Drilling and Blasting Technology
Prof. Kaushik Dey
Department of Mining Engineering
Indian Institute Of Technology, Kharagpur

Lecture-38
Problems-2

Let me welcome you to the 38 lecture of Drilling and Blasting Technology course. We are discussing about the different problems possible for to be solved for designing and utilization of the drilling and blasting in the actual practical field. Last class we have discussed how to determine the drilling rate if the penetration rate is known to us so, that we can access how much performance we can achieve from a particular drill machine. So, that is why foil the drilling machine, how many number of drilling machine has to be deployed, what will be the economics of that deployment, those can be accessed from this.

Though in this lecture economics is not within our scope of study so, we will discuss only upto the number of drill machines to be deployed in the mines in the excavation that will be discussed in this particular lecture. So, for that the background calculation requirement; that means, the calculation requirement for the drilling rate is already known to us, the number of delay considered in the previous problem may differ in a number in a different way in the different cases. So, that must be taken care of using the similar formula for the particular case. So, in this class we will discuss about the how we can calculate the number of drill machine essentially required to comply the target production for a particular excavation system.

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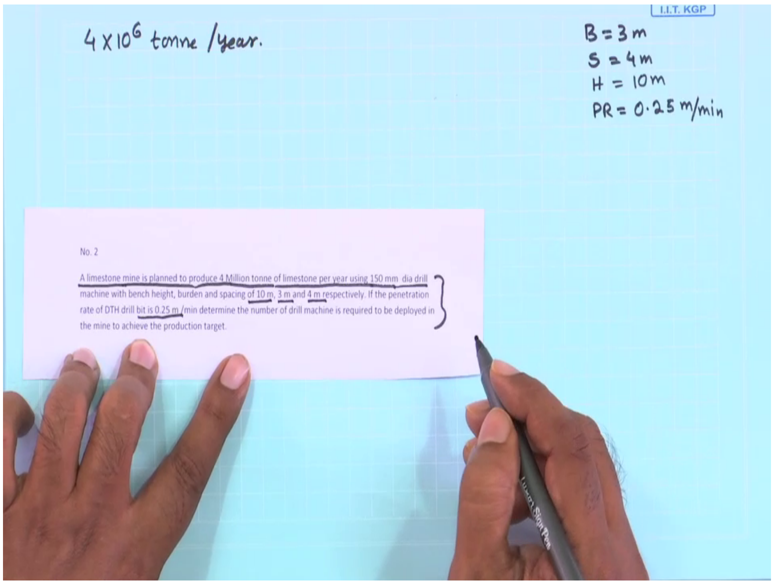

So, to understand that one let us consider this problem, in this problem the problem is given like this; a limestone mine is planned to produce 4 million tonne of limestone per year using 150 mm diameter drill machine. So, our production target is given that is 4 into 10 to the power 6 tonne of limestone will be produced per year. It is also given our blasting specification, so that we can assess the number of holes. It is given that Burden is 3 meter, Spacing is 4 meter and Bench height is given 10 meter and the penetration rate in last class we have seen the formula is available with the rock and machine properties.

So, that Penetration Rate is given for that particular machine that is 0.25 meter per minute. So, bench height, burden, spacing penetration rate is given and it is also told that other values must be shown assumed in this particular condition. So, let us consider this one, first we need to know to achieve this production how many holes need to be blasted?

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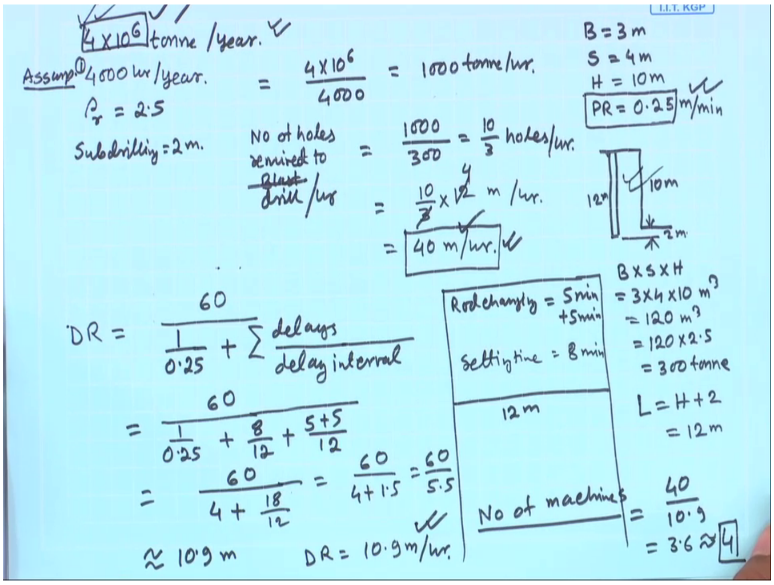

So, let us consider our available working hour in a mine is 4000 hour per year, you may have little bit so this is the first assumption.

