Surface Mining Technology
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Lecture 23
Excavation By Ripper - III

Let me welcome you to the 23rd lecture of Surface Mining Technology. We are continuing with the excavation by ripper. This is the third and final lecture of this excavation by the ripper. In this class, we will solve some tutorials. So, let us discuss as in every course we do.

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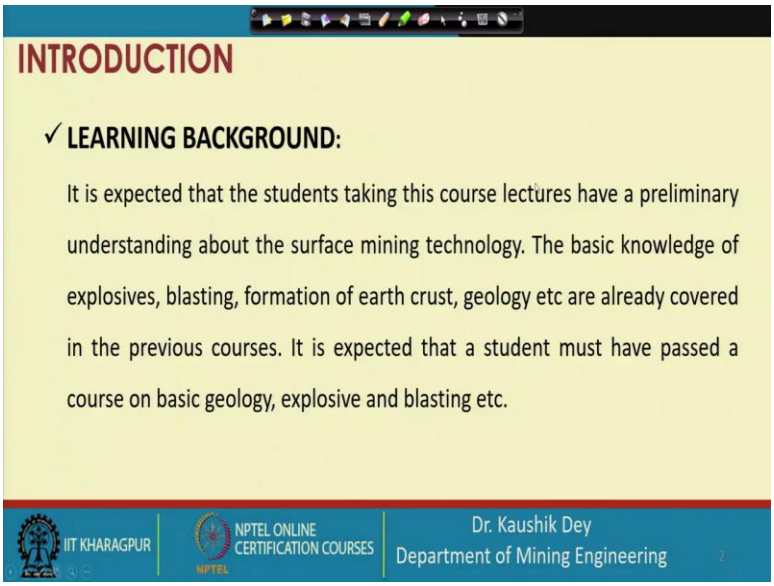

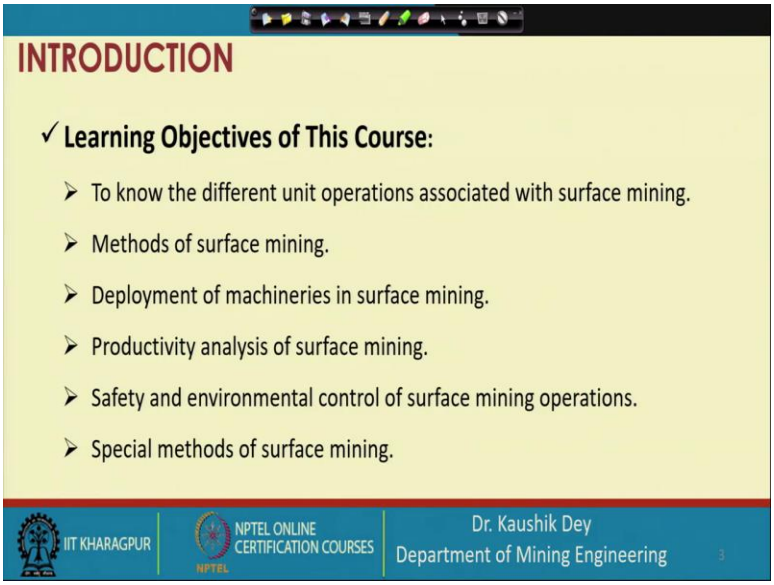

This is the learning background for the Surface Mining technology course, which we expect a student to cover before attending these classes. This is the learning objective of the surface mining technology course.

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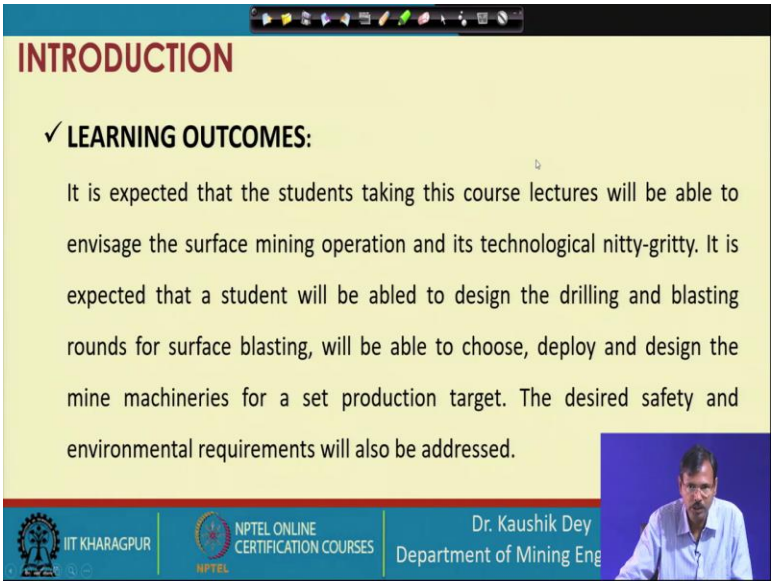

