Advanced Soil Mechanics
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Lecture-43
Summary of Module 3

So, welcome back all of you, we have now finished module 3 we have discussed different aspects of stress path which I feel and hope that it is sufficient for going on to the next or the last module on critical state soil mechanics. So, here in this lecture we will try to summarize what all we have learned in module 3.

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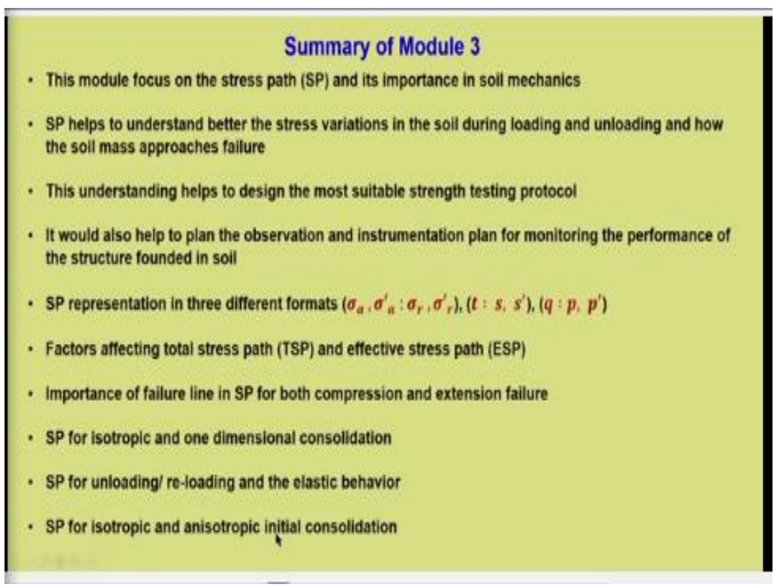

So, this module focus on the stress path and it is importance in soil mechanics which I hope you would have appreciated by this time how importance stress path is. Stress path helps to understand better the stress variations in the soil during loading and unloading and how the soil mass approaches failure. It gives a very clear representation which we have try to demonstrate in few of our lectures.

This understanding helps to design the most suitable strength testing protocol. Now if we do a kind of analysis prior to the actual driving of the shear strength parameters, it also helps to understand how different sequence of loading that happens in the field would give different stress path. So, we can try to project or we can try to use the laboratory testing, if is possible, like stress path controlled triaxial testing if it is possible we can always do that in the lab to get the best representative shear strength parameter.

So, it helps us in planning a suitable strength testing protocol. It would also help to plan the observation and instrumentation plan for monitoring the performance of the structure founded in soil. So, let us say that we are interested in doing some sort of monitoring, so we the stress path analysis in the beginning helps us to focus on what exactly and how and at what time we need to monitor?

So, the instrumentation plan or sensors placement and it is operation can be planned with the help of initial stress path analysis. Now stress path representation in three different formats we have understood σ_a, σ_r, t-s, s' and q-p, p'. Factors affecting total stress path and effective stress path has been discussed. Importance of failure line in stress path for both compression and extension we have understood.

And we have also defined the failure lines for different cases, different cases means the different stress path formats. Stress path for isotropic and one dimensional consolidation we have discussed. Stress path for unloading and re-loading and the associated elastic behaviour, because we are talking about the over consolidated state when we actually say it is unloaded, so re-loading also it follows the elastic behaviour.

Stress path for isotropic and anisotropic initial consolidation, so the influence of k, like depending upon the initial k value how it is going to change and where it actually gets place the initial the starting point. So, we have discussed for both $k_0 = 1$ and k_0 less than 1, k_0 greater than 1.