So, this is the first assumption where we are assuming that 4000 hours are available as the actual working hour in the mine. So, our hourly target we can consider 4 into 10 to the power 6 divided by 4000 is giving us 1000 tonne per hour. So, this is our hourly production target, now let us see from blasting 1 hole what will be our production we can achieve by blasting 1 hole. So, you know if you are having a blast situation like this is 10 meter let us consider 2 meter sub drilling; 2 meter sub drilling. So, the drilling length is 12 meter and by blasting this 12 meter our yield is basically burden into spacing into bench height; that means 3 into 4 into 10 meter cube and that is 120 meter cube of rock.

Let us go for second assumption here, specific gravity of rock or density of rock let us consider 2.5 as it is mentioned lime stone. So, it is assumed as the 2.5 specific gravity. So, this will become 120 into 2.5; that means, 300 tonne of material can be produced from blasting 1 hole. So, from there we can understand the number of holes, which is required to be blasted, blast or in other word required to drill also per hour is 1000 divided by 300. So this is 10 by 3 holes or you can say 10 3.3 holes needs to be drilled or needs to be and needs to be drilled in every hour.

So, this is the number of holes we have achieved. Now, let us convert into meter in this case the essentially requirement is consideration of the sub drilling. So, let us the assumption sub drilling is 2 meter or you can assume it is 20 percent considering that it is 2 meter. So, the length of 1 hole is, length of the hole is H plus 2 that is 12 meter. So, if we are converting this number of holes per hour to the number of meter per hour it will become 10 by 3 into 12 meter per hour so; that means, it is 40 meter per hour is our requirement.

So, now this is the requirement to achieve the production target. So, this production target has to be achieved for this particular mines so that 4 million tonnes of material or limestone can be produced. Now, let us find out what is the capacity of the machine, it is already given that the penetration rate is 0.25. So, we have to search out the drilling rate which is nothing, but the time this is given 60 minute considering the 1 hour, 1 by it is given in minute it is already given in minute you can see 0.25 meter per minute.

So, we can directly place 0.25 meter per minute as it is we have already considered in minute then the delays and delay intervals. So, this delays and delay intervals are not given. So, we need to assume the delays and delay interval here and for that, let us assume here and let us consider the rod changing time is again 5 minute plus 5 minute while we are taking it out and just like last class setting time is 8 minute. Let for particular this problem let us omit bit changing time or maybe other flashing time etcetera you may omit we may include, but as those are not mentioned in the problem and it is already discussed.

Let us limit it in these two delay only and in for both the cases the delay interval frequency is 12 meter. So, this can be expressed like this, 60 1 by 0.25 plus 8 by 12 plus 5 plus 5 by 12. So, again it can be written as 60 divided by 1 by 0.25 is 4 if you are considering this is coming 18 by 12. So, this can be 60 by 4 plus 1.5. So, 60 by 5.5 and if you calculate this, this is coming around 10.9 meter so; that means, DR is 10.9 meter per hour.

So, our final requirement is that we need to find out how many we need to find out how many drill machines are required our requirement is 40, but 1 machine is achieving this one. So, number of machine required; number of machines required is 40 divided by 10.9. So, this is coming around 3.6. So, machine can not be in fraction, so this can be approximated 4 machines. So, to achieve this production target we need to purchase 4 drill machine so that this production target can be achieved.

So, this is basically the assessment though it is not the optimization one, but this is the general assessment to determine the number of drill machine for a particular case. So, this is more or less to another type of problem which is discussed, which can which can be discussed in a drilling site and that is why by using this way you can estimate how many number of machines to be procured and that can be utilized properly for achieving the desired target production. So, this is more or less related to the drilling part.

Now, let us discuss something related to explosive also, in our very beginning in the first class we have discussed about the explosive properties, where we have discussed that explosive properties are having different strength parameters and this strength parameters maybe estimated or may be expressed in terms of relative weight strength relative bulk strength or the absolute strength. So, if some unknown explosive is there whose strength is not known to us, but while we are practicing ballistic mortar test or some other similar type of test, we can determine the relative strength of those material.

