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NATIONAL PROGRAMME ON TECHNOLOGY ENHANCED LEARNING

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Geotechnical Engineering Laboratory

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Lecture No – 19

Shear Strength

Next I will talk about the sensitivity of the clay and I show how you can perform the test and I can show some specimen result from the vane shear test. The term sensitivity is defining either ratio of undisturbed to the remoulded rate strength of clay.

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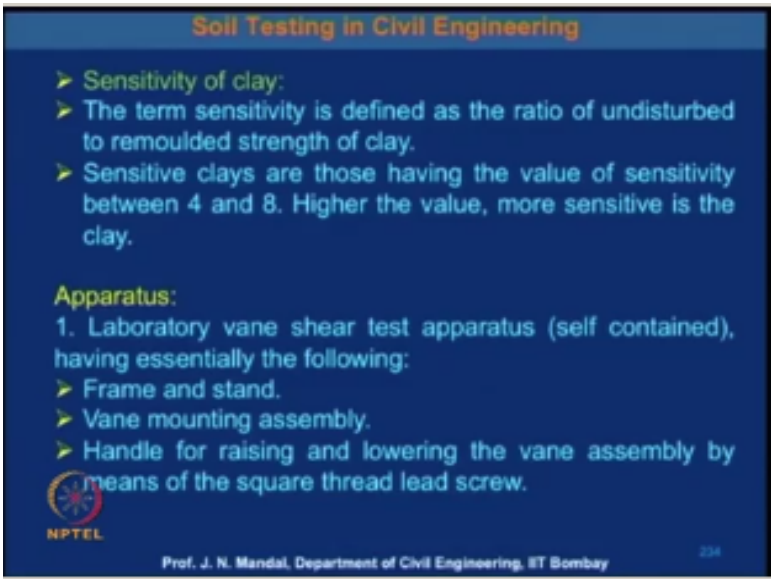

Now sensitivity clays are those having the value of sensitivity between 4 and 8, where the value of sensitivity means the more sensitivity in the clay. Now to perform the vane shear test you recall that certain apparatus, that is laboratory vane shear test apparatus that is self contained having the essentially the following one is the frame and the stand then vane mounting assembly then handle for raising and the lowering the vane assembly by means of the square thread screw. So I can also show you later that equipment then this the vane with the four blade 12mm width and 25mm long.

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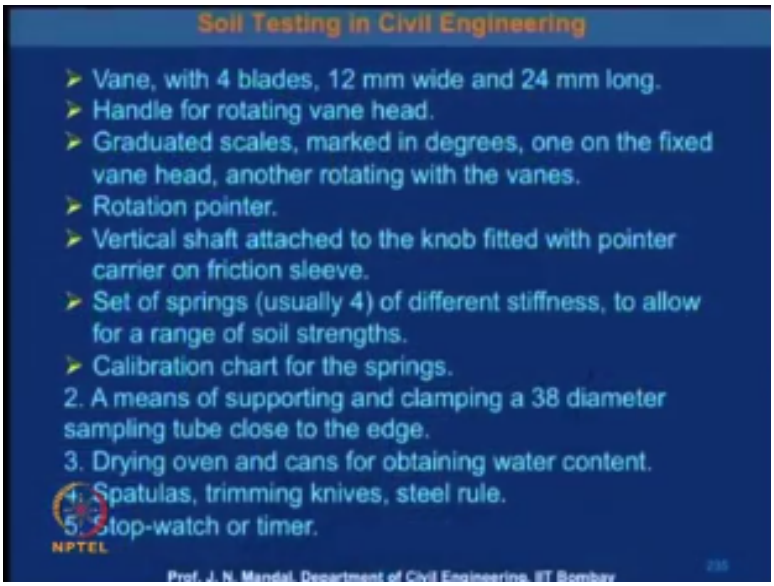

Handle for rotating the vane head graduated scale mark in degree one of the thick vane it another rotating with the vane then rotation pointer vertical shaft attached to the knob fitted with pointer carrier on the friction sleeves. Set of spring usually 4 of different stiffness to allow for a range of soil strength, then calibration chart for the spring a means of supporting and clamping a 38 mm diameter sample tube close to the edge.

