Surface Mining Technology
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Lecture No. 10
Opening Through Box Cut-2

Let me welcome you to the tenth lecture of surface mining technology. This lecture will cover the opening through box cut part 2. Part one is discussed in lecture number 9. So, this is you understand that box cut is the first initial cut we are discussing.

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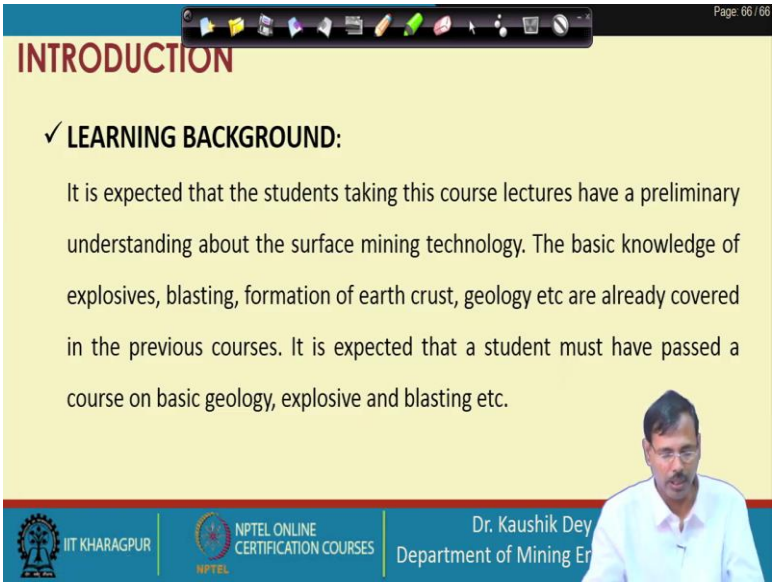

So, as the requirement, let us discuss the learning background required for the Surface Mining Technology course.

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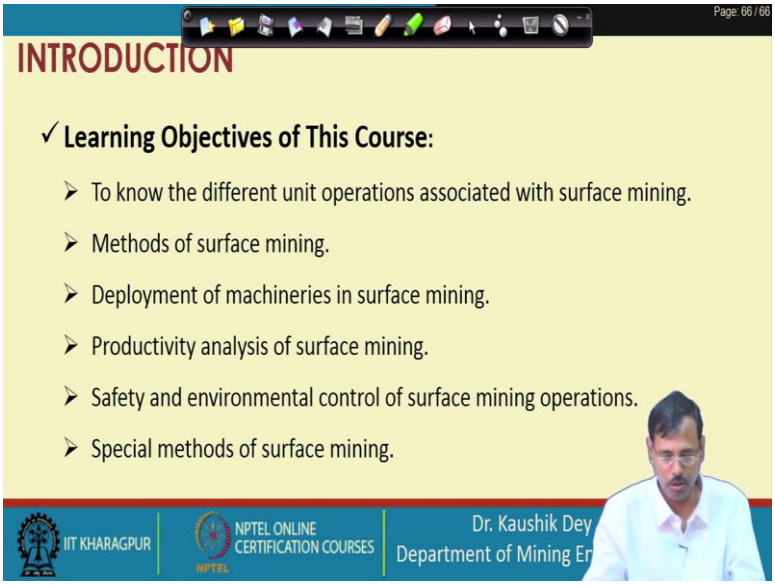

This is the learning objective of the Surface Mining Technology course.

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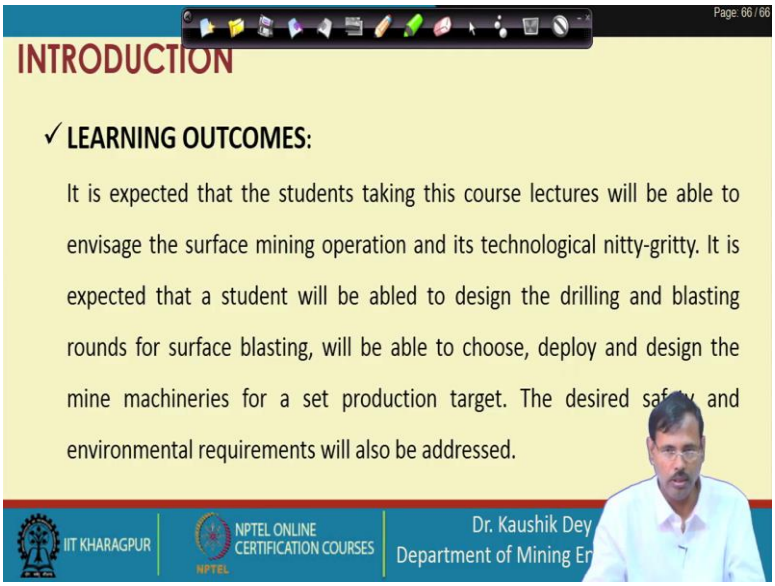

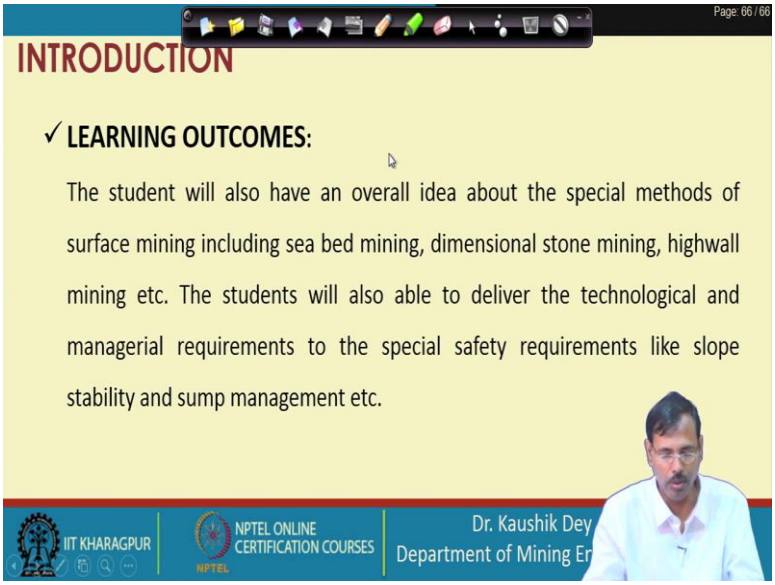

And this is the expectation from a participant who has undergone the Surface Mining Technology course. After finishing this would be able to deliver these things.

