Geosynthetics Engineering: In Theory and Practices
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Lecture - 60
Designing With Geofoam

Dear students, a warm welcome to NPTEL phase two program video course on geo synthetics engineering in theory and practice. My name is Professor J.N. Mandal, department of civil engineering, Indian institute of technology, Bombay, Mumbai, India. Now, this is module 13 and lecture number 60 designing with geofoam.

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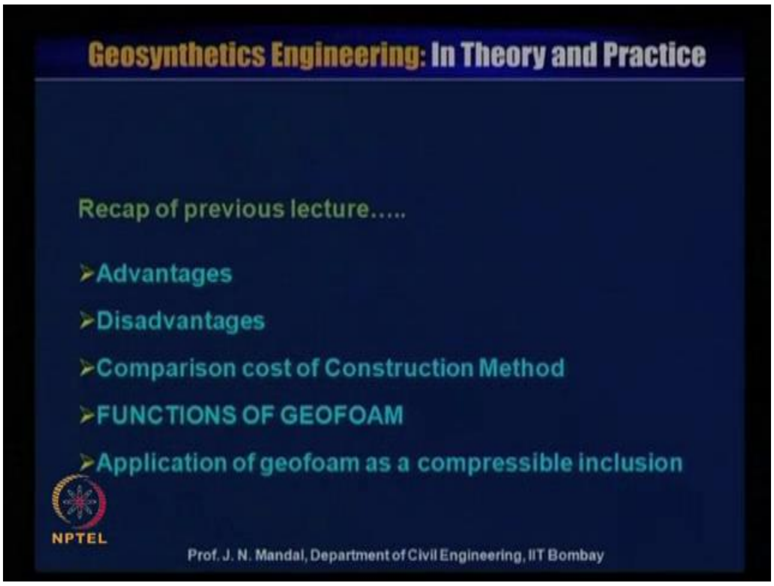

I will now focus the recap of the previous lecture. It is advantages of the geofoam, disadvantages of the geofoam and comparison cost of construction method, functions of geofoam, application of geofoam as a compressible inclusion.

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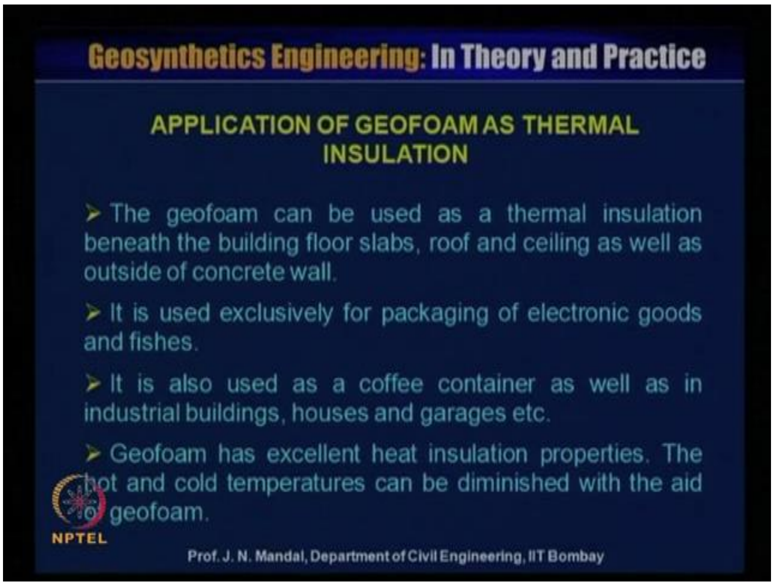

Now, I will address the application of geofoam as thermal insulation. The geofoam can be used as a thermal insulation beneath the building floor slabs, roof and ceiling as well as outside of concrete wall. It is used exclusively for packaging of electronic goods and fishes. It is also used as a coffee container as well as in industrial buildings, houses and garages, etcetera. Geofoam has excellent heat insulation properties. The hot and cold temperatures can be diminished with the aid of geofoam.

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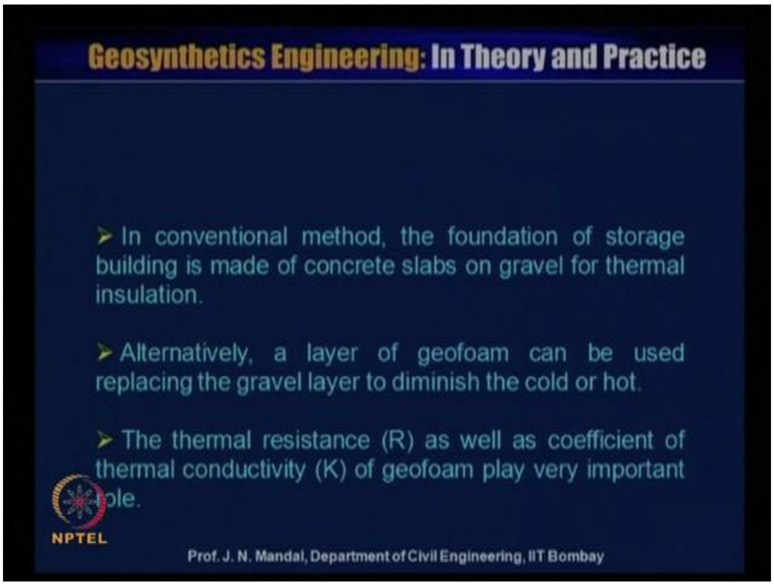

In conventional method, the foundation of storage building is made of concrete slabs on gravel for thermal insulation. Alternatively, a layer of geofoam can be used replacing the gravel layer to diminish the cold layer or hot. The thermal resistance R as well as coefficient of thermal conductivity K of geofoam play very important role. So, we will just use the geofoam alternative to the gravel or the brick. We will check up how we can replace the gravel with the geofoam and how there is a variation of the temperature either it is cold or the hot.

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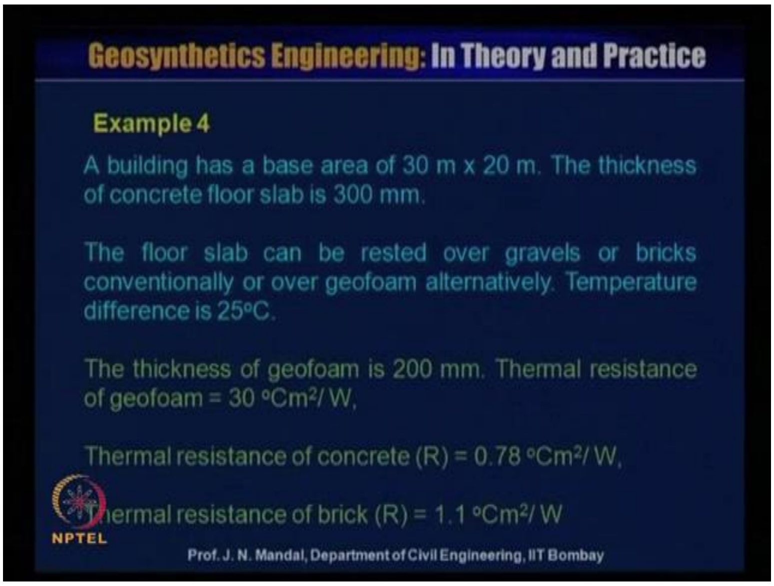

This example is a building has a base area of 30 meter into 20 meter. The thickness of concrete floors slab is 300 millimeter. The floor slab can be rested over the gravel or brick conventionally or over the geofoam alternatively and temperature difference says is 25 degree centigrade. The thickness of geofoam is 200 millimeter. Thermal resistance of geofoam is 30 degree centigrade meter square per watt. Thermal resistance of concrete R is equal to 0.78 degree centigrade meter square by watt. Thermal resistance of brick R is equal to 1.1 degree centigrade meter square by watt.

