Geosynthetics Testing Laboratory
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Lecture - 2
Types of Geosynthetics

Welcome. I am Professor J. N. Mandal, Department of Civil Engineering, IIT, Bombay. The name of the course is Geosynthetics Testing Laboratory. And this Geosynthetics Testing Laboratory, we have in IIT, Bombay have 2 courses that is (Refer Time: 00:41) for undergraduate students C492 and the post graduate course on Geotextile CE746. And this course is running 61984 at Indian Institute of Technology, Bombay. This module 1, the lecture number 1, I will discuss the physical properties of the geosynthetics material.

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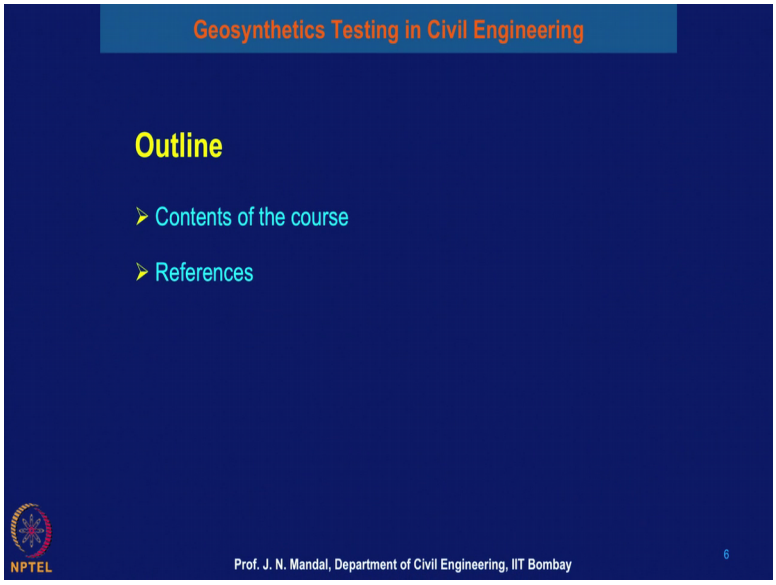

The outline of the course, I will discuss about the content of the course and I will provide some references.

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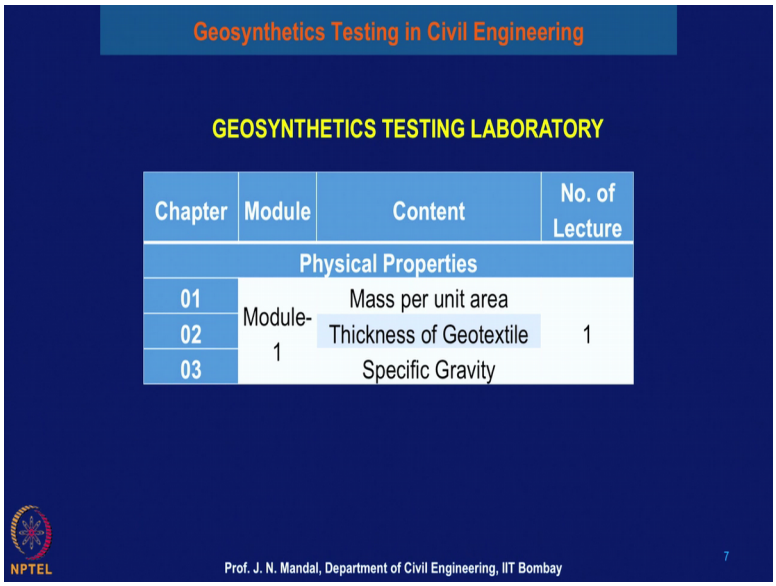

In this Geosynthetic Testing Laboratory will cover the chapter, module, content and the number of lecture. So, in chapter 1, we will go for Physical Properties of this synthetic material and module 1 is Mass per unit area, Thickness of Geotextile and the Specific Gravity.

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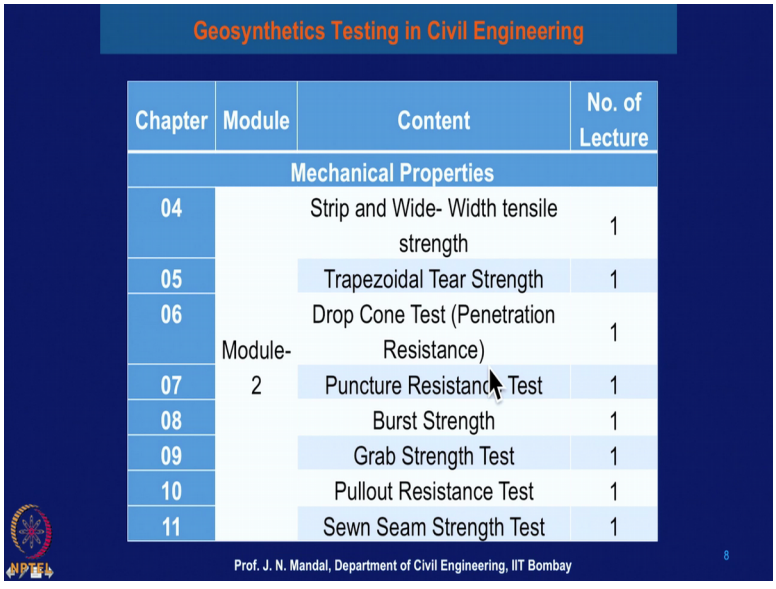

This is Mechanical Properties that is Strip and Wide-Width tensile strength. Next chapter 5 is Trapezoidal Tear Strength. Chapter 6 is Drop Cone Test Penetration modulus resistance. Chapter 7, Puncture Resistance Test. Chapter 8, Burst Strength; chapter 9,

Grab Strength Test and chapter 10, Pullout Resistance Test and chapter 11, Sewn Seam Strength.