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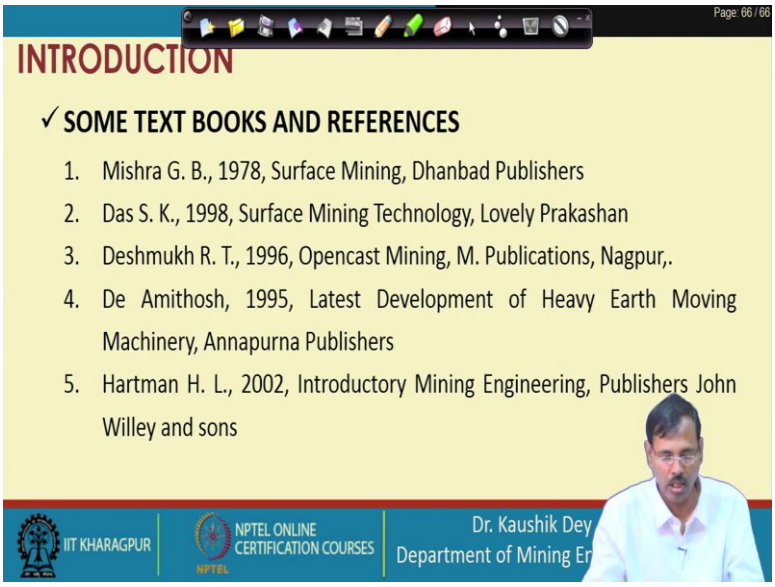

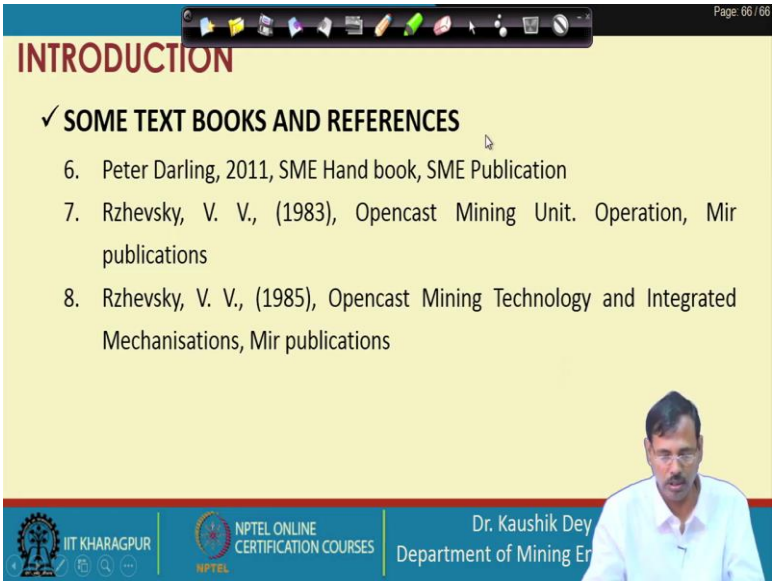

These are some of the textbooks and reference books in general for every class beforehand we show these slides.

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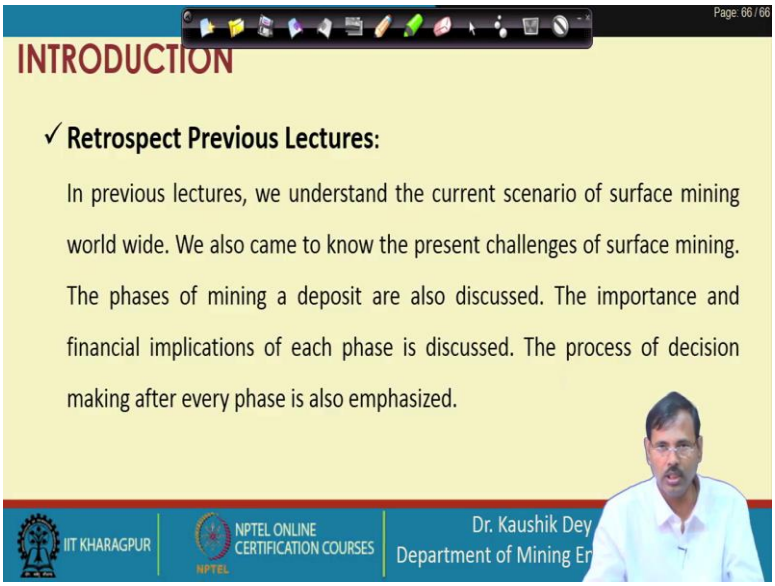

And this is the retrospect of the previous lectures. We have already covered up the introductory part. And in the introductory part, we have covered the general idea about the surface mining. The status of surface mining worldwide, we have discussed the phases of surface mining, we have discussed the stripping rescues, and in last class, we have started the opening of surface mines using box cut.

So, that is the first mining excavation carried out in surface mining. So, we have discussed what a box cut is. We have discussed how we will decide the location of the box cut. And we

have discussed if the box cut is carried out in the hard rock how the blasting should be carried out in the box cut in the previous lecture.

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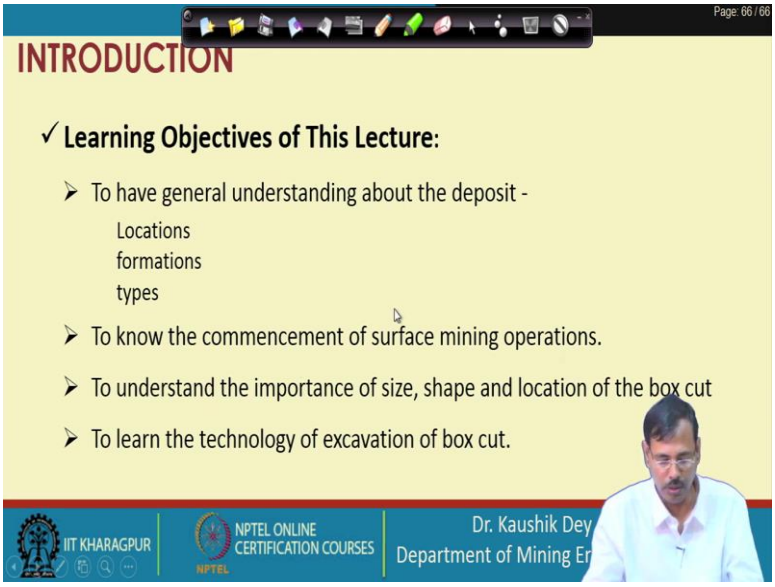

So, in this lecture, we have remained objective is same. So, in this lecture, basically, we will start the understanding about the sidestep of the box cut. And technologies other technologies required along with the volume calculations.