Drying oven and cans for obtaining the water content, and spatulas, trimming knives, steel rule and stop watch or timer, so now I show you that, that is the equipment.

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This is the vane shear test apparatus and soil is in this more and then it is in started this vane is in started here and then they in stork is applied, so you can apply the stork and it will rotted certain angle so you can make that some initial angle then you can rotate further and then you can go for the final angle θ final. So you can determine that what should be the θ initial and what will be the θ final and you know that what should be the tines of the spring and then you can determine what would be the stork apply on to this sample.

So this is the vane shear test equipment this is very simple tease and the equipment also is very small, now what is the procedure first of all the preparation of the test specimen clamp the sample tube.

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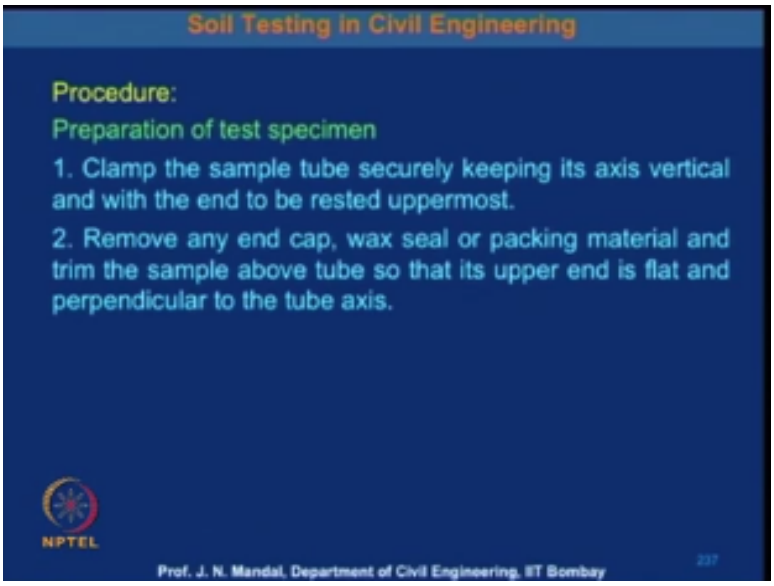

Securely keeping it axis vertical and with the end to be rested uppermost, then remove any end cap wax seal or packing material and trim the sample above tube so that upper end is flat and perpendicular to the tube axis. Now vane shear test clamp the tube in position and select the spring prepare apparatus and adjust the scale, measure initial angle of twist.

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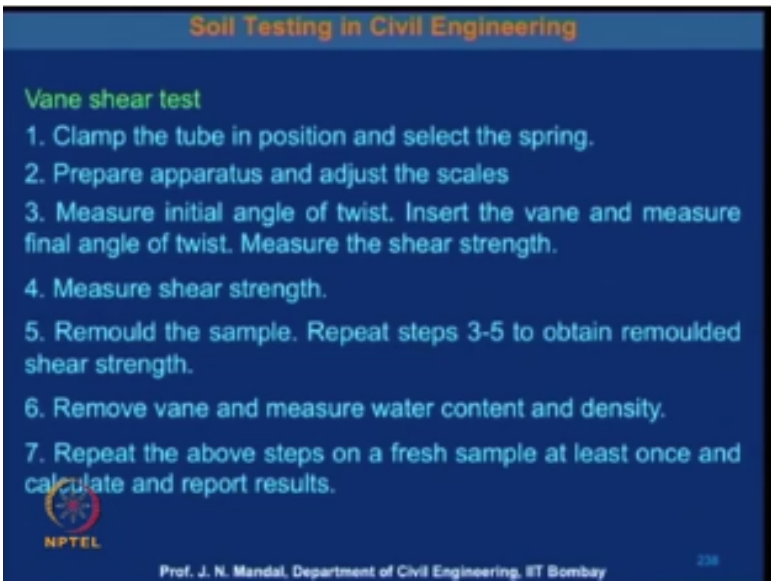

