Foundation Design
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Lecture - 18B
Deep Foundation- Part 1

I am going to start with your deep foundation. I have finished these earth pressure theories. Now it is deep foundation.

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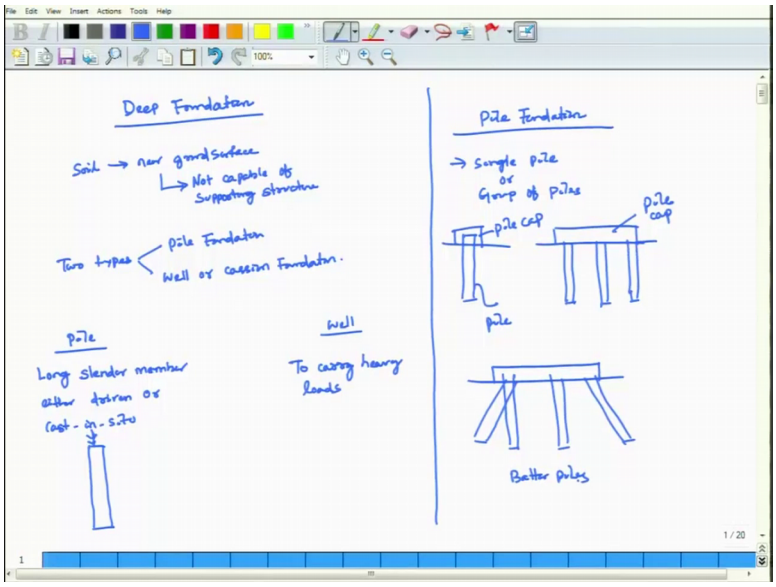

Where are your deep foundations are required? Particularly soil at near ground surface is not capable of supporting a structure; that means is a soil near ground surface not capable of supporting structure, structure. Particularly if I am not getting a bearing capacity at the shallow foundations the capacity I am not getting enough, at that point what you are supposed to do, modified this foundations like isolated to streep or strap combined a raft mat foundations. If it is not possible then you will go for deep foundations, then you will go for deep foundations.

There are 2 types one is pile foundation other is a well or caisson foundation. So, if I put it simple one pile what is pile and what is well very simple one. Pile foundation is a long slender member let us say very long slender member, either driven or cast in situ, simple way long slender member either it is driven or cast in situ. Means it is a long slender

member, how does to be installed? Either it has to be driven by means of hummer or cast in situ, take a bore whole cast ins in the ground and put it.

In details we will go well or caisson foundations, to carry heavy load to carry heavy loads. So, caissons diameter particularly railway bridge rails these are called caissons or pears. Now come to next step that is your pile foundation. So, pile foundation may be used as a single pile, it can be used as a single pile or group of piles. This is a pile cap there is a pile cap, this is my pile either it is provided single or group of pile or it may provided as a batter pile to register more lateral load. One is vertical middle is vertical and one side you can put batter, or you can put also both the sides both the sides also batter piles.

This is called batter piles; in broadly pile has been classified into 2.

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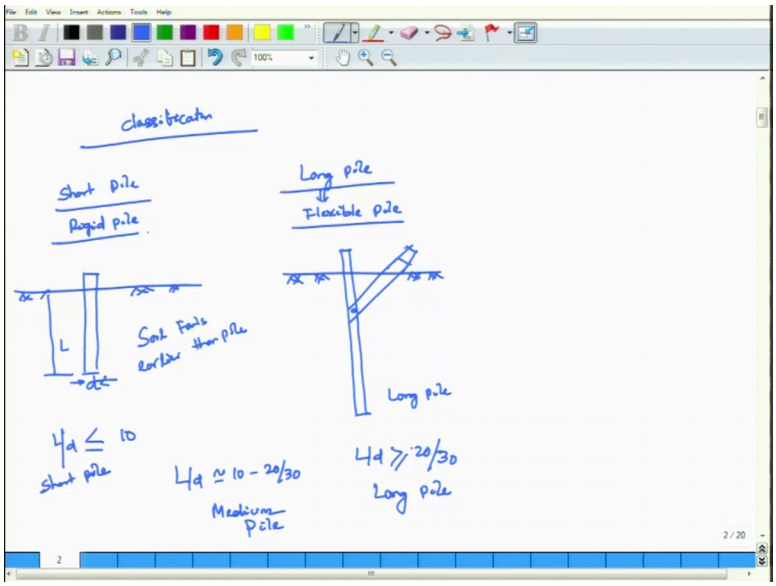

