Surface Mining Technology
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Lecture 49
Inland Transportation System - I

Let me welcome you to the 49th lecture of NPTEL online certification course Surface Mining Technology. We will cover the xp transportation system that is Inland Transportation System in this lecture, there will be two lecture on this, so this is the first lecture on inland transportation system that is basically after mining how the material is being transferred.

Inside the mine the we have seen, the material transportation system is through haul road and we are having restrictions because mining is basically a dynamic positioning system where the front of the machineries are changing every time, but after the mine the positioning of the materials and machines are more or less same. So, we can opt for the best way of transportation system, so there will be two lectures on this, so this is the first lecture but before going into the details let us see the learning background.

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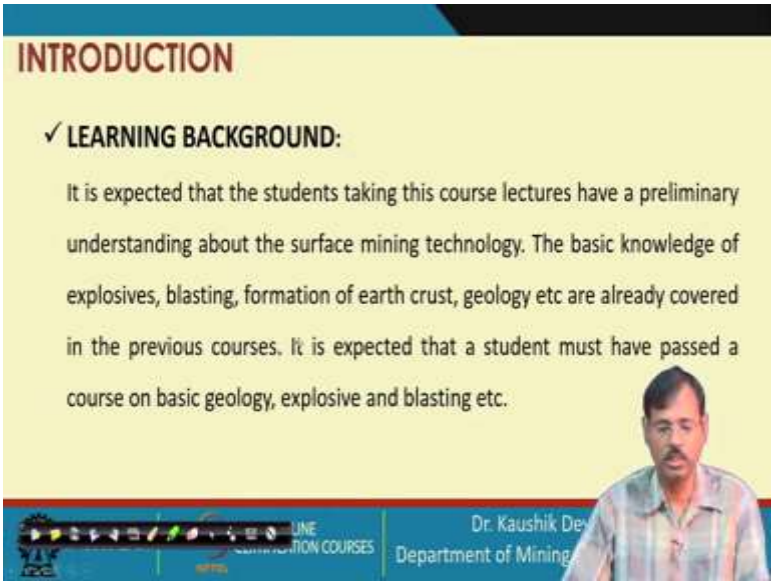

This is the learning background for surface mining technology course.

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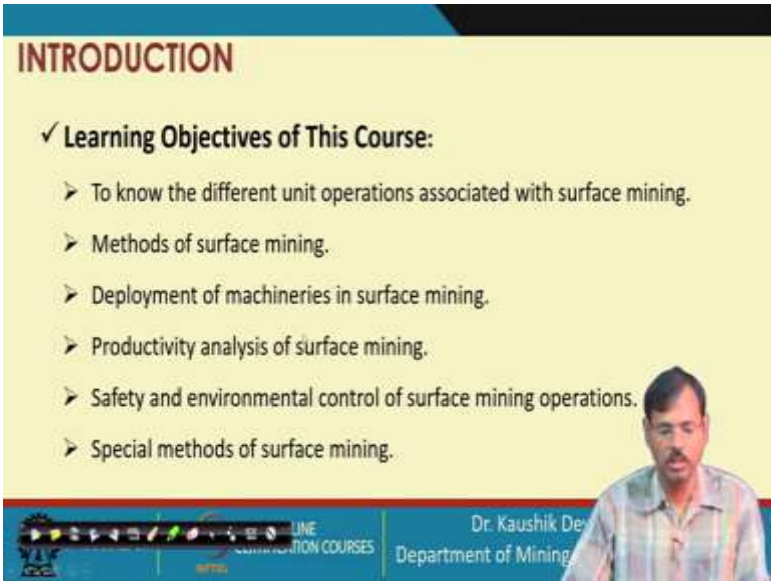

This is the learning objectives of the surface mining technology course.

