Drilling and Blasting Technology
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Lecture - 40
Problems - 4

Let me welcome you to the 40th or you can say it is the final class of this Drilling and Blasting Technology course and in this class we will discuss how you can design an underground blast. So, far we have already covered 3 lectures on different problems. You know how to assess the penetration rate, you know how to calculate the requirement of the number of drill machines, you know what is the what are the difference between penetration rate and drilling rate, how we can access the drilling rate for a particular machine, how we can access the penetration rate for a particular machine rock interaction those are known to you.

After that we have discussed some problems is related to explosive energy. We have discussed already for a surface blast design problem where for a given situation to achieve the desired target production how you can calculate or how you can design your blast for that particular situation is now known to you.

So, this basic problems are basically dealing with the managerial decisions, the execution for achieving the desired production target. So, in this class we will discuss about one problem which is related to the underground blasting. I think you will understand this one very easily.

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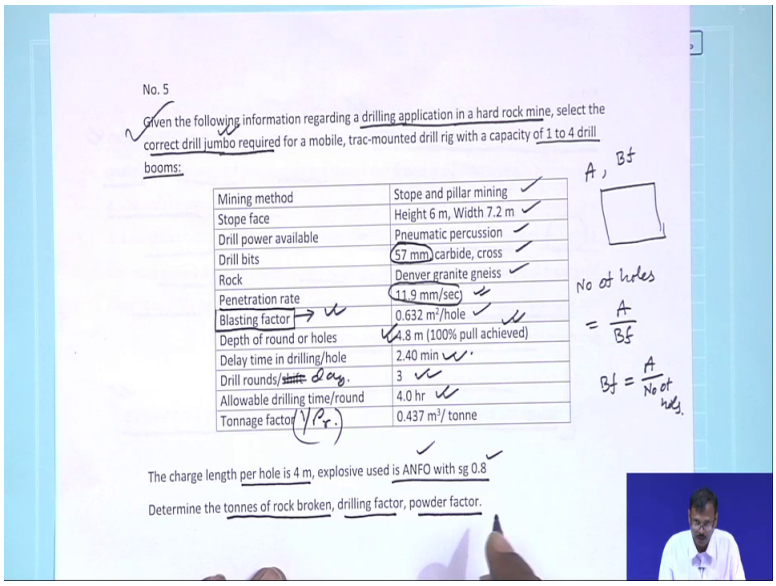

So, let us see the problem given here is about the drilling and blasting application for a hard rock mine. And we need to select a jumbo drill which may have 1 to 4 drill booms. So, how many number of booms are required into that particular jumbo drill we need to calculate, also we need to calculate something related to blasting also. But, prior to that let us see what is the situation, it is stope and pillar mining system. This is a stope face of 6 metre and width of 7.2 metre, drill power is pneumatic, drill bit is given. So, this is the 57 mm is the whole diameter, rock is also given.

Penetration rate is given 11.9 millimetre per second, blasting factor is given 0.632 metre square per whole. So, this is a new term probably you are getting. Basically, I have taken this problem from a book of Hartman. So, blasting factor is basically an American term, this gives you idea about the number of hole required to be drilled for an underground opening. That means, if this is the opening the cross sectional area of the opening is A and the blasting factor is B f, then the number of holes is equal to A by B f, blasting factor.

So, basically for a achieving the desired advance with the desired fragmentation, the number of holes to be drilled in that particular cross sectional area, if we divide the area with that number of holes, we will get blasting factor. So, blasting factor is basically A divided by the number of holes.

So, this is a new term one should know basically this gives us the idea about the how many number of blast holes to be drilled in that particular face to achieve the desired advance and desired fragmentation. Depth of the round that means, the length of drilling is given 4.8 metre. It is also mentioned that 100 percent pull is achieved which is very optimistic. But, let us consider that this may this may be possible also with the favourable rock condition rock mass condition in fact.

Delay timing is in a drill hole is given this one because we need these as you know penetration rate and drilling rate is different. So, to get the drilling rate this is essentially required. Number of drill round per shift is 3, allowable drilling time, allowable drilling time per actually this is not shift this is per day drill round per day is 3. Allowable drilling time is 4 hour and tonnage factor that means, basically the rho r is 0.437 metre cube per tonne.