So, now which are commercially available or say manufacturer is supplying a particular explosive to a mine site then, how the strength of that explosive can be estimated that is carried out through the ballistic mortar test, in terms of some best explosive which may be a TNT which may be ammonium nitrate fuel oil or maybe some special gelatin which are considered as the standard explosive. So, the supplied explosive is accessed relatively considering the base explosive, but how to determine the energy content in that explosive can be accessed using this problem. So, let us consider one such problem here.

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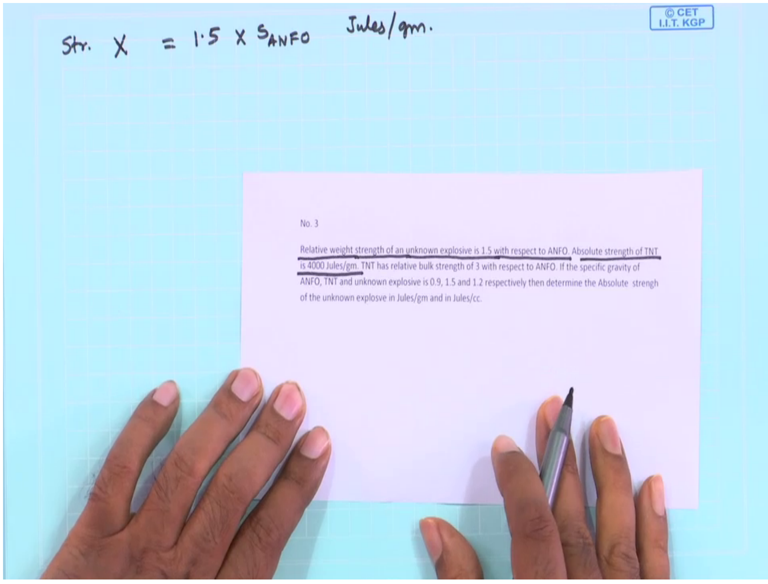

In this problem it is given the relative weight strength of an unknown explosive is 1.5 with respect to ANFO. So, suppose our explosive is named as x. So, the strength of this explosive strength of this explosive is equal to 1.5 time of the strength of ANFO, when it is expressed in Joules per gram, it is also expressed that the absolute strength of TNT is 400 joules per gram, sorry 4000 joules per gram. So, strength of strength of TNT is equal to 4000 joules per gram.

TNT has relative bulk strength of 3 with respect to ANFO; that means, strength of TNT is equal to 3 times of strength of ANFO, when expressed in Joules per centimeter cube, further it is also given the specific gravity of ammonium nitrate fuel oil, TNT and that unknown explosive that explosive is given.

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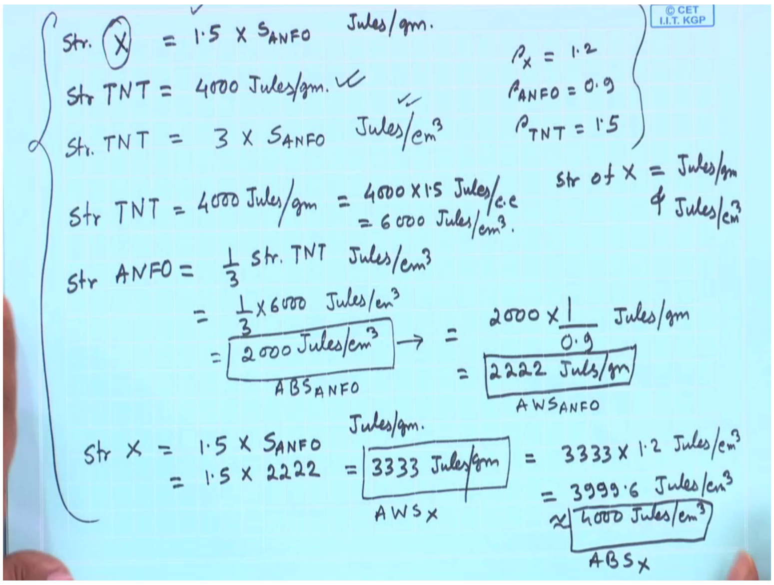

So, rho x is equal to 1.2 rho ANFO is equal to 0.9 and rho TNT is equal to 1.5. So, this is already given to us and this is the question which is given, and we have to determine the strength of the strength of X in terms of Joules per gram and Joules per centimeter cube.

So, this in this information is available to us we know the absolute strength of the TNT is this. So, let us convert this into the absolute bulk strength of TNT is equal to 4000 Joules per gram, specific gravity of TNT is 1.5 gram per centimeter cube you can consider. So, considering this it can be expressed as 4000 into 1.5 Joules per centimeter cube that is 6000 Joules per centimeter cube. Similarly, it is also given to us that strength of ammonium nitrate fuel oil is one-third of the strength of TNT when expressed in the absolute relative bulk strength.