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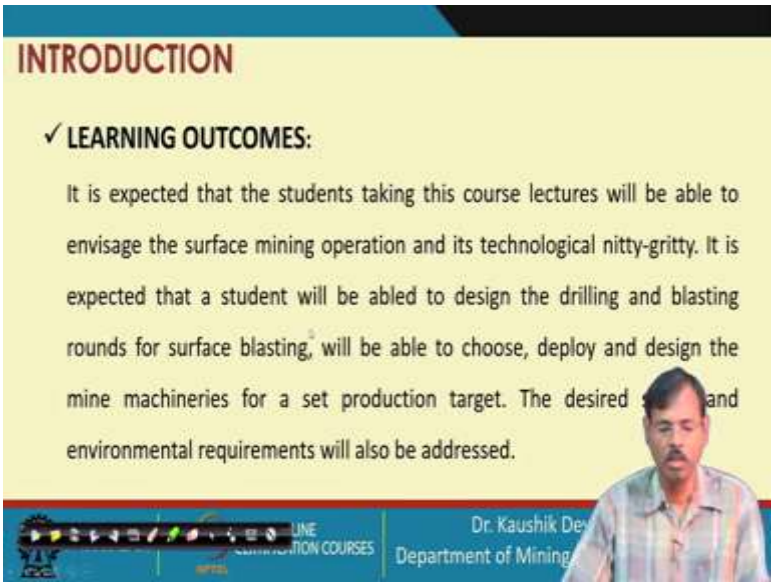

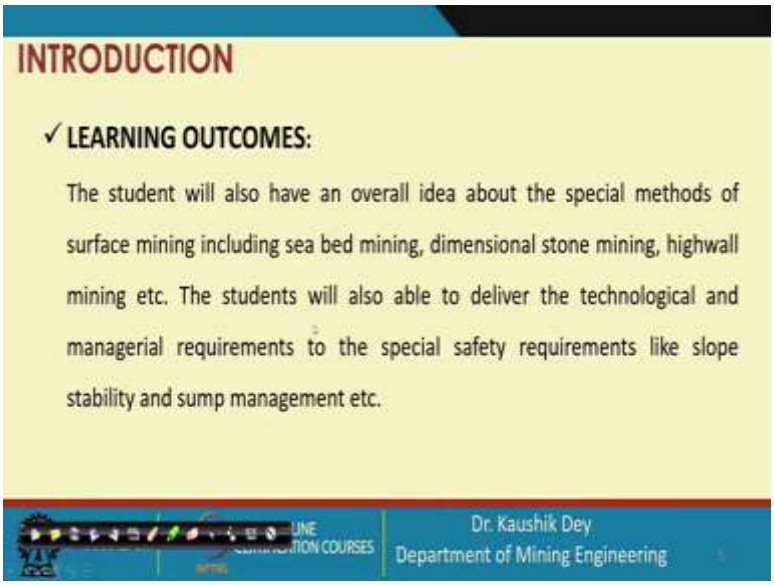

These are the expected learning outcomes, we are expecting from the participant.

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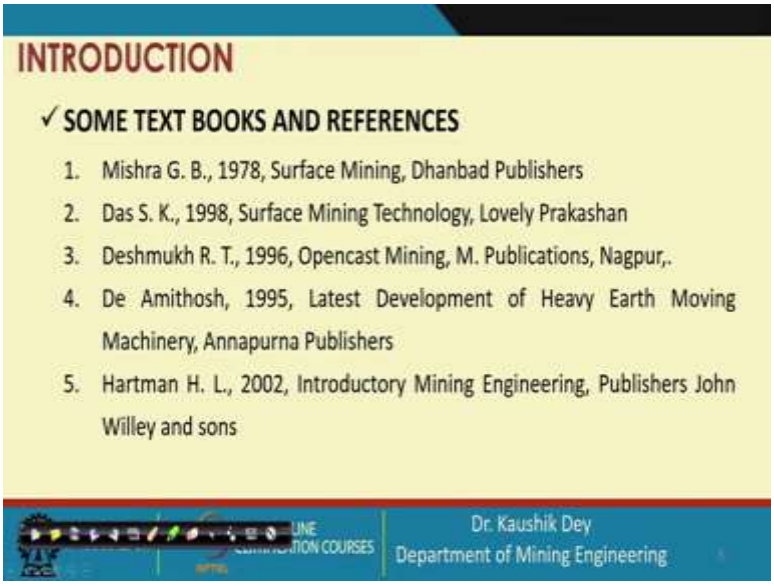