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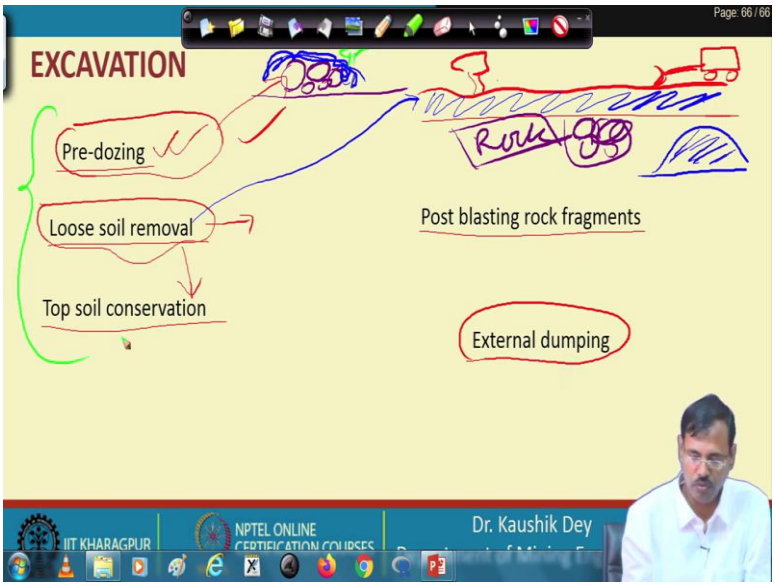

So, as we discussed, when deciding on the excavation system, if it is the hard rock, we have discussed that the blasting must be practised. But if it is a soft rock, we have to go for the pre dozing, then the loose soil removal, we have to go for the conservation of the top soil. And if

the blasting is carried out, the blast fragmented rock marks have to be excavated. And obviously, as it is a box cut, I have to go to dump the material outside the mine.

Now the first part is pre dozing. Pre dozing is basically defined as the top soil or vegetation cover, and we have to remove that one. So, we do not want the vegetation cover to be mixed with the rocks and soils, and that will remain there. Because that is hazardous, we do not want that. So, whatever is the top vegetable cover and that part has to be removed using the pre-dozing, and that is dumped separately in a particular place.

So, once the land is acquired for the mining purpose pre-dozing before excavation, the pre-dozing of the top surface is carried out to remove any vegetation at the place. Obviously, if there is any structure available, those are required to be removed from those areas before the excavation is carried out. After the pre-dozing, the next job which is required is called top soil removal.

Top soil where the vegetation is grown that is considered the very fertile soil and has to be restored has to be conserved. So, that can be used as the top surface when the over burden or non-fertile materials are dumped above that this soil can be used for the future growth of the vegetation. So, what is happening to suppose this is the earth crust and say that some vegetation growths are there.

So, first, we go for dozing this one to remove this top vegetation cover. Then this part then up to this part which is a top soil. this top soil part has to be taken out, and this has to be restored in someplace. So, this has to be restored in someplace separately below this part is rock. So, this is not fertile enough. We have to drill it, blast it and make it fragmented. Then, what will happen? This part has to be removed.

So, suppose this portion of rock material is dumped at this position. And above this, we can dump these soil covers and allow the vegetation's growth at this place. So, that is the basic idea of these first three one. These are very, very important and that has to be practised. And after that, we will go for fragmenting the rock and go for their dumping.

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So, you can see this is the pre-dozing. The first is pre-dozing and top soil removal. Then you can see the conservation of the top soil. The top soil is dumped here and allows its conservation. This top soil is dumped at this position, and we are allowing it conservation we are providing the moisture or water. And so that vegetative growth can occur here. Then, we go for drilling and blasting. The first drilling and blasting is carried out here.

After blasting this one, we go for removal of the material and dumping that onto the dumper. And finally, we have completed the excavation of the box cut. So, whatever material is coming out we have to dump this some outside area we have to dump all this excavated material.

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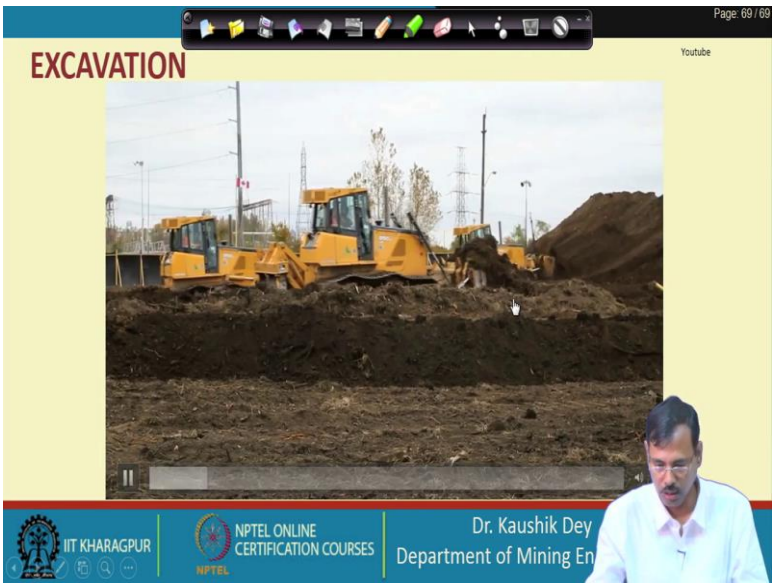