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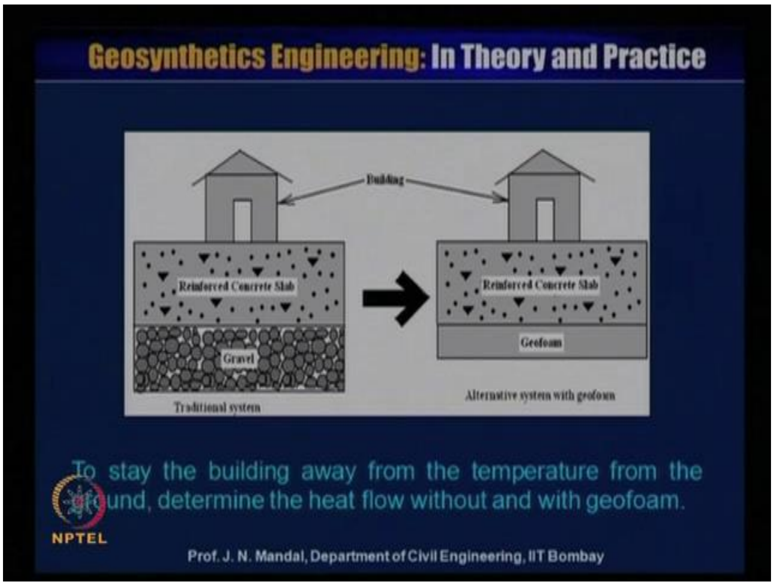

So, it is like that building. This is to stay the building away from the temperature from the ground and determine the heat flow without and with the geofoam. Sometimes, we require to storage some vegetable or any other kind of the material to protect. So, conventionally we build up a reinforced concrete slab and below that, we provide with the gravel. Then you are constructing the building on the top and how you can see? This is with the traditional system. We adopted the gravel as a material.

In the case of the conventional method, that when the temperature move from the ground towards the building, then you can observe that what kind of the heat flow are occurring and how you can measure the heat flow. If the heat flow is a on the higher side, then there is a possibility of the wastage of the vegetable or other kind of the material, but alternative to that system that if we use the geofoam alternative to gravel or the brick and then if you can construct a building for the storage here, then we will see that how the heat flow with the geofoam material.

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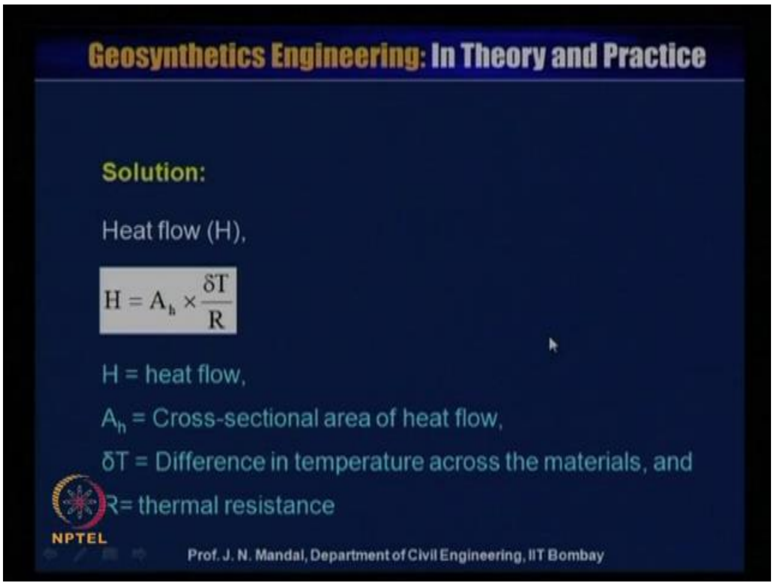

So, here is a solution. Heat flow is H the equation is H is equal to A h delta T by R, where H is equal to the heat flow. A h is equal to cross sectional area of the heat flow. Delta t is difference in the temperature across the materials and R is equal to thermal resistance.

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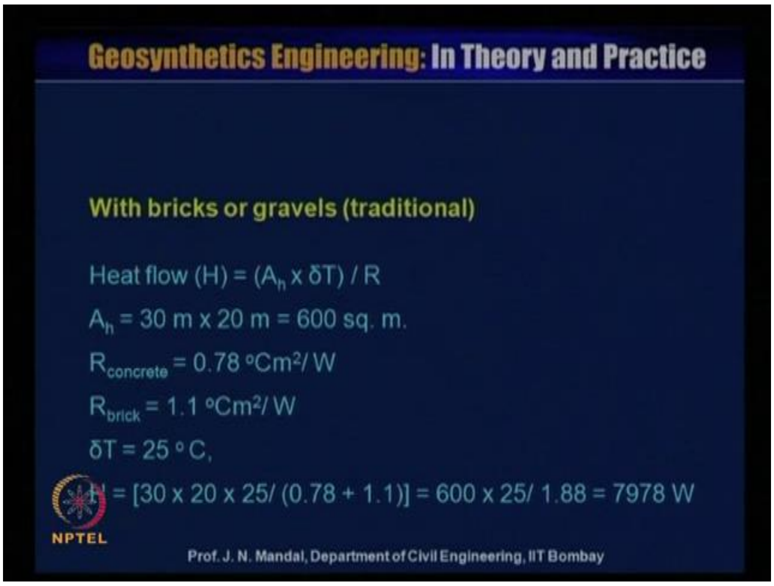

Now, when we will use the traditional method that means with bricks or the gravel, so we know the equation heat flow H is equal to A h delta T by R. Here, A h is the area that you know 30 meter into 20 meter is equal to 600 square meter. This R of concrete, I say that thermal resistance of the concrete is equal to 0.78 degree centigrade meter square by watt. Similarly, thermal resistance of brick, R of brick is equal to 1.1 degree centigrade meter square by watt. Temperature difference delta T is equal to 25 degree centigrade.

So, you can write H is equal to A h means area that is 30 into 20 into delta T. Temperature difference is 25, this divided by the R, R is thermal resistance for the concrete as well as thermal resistance for the brick. This is the traditional method where there is a concrete and also brick or the gravel. So, this is 0.78, R for concrete and 1.1 for the brick. So, this will be equal to 600 into 25 divided by 1.88. So, this will give 7978 watt. So, here heat flow you can see with the traditional 7978 watt.

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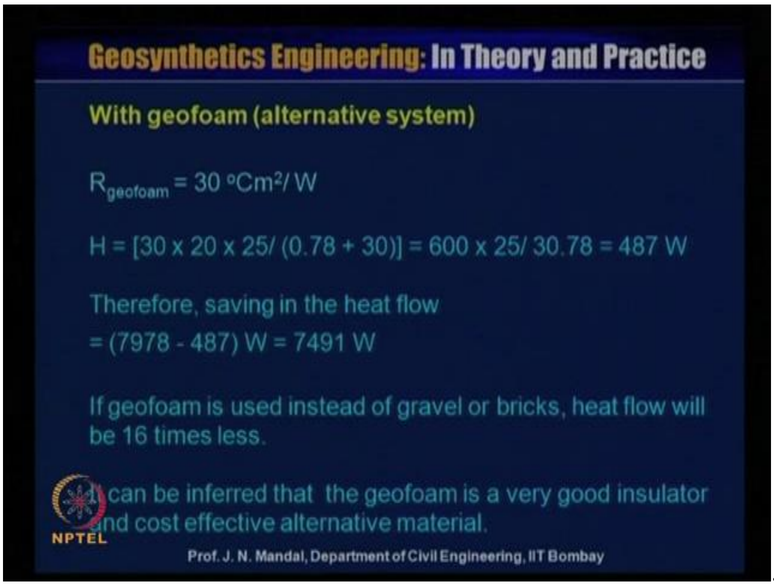

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Now, if you adopt the alternative system that is the geofoam or with geofoam, let us say thermal resistance of the geofoam is 30 degree centigrade meter square by watt. So, H is heat flow will be equal to you know that equation here. It will be the 30 into 20 into 25, this divided by this divided by this. You know what is the resistance for what I mention also that here that R for the concrete. So, R for the concrete is 0.78 plus that plus is 30. So, this will give you that 600 into 25 divided by 30.78. This is 487 watt. Therefore, saving the heat flow will be equal to 7978 that is here 7978, this divided by this minus 487, 487 watt. That means the saving in the heat flow is 7491 watt. So, if the geofoam is used instead of the gravel or the brick, heat flow will be 16 times less. So, you can save the energy. So, you can save the heat. It can be inferred that geofoam is a very good insulator and cost effective alternative material.