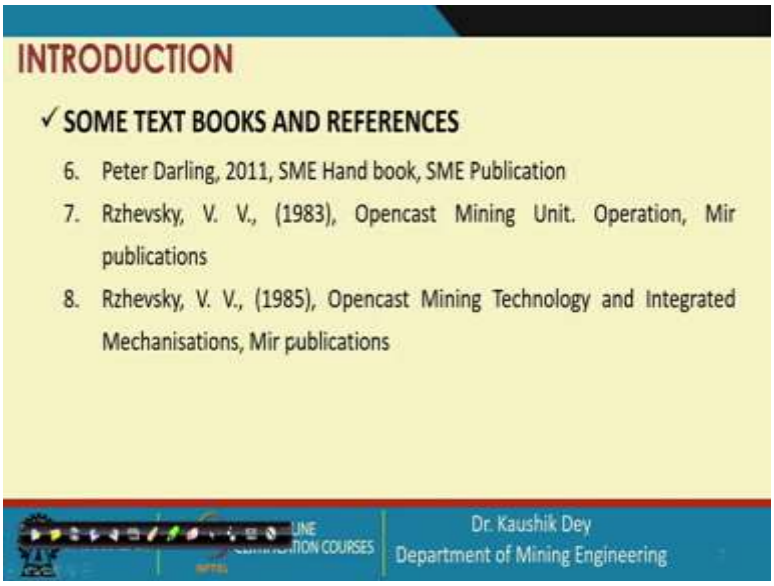

These are some of the text books and references, these are some of the textbooks and references.

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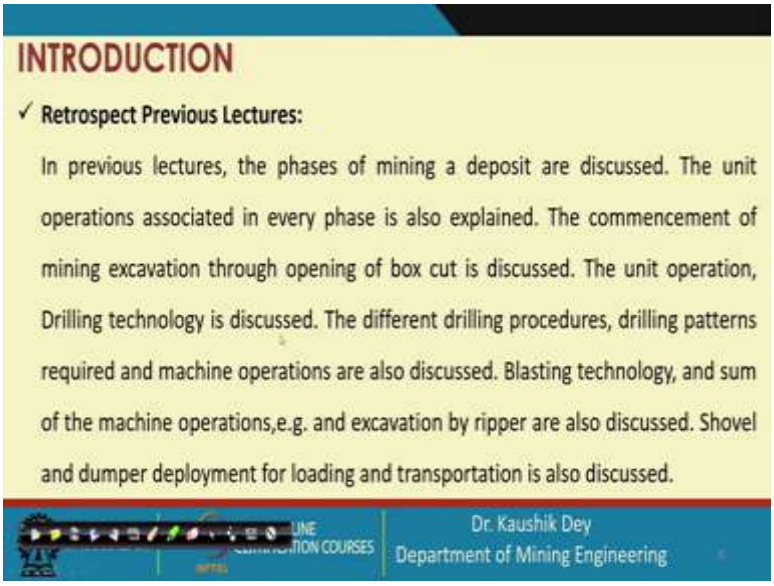

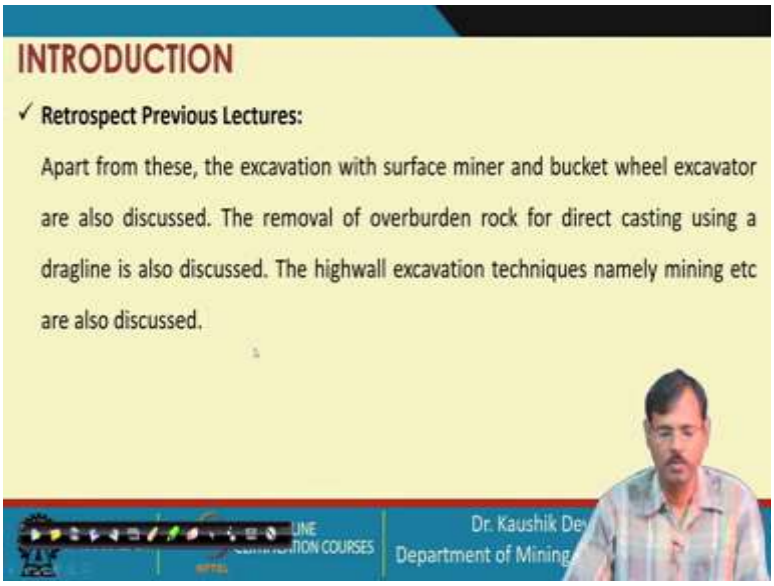

And before this lecture we have covered the phases of mining a deposit, the commencement of surface mining through opening a box cut. Then we have covered the unit operations drilling technology and we have covered the blasting technology, bench blasting technology, we have covered the excavation by ripper that is the blast free technology.