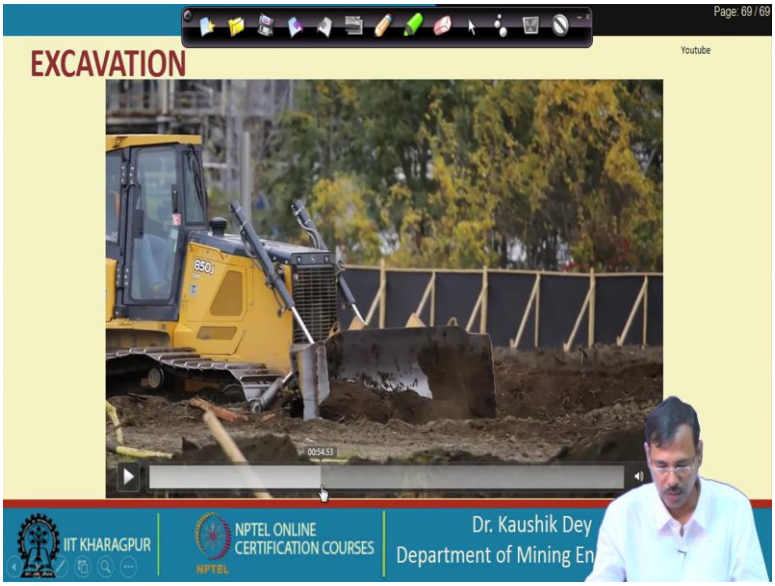

So, this is a video you can see. This is the top soil removal and its conservation. You can see this is the pre dozing is carried out to remove the vegetation. And this is the top soil is being removed, and it is conserved here.

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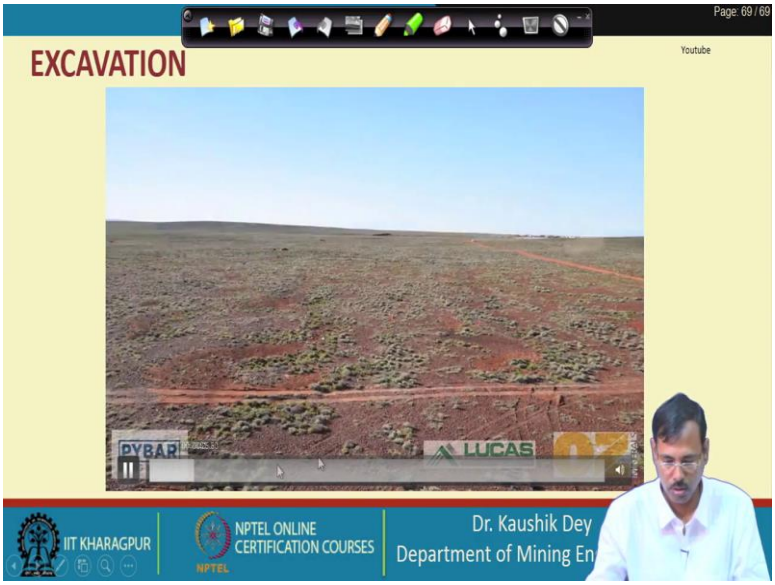

So, you can see this is the ground where the mining is proposed. This is the vegetation and top soil is removed. Now the box cut formation is started. So, this is the excavation is carried out this is the ramp is made. And this is the way we are carrying on now the drilling and blasting is started and we have carried out the construction of the box cut at this position.

So, gradually it is extended, and the machines are working, the ramps are reconstructed. So, all these operations are going on in this place. So, this is the way we should carry out see the when we are carrying out the box cut at this position, and you can see the top soil removal all this vegetation removal all this is carried out in the outside also. So, gradually, we are cutting it out formation of the box cut.

And box cut means that you are not excavating this at one point. Basically, gradually you are excavating the box cut, but the complete area is box cut is called in a sense that the box cut must accommodate a complete mining unit inside it. So, this is the complete mining units system is established here.

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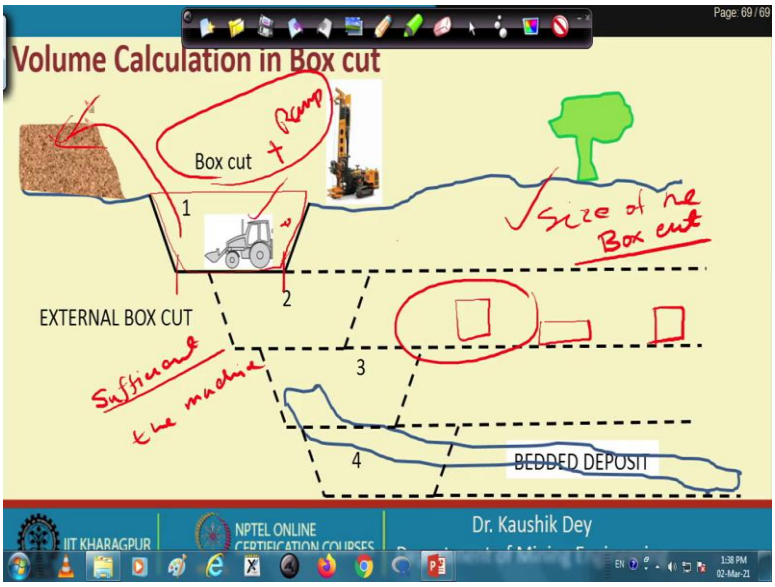

So, now let us discuss about the volume of the box cut excavation. What is this? This is the box cut we are considering. And what should be the volume of rock because the volume has to be accommodated here. And what is the volume of rock we are taking out from this box cut. For understanding this volume of rock, we have to understand the size of the box cut. What is the size of the box cut?

The size of the box cut should be sufficient to accommodate the machines. Now I have already told you accommodating machines means you have to provide the area to that machine for its operation. That means if a shovel is working at this position, you have to allow its area so that in which the shovel is working. You have to give a space for the dumpers to stand. You have to give a space for the drill machine to work here.

So, all these are the required area to be provided in the bottom of the box cut. So that means box cut is the size in which you are accommodating your one typical mining system one unit mining system in that area. So, whenever you are discussing the volume to be excavated by a box cut in the time you are deciding the size of the box cut, you are accommodating a list of missionaries in that box cut for their operations, plus there is a ramp provided.

So, box cut plus you are providing a ramp as the access to the box cut and that is the volume you have to sift from the box cut to the outside. So, we will calculate this one. And for this calculation, we will see how we are carrying out the calculation here.