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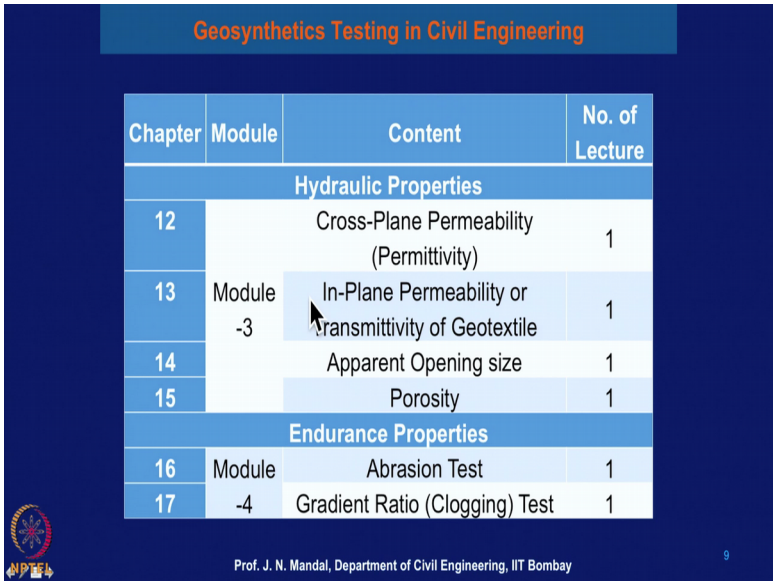

Next is chapter 12 is the Hydraulic Property that is Cross-Plane Permeability which is called the Permittivity and chapter 13, module 3 In-Plane Permeability or Transmittivity of Geotextile; chapter 14, Apparent Opening Size and chapter 14 with the Porosity. Next, we will discuss the Endurance Properties of geosynthetic material. Chapter 16 is module Abrasion Test and chapter 17 Gradient Ratio or which is called Clogging Test.

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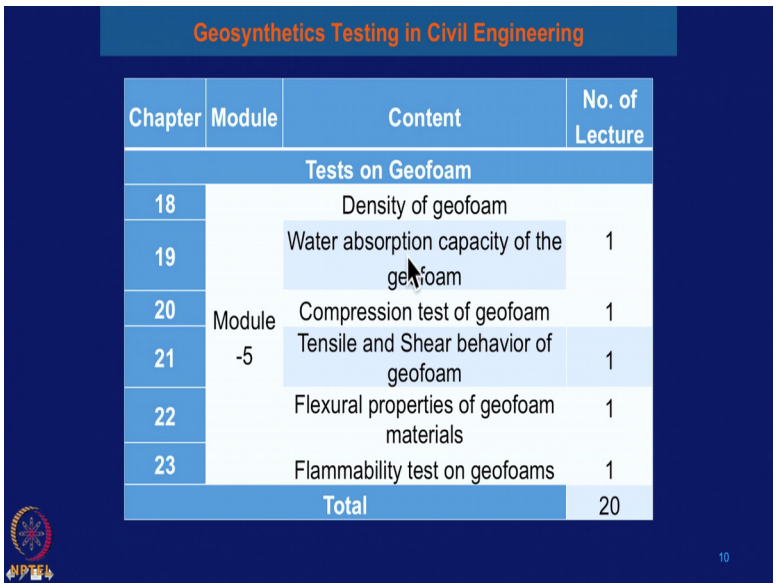

Result of the some test on the geofoam material which is super light material for chapter 18 will give the Density of the Geofoam material; chapter 19 Water Absorption capacity of the geofoam and chapter 20 that Compression test of the geofoam; chapter 21, Tensile and Shear behavior of the geofoam and chapter 22, Flexural properties of the geofoam materials; chapter 23, Flammability test on geofoams.

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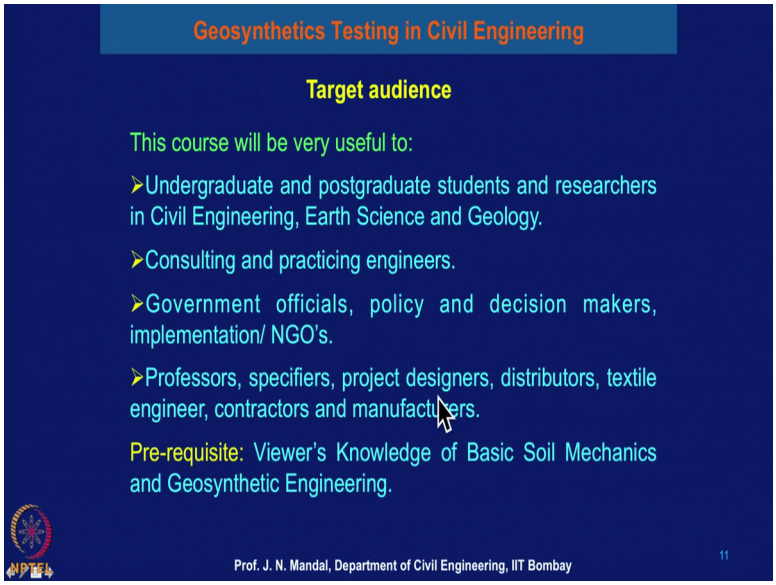

So, these are the test generally we will generally we will perform and main target audience for this course will be very useful to Undergraduate, post graduate student and research in Civil Engineering, Earth Science and Geology and the textile engineer, Consulting and the practicing engineer; Government official, policy and the decision maker, implementation and NGO; Professors, specifiers, project designer, distributor, textile engineer, contractor and manufacturer. The Pre-requisite for this course in here should haves some knowledge of the Basic geotechnical or Soil Mechanics and the Geosynthetics Engineering.

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I am for you giving some of the references for this course. So, you can go through some of the book this Mandal, J. N. and Divshikar, D. G. 1994. A Guide To Geotextile Testing, this Oxford IBH Company Private Limited. You can also follow the ASTM D5261 that is Standard Test Method for Measuring the Mass per Unit Area of Geotextile. ASTM D5199 that is Standard Test Method for Measuring the Nominal Thickness of Geosynthetics.

ASTM D792 that is Standard Test Method for Density and Specific Gravity or Relative Density of Plastic by Displacement. ASTM D1388 that is Standard Test Method for Stiffness of the Fabric. ASTM D4751, Standard Test Method for Determine Apparent Opening Size of the Geotextile.

