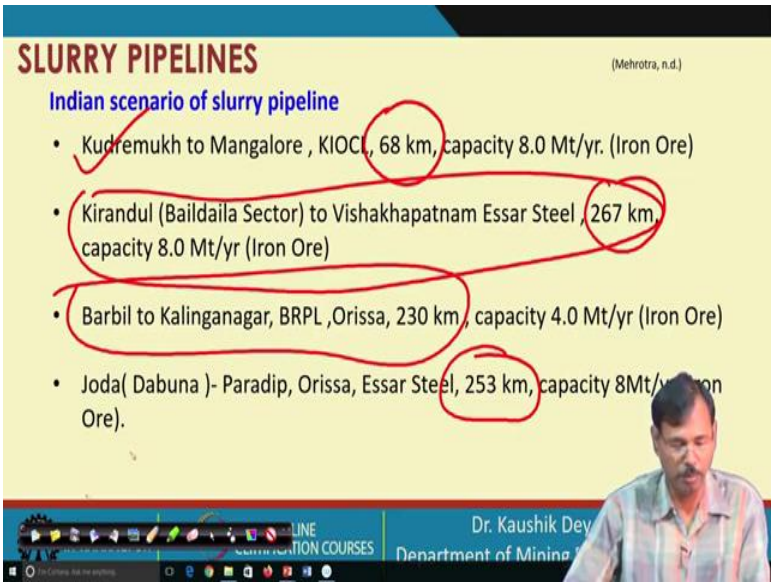

This is Indian scenario we had one from Kudremukh to Mangalore port; 68 kilometer which gradually stopped after that. Currently Kirandul to Visakhapatnam Essar still has set up 267 kilometer and another one in Orissa 230 kilometer and these are also another project of the Essar steel. So these are few notable slurry pipeline system of the country.

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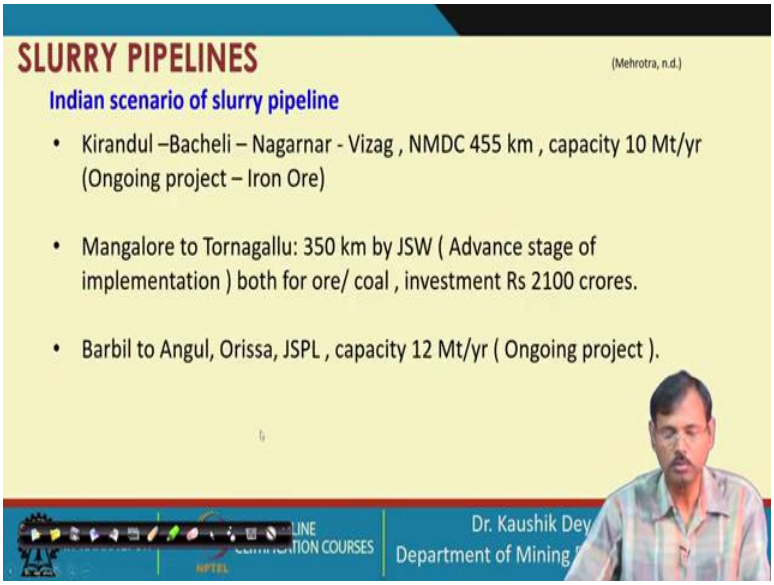

These are few more proposed one.

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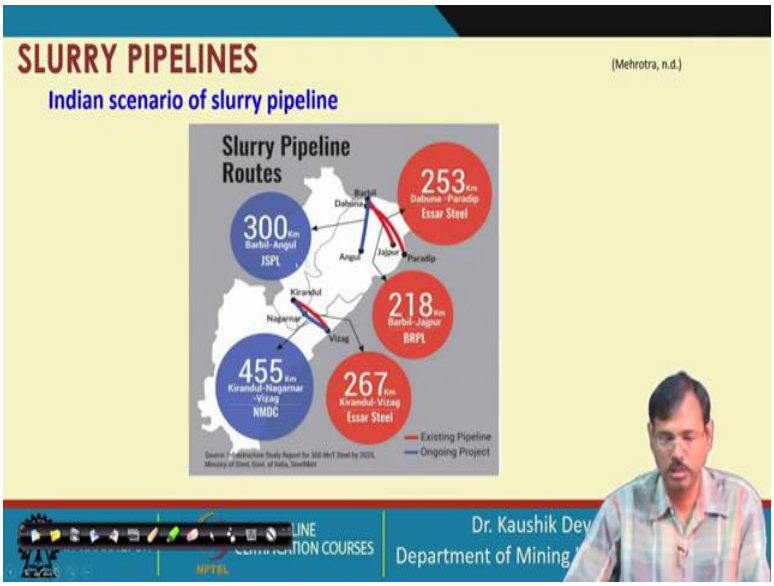

