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Geotechnical Engineering Laboratory

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Lecture No – 10

Compaction

Welcome I am Professor J n Mandal Department of Civil Engineering Indian Institute of Technology Bombay. Today I will discuss the testing procedure for modified folk test tests earlier I discussed the standard Proctor test now I present the modified proctor test. Now what is the procedure for the modified proctor test? Note the dimension of this mould color and the base plate; take the empty weight of the mould without the color and the base plate. Apply a thin layer of grease on the inner side of the mould and affix it to the base plate by means of wing nuts provided.

Then place the color on the mould now take about 4000 drums of air dry soil passing through sip side for 0.75millimeter in a clay. Note the hydroscopic moisture content of the soil.

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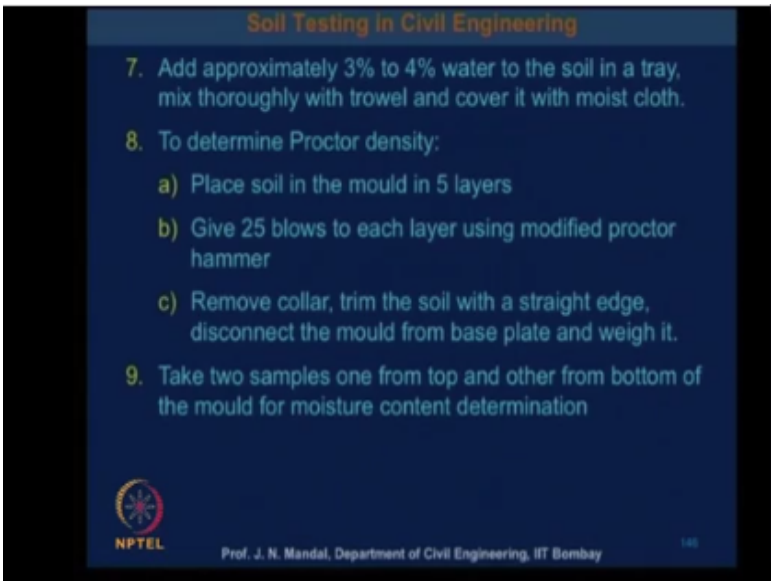

Now add approximately 3% to 4% of water to the soil in a tray and mix thoroughly with the travel and cover it with the moist cloth. Next to determine the proper density place, the soil in the mould in five layer and give 25 blow to each layer using the modified proctor hammer, remove collar, trim the soil with a straight edge disconnected the mould from the base plate and then weight it. Take two sample one from the top and other from the bottom of the mould for moisture content determination.

So you can determine the moisture content of the soil sample extrude the comp active sample from the mole break it into a original size, add another 3 to 4% of water and repeat the step as - 7 to 10, continue the operation until a decrease in the weight of soil is observed for at least two successive readings. Then draw a plot of moisture content versus the dry density and determine the maximum dry density and the corresponding optimum moisture content. Now how to calculate this? Specimen calculation for this modified Proctor test.

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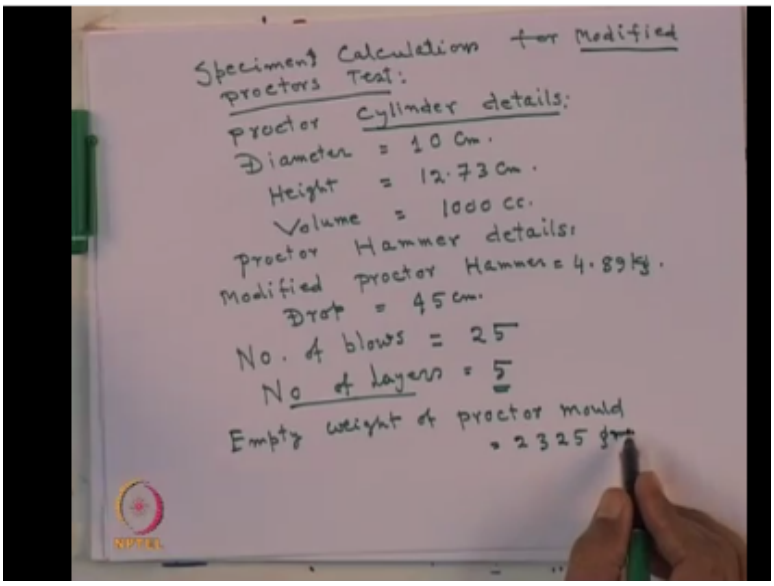