After that we have covered the excavation of blasted rock mass using the excavators, shovels and loading of those mud to the dumper transportation system and shovel dumper combinations, how that is made we have covered those part. After that we have covered the excavation by surface miner, then we have covered the excavation by bucket wheel excavator, drag line and also the high wall miner and just before this class we have covered the haul road construction maintenance and that is up to this we have covered.

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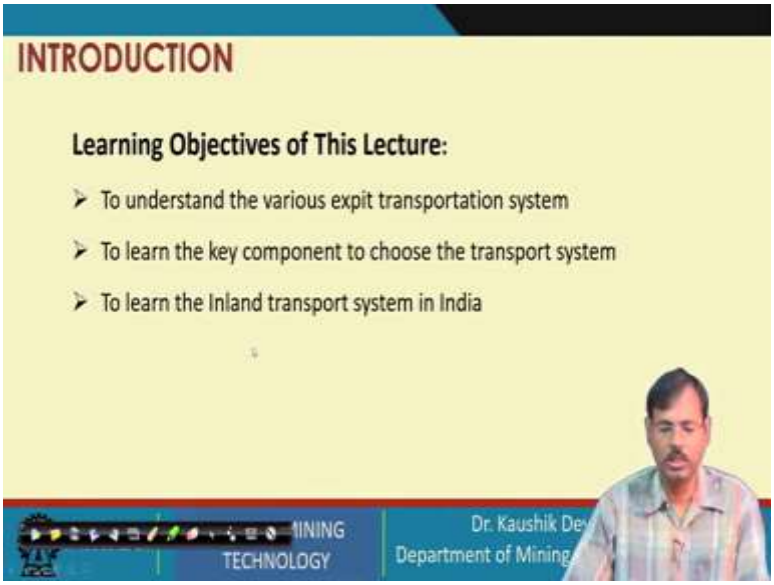

And the learning objective we set for this lecture, this lecture and the next lecture, these two lecture series, the learning objectives are set as to understand the various expit transportation system, to learn the key components, to choose the transportation system and to learn the inland transportation system in India.

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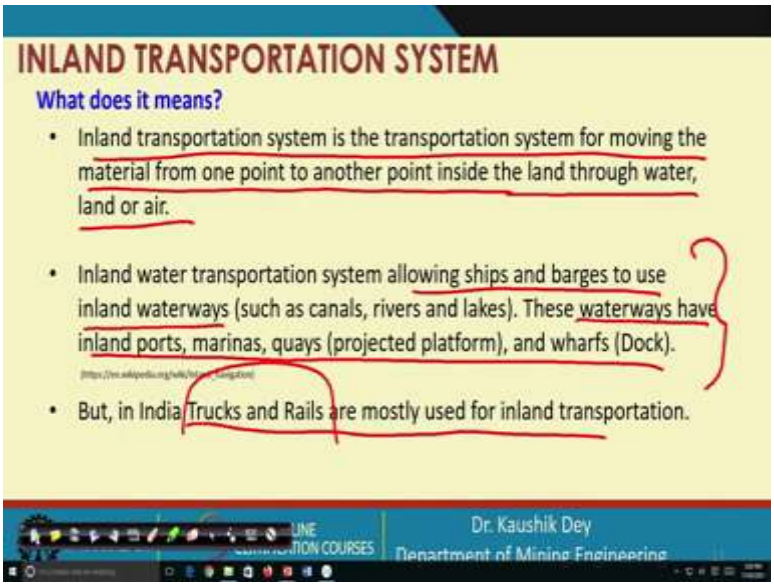

So basically, these are the three aspects we have covered but let us see what is inland transportation system. Inland transportation system is the transportation system for moving the material from one point to another point inside the land through water, land or air; that means

transporting the material from one place from where it is originated or where it is manufactured etcetera from there to the other where it is it will be used or it will be further transported or exported.

Up to that the transportation system made within the area of a country that is called inland transportation system. So, within this inland transportation system the taxes etcetera related to the transportation to the other countries etcetera those are not applicable, this is only country whatever the transportation system is made that is called inland transportation system. And this transportation can be carried out through the water, land or air.

Inland transportation system allowing ships, barges to use inland waterways; such as canal river lakes and this is have the inland ports, marinas and quays, wharfs but in India truck and rails are mostly used as the inland transportation system. Inland water transportation system is not developed so far in the country though India has started working on this, now the coal transportation system is being adopted in different places.

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And often we are using conveyors, pipelines, trucks, trains barges and as well as aerial ropeway as the transportation system within the country and we are having a number of examples related to this.