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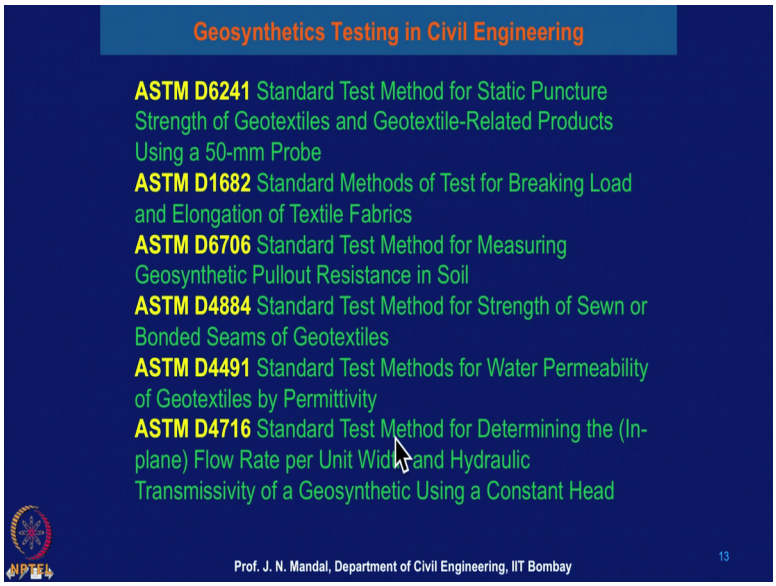

ASTM D6241 Standard Test Method for Static Puncture Strength of Geotextile related product using a 50 millimeter probe; ASTM D1682 Standard Test Method of Test Breaking Load and Elongation of the Textile Fabric. ASTM D6706, Standard Test Method for Measuring Geosynthetics Pullout Resistance in Soil.

ASTM D4884 Standard Test Method for Strength of Sewn or the Bonded Seams of Geotextile. ASTM D4491, Standard Test Method for Water Permeability of Geotextile by Permittivity. ASTM D4716, Standard Test Method for Determining the In-Plane or Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using Constant Head.

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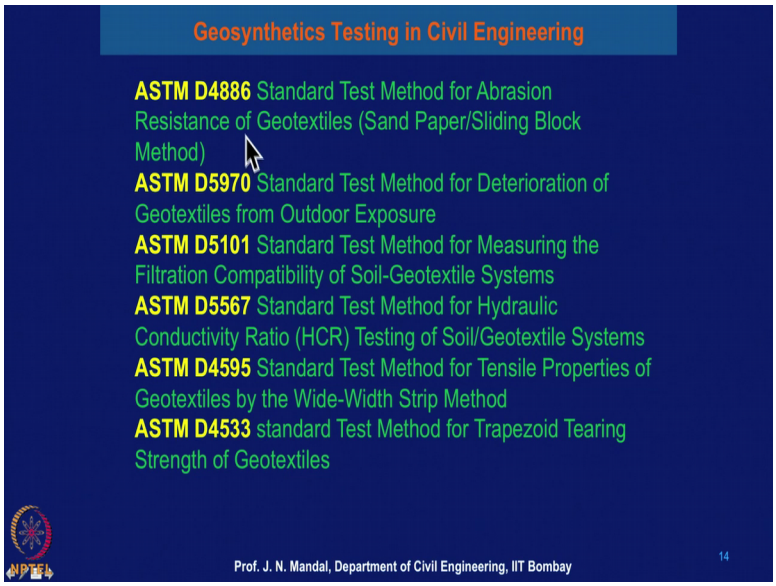

ASTM D4886: Standard Test Method for Abrasion Resistance of Geotextile Sand Paper or Sliding Block Method. ASTM D5970, Standard Test Method for Determination of Geotextile from Outdoor Exposure. ASTM D5101, Standard Test Method for Measuring the Filtration Compatibility of Soil-Geotextile System. ASTM D5567, Standard Test Method for hydraulic Conductivity Ratio that is HCR testing of Soil oblique Geotextile System ASTM D4595, Standard Test Method for Tensile Properties of Geotextile by the Wide-Width Strip Method. ASTM D4533, Standard Test Method for Trapezoidal Tearing Strength of Geotextile.

So, these are the a specification of which we will follow or during our geosynthetics testing laboratory. So, once should read this books and the specification; apart from this book I you can go the one of the book that is Geosynthetics Engineering in Theory and Practice and that is been published in the research publisher in the Singapore.

Now, what is geosynthetics? A planer product manufacturer form polymeric or natural material used with soil or earth as an integral part of manmade project structure or system. And this include planer structure, geomembrane, geotextile, geosynthetics, clay liner, barrier, geonet, geogrid, geostrip, geospatial and the geomat etcetera and 3 dimensional structure like geo- cell, geofoam, gabion and concrete filled mattresses.

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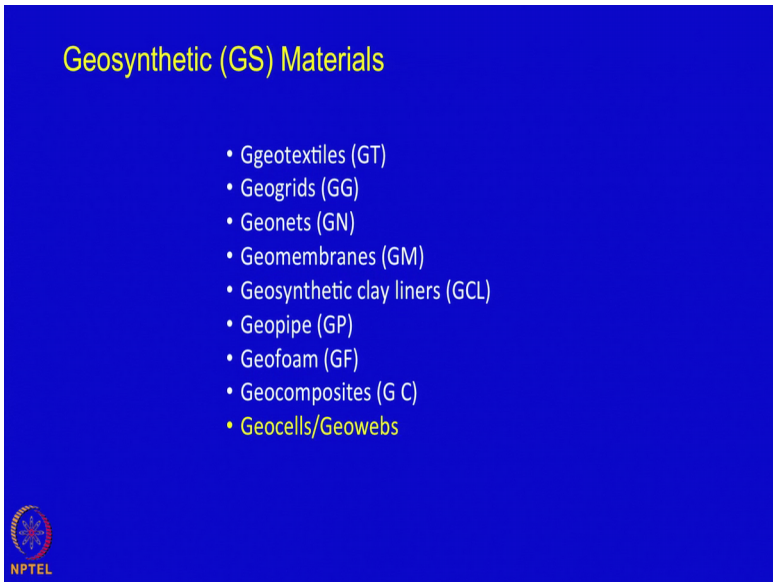

Now, there are different types of the geosynthetics material available in the wall. It is about more than 1000 different types of prefabricated geosynthetics material are available. The some of the geotextile material are presented here. This number 1 is the Ggeotextile; geotextile this is designated as GT. Then, Geogrid; this is designated as GG. This is Geonet; this is designated as GN.

This is Geomembrane; this is designated as GM. And Geosynthetic clay liner is designated as GCL. Geopipe is designated as GP; Geofoam is designated as GF and Geocomposite is designated as G C. Geocell and the geoweb. So, these are the different types of the material. Here, I am showing some of the geosynthetics material.