Insert the vane and measure the final angle of twist and then measure the shear strength, measure shear strength remove the sample repeat the step three to five time to obtain the remoulded shear strength, remove vane and measure the water content as well as density, repeat the above step on a fresh sample at least once and calculate and report results. I can show you that what should be the sample calculation or the vane shear test. Let us see some specimen calculation.

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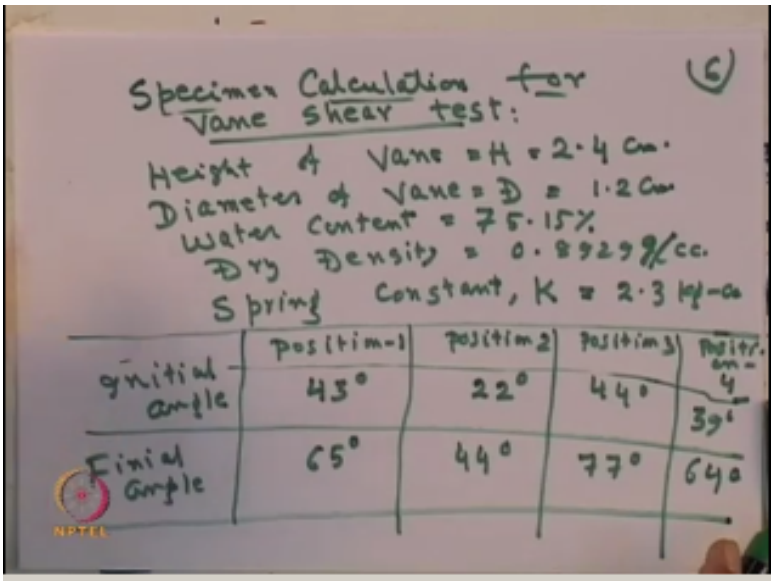

So this is the specimen calculation for vane shear test, so I am just showing you one specimen calculation or vane shear test. You know height of the vane is equal to h is equal to 2.4cm then diameter of vane that is d is equal to 1.2cm, let us say water content is equal to 75.15% and dry density let us say 0.8929g /cc. and then spring constant and spring constant that reignited at K = 2.3 kg cm.

So we have to take the reading let us say that initial angle let us say this is position 1, position 2, position 3, and position 4 so you have to see what will be the initial angle let us say that initial angle in position 1 is 43^0, and position 2 let us say 22^0 and initial angle in position 3 let us say 44^0 and what the position 4 this angle is 39^0, now what is final angle that means when you are rotating then this is the initial angle for position 1, 2, 3, 4, and similarly for the final angle.

Let us say for the position 1 is 65^0 for position 2 is 44^0 and for position 3 is 77^0 and position 4 = 64^0, so you can make the table in this form. So what will be the angle of twist angle of twist will be we can say 65 – 43 = 22 44 – 22 so angle of twist will be equal to 22^0 okay. So you know the angle of twist is equal to 22^0. Now you know the equation of T.