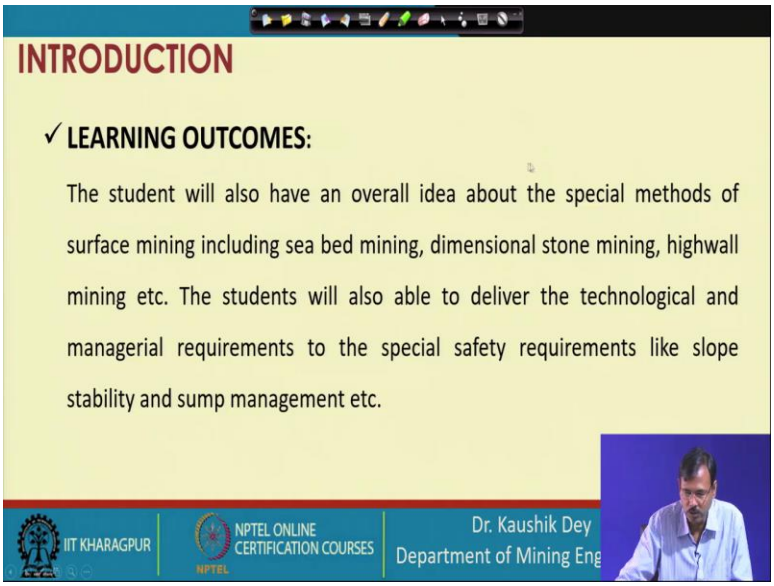

And this is the learning outcome we are expecting from a participant in surface mining technology course, these are few more learning outcomes we are expecting.

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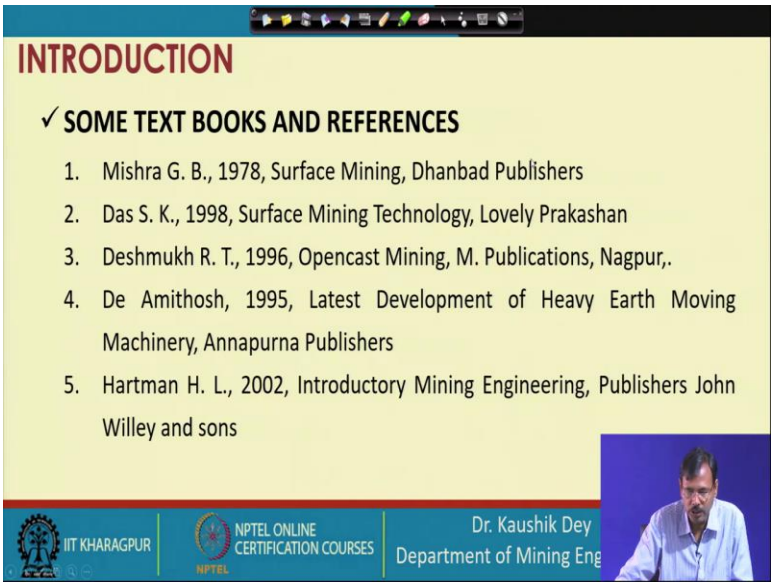

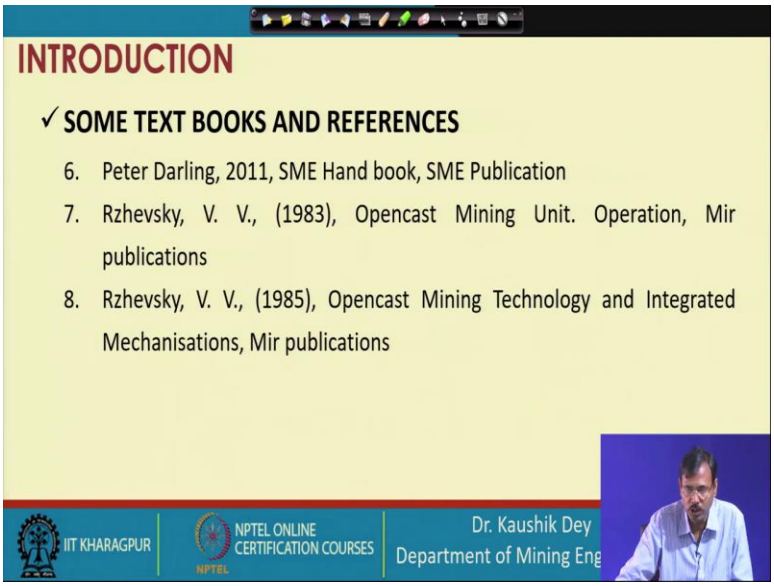

And these are the textbooks and some references. Apart from that, this is expected that the student will go through the or watch the different videos of ripper available in the YouTube and a number of texts are also available with the web sources. In this lecture, we have utilized a number of videos etc. from the YouTube.

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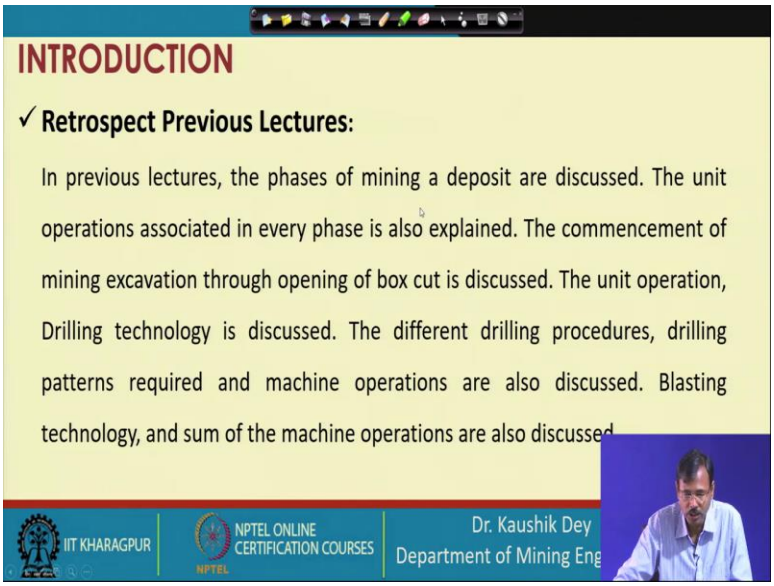