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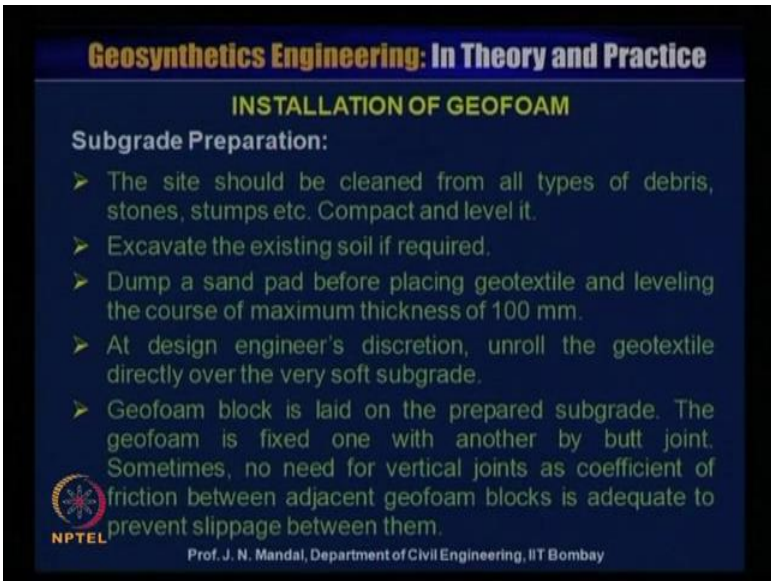

Now, I will discuss the installation of the geofoam. Now, you require sub grade preparation. The site should be clear from all type of debris, stones, and stumps etcetera and compacted and level it. Excavate the existing soil if required. Dump a sand pad before placing geotextile and leveling the course of maximum thickness of 100 millimeter. At design engineer’s discretion, unroll the geotextile directly over the very soft sub grade. Geofoam block is laid on the prepared sub grade. The geofoam is fixed one with another by butt joint. Sometimes, no need for vertical joint as coefficient of friction between the adjacent geofoam block is adequate to prevent the slippage between them.

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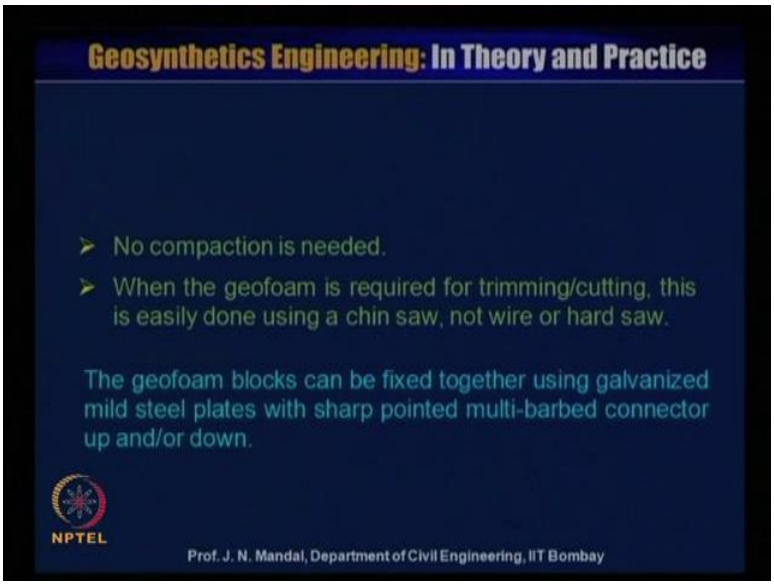

No compaction is needed. When the geofoam is required for trimming and cutting, this is easily done using a chin saw, not wire or hard saw. The geofoam blocks can be fixed together using galvanized mild steel plates with sharp pointed multi barbed connector up and down. So, it is like this.

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This is I am giving 1 small a model. This is the kind of the galvanized mild steel plate. This is the surf pointed. This is multi barbed. This is multi barbed connector and up and also you can see up and down like this. Suppose if this is the geofoam material and you wanted to connect this geofoam material one with the other. You can place it and then you can put the other material like this or you can place one by one. Also, you can join like this. So, it can be it can be jointed like this. Then you can place another also if it is required, you can place another also the geofoam. So, there should not be any slippage. So, this geofoam block can be fixed together using this galvanized mild steel plate with multi barbed connector up and this down.

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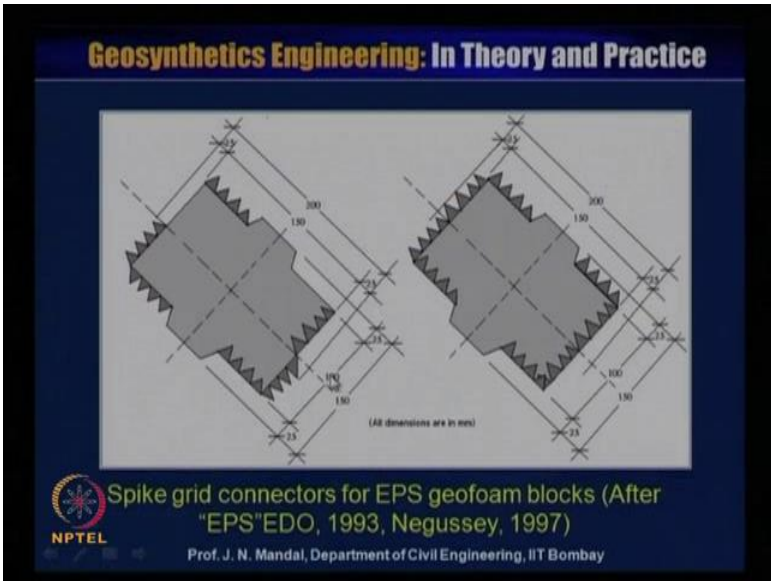

So, here is the spike grid connector of EPS geofoam block, after EPS EDO, 1993, Negussey, 1997. Here also you can see that this is 150 millimeter. This distance is about 100 millimeter. This is 25 millimeter. This is 25 millimeter. This is 150 millimeter. This is 25 millimeter. This is 25 millimeter and this is 200 millimeter. You can see this is the pointed that sharpen that galvanized mild steel on the top as well as in the bottom. So, like this kind of spike or this is what I what I this shows you also this is for the model, which we students have made this. So, it is like a 5 centimeter and this is 2 centimeter and this also the 2 centimeter this spike grid connector for the u p s geofoam block. So, you can use this kind of the spike grid for connecting the geofoam material one with another.

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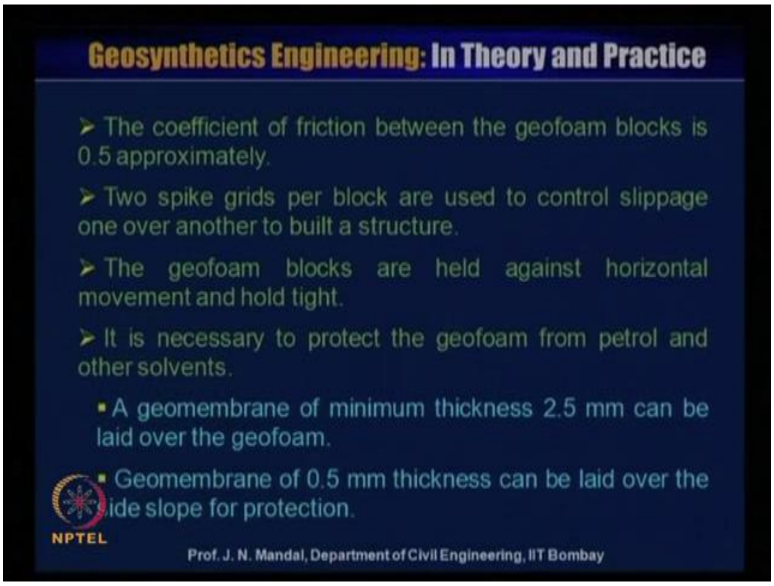

Now, the coefficient of friction between the geofoam block is 0. 5approximately.Two spike grids per block are used to control the slippage one over another to build a structure. The geofoam block are held against horizontal movement and hold tight. It is necessary to protect the geofoam from petrol and other solvent. A geomembrane of minimum thickness 2.5 millimeter can be laid over the geofoam. So, geo membrane of 0.5 millimeter thickness can be laid over the side slope for the protection. So, when there is a possibility for any leakage through from the petrol leakage, then you can provide with the geomembrane material, which can protect the geofoam.