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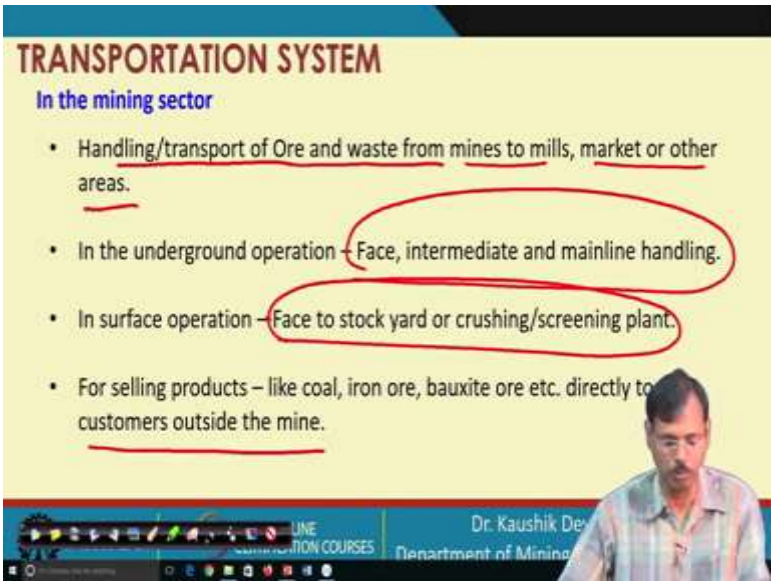

In case of export to the other countries, are mostly carried out through the ports and for very few cases it is basically carried out through the air but mostly the material is being transported to the water through the port only and that is the main reason behind that, the transportation cost is minimum through the waterways than the land and air that is why that is the easiest way to easiest technology or you can say economic technology that is practiced.

In mining sector material handling, transportation of ore waste from the mine to mill or market and other way is basically a part of this inland transportation system. In underground operation, it is faced to the main line handling, in surface operation face stock to the crushing so that is basically used and for selling directly to the customer side from the mine. So, either to the power plant or to the port it is directly used and that is considered as the inland transportation system.

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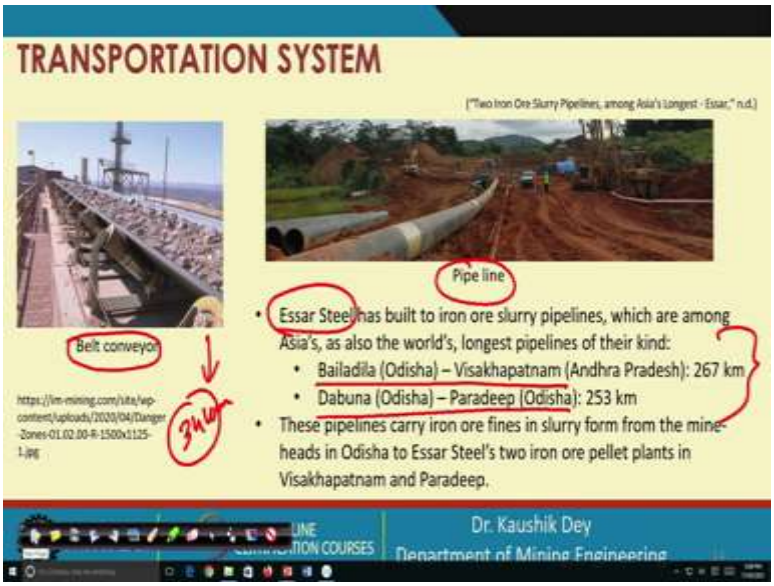

So, this are, two very common transportation system; one is the belt conveyor, another is the pipeline and India is having two very beautiful system, this pipeline is made from Bailadila to Visakhapatnam and to Paradeep port by the Essar steel and this is the longest slurry pipeline system currently in India and this is the conveyor system, this conveyor system in India also we are having a 34 kilometer cable belt conveyor system from Panchpathmali mine to its plant.

So that is also one very big achievements in the transportation, continuous transportation system of this material. So, these two system is basically continuous transportation system of the material.

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And let us look into these two system; this is the Panchpatmali mine which is basically a bauxite mine, one of the very big bauxite mine in which the material is transported, excavated by ripper system and ripper dozing, ripper scrapper, ripper dozer system, the material is being excavated then the excavator is loading the material to the trucks and this bauxite carried out by the truck that is basically dumping the material into the processing plant. And this is the ripper excavation system and this dozer is pushing that, after ripping the dozer is pushing and creating the heap then the excavator.