Further, before starting this lectures related to excavation by rippers, we have already covered the current status of surface mining worldwide phases of mining a deposit for surface mining, the different unit operations associated with the different phases are also explained. The commencement of surface mining through opening a box cut is also discussed. The unit, unit operations related to box cut is also discussed. Drilling technology for surface blasting is also discussed. And also, we have carried out tutorials related to drilling, performance and drill cost we have discussed and blasting technology is also discussed for the excavation of the rock mass.

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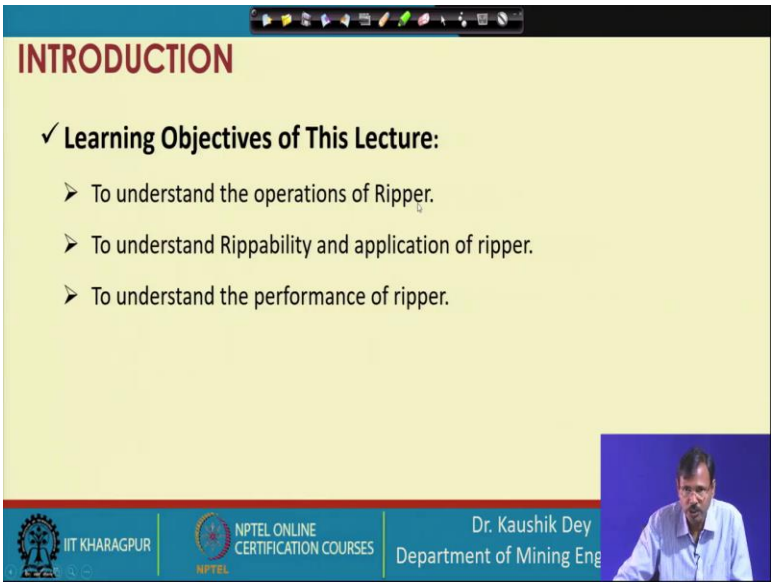

In ripper we have already covered 2 lectures related to that in which all the theory parts, the types of rippers then how the ripper is working Rippability of rocks these are also discussed in these 2 lectures. And in this final lecture, we are, we will cover the performance of the ripper, performance calculation of the ripper.

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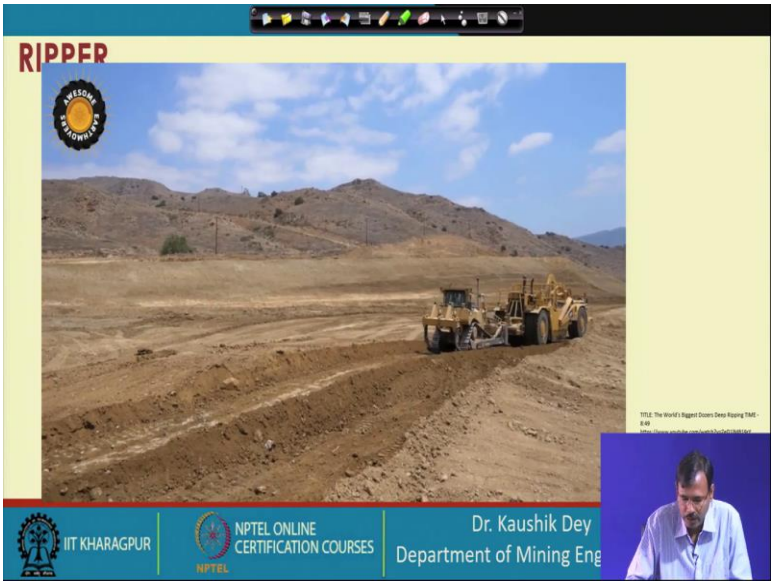