So I will show you some specimen calculation for modified folk that, so it is a modified proctor test earlier we discuss about the standard Proctor test. Now dividing the proctor at state detail that means proctor a cylinder detail, so it has a diameter = 10 centimeter, height = 12.73 centimeter and it has a volume and volume = 1000cc. Now this is the proctor cylinder detail, similarly Proctor hammer detail, this modified Proctor Hammer is 4.8 9kg and it has to be drop 45 centimeter and number of blow in case of modified proctor test = 25 and number of layer is = 5. So in case of modified proctor test then number of layer is 5 as in standard Proctor test we use number of layer 3.

Now empty weight empty width of proctor mould = 2325gram, so we know that what will be the proctor cylinder detail and also of the hammer detail. Now I will show you some the table.

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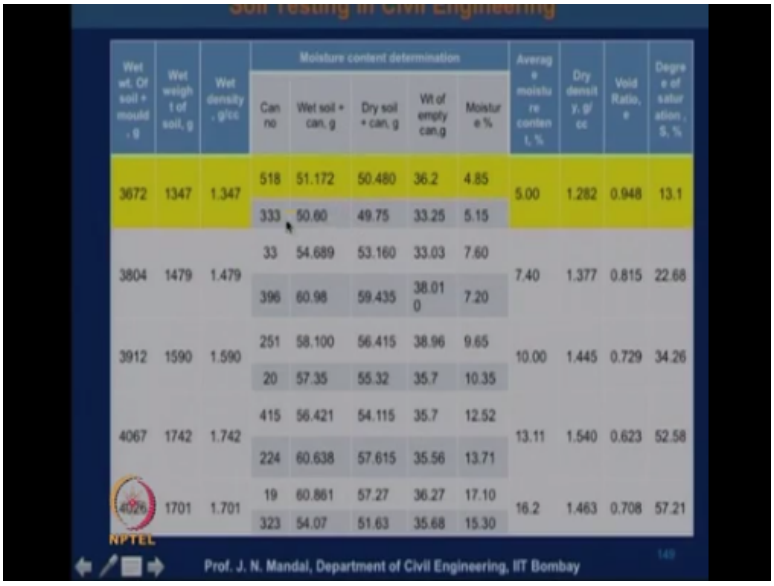

And this for the motor stander test first of all that you have to take the weight of the weight of the wet soil and the and the mould and then weight of the soil and then you calculate what is weight density? And then we take the different can number you know the what will be the weight soil + can in gram dry weight soil + can in gram, and weight of the empty can and then you determine what will be the moisture content ? Then what is the average this moisture content, then you determine the density and then the void ratio and then you can calculate the degree of saturation.

I am showing that one calculation here, and like that you can go for the different sample and determine the moisture content and the dry density. Now consider that with weight of soil + mould = 6672 ξ.