And these are pictorial view of the same.

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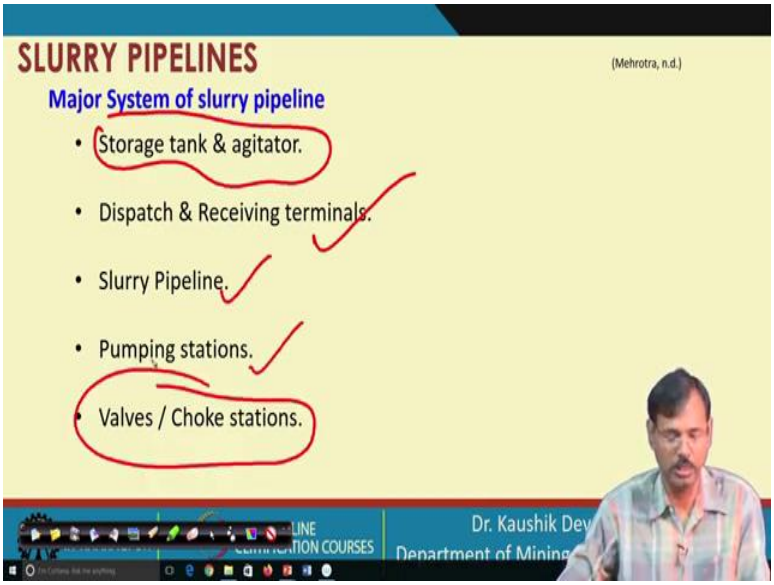

Major system which is required in slurry pipeline is storage tank, agitator, then the dispatch and receiving terminal, slurry pipeline, pumping stations, valves and choke stations and after that in the receiving station the dewatering system.

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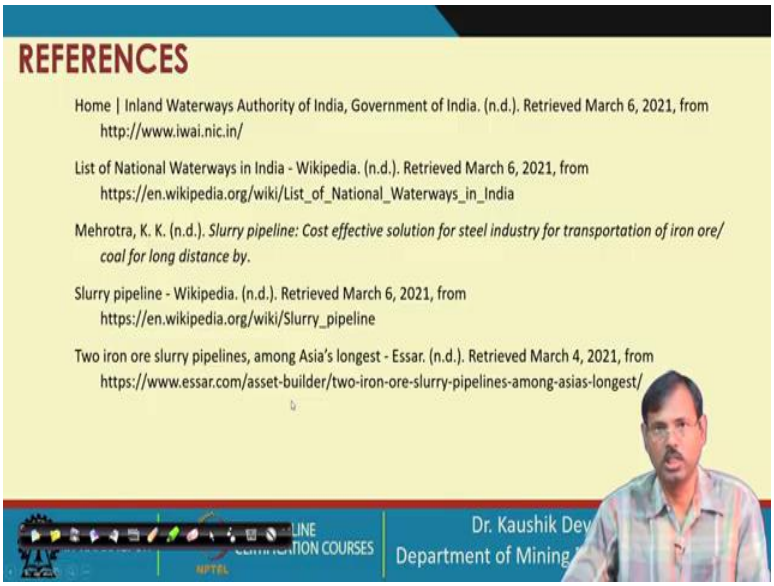

So, this is more or less all about the inland transportation system either, it is a water transportation system or conveyor system or pipeline system or truck or railway transportation system or maybe the cable ropeway details that is tried to provide in these two lectures. So let us stop here. Thank you.