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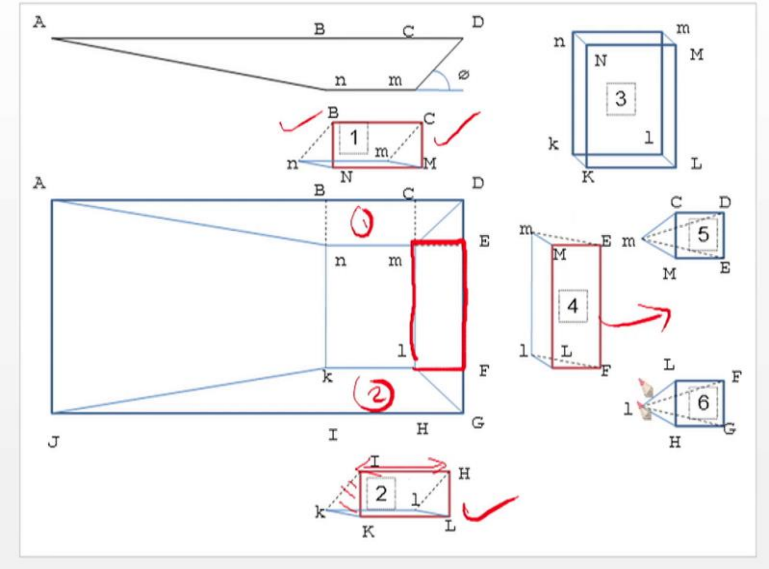

So, this box cut this figure is I have already shown to you this is the box cut as you cannot see the plan view let us come to a lower size display. So, this is the sectional view this is the plan view. So, you can have this is showing the slope. So, this is showing the slope. So, if you are taking out each point, let us look into this one by one. The first one is giving us the idea of this one.

You can see this capital B capital C and this small n m this is the face we are looking at here, which is a slanted face. So, this face we are observing at this position. So, this is the face we are observing at this position. This part we have already excavated. That means this face is already excavated. This face is this face, and this face lower face this part is excavated.

So, it is you can see it is basically a prism and you can easily calculate its volume. Volume of the prism using the formula available in the geometric. So, a similar face is available at this position. So, if this is 1, this is 2 so the volume calculation formula for these are the same. So, this is the volume of this side multiplied with this length is the volume of this one. Similarly, you can have a volume of this part which is given in 4 that is also another prism.

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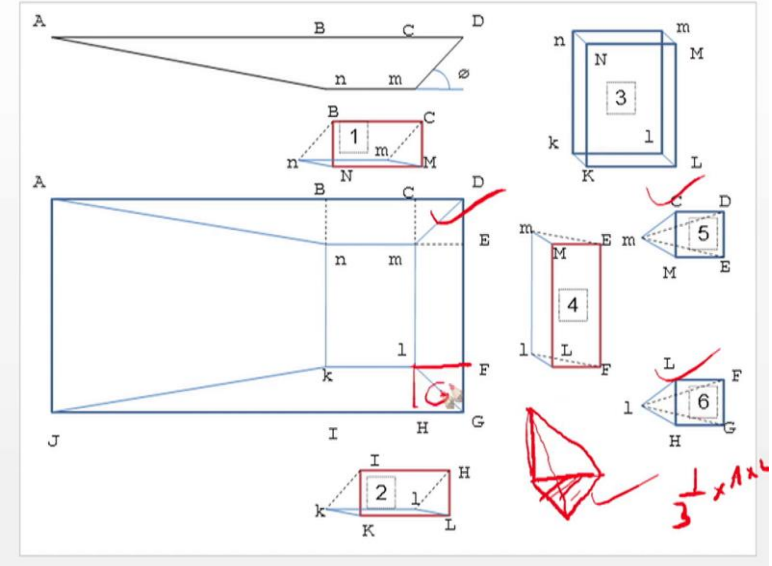

And this slanted face this m small m capital E capital F and small l. So, this face you are looking at this position, this slanting face. This vertical face is already excavated here also the hollow formula is known to you. The centrally this is a cube or you can say the parallelepiped is excavated. You know the formula is the multiplication of all the sides. This is the formula of the volume this is centrally at this position.

And if you look into this small part which is nothing but a pyramid typical pyramid. But in this pyramid, this is only the vertical surface. So, that means the point capital M small m, capital M small m is the vertical surface so arrestor like this. So, you can consider let me redraw it again. So, this is the vertical one, and rest are basically the slanting faces which is the right combination of this one.

So, this is also, you know one third A into h. The A is the area of this one and this one and this one is the same that is for this part this is the 6, this is 5. So, you can calculate the volume for all these. Let us look into this ramp part now.

So, if you are looking into the ramp part. In ramp part, this portion if you are looking at this. This is divided into three-part. One is we are considering this is completely excavated up to this top part first. Then whatever is additionally available here, we have to deduct that one.

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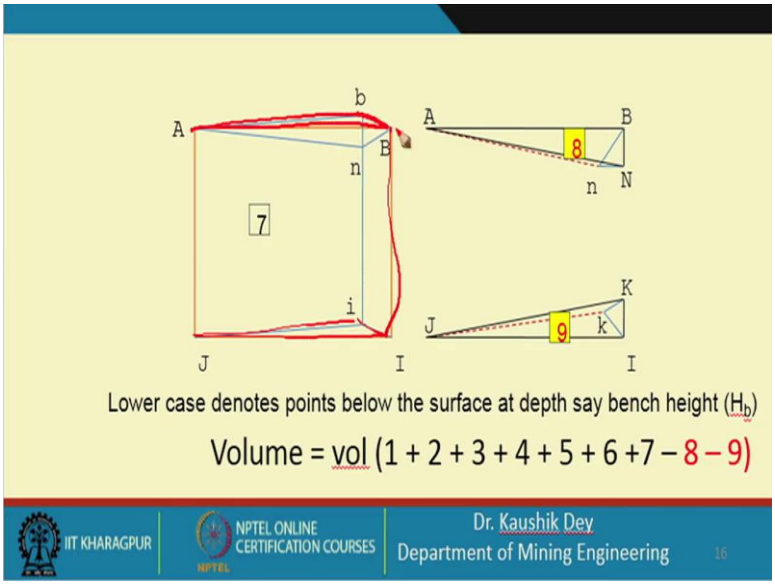

So, what we have considered in this case. We have considered that the complete ramp is excavated, which means this part and this part is excavated. So, volume is considered again if you are looking at this. This is similar because this is this part is vertical.