So, this is basically inverse of tonne inverse of rho r. So, this is giving us so, you can say this is inverse of rho r, tonnage factor 0.437 metre cube per tonne is the rock density.

So, it is also given charge length per hole is 4 metre, rest part is the stemming and specific gravity the hole will be filled with the ammonium nitrate fuel. So the specific gravity is 0.8 and so, is used as the main explosive and it is we need to determine the quantity of rock which is broken, drilling factor and powder factor ok. So, this is our problem, so, let us solve this problem. So, as per this first we need to calculate the drilling.

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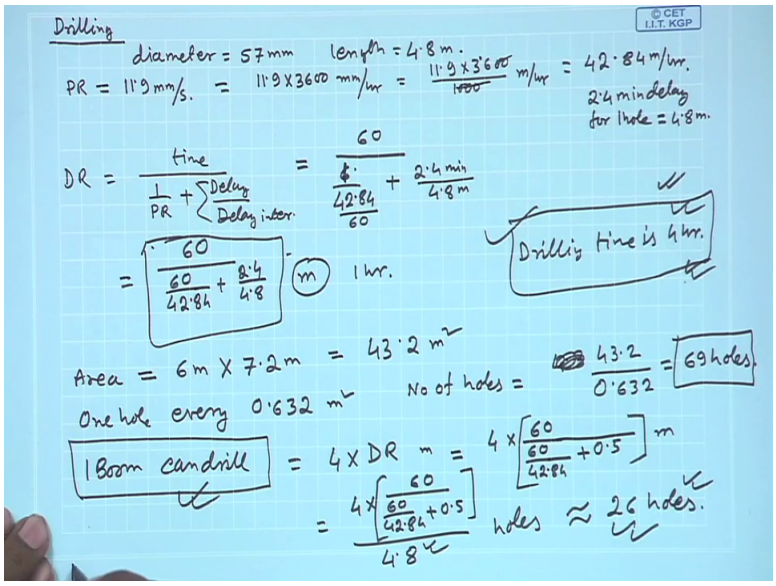

So, our penetration rate is given. So, we need to calculate for drilling. In drilling our diameter is given 57 mm, length of drilling is given 4.8 metre, penetration rate is given as 11.9 millimetre per second. So, we need to calculate the drilling rate. So, for calculating drilling rate we know it is the time by 1 by penetration rate by delay, delay interval. So, this part is already summed, so, prior to that let us convert this 11.9 penetration rate 9 millimetre per second into some convertible value that is let us 11.9 millimetre per second let us convert into hour.

So, in 1 hour there are 360 3600 seconds are there. So, this is millimetre per hour. So, if we convert it in to metre, so, this is 11.9 into 3600 divided by 1000 metre per hour. So, on calculation we are getting it is 11.9 into 3.6 because, this will be cancelled and there will be a point here. So, this is if you are multiplying this one you will get the value of 42.84 metre per hour.

So, this is the penetration rate, now let us calculate it for the given dealer. you can get this is for 60 minute, then penetration rate is 1 by 42.84 metre per hour that to convert it into the minute we have to divided by 60. And then convert it the delay for 1 whole delay it is given 2.4 minute, 2.4 minute is the delay for 1 whole; that means 4.8 metre. So, delay is 2.4 minute delay interval is 4.8 metre. So, this drilling rate equation is basically can be represented by 60 by 42.84 plus 2.4 by 4.8.

So, if you solve this one you can get, so, some value you will get let us not considered about the value at this point ok. So, this is the drilling rate we can observe. Now, what we are carrying out? we need to drill how many holes let us consider this one. So, the area is given to us as the 6 metre by 7.2 meter. So; that means, the cross sectional area is coming metre square and we need that we need to drill one hole must be drilled in every 0.632 metre square.

So; that means, the number of holes required to be drilled is sorry 43.2 by 0.632 is equal to 69 holes. So, this much meterage of drilling we achieve in 1 hour and also it is given that the allowable drilling time is 4 hour. So, our 1 boom of 1 machine can drill 4 into drilling rate that much metre in 4 hours ok. So; that means, it can drill 4 into 60 by 60 by 42.84 plus 0.5, 0.5 this is the penetration rate this much of metre in 4 hours.