In broadly there are many classifications are there. One is called short pile another is called long pile. Short pile is called a rigid pile. Long pile you also called as flexible pile. So, particularly what happened? Very simple definition of short pile if I put a ground surface here, simple definition short pile is you are rigid, soil fails earlier then the pile very simple way as for the polos and devis. You can take that book soil fails earlier then pile; that means, pile is So rigid soil fails earlier than the pile. If I take it a long pile, if take it as a long pile, what will happened? Pile fails earlier then the soil, and pile fail by means of bending.

Somewhere else it will be formed and if will fail it will fail by means of bending. So, this is a long pile or flexible pile very simple. Details I will go one by one also another one polo such given. Pile such been generally provided in a dimension less form L by B. L is your embedded length. L is embedded length. L by d not B sorry, L by d, d is your diameter. L by d is less than equal to 10 sometimes it is called short what is it. Between L by d 10 to 20 or 30, it is called medium pile, it is a short pile. Then L by d greater than equal to 20 to 20 or more than 30 it is called long pile.

Let us go to the other part of the fly pile classifications in detail So that you have an idea how the classification has been made.

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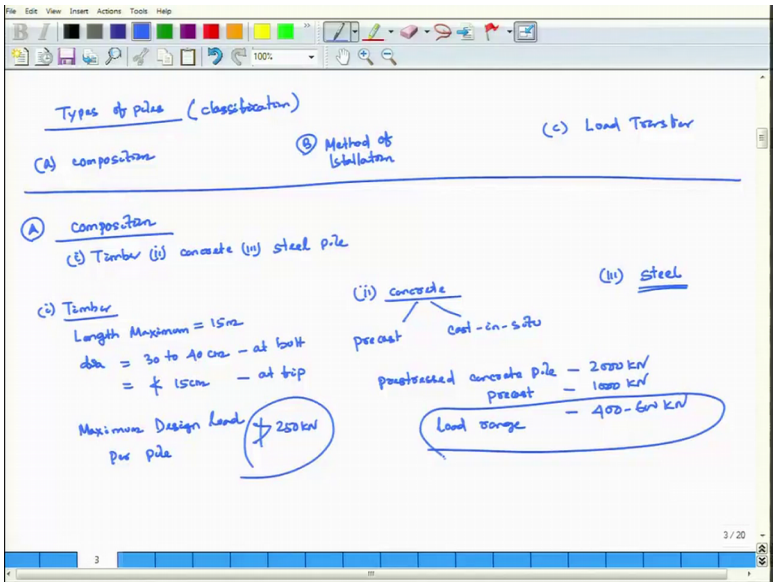

So, types of pile basically classification of the piles, or I can say types of pile, or I can say classification. So, this is based on there are three parts. First one is your according to composition, second one is your according to method of installation, then third one is your third one is your according to your mode of transfer of load or by means of load transfer. Classifications or a type of pile has been divided into three category.

First one is your based on your compositions. Second one is your based on your method of installation. Third one is your based on your load transfer. Let us start with first one. First one is your composition. According to compositions it may be timber, it may be concrete or it may be steel. First one is your timber. Timber pile is made up of wood a wood. So, length maximum you can take 15 meter, there are certain specifications length

maximum for timber pile you can take it 15 meter and dia generally dia generally 30 to 40 centimeter. And at bott and it is equal to less than 15 centimeter at trip.

In this case maximum design load for pile should not greater than 250 kilo meter, should not greater than 250 kilo meter. Because this is made up of wooden, second one is your concrete; second one is your concrete. In concrete again 2 types, one is your pre cast; other is your cast in situ. Maximum load on a precast pre stressed concrete pile is 2000 kilo Newton. And precast it is 1000 kilo Newton. Optimum load range, optimum load range is 400 to 600 kilo Newton. Then third one is your steel piles.