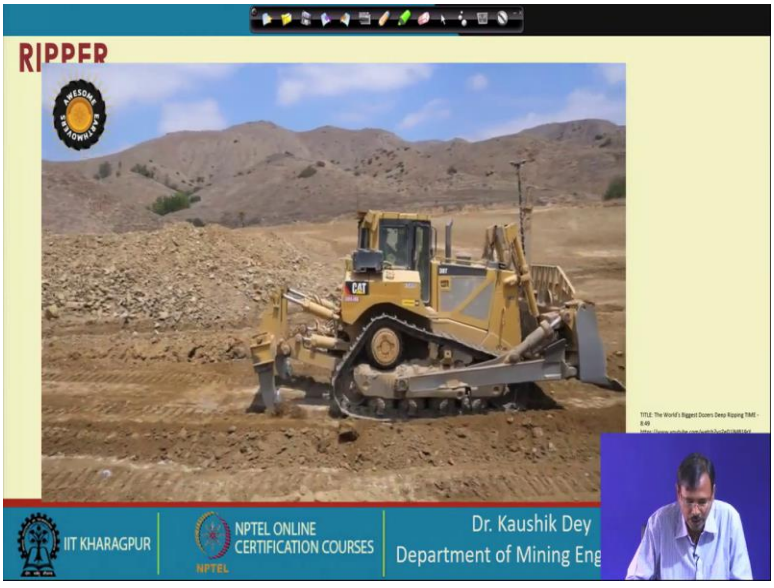

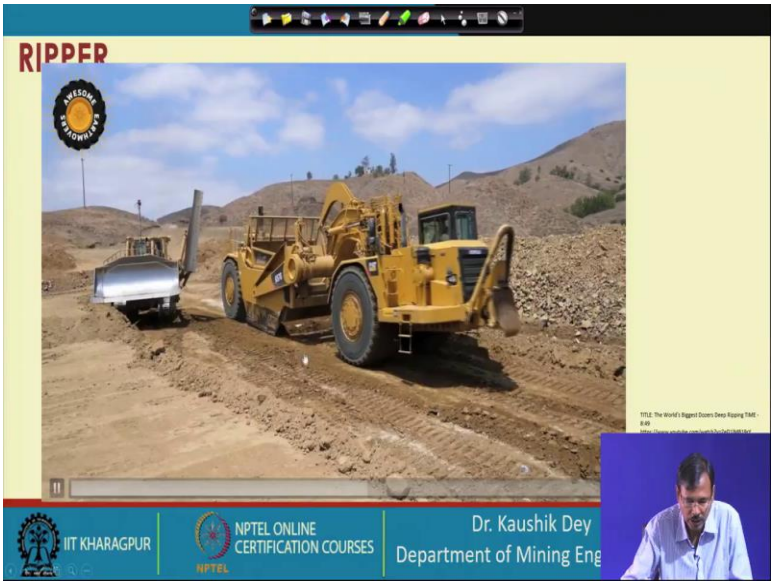

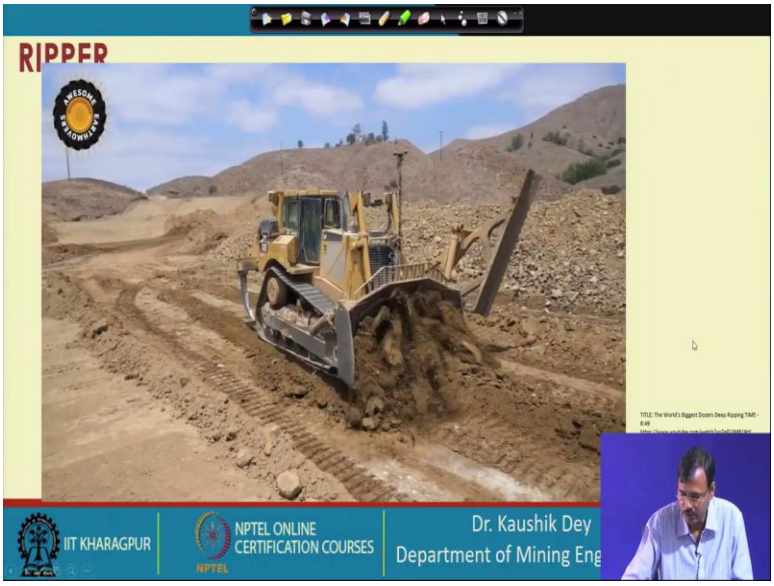

But to do so, let us once again watch this video, this video is already shown you in the first lecture of the ripper, but this video is essentially required, this video is essentially required here to see the working cycle of a ripper. See if you are considering the operation of this particular ripper, this particular ripper is basically spending his some of his time for providing the tendon force to the scrapper, here as it is providing the tendon force to the ripper pushing force to the ripper, sorry to the scrapper, then assign it to the scrapper then it is returning back empty.

This is also unproductive hours, but these unproductive hours cannot be avoided. So, these hours are important, but this cannot be avoided. Now its productive hours are starting it is started to rip

the ground. So now you can see it is started its productive hours. And this is one side rippable, the ground is one side rippable as we have discussed.

So, after this again, you see the unproductive hours but unavoidable hours are started with the ripper. So, these unproductive hours are unavoidable. So, rippers have to travel back empty without ripping so this ripper is empty traveling back now; now it is carrying out the ripping again. So, from the very beginning, whatever we have seen so far, this ripper only utilizes 2 cycles of productive hours, which means it covers two slots of cutting.

So, the first slot is already caught, the second slot is completed just now, and now it is empty travel back, but this portion is already covered, and cut is achieved. So, it has to wait until the new scrapper is coming and push that scrapper from behind. So, he has to wait unless and until the scrapper is taking out the material and allowing a free surface for the further ripping it has to wait. So, now, let us push the video a little bit. So, now you can see the scrapper has come. So, it is now again providing the tendon force.

You can see the scrapper plate here, which is taking the material. So, now it is, again, this is an unproductive hour, the ripper is not working, but the dozer is pushing the material. So, as it is, the same machine is utilized differently. So, the ripper cutting is not; ripper cutting is not very effective in this case; only limited hours are utilized for this cutting. So, this ripper must now travel back empty without cutting.

So, the ripper has traveled back; see again it is started. It is cutting a new cycle. So, this is again the productive hours have started, it is returning, and it is starting to cut. So, this part is very important to understand the cycle of operation of a ripper, and this is the dozer utilized to take the material.