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And this is this cable belt conveyor longest cable belt conveyor; 14.6 kilometer long single flight multi curve cable belt conveyor which is the longest cable belt conveyor and you can see this is adapting the ground clearance, adapting the undulation in the ground very well, so that is in the hilltop and to the hill bottom this is the plant, aluminium plant and from this hilltop mining to that hill bottom this cable belt conveyor system is working that is a single flight cable belt conveyor system.

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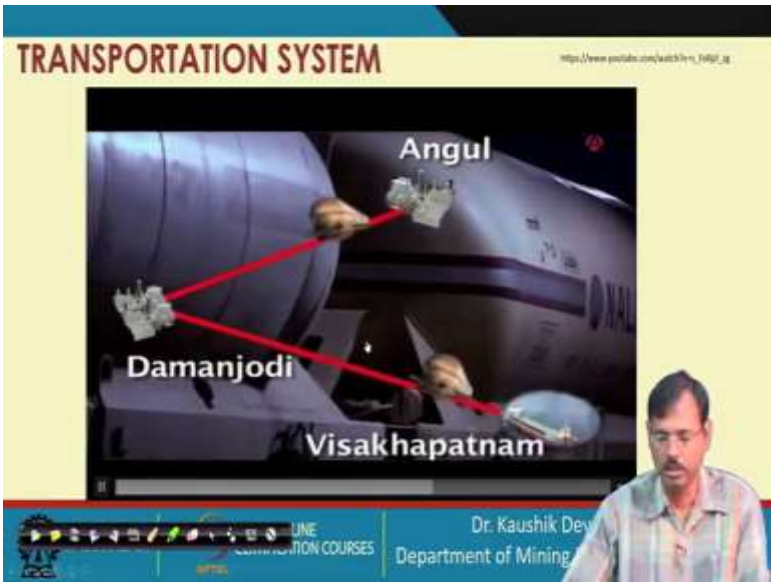

This is the from the stack yard, the material is basically reclaimed and that is again taken to the ball mill. So, this is the ball mill and rod mills are also there and then that is being taken for to the aluminium metal from this in the refinery. So, there the refinery is basically taking out the aluminium and then the aluminium bricks are made for the further transportation. So, this is the aluminium and these are moving to the Visakhapatnam for export and for a further refining system, so this is the conveyor system.

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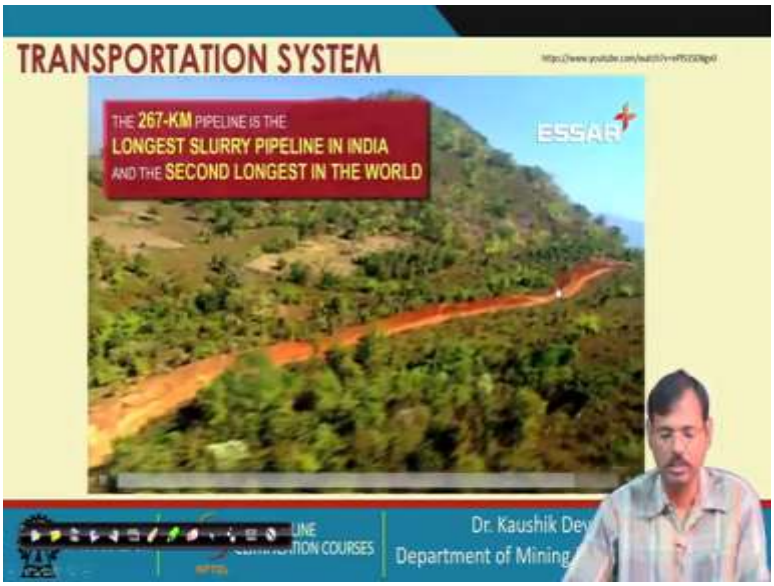

Let us now look into the slurry pipeline system. This is the slurry pipeline system constructed by the Essar, you can see the terrain through which the slurry pipeline is basically led. So, this is the slurry pipeline system, the slurry is made and from this plant, the slurry pipeline, through this slurry pipeline more than 200 kilometer, the material is transport, time to time, the pumping arrangements are made.