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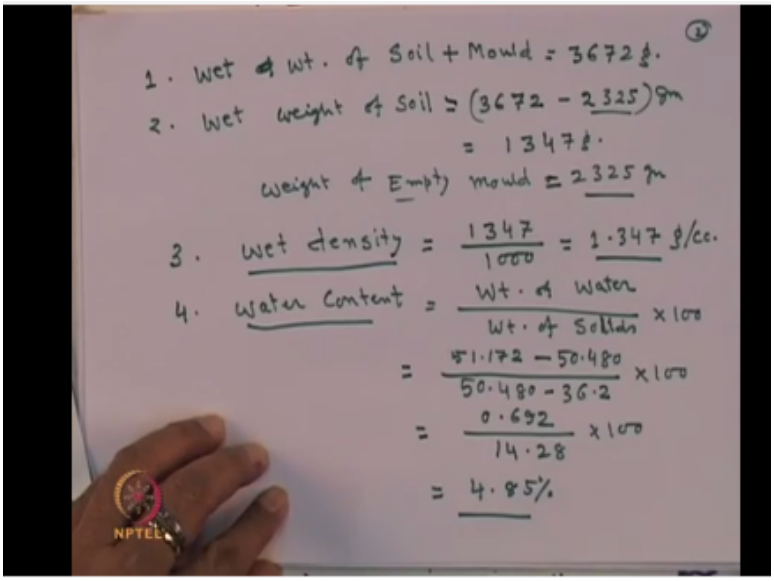

Now weight of soil will = 3672 - 2325 gram = 1347, because weight of empty mould = 2325gm, this is empty white, so this so you can calculate the weight of the wet soil. Now you calculate what is weight density? Weight density = weight of oil, this weight of weight solids 1347 and this divided by the one volume is 1000 to see, so this will give you 1.347g/cc. So you can calculate the weight density that is 1.347g/sec. We can calculate the water content, water content in the weight of water and / weight of solid x 100.

The weight of water which we can calculate that here; this weight of water is about PP 1.172, 51.172. PP 51.172 weights of water + can this - if this is dry so this is a dry soil, and the can this is 50.480, so this is 50.480 this divided by that what should be the weight of solid? That means weight of solid will be 50.480, this is 50.480 - this is weight of empty can 36.2. So this is 50.480 - this is 36.2, so this x 100, so calculate this you can have zero 0.69/ 14.28 x 100. So this will give you order content of 4.85%, so you can determine the water content that is about 4.85%. Here you are it is it is here it is that water content 4.85%, so you can calculate the 4.85%.

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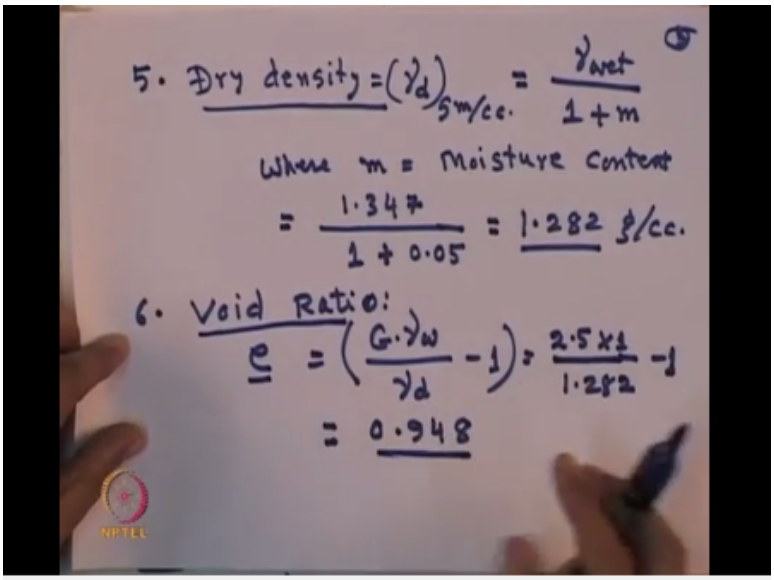

Now you have to calculate that what will be the dry density? So dry density is designated at γd and this is gram /cc, so this will be = γ of weight this divided by 1 +M where m = moisture content, that is moisture content. So γ of weight which we have calculated earlier , hat is here γ of weight density 1.347, so we can write 1,347 this divided by 1 + moisture content and here we are taking that average this is moisture content, average moisture continues 5, so 1 + in that mean average moisture content % it will be the 0.05.