If you convert it to the holes you will get 4 into 60 divided by 60 into 42.84 plus 0.5 divided by 4.8. As this is the length of 1 whole number of holes. So, if you solve it you will get it can drill 26 holes can be drilled by 1 boom of the jumbo drill. So, if your drill machine is of 1 boom jumbo, it can drill 26 holes in 1 4 hour time which is the allowable drilling time for a particular face.

So, that 3 blast round can be carried out in one day considering 4 hours of 8 hours shift is 4 hour for drilling time, rest 4 hour is for charging, blasting and fume dispersion time. So, it can be carried out 4 round in 3 around 3 blast round in one day. So, considering that drilling hour given is 4 hour, in 4 hour 1 boom can drill 26 holes so; that means, for drilling our requirement is 69 holes.

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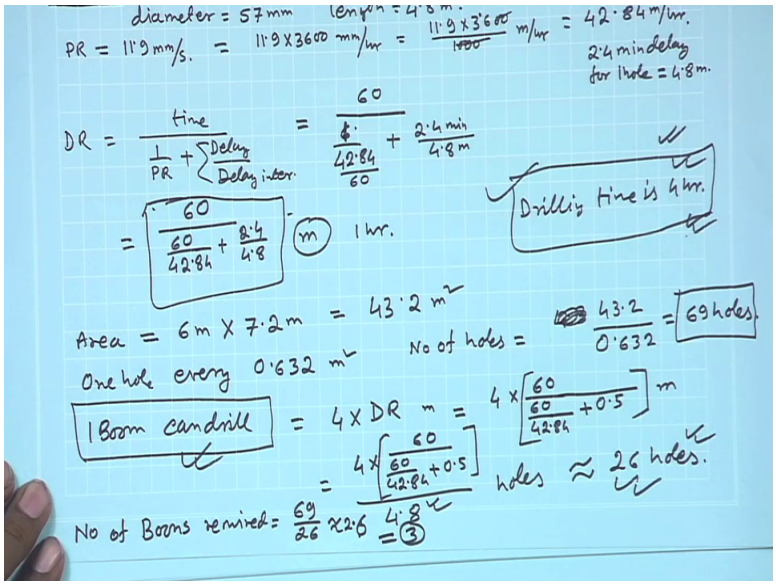

So, drill this 69 holes the number of booms required. So, the number of booms required is equal to 69 by 26 that must be 2 point something. So, as it is around coming around 2.6. So, 2.6 means 2 boom cannot give address this one. So, there must be 3 booms are required in that drill machine.

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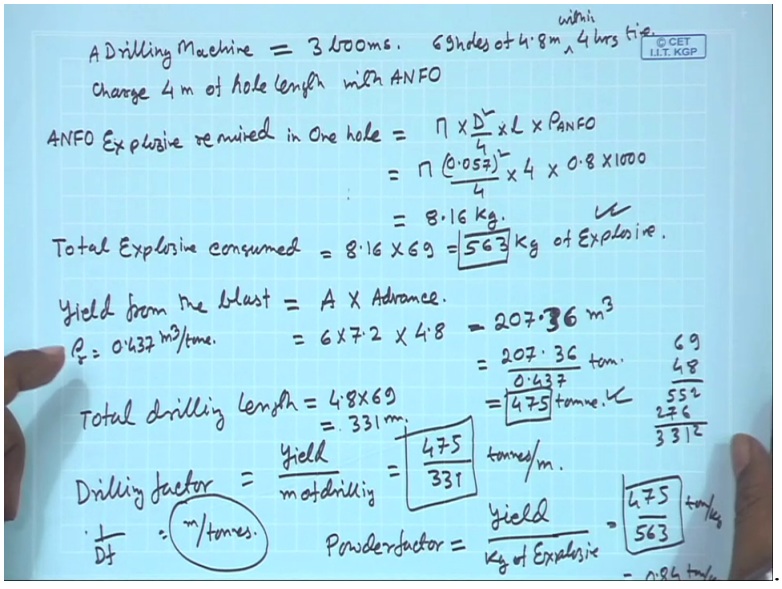

So, in this particular case of drilling we need to have a drill machine is required which should have at least 3 booms. So, that we can achieve the target of drilling 69 holes of 4.8 metre length in 4 hours or within 4 hours time within 4 hours time ok.