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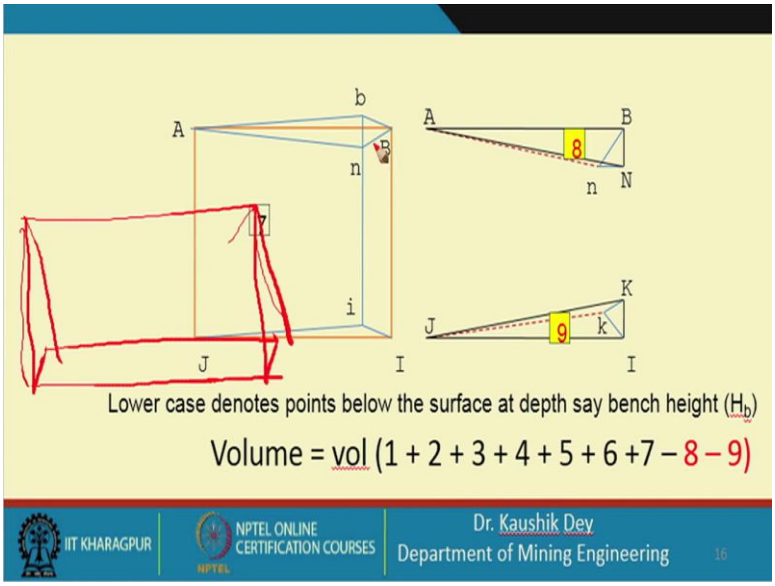

So, let me extend this one. This is this face A B I J, and there is a little bit of extension here and we have taken it out like this. So, this is this shape and you understand this is this area. We have to take this volume into this by minus divided by 2 you will get this complete area. So, you have to multiply with this and if you are divided. So, a half of this parallelepiped is basically the volume of this one.

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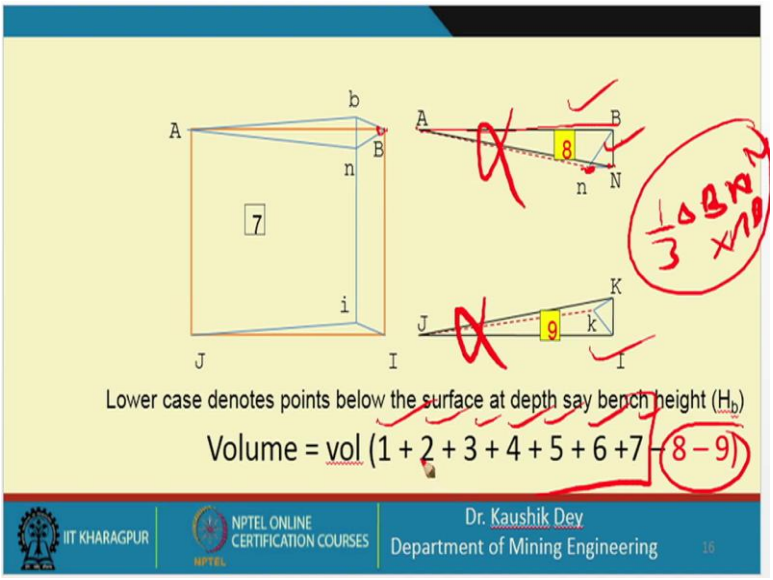

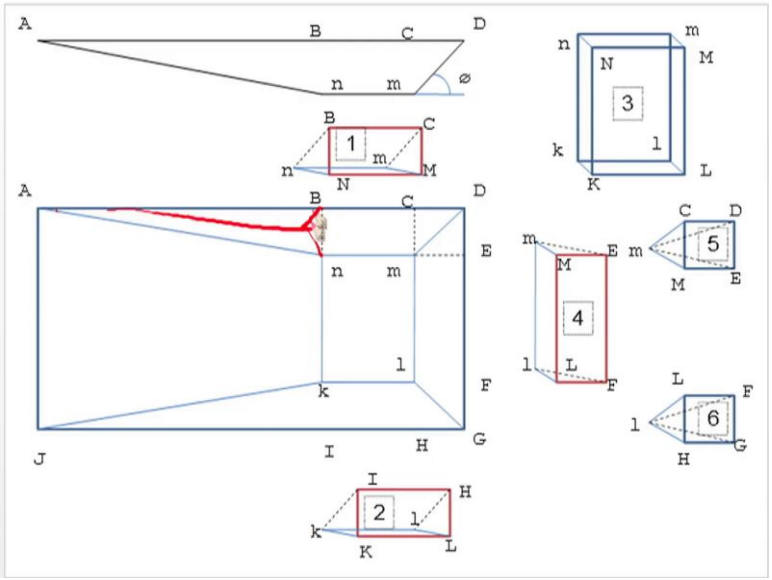

You can calculate in the 7, but this face has this B part not excavated. It is excavated only up to a small n part. So, the above small n is not projected. So, you can see this small n up to this is excavated. Here you can see the small n is the existing one small B is not excavated, which is small b is somewhere here which is not excavated in this figure. So, we have to this is this wall this portion volume is not excavated.

So, we have to find out the volume of this one again. This is a pyramid, and this is the capital B is this point, this is the small n, this is the capital N, and this is the A part. So, this is not excavated here. So, that volume we have to calculate which is nothing but the one third the area of B, b small n capital N and the height AB. If you are calculating this one this 8 and 9 are similar that you have to subtract.

So, the total volume can be calculated as the summation of 1 plus 2 plus 3 plus 4 plus 5 plus 6 plus 7 and this 8 and 9 you have to subtract from there. Because in 7 you have considered this is this excavated but actually it is not excavated. But if you really think that this volume is not that much significant. So, you can deny that one and you can consider up to this is also pair accuracy will get if you are not considering this one also.