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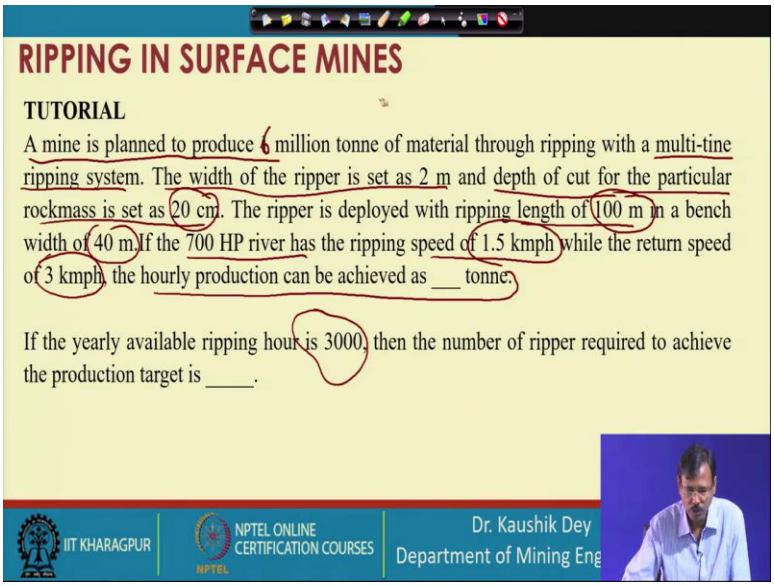

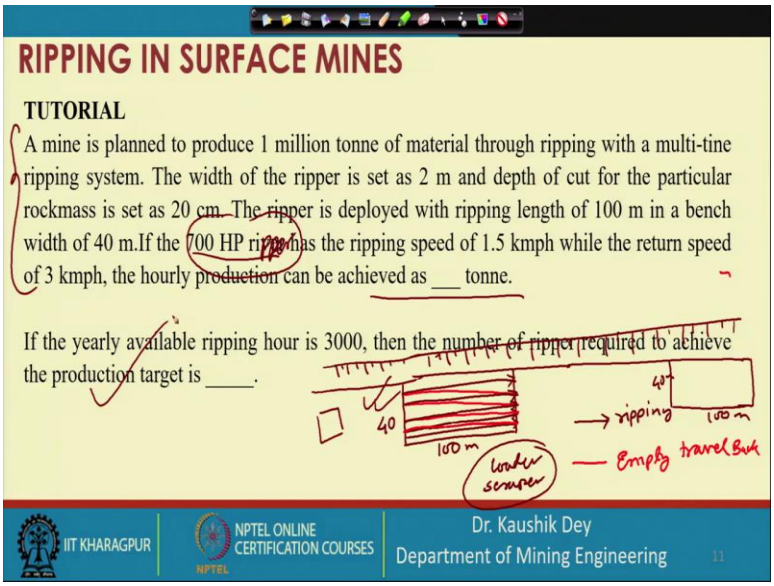

Now, in consideration of this, let us see a problem. The problem is we have to find out the performance of a ripper and consider a mine plan to produce; I think this is 6 million probably, 6 million tons of material through ripping with multi tine ripping system. The width of the ripper is set as 2 meters, and the cutting width and the depth of the cut for the particular rock mass is set as 20 centimeters.

The ripper is deployed with a ripping length of 100 meters, which means the bench height in our video you have seen the ripping width, ripping length we have kept 100 meters and the bench width is 40 meters. The 700 HP ripper has the best ripping speed, considered the 1.5 kilometers,

and the return speed is empty; that is why the speed is higher. So, the return speed is 3 kilometers per hour. Then we have to decide or compute the hourly production that can be achieved, which means hourly reaping that can be reached from the ripper, and we have to find out how many rippers we should keep achieving this target production.

So, we have to understand the problem. In this problem, it is expected that this is mine plan; let us consider, that this is the bench in this bench you have deployed the ripper. So, this is the bench you have deployed. Now, the bench width is 40 meter and you have deployed your ripper for a width of 100 meter. So, when you will rip this one you have to rip this then you have to return, you have to return back without, then you have to return back empty. So, let us consider the red colored is empty. So, this is the empty return this is also the empty return. And these are the, these are the ripping.

So, these are ripping and these are empty travel back So, that means, this is the 40 meter width has to be covered 100 meter length and it is expected after completing this cycle the ripper may be deployed at this position again 40 meter by 100 meter. So, that this will be allowed to be taken by a loader or by a scrapper whatever it is the method of excavation, but our ripper is only deployed in this particular case for ripping this one.

Now, if this is the problem, then we have to find out in this particular case, what is the hourly ripping will be achieved by this 700 HP ripper. So, what will be the production rate will achieve in the next part is obviously understood if the production rate is known, how many the number of ripper is required to find out the, to find out the to achieve this production target. So, this is 6-million-ton production target needs to be achieved.