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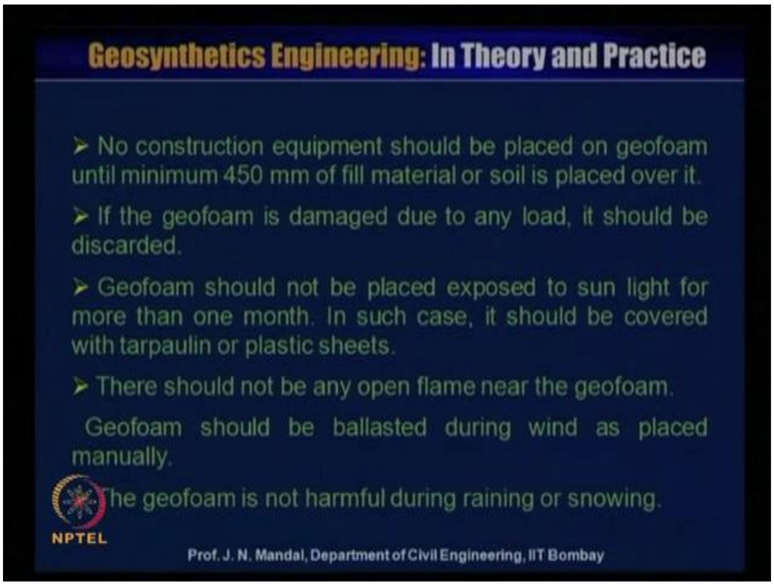

No construction equipment should be placed on geofoam until minimum 450 millimeter of fill material or soil is placed over it. If the geofoam is damaged due to any load, it should be discarded. Geofoam should not be placed exposed to sun light for more than 1 month. In such case, it should be covered with tarpaulin or the plastic sheet to prevent it from the ultraviolet light. There should not be any open flame near the geofoam. Geofoam should be ballasted during the wind as placed manually because it is a very light material. The geofoam is not harmful during raining or snowing.

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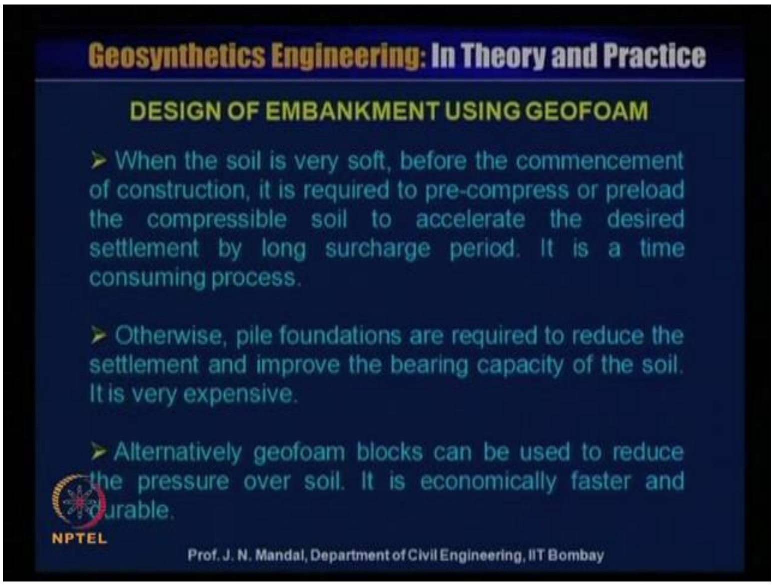

Now, I will discuss the design of embankment using geofoam. So, you have now the earlier idea that how the geofoam is to be installed. Also, you have some idea how the geofoam can be used as a thermal insulation, which can minimize the heat flow. Now, we want to use this geofoam for the construction of the embankment. Now, when the soil is very soft before the commencements of construction, it is required to pre compress or pre load the compressible soil to accelerate the desired settlement by long surcharge period. It is a time consuming process. Otherwise, normally we go for pile foundation, which are required to reduce the settlement and improve the bearing capacity of the soil. It is very expensive. Alternatively, geofoam blocks can be used to reduce the pressure over the soil. It is economically faster and durable.

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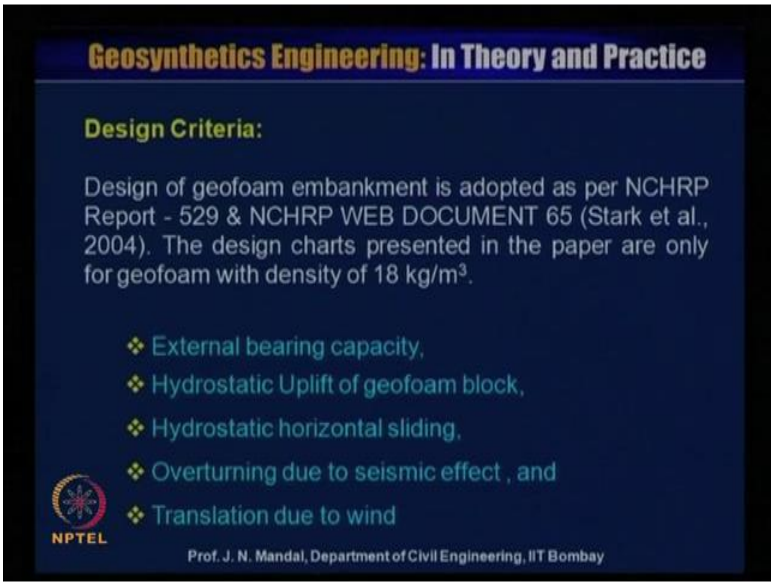

So, for the design, the design criteria, the design of geofoam embankment is adopted as per NCHRP report 529 and NCHRP WEB DOCUMENT 65, Stark et al 2004. The design charts presented in the paper are only for geofoam with density of 18 kilogram per meter cube. When you will design, then you have to satisfy this all the basic criteria. That means you have to satisfy that what will be the external bearing capacity, hydrostatic uplift of the geofoam block because it is a super light material and hydrostatic horizontal sliding and over turning due to the seismic effect and translation due to the wind.

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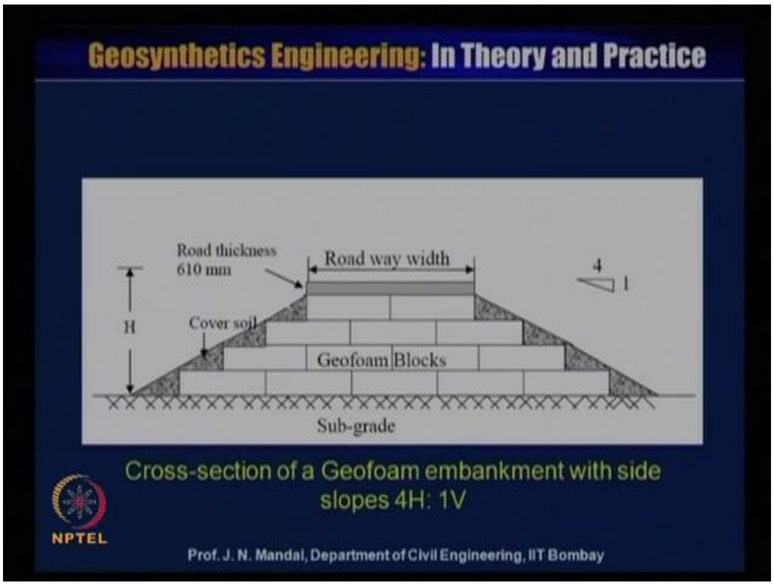

So, you have to check all. So, here is 1 cross section of the geofoam embankment with the slide slope 4 horizontal to 1 vertical. You can see this is the geofoam block. This is the sub grade. This is the roadway width. So, this road thickness let us say about 610 millimeter and this is geofoam block. This portion is to be filled with the soil, which you say that it is a cover soil. The height of the embankment is H.

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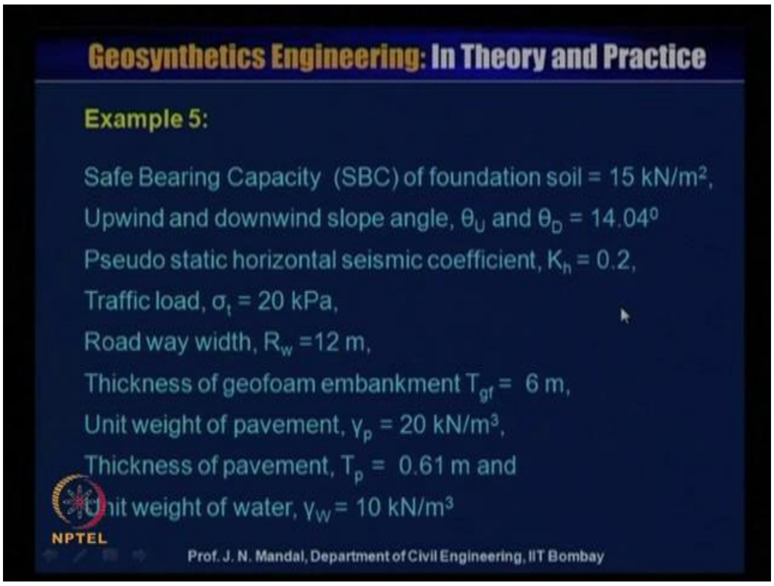

Now, I give 1 example. Let us say safe bearing capacity, SBC of foundation soil is equal to 15 kilo Newton per meter square. Upwind and downwind slope angle theta U and theta D is 14.04 degree. Pseudo static horizontal seismic coefficient, K h is equal to 0.2. Traffic load sigma T is equal to 20kilopascal. Road way width, the R w is 12 meter. Thickness of the geofoam embankment, T g f is equal to 6 meter. Unit weight of the pavement gamma p is equal to 20 kilo Newton per meter cube. Thickness of the pavement, T p is 0.61 meter and unit weight of water gamma w is equal to 10 kilo Newton per meter cube.