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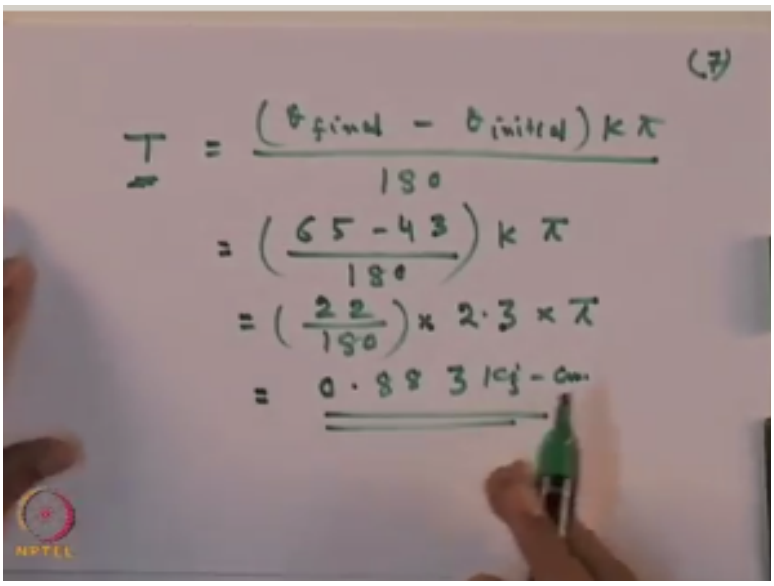

T = θ of final – θ initial this x k x π /180, so what is θ in the final that is 65 and θ initially 43^0. So we can raise that 65 – 43/ 180 this x k x π. Again if you detect them it will be the 22/ 180 x k value so k value also is given that is spring constant is k 2.3 kg so this into 2.3so this into this is π, so if you calculate you can have the 0.883kg cm. so you can calculate that what will be the T, so T value = 0883 kg cm. now we have to determine what will be the shear strength of the soil. So you know that earlier this equation for the shear strength of the soil okay.

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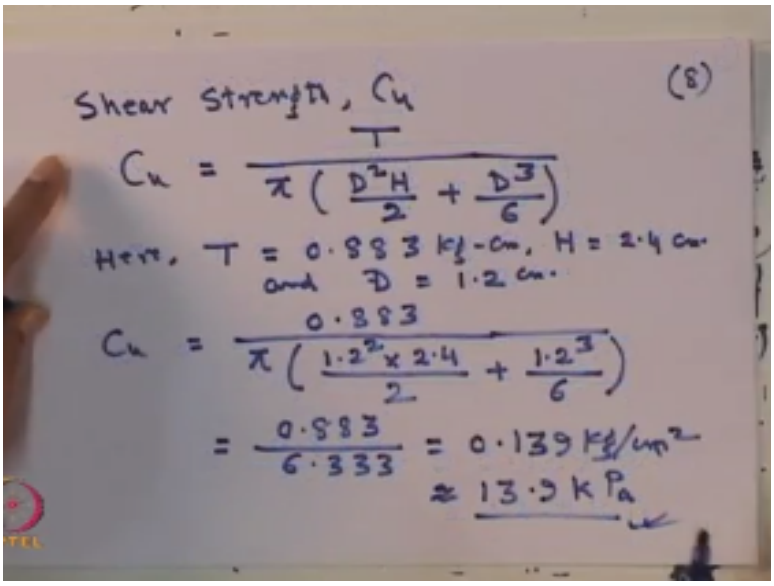

In vane shear test so shear strength that is Cu so Cu can be express as $T / \pi (d^2 H / 2 + d^3/ 6)$, here T = and you know this is 0.883 kg cm and h = 2.4 cm and D = 1.2 cm, so cu can written as $0.883/ \pi (1.2^2 x\ 2.4 / 2 + 1.2^3/ 6)$ so if you calculate we can have 0.883 / 6.333, so this will be equal to 0.139kg/cm^2 that means this will be approximately 13.9kPa. So shear test u is 13.9 kPa vane shear test is very important and now you know how to evaluate the shear strength of the soil by the vane shear test.

You know what are the theory how to calculate the torque and you know what is being constant you know what is the diameter of the vane and height of the vane, so you can also determine dial at rotating at a particular rotation in the initial rotation and the final rotation you take the depends of the θ final and the θ initial and the spring constant. So we can calculate what is torque if the torque is known and you know the diameter and the height of the vane so you can calculate the what should be the shear strength of the soil saturated soil using the vane shear test.

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