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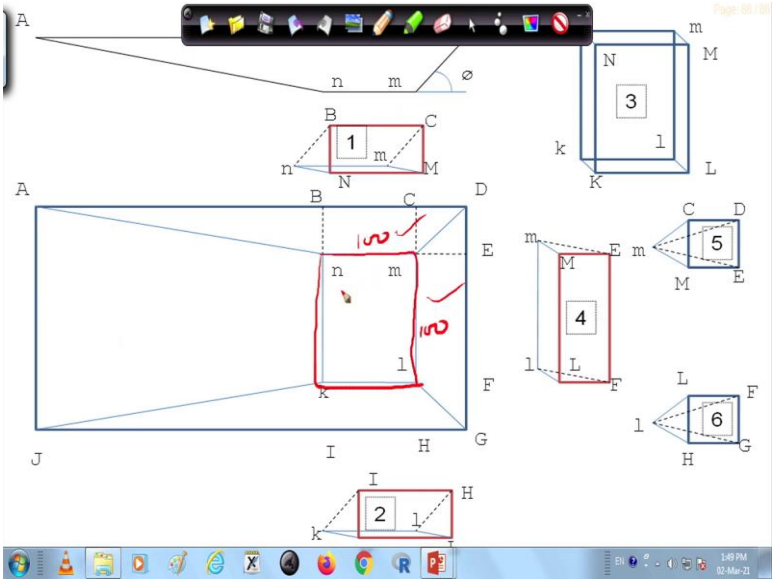

So, if you are considering the length and width required at this position, there is a chance that. The length and width required at this position is 100 meter by 100 meter. Say we need 100 meter by 100 meter box for operating our machine this is the size of the box cut we are considering 100 meter by 100 meter if this is the size of the box cut we are expecting. Then now volume if we are trying to calculate accurately, then what will be the volume.

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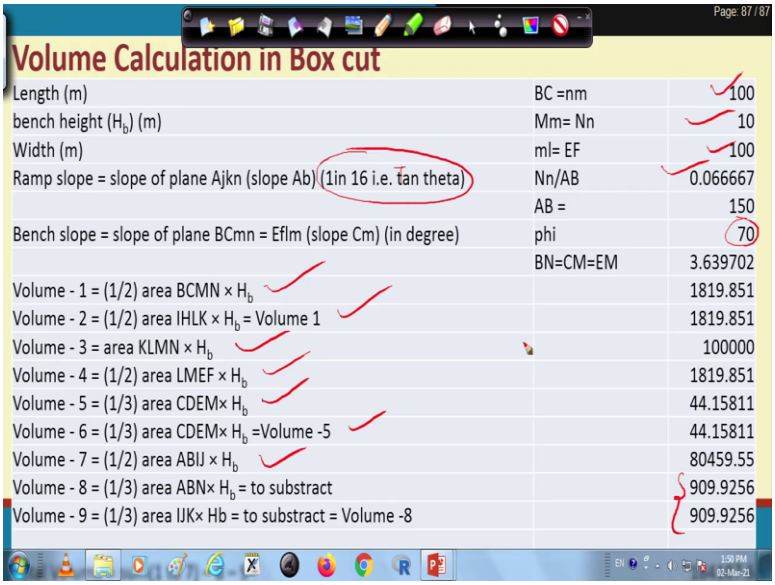

So, in this problem we have tried to find it out. So, this is the box size. This is the bench height we have decided. And these are the angles ramp angle we have considered 1 in 16 that is tan theta. So, we have considered this is the tan theta value. And when slope angle we have considered 70 degree.

So, with these considerations, we have determined these values volume 1, volume 2, volume 3, volume 4, volume 5, volume 6, and volume 7. So, volume 8 you can see it is only 900 cubic meter. So, it is 2000 cubic meter, and altogether I think the total is not coming let me escape from here.

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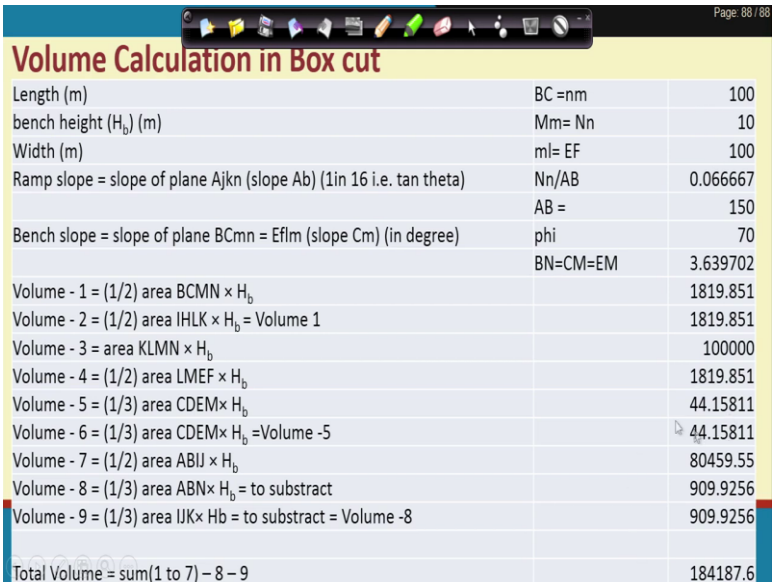

So, we have to add. So, this is the total volume it has come. So, total volume it has come a 1 lakh 84000 meter cube. So, this 2000 meter cube to 1800 meter cube is not significant enough in this. So, you can fairly approximate it is not comprising event 2 percent of the even 1 percent it is not even 1 percent of the total area. So, if you are not considering this one then also you are fairly estimating the total volume of the box cut.

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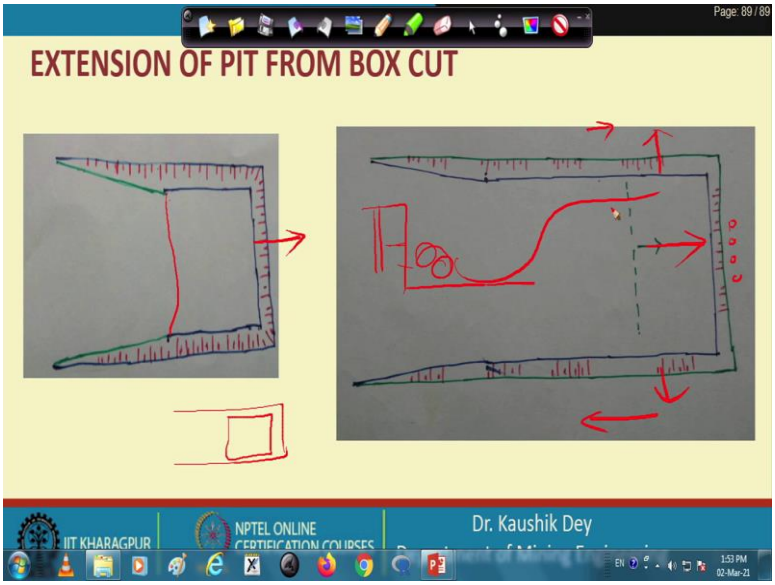

The next important part is that after box cut, we will proceed. So, I am presenting here some hands sketch to see. Say this is the box cut here. So, you can see this is the box cut, and this is the box. So, this is the box and you have to then go for after this box cut you have to extend your pit gradually. So, what you do initially, you extend from this towards this direction.