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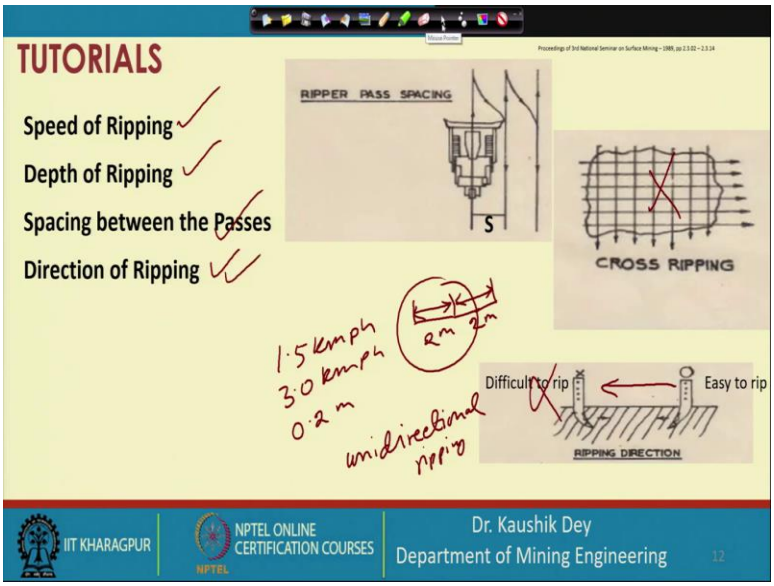

So, so far we have considered the speed of ripping is 1.5 kilometers per hour, empty travel speed is 3.0 kilometers per hour, depth of ripping is 20 centimeters which mean 0.2 meters, and spacing between the 2 passes we have not considered we have considered the width of ripping is 2 meter. So, all these widths will be simultaneously considered.

So, this is 2 meters, 2 meters, and 2 meters. So, that is the width of the spacing. So, cross ripping is not our condition, our condition is that we will ripping in one directional, so our condition is unidirectional ripping. So, we are ripping at this direction, this direction we are not ripping. So, these are the considerations in our problem, and based on that let us solve the problem.

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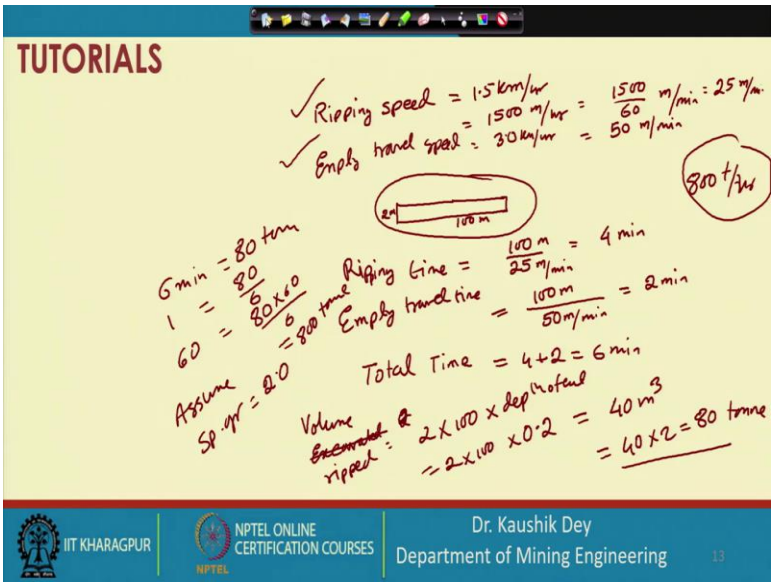

So, this is the blank page kept for the solution. So, our, so our ripping speed is 1.5 kilometer per hour. So, meter per hour, so it is coming 25 meter per minute. Empty travel speed 3.0 kilometer per hour, so 50 meters per minute. Now, let us consider what is the time required for producing or ripping a portion of 2-meter width 100 meters long.

So, if this is the portion then it has to move once and returning back. So, the tine required for excavating this one is one ripping travel another empty travel and the time required to produce this is equal to 100 meters divided by 25 meter per speed per minute. So, that is equal to 4 minutes. So, this is ripping tine. Now, if it is considered, what is the empty travel time then it is 100 meter divided by 50 meters per minute. So, it is 2 minute. So, the total time required to rip this 2 meter by 100-meter slot is 4 plus 2 is equal to 6 minutes.

Now, what is the volume we are excavating at this? So, the volume excavating in one slice is volume excavated or ripped you can say in other words, ripped is 2 into 100 into the depth of cut so 2 into 100 into 0.2, so that is 40-meter cube. Let us assume the specific gravity of the material is 2.0. So, the what is 40 into 2 is equal to 80 ton. Now, the performances in 6 minute you are excavating 80 tons and 1 minute 80 by 6 in 60 minutes, 80 into 60 by 6 that is equal to 800 ton.

So, our production from this machine or ripping you can achieve from this machine is 800 tons per hour is the production achieved from this machine. So, the first portion is solved. We know the machine is performing 800 ton per hour ripping who is using this 700 HP motor, HP engine.

Now you can have cost calculation also in the similar way you carried out in the drilling part which it is expected you will cover in your home assignment, but this is not discussed in this class. Now, let us find out how many number of rippers are required to achieve the 600 million tons of ripping.