So this will give you the dry density of 1.282 g/sec, so you can calculate the dry density of 1.282. So here what is the identity is 1.282. Now next is the void ratio I do calculate the void ratio, and that denoted as e so e = you know g x γ W / γ of D and this – 1.

So G you know that this big cavity which we calculated from the Pacific gravity test and with γ W = 1 / γ of d γ of d in γ d is 1.282 , so this is 1.282 and – 1, so then void ratio value will be equal to 0.94 state. So we calculate the void ratio E is 0.948, so we calculate dry density, we calculate the word ratio. So here it is that the identity 1.282 here the bard ratio0.948. Now we will calculate the degree of saturation.

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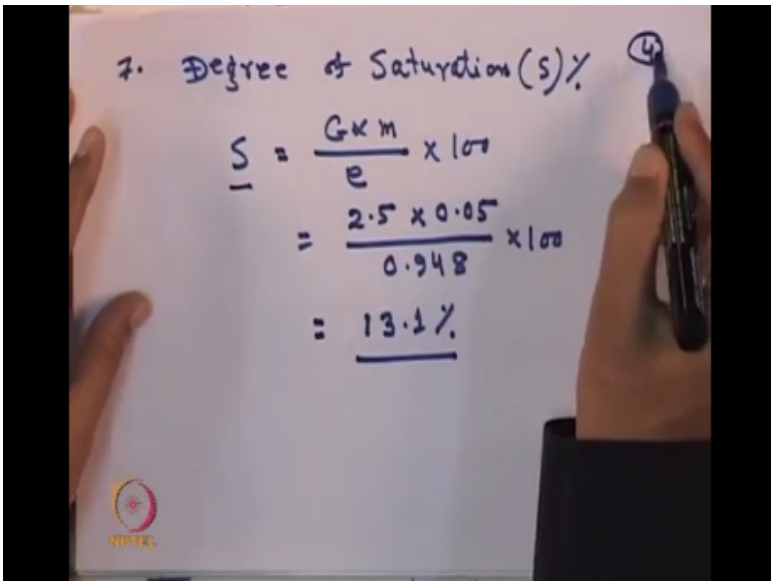

Degree of saturation and degree of saturation is and in %, so S will be = G x m this divided by e x100. So you know the G Pacific gravity that is 2.5 m is moisture content 5% a that means 0.05 and that divided by we calculate the e value even H a value evaluates 0.948, so this is 0.948 , so x100. So this will give the value of degree of saturation is 13.1%. So degree of saturation you can calculate a 13.1 %, so this degree of saturation, the degree of saturation is shown here that 13.1%.

Like that you have to you can fill up this table and you can determine all the moisture content void ratio degree of saturation and you know from this, large different value of the dry density and the you know the different moisture content. So you can make a correlation between the dry density and moisture content or the modified book therapist. So what you can that you can.

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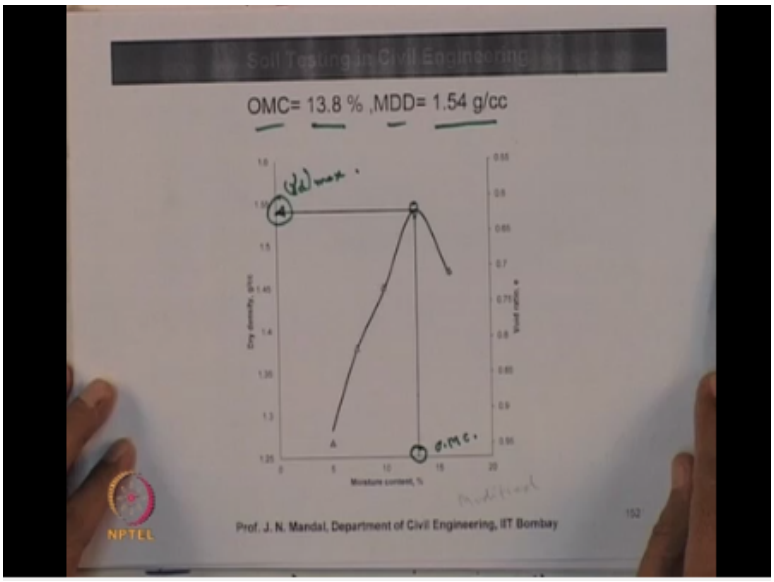