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There are 2 types of the geosynthetics material; one is the woven geotextile material, another is non woven geotextile material. So, when you say it is the woven geotextile material, you can see here this geotextile material, this filament are perpendicular to each other and showing one of the woven geotextile material, this the woven geotextile material and these are the filament are perpendicular to each other.

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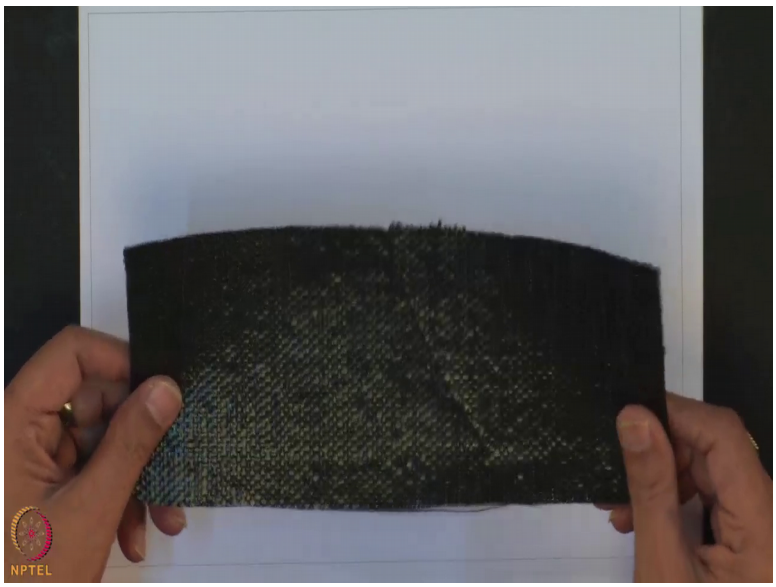

So, it is called the woven geotextile material.

This woven geotextile material, we have to determine what should be the tensile strength of the woven geotextile material and the corresponding the elongation and some other test. So, this is a kind of the woven geotextile material. This geotextile material made of the this geotextile material made of polymer material.

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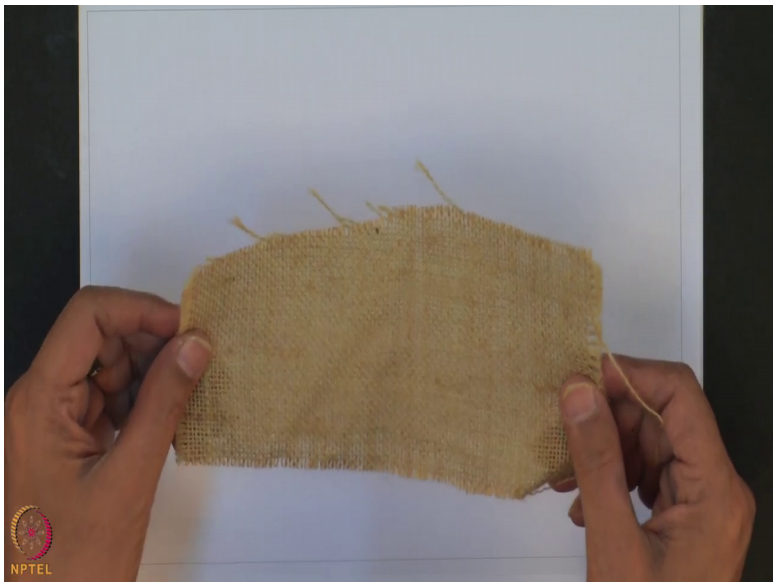

You can also develop this woven natural geotextile material. This is woven jute geotextile material. Here, you can see this filament are perpendicular to the each other. So, it is woven jute geotextile material. So, it has also the tensile strength in the machine direction and also cross machine direction and corresponding to the elongation. What? We will study.

So, this geotextile material is the woven geotextile material. We are in non woven geotextile material. This non woven geotextile material when the filament is very random like a blanket. So, these are the non woven geotextile material. I can show you some non woven geotextile material. This is non woven geotextile material.

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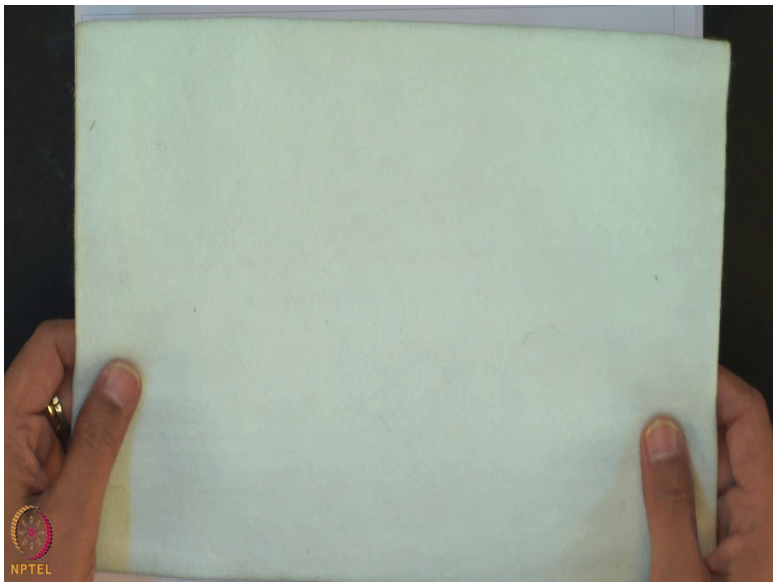

So, this filament is very random. So, you have to perform what will be the tensile strength in the machine direction as well as in the cross machine direction and what will be the elongation for both machine as well as cross machine direction. You can also perform the test in the diagonal direction. So, this is the non woven geotextile material which filament are very random.

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So, this is the natural non woven geotextile and this geotextile material is made from jute fibre. So, natural material also used for the as a geotextile material. So, this is the non woven natural jute geotextile material.

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So, most of the cases that this material can use as a filtration and the (Refer Time: 14:55) material and as well as reinforcement. Next this is the geogrid material. So, these material have a uniaxial geogrid and also the biaxial geogrid uniaxial geogrid and also biaxial geogrid. This is the uniaxial geogrid ok.