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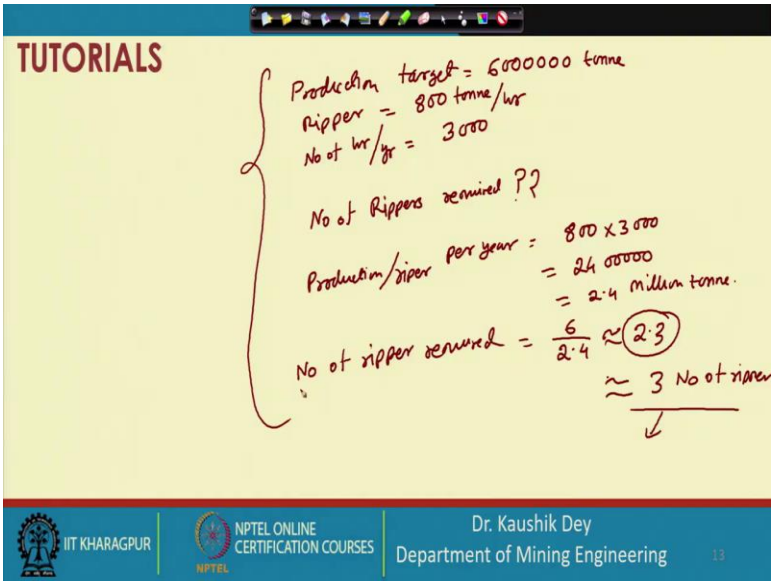

So, our production target is sorry, 6 million ton. So, this is the production target and our ripper performance is 800 ton per hour, number of hour available in the year 3000 this is given in the problem. So, our number of rippers required we have to find out. So, let us see the production we will get from one ripper per year is equal to 800 ton into 3000 hour. So, that means 24. So you can say it is 2.4 million ton.

So, the number of ripper required 6 divided by 2.4. So, that is coming 2.3 maybe. So, as 2.3 you have to take the higher number of that one. So, 3 numbers of ripper is required to achieve the production. So, you cannot make it 2 because that will not satisfy the requirement of the 6 million ton, if you are using 3 obviously, a one ripper will or some of the ripper may not be fully utilized, but you will achieve the production target of 3 million ton per year.

So, I believe now, you are able to understand this problem, but there are n number of different applications of this, our key point was that we have assumed this is carried out by a unidirectional ripping where the empty travel back is met at a speed of, at a speed of 3 kilometer per hour in an empty travel back mode.

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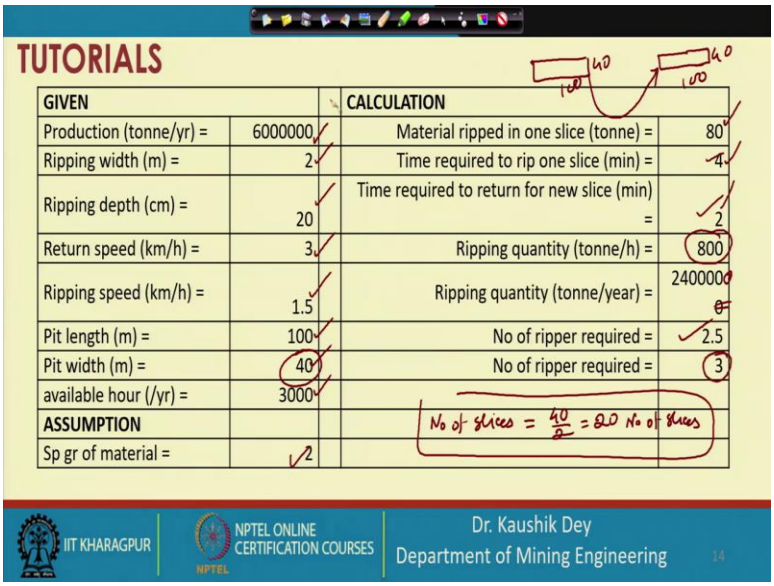

So, this is the calculation that I have made. So, this is the requirement, this is the ripping width, ripping depth, ripping return speed, ripping speed, pit length, pit width, available hour and this is the assumption. Now, this pit width is not utilized in this problem, but the number of slices taken for one place is 40 by 2 which means 20 slices are taken at each bench.

So, now, if something is given that after this to move to this slide, this slot to take this 40 by 100 area again 40 by 100 area, then the sometimes is required then that time has needed to be incorporated here or it may be possible if you increase the length from 100 meters to another meter what will be the benefit that can be also incorporated there.

So, all these facilities are available, but this is in consideration that we have found this is our material ripped in one slice, this is the time required for one slice for ripping for return back, this is the production hours and this is actually 0 at this position and this is the number of rippers required and this is the number of required for this production. So, these are the considerations the same problem may be considered for cross ripping also.

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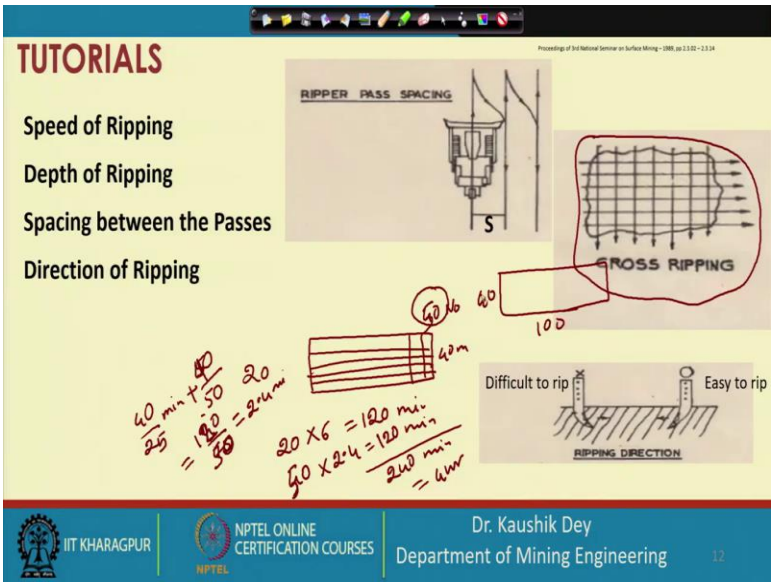