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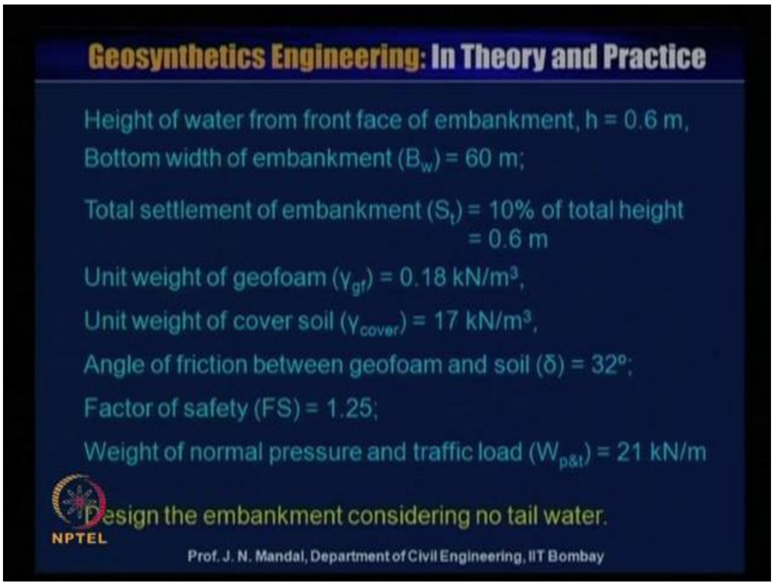

Now, height of the water from the front face of the embankment h, small h is equal to 0.6 meter. Bottom width of the embankment, B w is equal to the 60 meter. Total settlement of the embankment that is S t is equal to 10 percent of the total height because total height is 6 meter. So, ten percent of the total height will be equal to 0.6 meter. Unit weight of geofoam gamma g f is equal to 0.18 kilo Newton per meter cube. Unit weight of cover soil gamma cover is 17 kilo Newton per meter cube because generally it is filled up with the soil. Angle of friction between the geofoam and the soil delta is equal to 32 degree and factor of safety is 1.25. Weight of the normal pressure and the traffic load that is W p and t is 21 kilo Newton per meter. So, you have to design the embankment considering no tail water.

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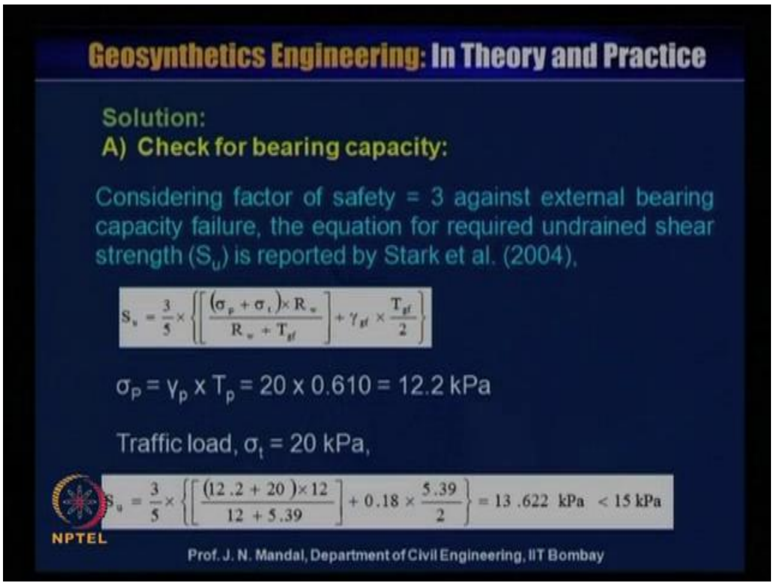

So, I will show you for the design for this embankment. Now, this is the solution a check of bearing capacity. Now, considering the factor of safety is equal to 3 against external bearing capacity failure, the equation for the required undrained shear strength S u is reported by Stark et al 2004. So, this is the equation. S u will be equal to 3 by 5 into sigma of P and sigma of P is the sigma P is the normal stress applied by the pavement at the top of the embankment that is in kilopascal.

Sigma of t is the normal stress applied by traffic surcharge at the top of the embankment and unit is kilopascal. R w that is width of the road and this is also R w, width of the road plus T g f that is thickness of the geofoam. This plus gamma of g f unit weight of the geofoam into T g f, thickness of the geofoam divided by 2, so have to calculate that what will be the normal stress applied by the pavement at the top of the embankment. That is let us say here sigma P. So, sigma P is equal to gamma p into the T p. So, this is the thickness of the pavement. This is the thickness of the pavement and this is the unit weight.

So, this is 20 into T p is 0.610. So, this will give 12.2kilopascal. So, traffic load is given, sigma t is equal to 20kilopascal. So, it is given in the problem. So, S u that undrained shear strength or required undrained shear strength, S u will be equal to 3 by 5. This is into 12.2 that is sigma of P plus the traffic load sigma t is 20 into this R w. That is road width is 12 meter. This is 12, this divided by R w 12 plus T of g f, which is equal to the 5.39.

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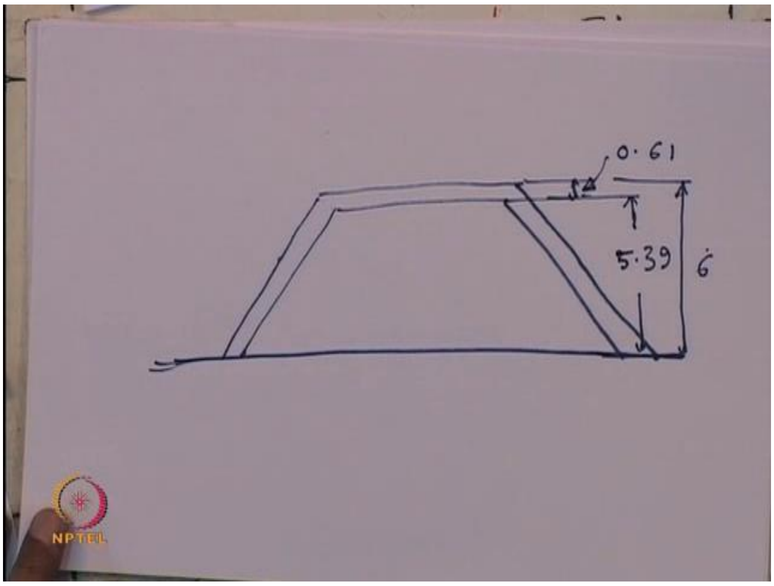

I am just trying to say tell you here that so this is the pavement system here and this total height, which is 6 meter. This part is equal to 0.61. So, this height will be 6 minus 0.61 that means this will give that 5.39. So, this is 5.39 and this is 0.61. So, you can write that this, so this is basically geofoam. So, this is geofoam 5.39. So, T of g f will be 5.39 plus this is unit weight of the geofoam that is 0.18. It is given into T of g f, thickness of the geofoam that is 5.39, this divide by 2, so this is equal to 13.622kilopascal. You know that that our bearing capacity is given is less than equal to the 15kilopascal. So, it is less than equal to 15kilopascal.