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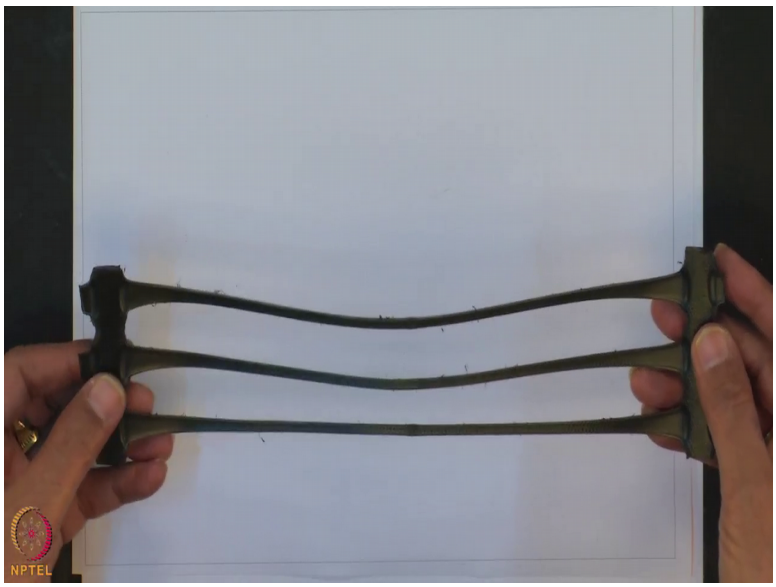

And this act as a reinforcement and you have to determine what will be the tensile strength in the machine and cross machine direction and corresponding to the elongation. And this kind of the geogrid material can be used for the for the construction of the reinforced soil retaining wall or the reinforce soil slope and also you can use for the geogrid material for the road construction and this is the uniaxial geogrid material.

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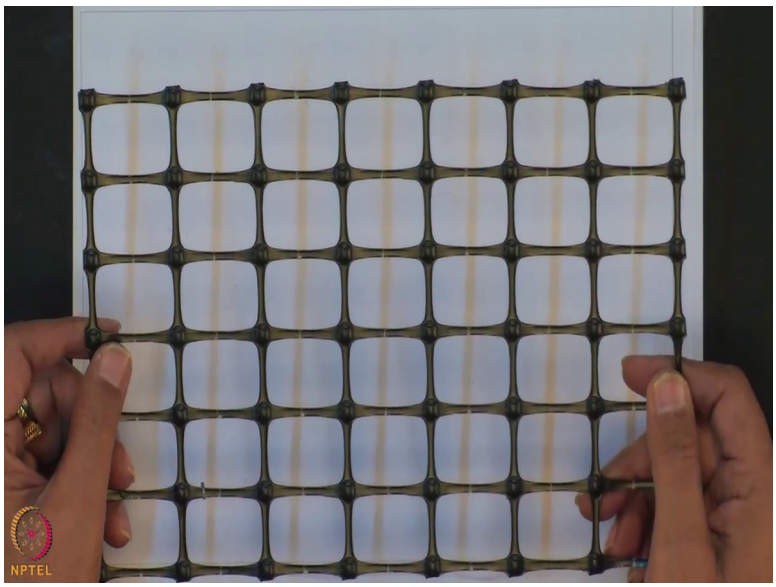

This is biaxial geogrid material this is biaxial geogrid material. So, this also can be used for the railway. It has also the tensile strength in the machine and cross machine direction and corresponding to the elongation. There are some other materials also used for the construction of the reinforce soil retaining wall.

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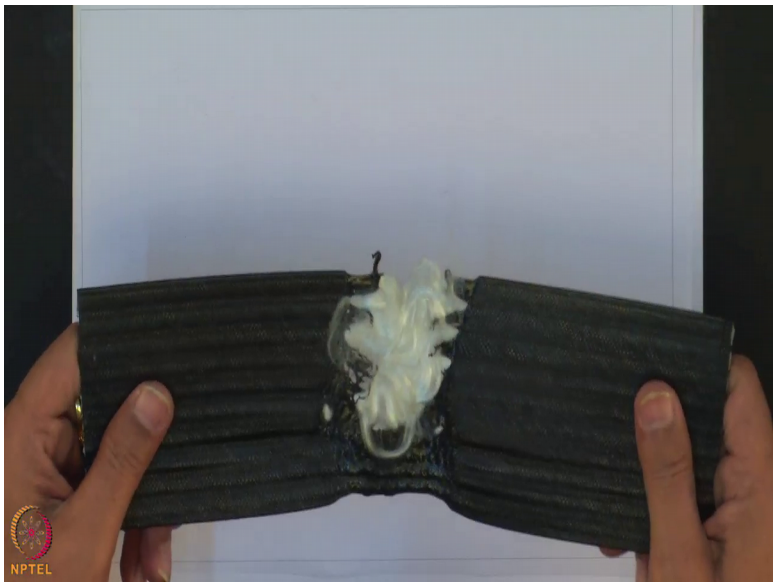

And this is what you call the friction tie. So, this kind of the material also can be used for the construction of the reinforce soil wall and it is called the friction tie. We can use some material for the reflection cracking.

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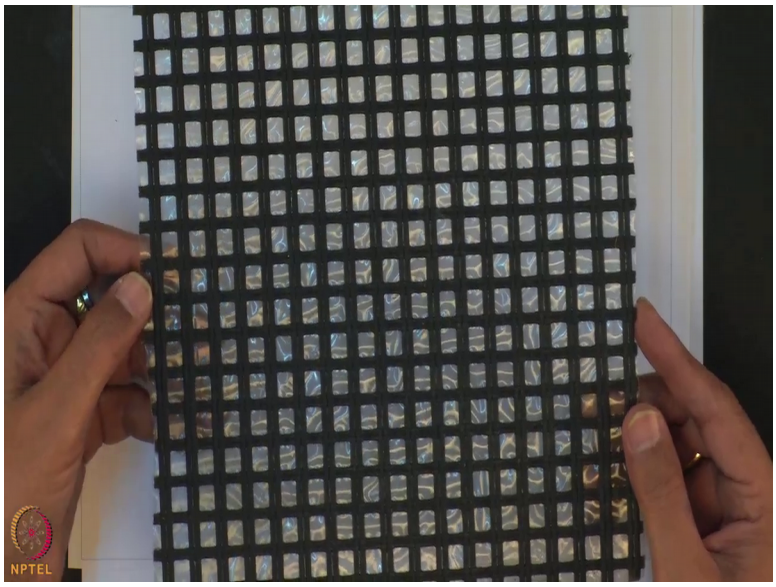

So, this the kind of the material which you can use for the reflection cracking material. It had been used also in the airfield pavement for the reflection cracking and it has strength also 100 kilo Newton per meter or 50 kilo Newton per meter. So, this is all glass polymer material.