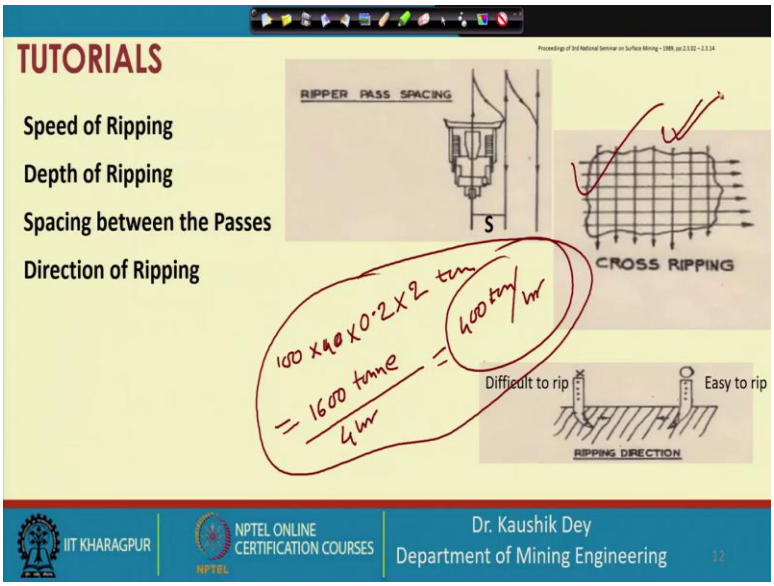

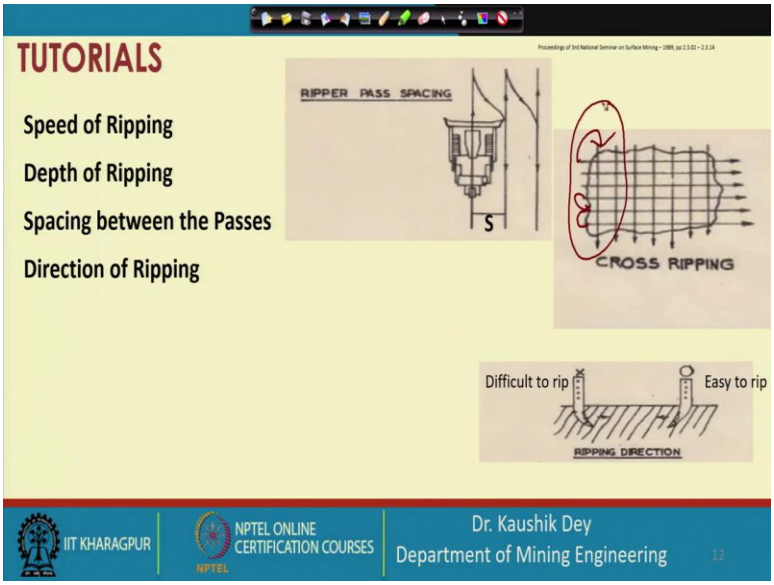

If the cross ripping case, if the cross raping case is considered in that case, the additional requirement which has to be considered is the number of slices you have considered here is 20 numbers and in a width wise the number of slices considered here is 40 numbers. So, the time required for this 20 slice is 20 into 6 which is 120 minutes, and if you are considering each slice of this 40 meter, this is the time required, the travel time required is 40 by 25 minutes and the return time is 40 by 50 minutes.

So, it is becoming 45 by 75 minutes, 120 by 75 minutes sorry, 50 minutes required. So, that is 2.4 minute is the traveling time. So, here you have to go for sorry, 50 slices, so 50 into 2.4 that is also coming 120 minute. So, basically, you have carried out 240 minutes that means, 4 hours to excavate this 100 meter, this 100 meter by 40-meter slice with 0.2-meter depth. So, that is why your production will become, your production will become 100 into 40 in 0.2 and your density is 2. So, this is the ton. So, it is coming 1600 ton.

So, this 1600-ton material is now produced in 4 hours of ripper operation. So, your production per hour is becoming now 400 tons per hour. So, which one earlier was 800tonsn per hour now, is this cross ripping, your production has reduced, and your production has reduced to 400 tons per hour. So, this is a change in your performance if you are opting forcross-ripping. We have ignored here all the setting times from this place to this place, this place to this place, or maybe this place to this place. So, all the setting times are not considered. We have excluded these setting times despite that; our performance has been found to be reduced to half from the unidirectional ripping to cross ripping.

Similarly, your performance will become double, if, instead of unidirectional dipping, you have gone to the bi-directional dipping. In that case, your performance will be doubled. So, these things are very, very important considerations and should be considered while the ripping performance and ripping are calculated based on its deployment and the method of ripping, the performance has to be calculated. So, this is more or less all for the ripping. We will continue our next topic in the next class. Thank you.