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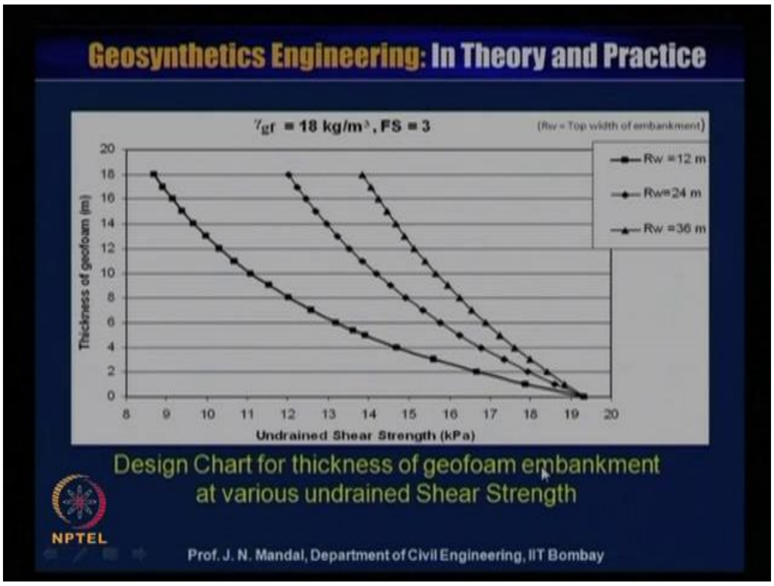

So, here is a design chart. So, this is design chart for the thickness of the geofoam embankment at various undrained shear strength. So, this axis is the thickness of the geofoam and this is the various undrained shear strength value for the different top width of the embankment. So, top width R w may be 12 meter for this top width, R w may be 24 meter or top width R w may be 36 meter. This may be 2 way or may be 4 way or thus 6 ways. So, any way for national highway, which may be the 4 way 6 ways and this factor of safety is equal to 3. Unit weight of geofoam is 18 kilogram per meter cube.

Now, you can have a nature of the curve like this that thickness is reducing with the increasing the undrained shear strength of the soil. So, this design chart is for obtaining the minimum thickness or what will be the height of the geofoam, T g for a factor of safety 3 against this external bearing capacity failure of a geofoam embankment. I can give you that 1 of the small examples for this design chart.

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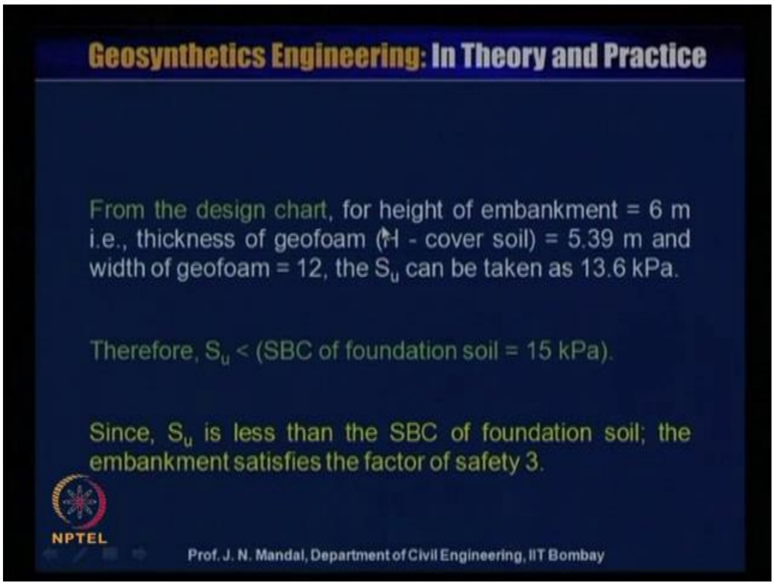

From this design chart, for the height of the embankment is 6 meter and thickness of the geofoam that total height 6 minus cover soil, I showed you 0.61. So, 6 minus 0.61 is equal to 5.39 meter and width of the geofoam that means this is the width of the geofoam. This we talk about, this is what you call the R w. This is R w is equal to this is 12. This is 12 R w and the S u can be taken as 13.6kilopascal. So, you can see here that this is about width of the geofoam is 12 meter. So, let us say consider here R w is 12 meter. So, if you know that 12 meter and you know that this is that thickness of the geofoam 5.39 meter. So, this is here somewhere 5.39 meter somewhere here.

So, then you can move horizontally and your width is about 12 meter. So, width about 12 meter, then you can move vertically downward. So, you can see that this undrained shear strength value S u lies between 14 to something 15, so which you give this value that 13.6kilopascal. Therefore, this undrained shear strength value; it is less than the safe bearing capacity of the foundation soil that is 15kilopascal. Since, the S u is less than the safe bearing capacity of the foundation soil; the embankment satisfies the factor of safety 3.

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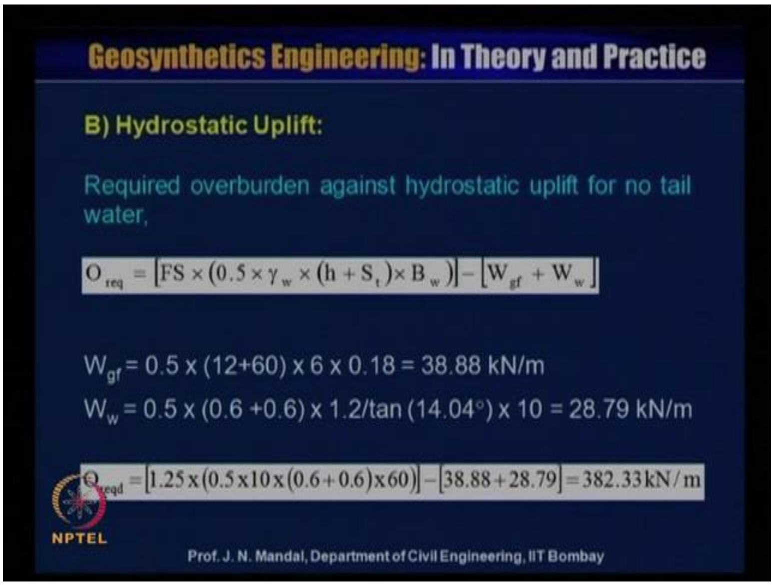

Next is B, hydrostatic uplift required over burden against the hydrostatic uplift for no tail water. So, this is the equation. O required is equal to F S into 0.5 into gamma w into h plus S t into B w minus W g f plus W w. So, here I am showing you that what is h and what is S t?

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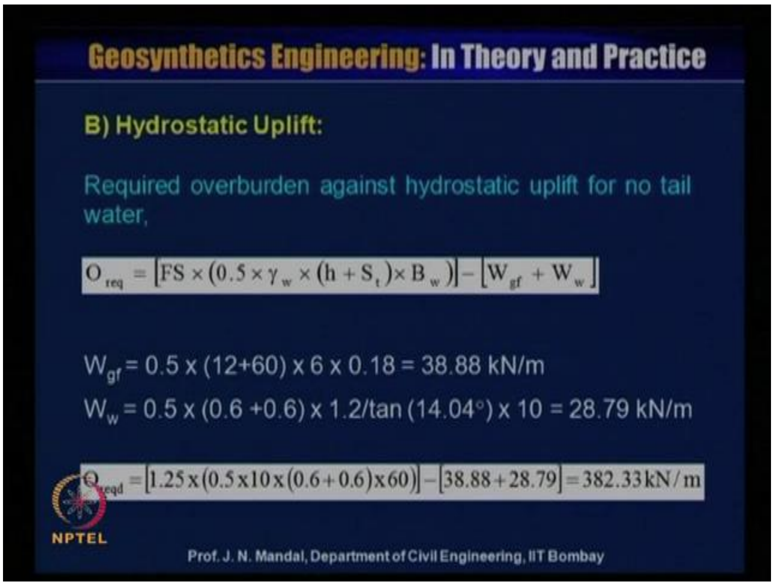

You can see here that hydrostatic uplift analysis with no tail water. After Stark et Al, this is the road width. This is R w. This is bottom width that is of B w. This is W g f. That means weight of the geofoam embankment and this is the W w. This W w is the vertical component of the weight of the water on the embankment phase above the base of the embankment on the accumulated water side because this side is the water.

Here also, the U that U is equal to uplift pressure acting on the base of the embankment. Here is the S of t that is total settlement. Here is the small h that is vertical height of the accumulated water to bottom of the embankment. Also, you can see that what will be the water pressure also is acting, which may act as one third of this base, so that you do not need here. This angle is equal to the theta and this is h is equal to height of the embankment.

So, we know that this is unit weight of water. You know what is h, S t. You know what is B w. This is road width B here. Base width that is B of w and this is W g f. You know this is W of g f will be the weight of the geofoam. Then you know what W w is. Now, you have to calculate that W of g of f that means weight of the geofoam. Now, new weight of the geofoam it is like this.