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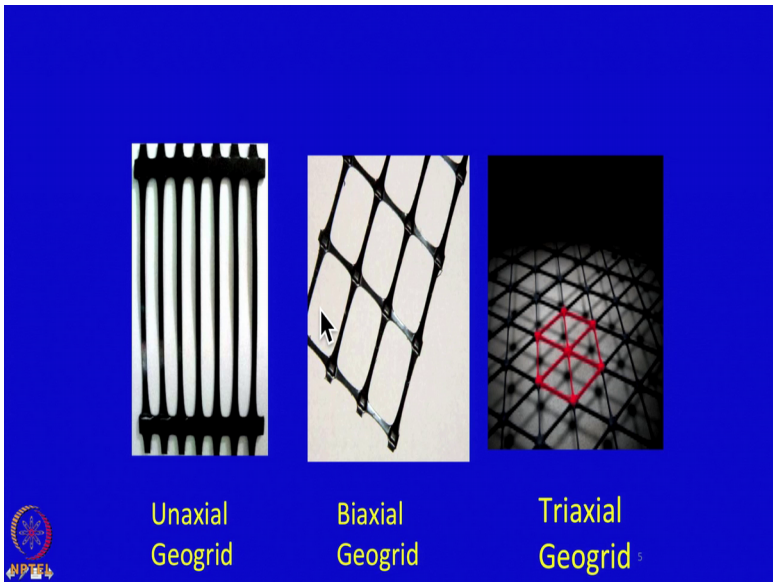

So, this geogrid material is used, this is Uniaxial Geogrid; this I showed you that Biaxial Geogrid. There are another also new material has come which we called that Triaxial Geogrid material and this Triaxial Geogrid material also is made from the bamboo and also polyester material.

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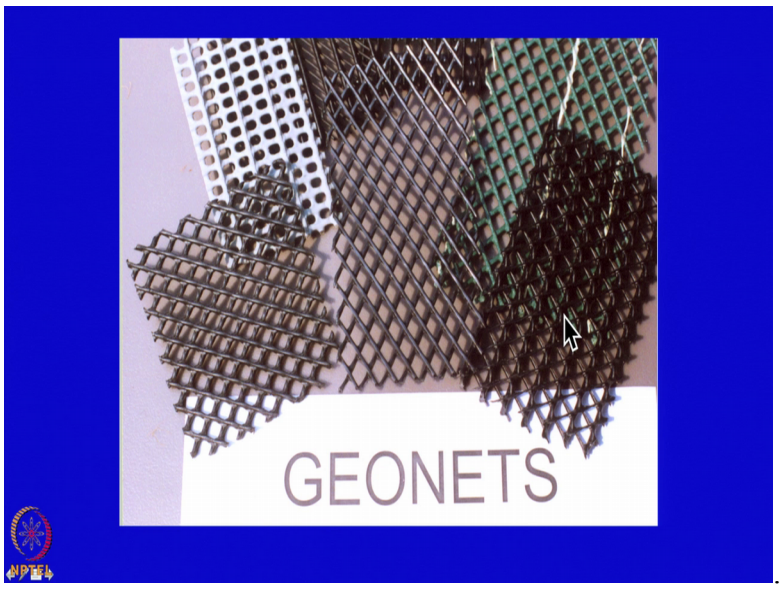

This is Geonet material and this is the rhombus in size this is the Geonet material.

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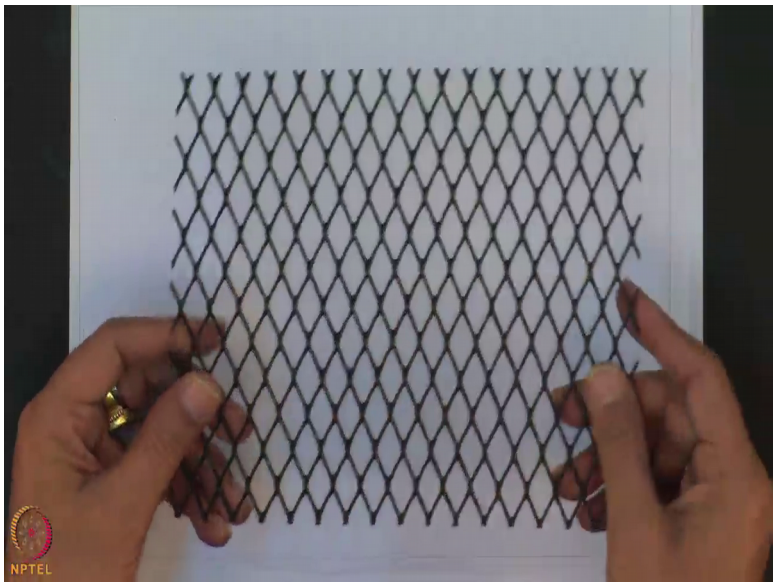

This Geonet material is used for the drainage and the filtration you can use for the Lanchow. What there is a problem with the drainage and the filtration, you can use this kind of the Geonet material.

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The all earlier material all the material are polymer material and all are polymer material and also the natural material.

Now, this is geomembrane material. So, this is impossible material, it is like a lava. So, you can use this kind of the geomembrane for the land (Refer Time: 18:27). Also you can

use for the earth and dam to control the sea phase, for the channel liner, for the reservoir; you can use this material and this geomembrane material I am saying this is a impermeable material and in this geomembrane material, we can see both the side are smooth; smooth geosynth[tic]- geomembrane material.

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This is smooth geomembrane material. So, if we want to use in a slope of land flow and then, you sometimes require there will be the mobilization of the friction between the slope soil layer and the geomembrane and that is the why that there are some geomembrane material also develop.

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The one side of the geomembrane is very rough which can be face towards the slope of the soil because, there will be a development of the friction between the rough of the geomembrane side to the soil and the other side is a smooth.

So, we can develop the any kind of the geomembrane material, I just smooth on the both the side or one side is the rough and another side is the smooth depending upon the type of application whatever you require the mobilization of good friction between the soil and the geomembrane. Then you can use the rough geomembrane material. So, these are the all impermeable material. This, another exciting material also this is Geosynthetic Clay Liner.