Say this is the profile of the, you can see from the Bailadila through this Sukhma this is the dense forest, reserve, so through this dense forest and critical terrain this pipeline is laid most of the places, the pipelines are underground cannot be seen from the surface because this is also

elephant corridor and if it is kept in the surface, that can be damaged by the animals. So, all these are basically controlled in this pipeline system.

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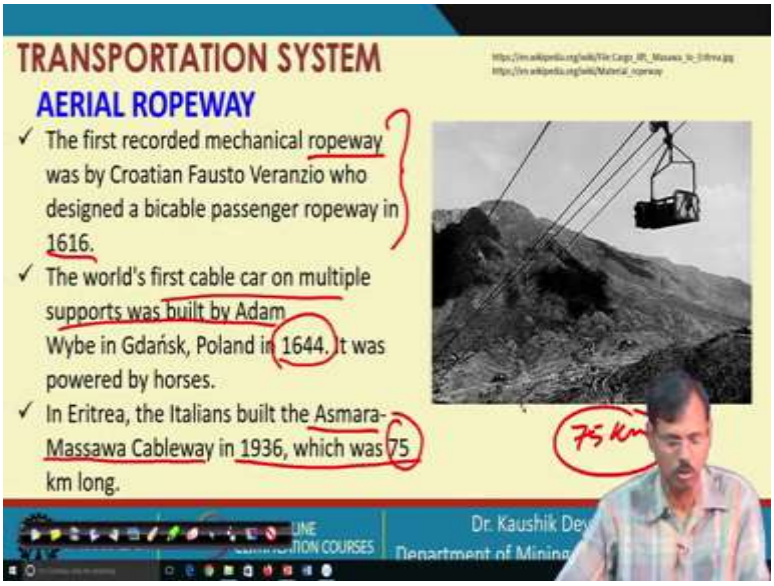

Apart from that aerial ropeway is also another system which basically was very popular in earlier days. The first ropeway was made in 1660 and the first cable car on multiple supports was made by this was made for transferring sand from one side of the river to the other side of the river, so this did not have multiple support system but first multiple support system was made in 1644.

And then the one of the longest cable way is made 75 kilometer, this is the photographs of this 75 kilometer cableway was Asmara to Massawa cable way that was made by the Italians in 1936, in India also we had Chasmala to Banpur Isco, we had a very big ropeway transportation system, so it was earlier operating very well.

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And these are having different mono cable system, this is the mono cable system, this is the bi-cable system, so there are many mono cable, bi-cable, tri-cable systems are possible with the aerial ropeways and currently aerial ropeway is not that much popular.

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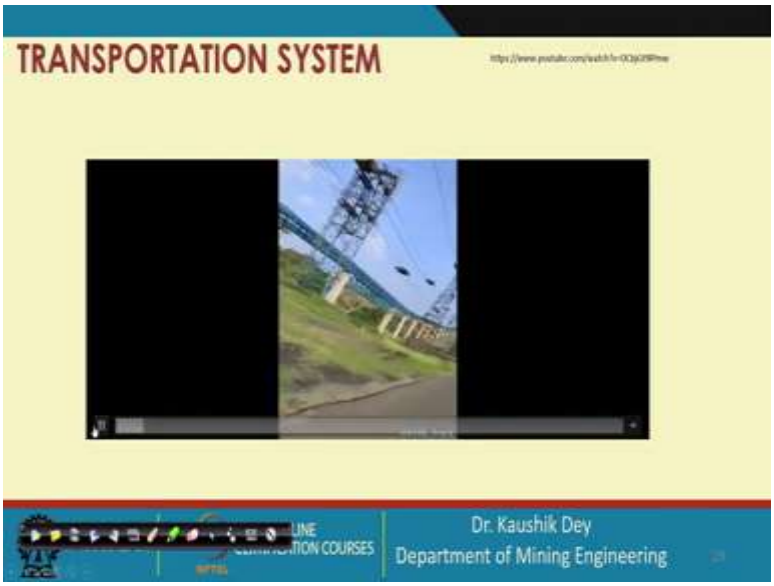