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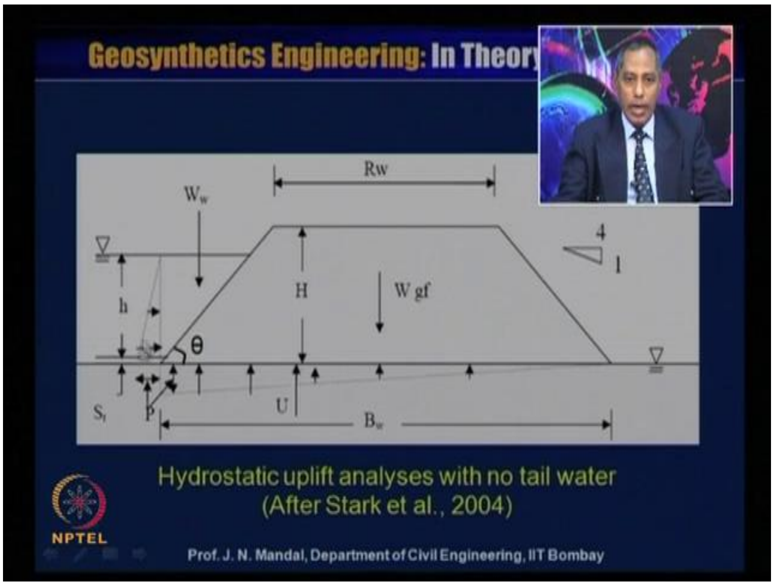

Suppose you consider this is the embankment. This is made of the geofoam and it has a the top width is R w and bottom width is B w. So, it is given, top width R w is given 12 and bottom width B w is given 60. So, it will be half into 12 plus 60. The height this is like a trapezoidal. So, you can measure that what will be the area that means half into 12 plus 60 into height is 6. So, height is 6 into that unit weight of the geofoam that is 0.18.

So, if you can calculate, then you can have the W g f is equal to 38.88 kilo Newton per meter.

Similarly, you have to calculate what should be the W w, that means weight of the water. So, this is the weight of the water here. This is the triangle here. So, this distance is h and this distance is H t. So, this S t is generally we have considered the 10 percent of the height h, h that means 0.6. So, this is S t, 0.6. This small h also given in the problem is 0.6. So, this height will be, so this height will be 0.6 plus 0.6. So, 0.6 plus 0.6, so that means it will be 0.6 plus 0.6, so half into 0.6 plus 0.6 into this angle. This angle is equal to the theta. So, theta, this value is 14.04 or 14.04 or 14 degree, approximately 14 degree.

So, this is tan of 14.04 degree, so into 1.2 because this to here that is 1.2, so this is theta. So, it will be 1.2 divided by tan of 14.04 will give you this. So, why it is written 1.2 divided by tan 14.04 degree into that unit weight of water is 10. So, if you can calculate, then you can have W w is equal to 28.79. So, this is the area of that triangle and the unit weight of the water. So, you can have this value.

So, you know now that what will be the weight of the geofoam, what is the weight of the water. Now, you substitute this value in this equation. So, O required will be factor of safety given 1.25. Then this is into 0.5. Again, gamma w is equal to 10 into h plus S t. I say 0.6 into bottom width is 60, that is 60 minus W g plus W g is given 38.88 plus W w is given 28.79. So, it will give 382.33 kilo Newton per meter. So, this I told you that what the hydrostatic uplift analysis with no tail water is…

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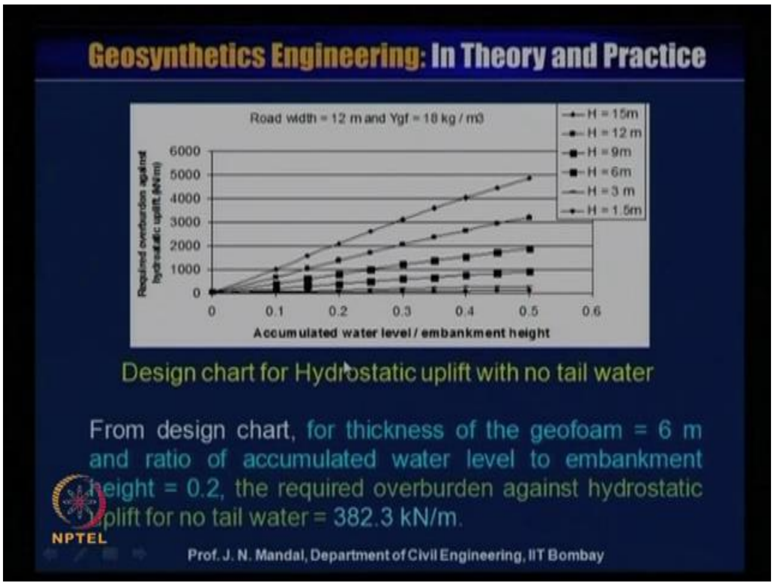

Now, this is the design chart. This is design chart has been made for hydrostatic uplift with no tail water. So, this design chart is this is the accumulated water level or a by embankment height. This is the required over burden against this hydrostatic uplift that is in kilo Newton per meter. So, this also road width is 12 meter and the unit weight of geofoam is 18 kilogram per meter cube. For different H value that means H may be 1.5 meter, 3 meter, 6 meter, 9 meter, 12 meter and 15 meter, so here it is given.

So, from this design chart for thickness of the geofoam, let us say 6 meter. So, your height of the embankment is 6 meter. If height of the embankment is 6 meter and the ratio of accumulated water level to embankment height is 0.2, it is here 0.2 and then require over burden against the hydrostatic uplift for no tail water. So, you from 2, then you move for the 6 meter height of the embankment. So, you can have some value what is called the required over burden against the hydrostatic uplift for no tail value is about 382.3 kilo Newton per meter. So, from this design chart, you can calculate that what will be the required over burden against hydrostatic uplift with no tail water.

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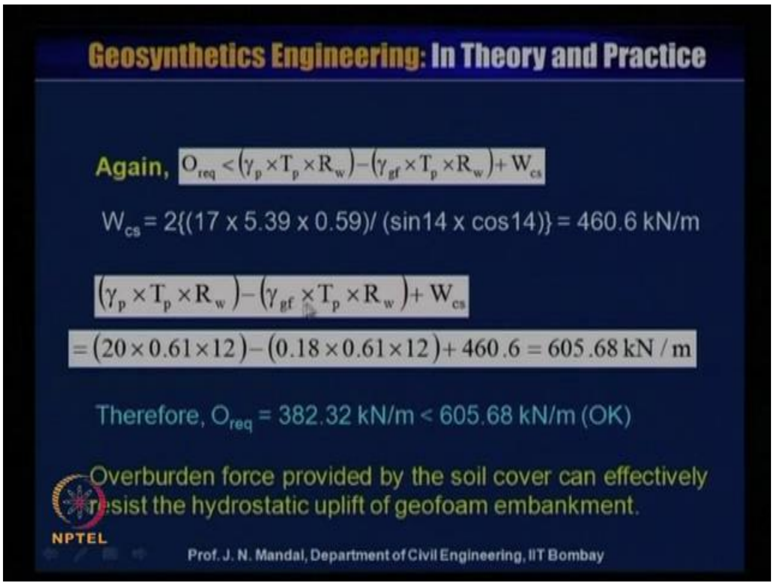

Again that O required is equal to gamma p into T p into R w minus gamma of g f into T p into R w plus W of c s. So here, for that W of c of s, how you can calculate the weight of the cover soil? So, for the weight of the cover soil, I can show you that how this weight of the cover soil W c s has been determined. So, this is the cover soil.

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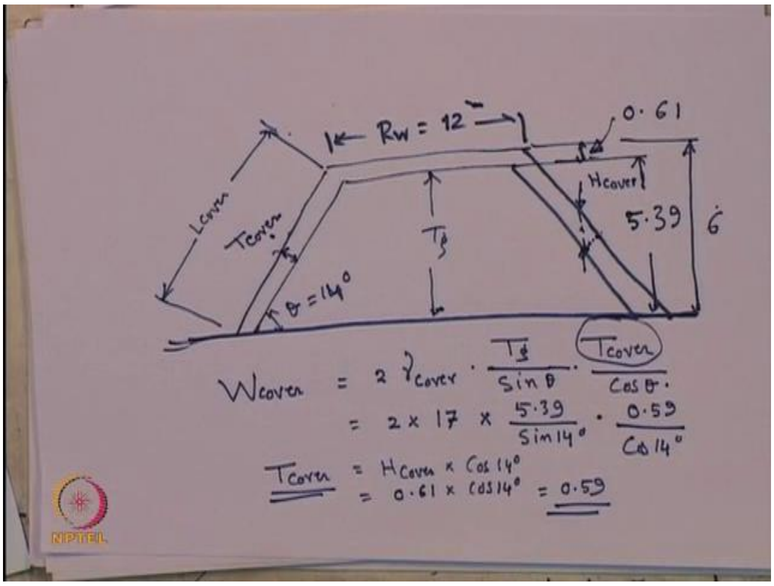

Now, this cover soil, suppose this to this, this is what you call the H cover. So, this H cover is the vertical thickness of the soil cover. This is vertical thickness of the soil cover, whereas this is also a cover. This is let us say, that this is T cover T cover. So, this is the perpendicular thickness of the soil cover. So, this and this is not the same.