Steel piles generally used to remove this corrosion, if there is a corrosion effect generally in european and US. They prefer for a steel pile; depending upon your availability of the material sometimes to save your cost. The composition sometimes we consider if plenty of who the timbers are available then you can go for timber pile, the limitation of these it cannot take maximum load of 250 kilo Newton more than 250 kilo Newton. Length you cannot go more than 15 meter. Then there is a concrete piles, either it is a precast or cast in situ. Pre stress concrete pile is your 2000 kilo Newton. Precast is your 1000 kilo Newton. Load range is your 400 to 600 kilo Newton.

Then there are steel piles, more discussion I will giving more discussion later. Then second part is your method of installation.

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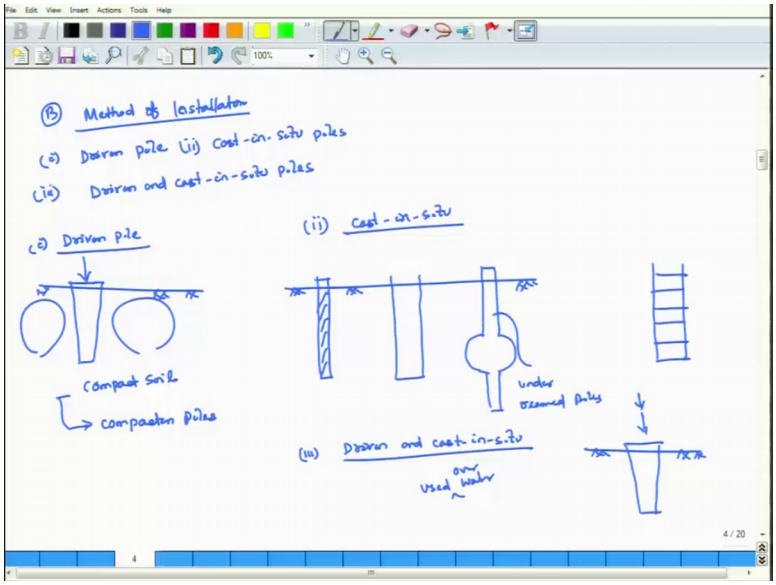

Method of in installations I can three types. First one is your driven pile, second one is your cast in situ piles, third one is your driven and cast in situ piles. Now come to driven piles, first one is your driven pile. If you look at the driven piles, it generally what happened from the top by means of hammer. This pile has to be driven inside it; once it has been the inside driven, so nearby soil nearby the soil get disturbs. Primary aim of this driven pile sometimes it is used to compact your soil. That is why it is called compaction piles. Then second one is your cast in situ. Second one is your cast in situ. Second one is your cast in situ, in cast in situ what is it mean by cast in situ? You take the material.

So, first what we are supposed to do? Make a larger borehole then prepare the caging steel caging in the field. And this caging will be inserted in the borehole. Then after that do the concreting. Cast in situ; that means, everything has been done in the field step by step. So, cast in situ it may be a stress update, it may be a stress update. Or it may be under reamed. Ball shaped under reamed at the bottom it has been provided. So, to protect your particularly expansive soils where there is a expansion during the rainy season, and during the hot season there is a contractions. So, there is kind of ball shape one soil expand it will not exhaust pubic pressure on your foundations.

So, this you can do it by means of cast in situ. Next is your driven in cast in situ. Driven in cast in situ if I put it. In this case what will happen? This pile has been casted completely in the ground in situ in the field, completely casted. Taking caging and making the pole ceiling the pile has been casted, and then it has been driven. So, that is why it is called driven and cast in situ. So, it has been used over the water particularly it has been used where there is a water over water there is a water is there it is very difficult to go for bore hole and place the caging. So, what will happen? You do the piling and bring it to the field do the piling in the field bring it in the field and simply drive it that is why it is called driven and cast in situ.

So, classification based on your mode of transfer Based on your transfer of load.