Draw the curve in between moisture content in the x-axis and dry density in the y-axis and you can see the curve a different value of moisture content. You are having the defined by density and it leads to the peak value and then it decreases the density with increasing the quadrant content, so you can have a nature of curve, like this and from this curve you can determine, that what will be the maximum the identity? Here maximum density you can calculate that what will be the optimal moisture content it is optimum moisture content here and this is the maximum density you can determine from here.

So here optimum moisture content is about 13.8% and maximum dry density is about 1.54. You can draw also that define void ratio value on this side, so this is the relationship between the density of moisture content and from this curve you can determine, that what is the maximum diagnosis and optimum moisture content for the modified proctor test. Now we determine the zero void line for the modified Proctor test.

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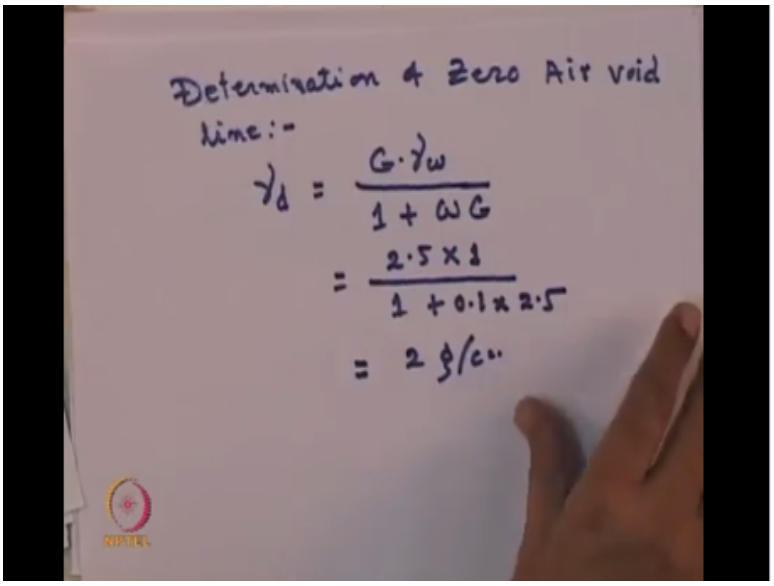

So how to calculate the zero void line right, so determine determination of zero air void line zero add void line so zero and white line can be expressed as γd = G x γ W / 1 +W x G. G is become this specific gravity, so the specific gravity you know 2.5γ W value you know that is 1and this 1 +again that, this is W and this is D, so W is 0.1 x G value is 2.5. So this gave the density value about 2g / c. So you know that γd value also you know that what is moisture content. So from this you can draw the zero air void line.

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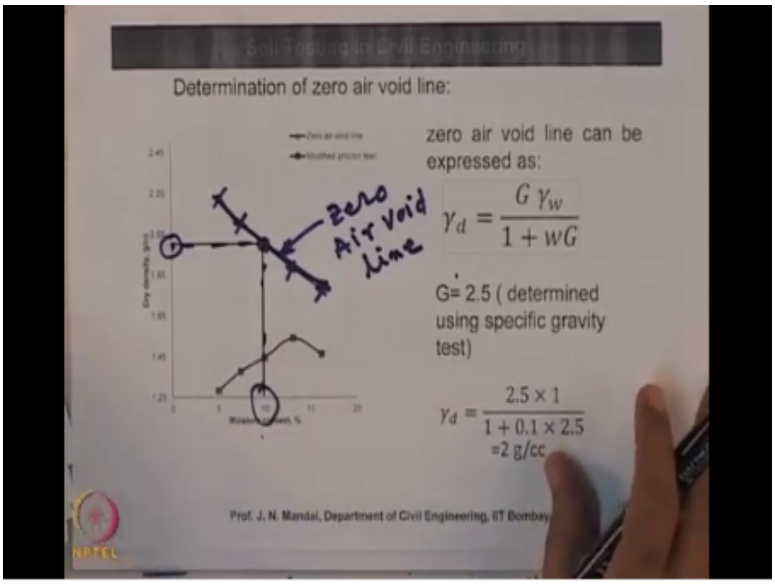

