Geotechnical Engineering - II

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Lecture No. 37

Sheet Pile Wall Introduction-II

So, now, I would like to show you some videos. So that you may realize, how a geotechnical engineer speculates that what type of infrastructure can be created by utilizing sheet piles. Once that is clear, then we will go into the analysis part of it. I wish to show you some of the YouTube videos which would clear your idea and concepts about how infrastructure is being done with the help of sheet piles.

I will email these links to you as well. And this is where he has tried to show the type of sheet pile construction which are being done. I think you can look at this, this is the basic unit of a sheet pile for a better connection, better connectivity. You can have a concrete sheet pile or reinforced concrete sheet pile also advantages disadvantages are given.

This is how their attachments are done, or interlocking is done. So, this is the interlocking system, these two units are the mirror units. Each unit is embedded into the ground and then they are interlocked.

This is how the sheet pile wall is being created. This is the first installation followed by the next hammering of the sheet piles and they get embedded into the soil mass. So, this is the ground level you take the sheet pile, so sheet pile would be something like this. So, it will be something like this, you can hold it from top and push it down or tamp it from the top.

I think this video will give you a very clear idea about how sheet piles are installed. So, this is how the sheet piles are lifted and then look at the way the installation takes place. So, this area what you are observing here is going to be excavated. You want to create an underground facility.

So, this is how the cordoning off of the entire area can be done. This is how the connections are being done, interlocking, and once the unit gets fixed with the previous unit, you can tamp

it from the top. So, this is basically mechanization of construction in Geotechnical Engineering. Nowadays we have the best possible machines and tools which can be utilized to construct the facilities within no time with lot of precision.

Otherwise, I am sure you will realize it is very difficult to tap the sheep pile into the ground and that was one of the deterrents earlier days. Now how this has been pushed into the soil mass. So, soil mass should be soft. So, depending upon the resistance, which is being offered by the soil, you can adopt a technique of installation.

So, this is what I was explaining over here that if you want to create underground space, you can just tamp the sheets of piles into the ground and then you can create the desired space.

There is another good video of the installation of the PVC sheet piles. PVC sheet piles are mostly used for retaining the leachates which are coming out of the landfills. The concept here is that the edge of the sheet which is being pressed into the soil happens to be very sharp.

So, in this system where I showed a very sharp edge, what will be the free body diagram of the sheet pile.

So, suppose, if I take a sheet pile over here, a good question would be drawing the free body diagram. The thickness is absolutely less. Few centimeters or mm. So, once you are tamping it inside the first thing is friction will get mobilized. So, the moment friction gets mobilized it becomes a non-Rankine wall, this is a deviation from the Rankine theory. Later on, you will see that most of the analysis which we will be doing for analyzing the sheet piles would be based on Rankine theory only, but then we tend to ignore this shear stress. Why? Because a very thin element which is being inserted in the ground and this is the cutting edge.

So, there cannot be much resistance offered by the soil here. So, this is the cutting edge. So, this system which is a flexible system goes into the ground or remains outside and gives you the advantage. The paradox is though the element is flexible, we assume the system which gets created because of the sheet piles is a rigid system, rigid body. So, we apply the concept of rigid body to analyse it, approximations.

Another thing which you must have realized is that when you are designing the sheet piles the whole idea is to convert the pressures into what form deflection, but excessive deflection is going to cause the failure. So, deflection should be within control. So, having done these concepts now, I will introduce the concept of how to create different types of sheet pile structures by using sheet pile units that will follow after through videos.

So, again to continue with this video now, you can realize that the way sheet piles have been inserted and you have created a cofferdam. So, this is the industry which might be polluting which might be spilling out lot of chemicals into the ground and I want to control that.

So, this is an industry which might be producing different types of chemicals which are leaking and then there is a water table there is an aquifer and we do not want any leakage or any chemicals to migrate into the fresh water and contaminate the whole thing. So, this is where the sheet pile has been installed. So, this confines the whole area and makes it leak proof.

Let us move on to some other examples of sheet pile. I think this is a concrete pile which is being driven into the sea wall and I hope this shows how the sea wall is being created. So, the whole sheet pile has been held as between the callipers and these callipers are pushing the pile, deep inside the ground. And you can see there is a top head of the pile which is being either tamped by percussion the pile will break. So, it has to be pressed and then you can see the movement of the pile inside the ground. So, this is what you were talking about the concrete sheet piles.

The basic idea is to create a space which I can utilize by excavation or by loading it on the top. These are expensive infrastructures where you have to spend a lot of money to create the workable land.

The same driving in you can see how the joints are created over here if you concentrate on this part of the video, you can see how the joints are being created. And then ultimately all small, small segments put together they form a monolithic structure. This is another good way of looking at this how interlocking of two elements of sheet piles has been done.

So, next time when you are passing by and you see any excavation going on please have a close look at how the excavations are being done and there have been many disasters also in the

recent past when the design was not done properly. But once you have created inside space you can excavate it, the sheet pile is in between the tongs and the tongs are pressing them down. Hope this gives you a fair idea about how sheet piling is done.

This is same thing again to show you how the installation is done in a very clear manner. So, what as a Geotechnical Engineer we would like to do is? We like to analyse these systems by using the concepts whatever we have studied so far. Mostly the earth pressure theory and the material properties in terms of shear strength characteristics.

This is a good example of waterfront structures and how they are being made by using sheet piles. This is a very specialized construction.

First the firmwork has been done and then followed by insertion of the sheet pile for maintaining the alignment, I think this is good enough to give you an idea about how the sheet piles are done.

And this shows that how anchoring can be done. So, I will be talking about the anchoring phenomenon also how anchors are being used for creating the sheet piles and for their better stability. This could be simple anchors this could be pre-drilled anchors or even self-drilling anchors many times depending upon your budget. So, basically the whole wall is being pushed back side.

So, if I want to attain much higher heights what I should be doing, I have to pull them back so, this becomes an anchorage system. I will be discussing about this. Most of the time the near surface disposal facilities for nuclear activists are also tend to more than 10 meter deep. Second thing is rather than creating such type of space, it is always better to create a small shaft and then install your canisters over there, but yes, technically this can use, but imagine the volume of soil mass or the rocks which we are going to remove.

So, if you have to create a rock system, there is no point in doing the sheet piles because rocks are self-stable. This is meant only for retaining the soils or compacted soils. Second thing is you have to take a decision based on the cost and the advantage which you are going to get. Yes, but one of the good examples would be if I want to create a shallow disposal facility which in within which is within 10 to 7 meters of depth, this could be a good answer or solution.

So, you have to design a barrier system truly speaking the sheet pile acts as a barrier over there. Yes, impermeable barriers. Applications have so many it depends upon how you are using these concepts.