So, the strength of ANFO is one-third of strength of TNT is expressed in Joules per centimeter cube because it is expressed in bulk strength. So, this is one-third of 6000 Joules per centimeter cube that is 2000 Joules per centimeter cube. So, this is now known to us then we can convert this to the absolute weight strength of for the ammonium nitrate fuel oil. So, absolute weight strength this is the absolute bulk strength then you can convert this to absolute weight strength so; that means, this can be written as 2000 into 1 by 0.9 Joules per gram.

So, it will comes around 2222 Joules per gram which is nothing, but the absolute weight strength of the ANFO, now it is given for unknown explosive the absolute the relative weight strength is 1.5 with respect to ANFO. So, that is why the strength of, absolute strength of explosive X is equal to 1.5 times of S ANFO if givens give gives expressed in terms of Joules per gram then it is coming around 1.5 into 2222 that is coming is approximately 3333 Joules per gram.

So, the strength of this unknown explosive is this one and this can be called as Absolute Weight Strength of Explosive X. So, this is the absolute weight strength similarly we can determine the absolute bulk strength also. So, if you would like to know the absolute bulk strength of this you have to multiply it with the density. So, absolute bulk strength of this one is coming into rho of x that is 1.2 Joules per centimeter cube, which can be calculated as 399.6 Joules per centimeter cube or in order 4000 Joules per centimeter cube.

So, this is basically the Absolute Bulk Strength of Explosive x. In fact, this is the procedure and if you know this procedure you can express it any terms.

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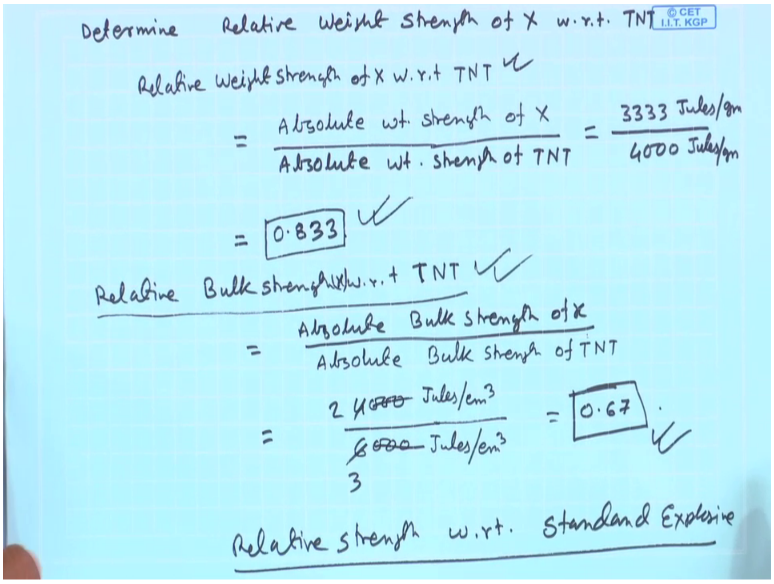

Say suppose in this case it is given to us Determine the Relative Weight Strength of Explosive x with respect to TNT. So, this is very easy for us now because we have seen the relative weight strength is nothing, but the ratio of weight strength of x with respect to TNT is equal to absolute weight strength of X divided by absolute weight strength of TNT.

And in this problem both are known to us absolute weight strength of TNT is 4000 Joules per gram whereas, we have determined the absolute weight strength of this explosive is 3333 Joules per gram so; that means, it is coming around 0.8833. So, this is the relative weight strength of explosive X with respect to TNT, similarly if it is asked to determine the Relative Bulk Strength with respect to TNT then it is easy Absolute Bulk Strength of X by Absolute Bulk Strength of TNT.

And in this case it is for X it is 4000 Joules per centimeter cube here it is 6000 Joules per centimeter cube. So, it is so, this is coming around 0.67. So, this is 0.67 is the relative bulk strength of explosive X with respect to TNT and this is the relative weight strength of explosive X with respect to TNT. So, basically for any during blasting the any explosive which is supplied by the manufacturer, then the unknown explosive should be tested with the desired testing facilities to know their relative strength, to know their Relative Strength with respect to any standard explosive.

Then the energy content of that explosive may be easily known and that explosive may be converted to the relative strength for any other type of explosive. So, that is why the strength of the explosive is very very important and that can be computed or that can be estimated by this way. So, more or less we are we have already covered drilling part we now we have covered some explosive strength determination also. So, let us stop this class at this position in next class we will try to identify how to assess the drilling and blasting design for some particular instances.

Thank you.