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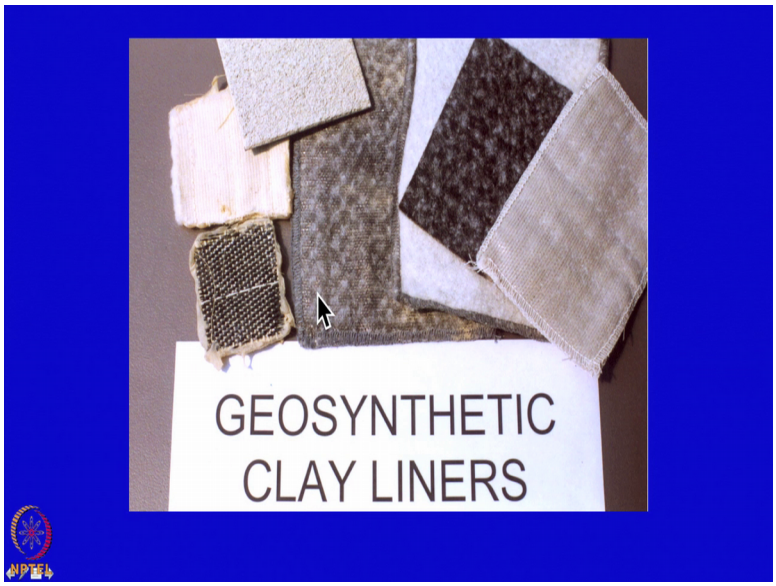

And this geosynthetic clay liner is made of geotextile, bentonite, and the geotextile. It is like a sandwich form. So, when the water will come in contact with the bentonite and it is expand and it act as a impermeable material.

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I will show you that some material, this is the material which is that GCL or geosynthetic clay liner. It may be the woven, bintonite and the non woven or woven or geomembrane any combination. So, you can use of this geosynthetic clay liner as a impermeable material and this is alternative to the geommebrane material.

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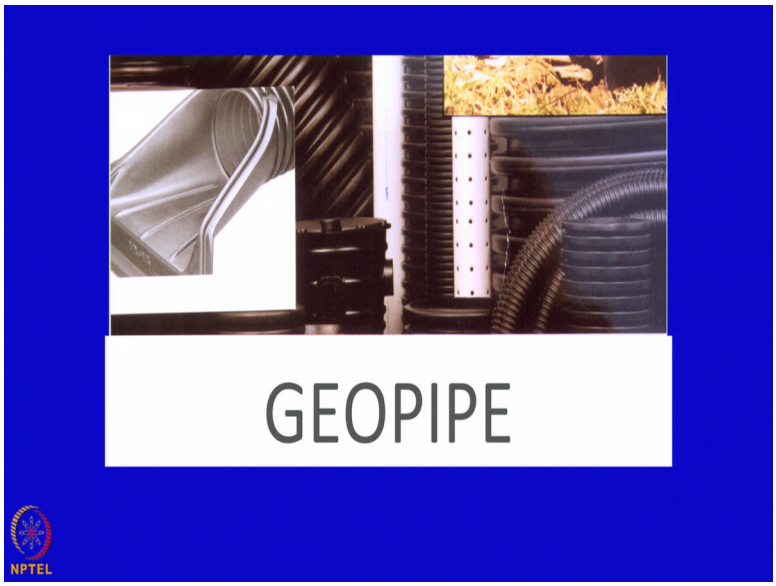

So, you can you use also in the land field and Geopipe as you know we use it.

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So, this is one of the exciting material which you call the Geofoam and in textile term and this textile term, it is called the expanded bentonite material and you can have with the different size and shape and the different density, this geofoam material.

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And this is you can have it different different shape and size is a different density of the material and this is the geofoam. It is nothing but a thermocol which you take a cup of coffee or tea. You can have the different size and the shape and the density and this is the block you can have it in the 2 metre by 100, 500 millimeter by the 300 millimeter and this weight about 36 kg.

You can simply place for the construction of a magnet on the soft soil. So, one should know what should be the characteristics of the geofoam material. So, this is a kind of geofoam material.

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And its density is about 100 time less than the soil. So, it has a lot of potential used for the construction and amendment of soft soil or you can use at the back of the retaining wall to reduce the that later pressure drastically. And this is the geocomposite material, all the material what I told that geotextile, geomembrane, woven and nonwoven geotextile material, geogrid; any combination of geogrid, non woven geogrid, woven material is a geocomposite material. Geonet or the non woven geotextile material also is a geocomposite material. I will show you some of the geocomposite material. This is the geocomposite material ok.

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This is non woven and the Geonet material and the non woven. So, this is the geocomposite material. You can have also this is also you can say geocomposite material.

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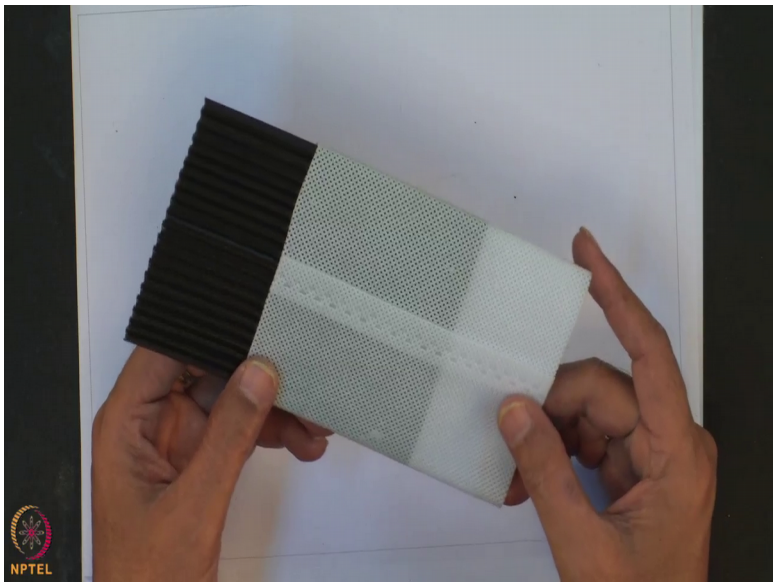

And basically this is the material which we use for the ground improvement; when the ground is very soft. So, we use generally the sand rein and it takes time to consolidated maybe 2 year, 7 year 21 year. Alternative to the sand rein, you can use this is prefabricated particle bandwidth or which is called popularly known as the PVD. This is also the composite material because this is the core material and the other side is a jacket material and this is the non woven spun bonded geotextile material and this is the core.