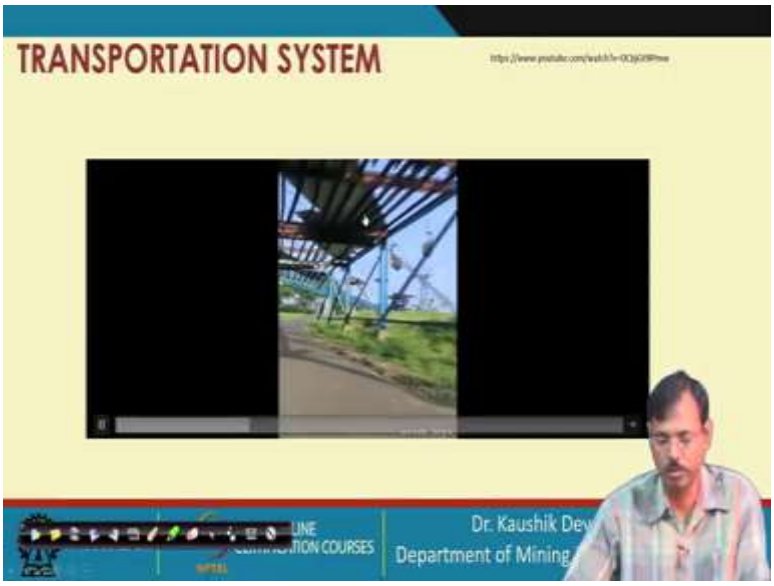

You can see once this aerial ropeway which is working in the Jamadoba in the West Bokharo area,, Jamadoba, that can be seen in this, this is the YouTube you can see this is the aerial ropeway which is carrying the coal, so that can be observed and this is the support system provided so that if any accident occurs, the material will not fall down on to the head of the normal pedestrians.

So, there are two types of ropeways being used here, so one is tri-cable, another is bi-cable. So, this was another crossing and this is basically allowing the utilization of the air and that is why the surface will remain free that can be utilized for cultivations and other purpose, so that is basically an advantage of the ropeway system and ropeway from the hilltop to the hill down system is transferring the material is found having very good mechanical advantage. So, that is also energy efficient that can be used very easily.

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So, these are the other transportation system. In this transportation system truck is mostly used, a very-very common transportation system in the country in India. The truck transportation system is good for a small distance transportation system and for long distance in general we use the railway transportation system.

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If this is in Indian context, these are the barges, are often used in the US mines. Now the truck transportation, that conveyor transportation system, slurry pipeline transportation system these are continuous transportation system and ropeway also; continuous transportation system. The

truck, the train that is the rail transportation system is basically a batch transportation system and barge, and barge and truck this transportation system is basically the discrete transportation system in which a single unit is basically transferred. A single unit basically transport in this system.

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But if we are trying to prepare a list based on the cost then the transportation system of barge is not that much costly. Then the operating cost of the conveyor and slurry is also not very high but these are having a very high capital requirement, high capital requirement for these cases and train is not that much costly but the dumper transportation is very-very costly transportation system and that may be avoided in often, in some cases.

Another problem with that applicability of the barge transportation system is it solely depends on the occurrence of the rivers, lakes etcetera that may not be possible always. And second is the loading and unloading system for the barge transportation system is little bit critical in case of the surface transportation system it is a little bit easy.

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The export system when we are considering we are only having the one option that is the cargo ships that is basically utilized for the export transportation system, that is the utilization of the cargo ships.

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But while the transportation systems are required along with this transportation system we always should have the storage facilities, so for that the storage facility is required as the intermittent between the system, so that the first unit operation that is the production from the mine if that is affected that should not affect the inland transportation system.

So, we should have a stock yard from which the transportation system or the regular transfer of the material can be ensured. So, that is why the intermittent system stock yard, stock piles are maintained. Similarly, when the plants are also operating, they are also having a stock yard at this place so that any problem occurred at this place that will not hamper the operation of the plant.

So, this stock yards are provided like this and these are the stock yards, generally this type of machine this is called reclaimer stackers, stacker reclaimer these are the machines, stacker is used for stockpiling, reclaimer is used for reclaiming the stock and these are the other system where a few front end loader or wheel loaders, excavators, trucks these are used for the stacking.

And this is for the stacking or reclaiming of the material. Often this type of bins are also provided where the material is directly stored through the conveyor system and material is discharged automatically to the transporting system. So, this type of stacking systems are also possible.

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Nowadays in modern days the automatic loading system are available in which very-very fast and precise loading of the equipment especially the train racks are possible with this system. So, these are the current technologies, here the train racks are loaded by the fronted loader, there automatic loading this type of systems are also available nowadays.

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So, these are the reference we have used for this lecture. We will continue with these lectures in the next class also. Thank you.