So, this is H cover that means vertical thickness of the soil cover. This is the perpendicular thickness of the soil cover, which is T cover. You know that this is the thickness of the geofoam that is T of this thickness of the geofoam that is called the T of g. Also, this is the let us say L cover. So, that means this is the length of the soil cover on the side of the embankment. So, we have to calculate that what is W of cover?

So, to calculate the W cover, you can write this equation. W of cover is equal to 2 into gamma of cover into T of g divided by sine of and this angle is equal to theta that is about 14 degree. So, this into sine of theta into T of cover divided by cos of theta, so this is 2 and gamma cover is given is equal to 17 into thickness of this geofoam. You know 5.39, this divided by sine theta means sine of 14 into that. Now, we will go for the T of cover and this is also cos of this is 14 degree.

Now, we will see how you can calculate that what is called the T of cover. To calculate the T of cover, you can see here, you wanted to calculate that what will be the T of c. T of c is here. This angle is equal to theta. This angle is equal to theta. So, this T cover will be equal to H cover into cos of 14 degree that means T of cover is equal to H of cover into cos of 14 degree. So, this will give H cover, you know 0.61 into cos of 14 degree. So, this will give 0.59. So, you know that T cover will be 0.59. So, you can write this is 0.59.

So, now I am just showing you here that W of cover that is 2 into gamma is 17. This into thickness of the geofoam 5.39 into this is the T cover, thickness of the cover 0.559 as you calculated this divided by sine of 14 degree into cos of 14 degree. So, this will give 460.6 kilo Newton per meter. So, again gamma p into T p into R w minus gamma g f into T p into R w plus W of c s weight of the cover, so this you know gamma p is 20 T p is 0.61 R w is 12 minus gamma g f 0.18 T p is 0.61 and R w is 12 plus W c s is 460.6. So, this will give 605.68 kilo Newton per meter. Therefore, O required is 382.32 kilo Newton per meter, which is less than 605.68 kilo Newton per meter that means it is, so over burden force provided by the soil cover can effectively resist the hydrostatic uplift of geofoam embankment.

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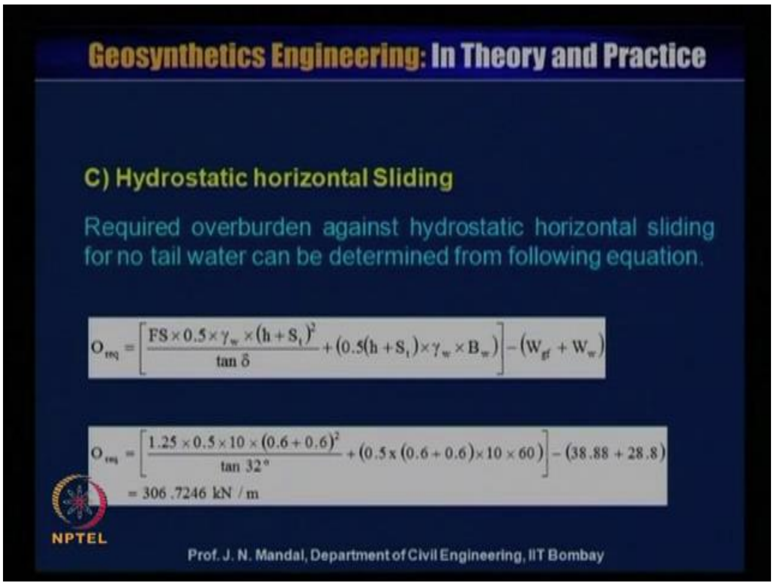

Next see hydrostatic horizontal sliding. Required over burden against hydrostatic horizontal sliding for no tail water can be determined from the following equation that is O required is equal to F S that is factor of safety into 0.5 gamma w into h plus S t square divided by tan delta where delta is equal to friction between the soil and the e p s geofoam plus 0.5 h plus S t into gamma w into B w minus W of g f plus W of w. You know all the terms. What is h, S t, gamma w, B w, W g f and W w?

So, O required is factor of safety 1.25. This is 0.5 gamma w unit weight of water 10 plus h is equal to 0.6; S t is equal to 0.6. So, 0.6 plus 0.6 square, this divided by tan delta, delta value is given, 32 degree plus 0.5 plus h plus S t 0.6 plus 0.6. Then gamma w is 10 and B w is the base width of the embankment that is 60 minus this weight of the geofoam we calculated earlier, 38. 88. Also, weight of the water that is W w also you calculated, 28.88 earlier also we have calculated. So, you can obtain O required will be equal to 306.7246 kilo Newton per meter.

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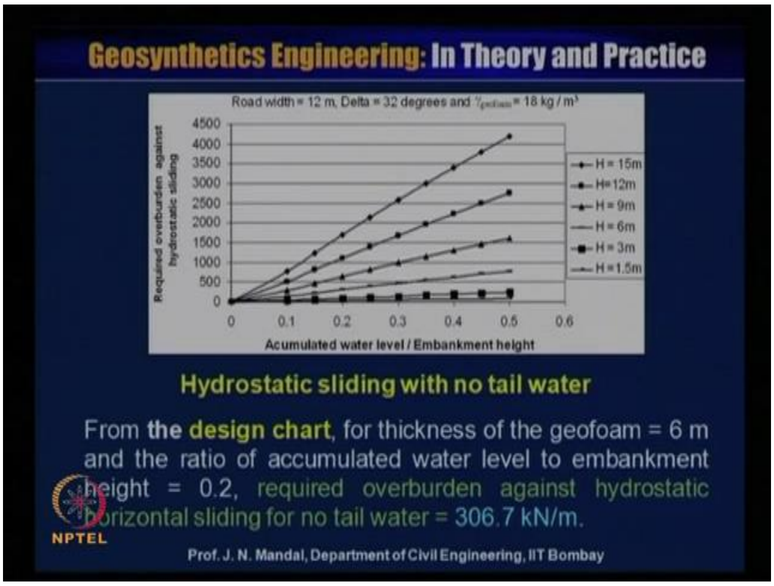

Now, this is the hydrostatic sliding with no tail water. So, here this accumulated water level by embankment height 0.1, 0.2, 0.3, 0.4, 0.5, 0.6 and this is required over burden against the hydrostatic sliding. This is road width considering 12 meter, delta value is 32 degree and the unit weight of geofoam is 18 kilogram per meter cube that density of the geofoam and the height of the embankment is 1.5 meter, 3 meter, 6 meter, 9 meter, 12 meter and 15 meter. So, you can calculate that what will be the required over burden against this hydrostatic horizontal sliding for no tail water.

So, here for the design chart, thickness of the geofoam is 6 meter. So, this thickness is 6 meter and the ratio of accumulated water level to the embankment height is 0.2. So, from this 0.2, you move up where the H is equal to the 6 meter. Then you move horizontally. So, required over burden against the hydrostatic horizontal sliding for no tail water, you can have 306.7 kilo Newton per meter. So, you can see also here that what we received 306.7246 kilo Newton per meter and from this also design chart, you are having the required over burden against hydrostatic horizontal sliding for no tail water is 306.7 kilo Newton per meter.

Again, O required is less than gamma p. T p into R w minus gamma g f into T p into R w plus W of c of s. So, gamma p into T p into R w minus gamma g f into T p into R w plus W of c s, so gamma p, it is 20 that is unit weight of the pavement is 20. Thickness of the pavement is 0.61 and R w is equal to the 12 minus gamma of g f. Unit weight of the geofoam is 0.18 into this is thickness of the pavement that is 0.61 into R w, road width into 12 plus W c s, so which we calculated what will be the weight of cover soil that is 460.6. So, this will give that 605.68 kilo Newton per meter.

Therefore, O required is 306.7264 kilo Newton per meter, which is less than the 605.68 kilo Newton per meter that means it is because O required you calculated 306.7. So, it is less than 0, 605.68 kilo Newton per meter. So, over burden force provided by the soil cover can effectively resist the hydrostatic horizontal sliding of the geofoam embankment. So, you have some idea that how you can design that if the water level it may be on the 1 side, it is considered sometimes for the embankment construction. You can also design for the water level at the both side of the embankment too. So, with this, I finish my lecture today. Let us hear from you any question?

Thanks for listening.