So, you can insert it into the subsoil; there will be dissipation of the probe water pressure and this channelize to the channel. So, these kind of material also will perform the test and also we should know that what should be the quantity of water can pass through this material and what will be the tensile strength and other property. So, this also you can say as a geocomposite material. We can have also different types of the geocomposite material one bonded non woven geotextile material and plastic core.

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And then also we can say the natural material also like a PVD.

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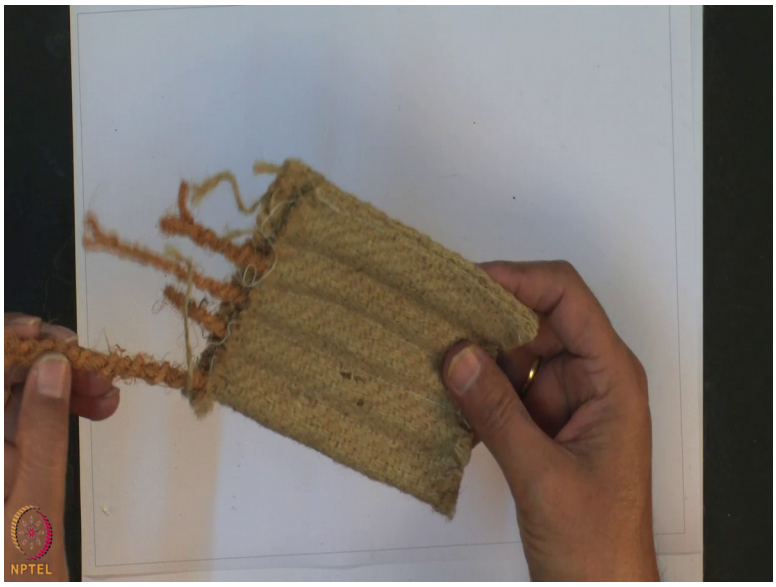

The outside is a woven and non woven jute material and quiet coconut fibre; this act as a probe of water. So, this is the jacket and this is the core material. You can use also this kind of also as a geocomposite material. This, another material which you call the Geocell.

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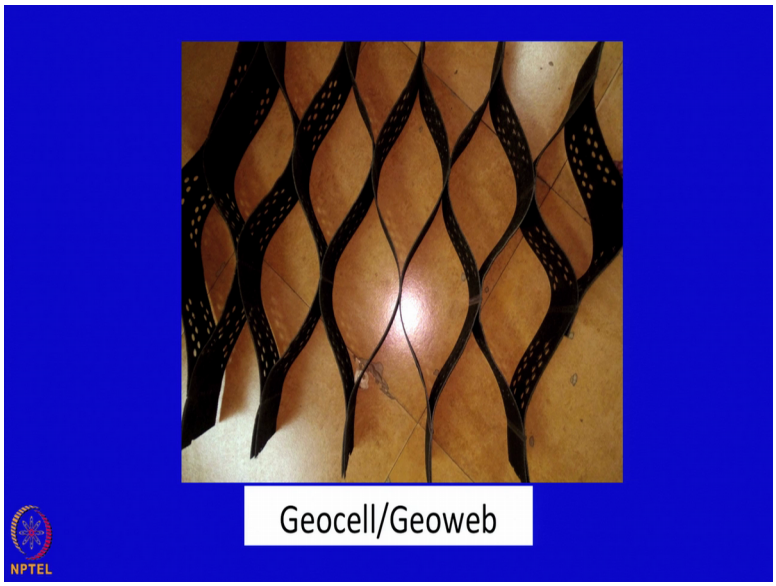

So, this the Geocell, this is the hexagonal, hexagonal; 3 dimensional hexagonal structure.

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So, this Geocell or the geocell you can be claps; it can be expanded and it can be filled up with the different types of the filling material, gravel sand and place it and compact it. You can construct the road, you can use for the slope, you can use for the erosion control with a potential application of geocell material in Civil Engineering.

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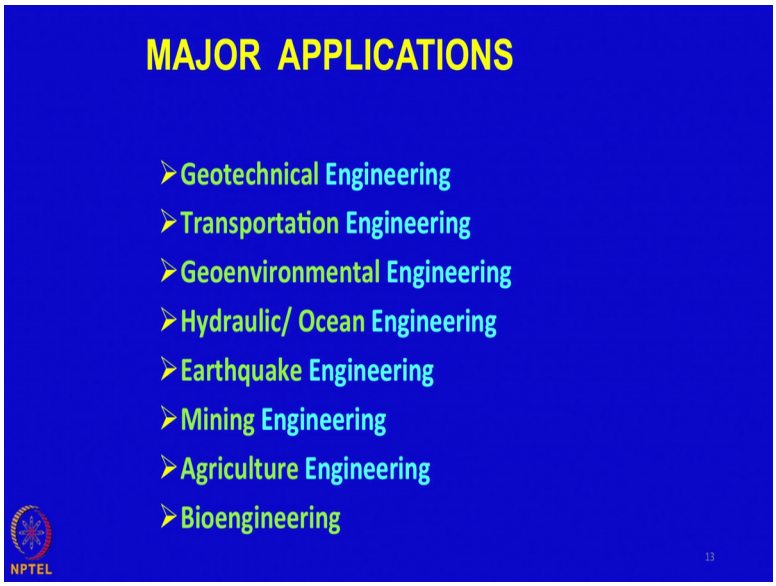

So, what are the major application that is Geotechnical Engineering, Transportation Engineering, Geoenvironmental Engineering, Hydraulic or Ocean Engineering, Earthquake Engineering, Mining Engineering, Agriculture Engineering and Bioengineering.

Also these are the material what I have shown you it is a woven and non woven geotextile material and how you can make use all this kind of the material in the different engineering system. It may be Transportation Engineering; it may be Environmental Engineering; Hydraulic Engineering and Mining Engineering; Agriculture and Bioengineering.

So, this will be very helpful for the use of the geosynthetics material in different projects. So, we should know that what should be the exact properties of the geosynthetics material required for certain application.

Thank you.