So, you can extend in this direction, and after this extension, you can go for the further extension towards this direction and this direction. And then you gradually proceed towards this direction. So, in general, you are gradually moving or extending your pit and in this case, for all the cases, say this if you are looking into the sectional view. After this one you will go for drilling this one so you will carry out the holes at this position.

And then you are blasting this one. So, it is gradually extending like this way, and you are taking out the material from here through the ramp to the outside. This is the reverse way I have drawn it.

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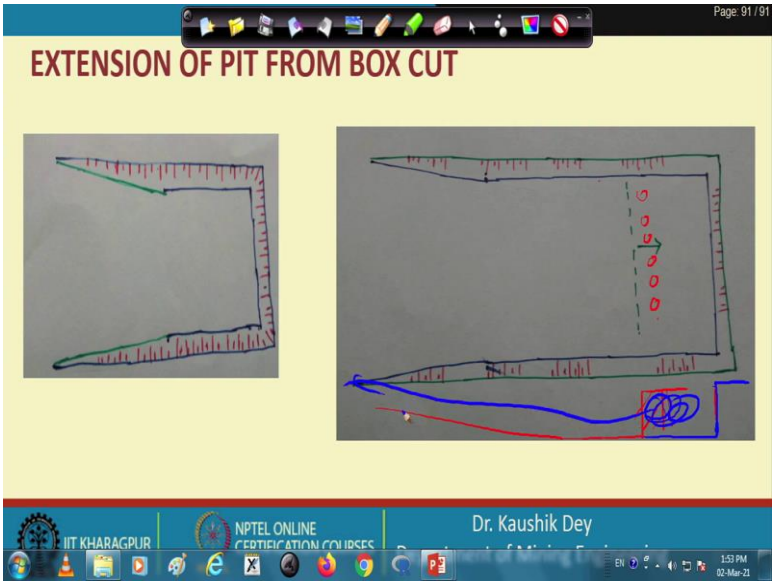

So, if you are considering this. This is the bench. Let me do it share it itself. This is the bench. So we have drilled at this position. So, these are the holes we have made, then we have blasted this one so up to this is blasted. So, this portion is blasted this is the new face and whatever is the fragmented rock, that rock is taken out through this ramp. So, this is the extension. This extension is further continued.

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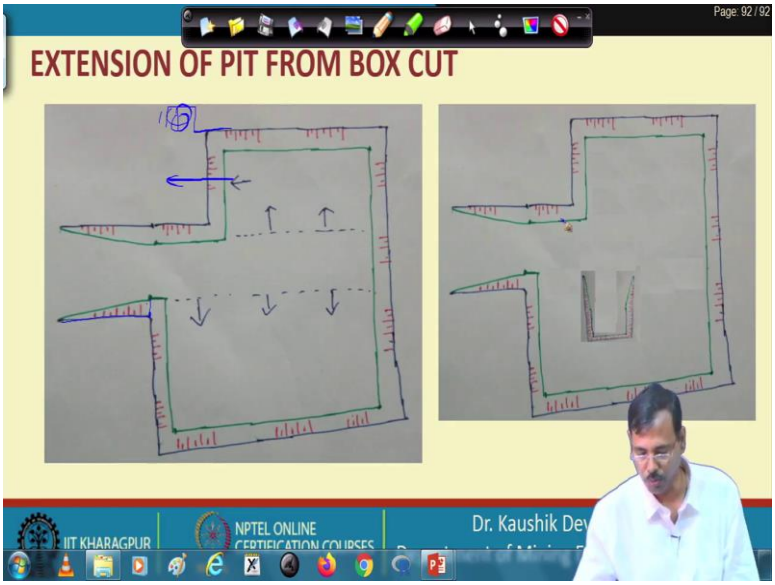

And gradually, you are now expanding towards sideway. And this is the expansion you have carried out in this way after this is expansion you are moving towards this. And this is the excavation you have to carry it carry here. So, now your excavation will be like this. So, here

you will excavate this one. So, it will gradually become what will happen from here you are at this position, and you are extending to this.

So, you have reached this position and finally what will happen if you move it out. Then you will go for excavation in this one up to this. So, gradually you are moving out towards this direction.

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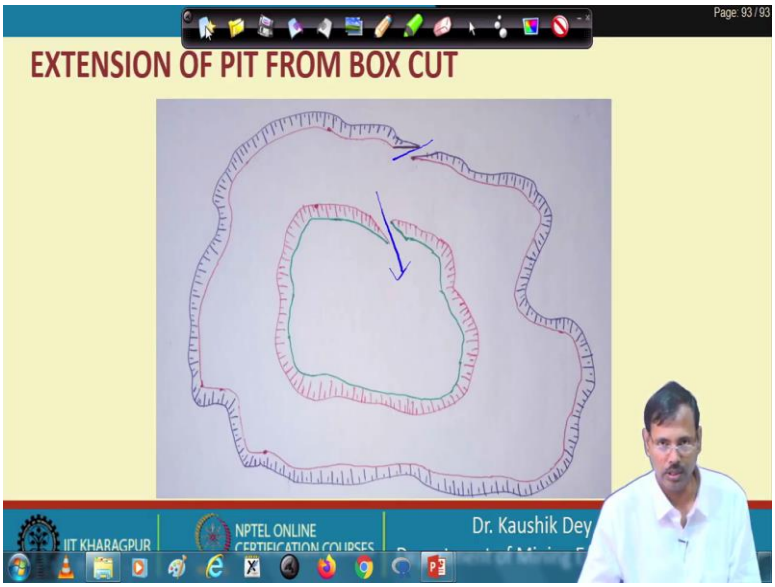

And finally, we will come out with a pit like this. This is your first bench; from this your ramp is moving there. This is the second bench we have constructed. So, after the first bench was made, we started another opening you have created here. So, this is not called box cut but this is the box opening for the next bench.

So, that is carried out. We have discussed this part in your pit layout, which is discussed in the introductory part. So, this is the extension of the benches after the box cut. So, this is the end of the box cut. We will continue with the next topics in the next class. Thank you