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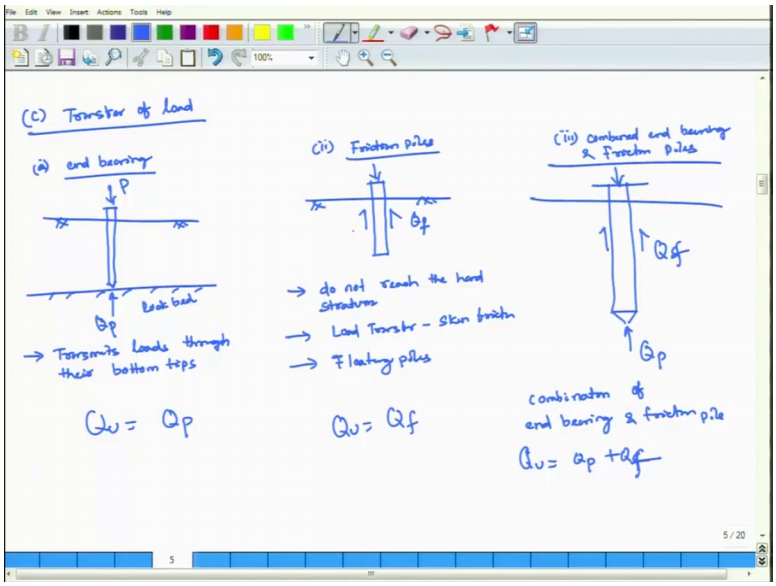

So, there are three types. First one is your end bearing, second one is your friction piles, third one is your combined end bearing and friction piles. So, what is it mean by end bearing? Suppose there is a rock bed at a solid depth or may be considerably regionably depth below the ground surface, generally pile at the end pile has been inserted So that it rest on the rock bed. So, enter capacity whatever the load coming onto the pile will be taken by your end point or end bearing. So, what is it mean? Transmits loads through their bottom tips.

So, regionable: at a regionable depth there is a harsh data or rock, then what will happen pile has been extended or driven or hammer up to your or pushed inside the ground surface up to your rock bed So that low load transfer mechanism will be whatever the load is coming it will be taken by your bottom or tip resistance. Then there is a friction pile. Friction pile means the load taken by the pile by means of your soil frictions. What is it mean? In this case do not reach your hard stratum. Do not reach your hard stratum. No need to push it very long to your hard stratum pile. Transfer the load through your skin friction. Low transfer through your skin friction this is what I have shown. And it is called also floating pile. So, if this is my load p is coming here I can say it is q p. Here it is your q s q frictional because of your site resistance.

Now, combined end bearing and friction piles, combined end bearing and friction piles if you look at here what does it mean? Combined end bearing friction pile means if I draw

it, load transfer from pile to ground or from superstructure to foundation it will be by means of end bearing as well as frictional resistance; that means, by means of q p as well as q s; that means, it is combination of combination of end bearing and friction piles; that means, total load Qu is equal to Qp plus q s or Qf let me put it frictional resistance q f, here Qu is equal to only by taken by frictional resistance, here Qu is equal to only q p.

So, if I summarize what are the different classifications, types of piles as for the classifications one is your compositions, by means of based of materials, second is your method of insulation, third is your load transfer. Compositions are your timber, concrete and steel piles generally used, so each having limitations as well as advantage. So, you will decide or take a called depending upon your availability of the materials. So, timber piles limitation greatest limitation is maximum load it can take up to 250 kilo Newton. Beyond it is not advisable. Maximum length you can go up to 15 meter. Concrete it is precast as well as cast in situ. Then pre stress concrete pile load will be taken as 2000 kilo Newton precast on 1000. So, steel piles particularly for corrosion to prevent your corrosion you take this steel pile has been used.

Method of installations driven cast in situ driven in cast in situ piles. Driven means the pile will be taken then you driven it from the ground surface. So, once you drive it nearby soil also get compacted. So, that is why it is called compaction piles, cast in situ means cast in situ means, you have to do everything in the ground. Take a bore hole preparing your caging in the ground insert the caging to the also concreting. It may be a streets of pile or it may be a under reamed ball say piles. Driven and cast in situ particularly was water table is there in water is there which is bore hole cannot be done. In that is case pile cast it in the field then same in situ you do this by means of driven. Then low transfer three type’s end bearing friction piles combined end bearing and friction piles. End bearing means if there is a pile the load enter load to the pile will be taken by your end or tip of the pile friction pile means if there is a load coming to the pile. So, it will be transfer by means of side friction or skin frictions combined end bearing and friction piles means, so load will be transferred form super structure to foundations by means of friction side friction as well as tip resistance. So, Qu is equal to in this case end bearing Qp. Here Qu is equal to frictional resistance Qf. Here Qu is equal to Qp plus Qf.

I will stop it here. So, next class we will go in details about the pile foundations.

Thank you.