So, this is our essential conclusion in this problem. So, let us look into the next part of this. We have to charge explosive, we have to charge explosive in this whole to achieve the, we have to charge explosive in this hole. So, that we can achieve the desired production and it is given that we need to charge 4 metre of hole length with ANFO.

So, let us see how much explosive is will be consumed by this 4 metre length. So, the explosive or you can say ANFO, ANFO explosive required in 1 whole is equal to pi D square by 4 into L into rho ANFO. So, it is pi drill hole diameter is known to us that is 57 mm so, 0.057 metre square divided by 4, the whole length is also known to us, it is 4 rho of ANFO is 0.8. So, to convert it into the kg we need to multiply it with 1000. So, if we compute this one we can understand in 4 metre length the explosive consumed will be 8.16 kg ok.

So, on computation we know that 8.16 kg of ANFO will be consumed in one hole. So, the total explosive consumed total explosive consumed 8.16 into 69. So that means it is coming around 563 kgs of explosive. Now, let us see what is the yield from the blast.

So, the yield from the blast is basically the cross section area and the advance. So, the cross section area is basically known to us 6 into 7.2 metre and the advance is also you have achieved a 100 percent advance; that means 4.8 metre. So, the total rock broken is 207.8 0.36, 0.36 metre cube if we multiply these 2 we can find out it is coming 207.36 metre cube of rock.

So, density is also given to us that is given or you can say inverse of density, rho r is given 0.437 metre cube per tonne. So, if you are converting this to tonne we can get 207.36 divided by 0.437 tonne so; that means it is coming 475 tonne. So, that to 475 tonne is the yield, 563 kg is the explosive consumption and total drilling length is equal to 4.8 into 69. So, that is the approximately it is coming around.

Let me multiply it here. So, it is coming around 331 metre approximately, 0.2 approximately. So, this is the total drilling length they carried out in the face. So, now, drilling factor is basically the yield per metre of drilling. So, that is equal to 475 by 33 331 metre so, this is comes in tonnes per metre or it may be expressed in different metre per tonne also.

So, it may be 1 by D f it is it maybe in metre per tonnes also in the similar way as the charge factor. Similarly, powder factor so, this is the drill factor. So, the powder factor is equal to yield per kg's of explosive is equal to 475 divided by 563. So, this is the tonne per kg. So, it is coming around 0.84 tonne per kg. So, this is more or less the calculation you can carry out for a you can carry out for calculating the drilling factor and calculating the powder factor.

So, this is more or less we have covered the underground blast design part and say you can consider our course is over by this lecture. So, in a in a very short summary I can say after attending the full course you are now able to understand the different types of drilling basic mechanism of the drilling, you can understand what is the rock, how the rocks are formed also.

You are able to understand the what is penetration rate, how the penetration rate may be assessed, how the drilling rate may be computed, if the penetration rate and other application delays are given to you can understand how the drilling can be carried out in different patterns for the surface and underground excavation cases. You can understand the different special types of drilling techniques though those are not essentially required for our blasting purpose. Then also a class of class on that is also covered.

In this course you are now able to understand what are the difference, what is explosive, what are the different accessories, how they are evolved, what are the necessities, what are their properties, how you can test those properties those are also now known to you.

You are now able to understand how the explosive different blasting may be designed for different cases, how the different blast parameters or significant, how they are designed. Then you are able to carry out those blast designs for the trial blasting cases in surface excavations, in underground excavations.

You also know how to assess the different blasting results from the different typical measurements like fragmentation, a fly rocks, ground vibrations, then powder factors all these are now known to you. You can assess the damage you know that special type of control blasting techniques. And you can design the drilling and blasting for any particular type of excavation system required either on the surface or for the underground.

In fact, this is my expectation from those who are attending this course should able to design the blast for their particular requirements. They can do that one, they can assess their result and they can give the best or you can say optimum design for their specific requirements.

So, let me give you best wishes for the examination which you are going to appear after this attending this lectures and so far I understand that you have already attended those assignments also. So, these are already some of the knowledge's you have already covered on that. So, with the best wishes let me say you.

Thank you.