Here it is so these are modified proctor test diagram, the identity versus master content this is the call and this is the curve for the zero air voids line. This is 100 % saturation, so we calculate that that γ_d is about to g/ per cc and you know at a particular moisture content, that is moisture content when it is the tail, that means you know that this is moisture content is 10 % and then you calculate γ_d = 2g, so for this 10% must have contained, so and that dry density is 2, so you can have a point like this. So similarly you can calculate the dry density using this equation.

So you can have a several point like this and then you can draw and you see the zero air voids line this called the zero air voids line. Zero adds void line, so this is for the modified Proctor test and how you have to calculate the zero air voids line. So similarly you can calculate for the different air voids line, here it is shown that this is zero void line when s = 100 % when this = 80 % when s = 70% and when that = 60 %. For different degree of saturation also you can draw this line. So for the different % and showing you one calculation how you can draw γ_d the for a particular degree of saturation.

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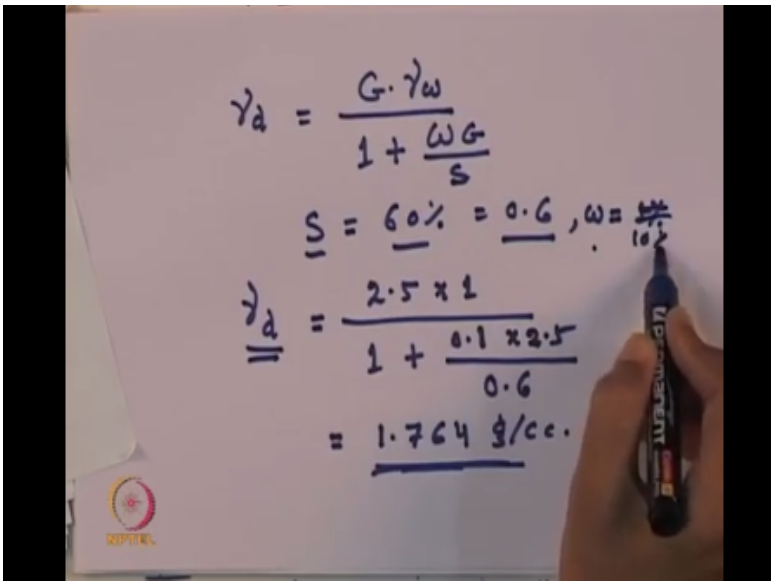

Let us say that γ_d = G x γ W/ 1+ W x G this divided by s, now if you consider that I need the degree of saturation s i = 60% that means this is 0.6 that means is 0.6, we determine what is let us say that γ_d , so let us say that γ_d = you know G value is 2.5 γ W value is = 1 this divided by 1 + and then for a particular water content W, let us say this 1% , so this will be the 0.1 x this is 2.5 g value this / s is 60% that means 0.6 . So you can calculate that let us say that γ_d will be = 1.764 this is gram/ cc.

So you can calculate let us say that γ_d .1.674 while a particular, that water content okay water content into say this is 10 % is water content okay, so here is the figure you can see that value which we calculated about 1.764 this is 1.764 γ_d, so corresponding γ_d and for a particular moisture content of 10%, so you can get a point and in which that is value = 60^0. So for the degree of saturation 60^0 you can draw a line, so you can similarly you can draw the line for the 80^0, 70^0.

So for this modified proctor test if you can draw the maximum dry density and the corresponding the optimum moisture content also you can draw the zero void line all different degree of saturation and this modified Proctor tester is also very important for any infrastructure project thank you.

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