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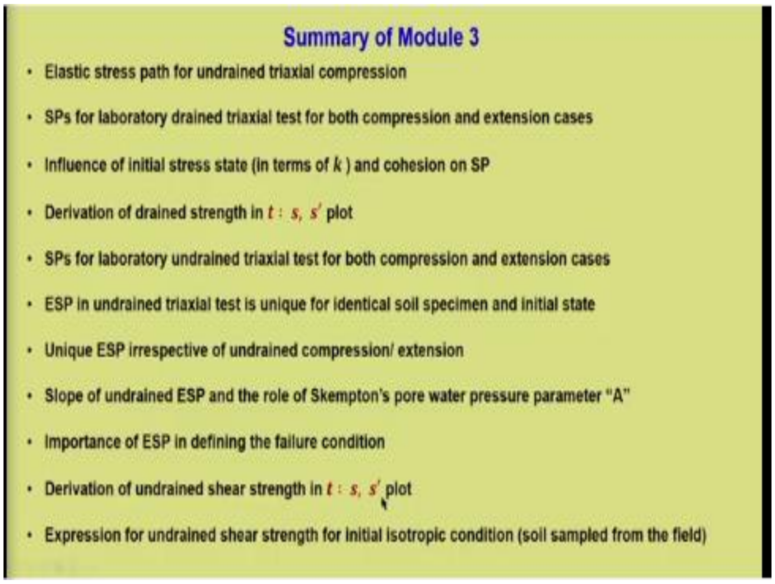

Elastic stress path for undrained triaxial compression, we have already seen that. Stress path for laboratory drained triaxial test for both compression and extension, we have discussed all the 4 cases with different permutation, combination. Influence of initial stress state that is in terms of k value and what is the influence of cohesion on the stress path, we have seen that it gets extended above, so the available strength increases.

Derivation of drained strength in t-s, s' plot, stress path for laboratory undrained triaxial test for both compression and extension, just similar to what we have discuss for drained test. But here A parameter, Δ u determination and the uniqueness. So, ESP in undrained triaxial test is unique for identical soil specimen and initial state. Unique ESP irrespective of undrained compression or extension.

Slope of undrained ESP and the role of Skempton's pore water pressure parameter A, we have seen that. Importance of effective stress path in defining the failure criteria, so we have to keep in mind, it is not the total stress path; it is the effective stress path for undrained case that determines failure. So, where the effective stress path touches the failure line that is our point of failure.

Derivation of undrained shear strength in t-s, s' plot, expression for undrained shear strength for initial isotropic condition that is soil sample from the field. That is extension of this particular condition where we know that due to sampling there will be initial pore water pressure of negative initial pore water pressure. So, since it is pore water pressure it becomes isotropic condition, so it gets shifted to the isotropic line. So, it is a just modification of what is discussed in this.

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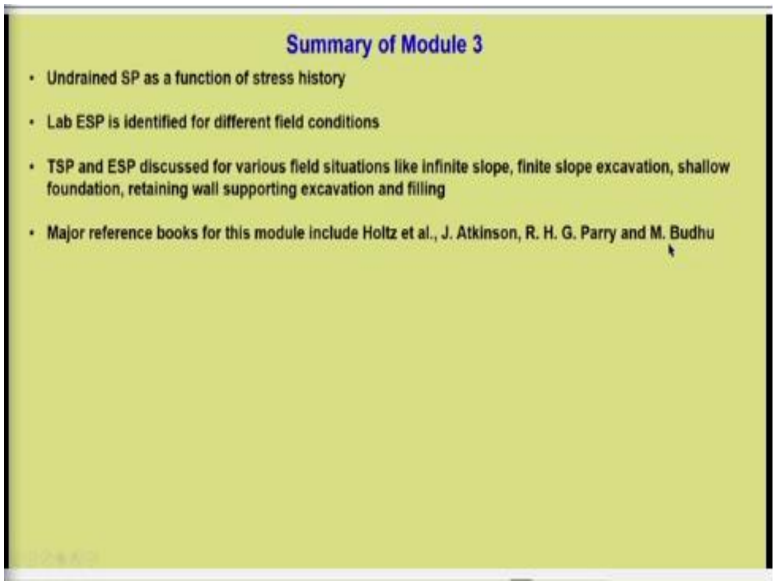

So, undrained stress path as a function of stress history, lab effective stress path is identified for different field conditions that was the last part of our lecture where we discussed about how the stress path can be identified for various field conditions. So, total stress path and effective stress path discussed for various field situations like infinite slope, finite slope excavation, shallow foundation, retaining wall supporting either excavation or filling. So, all these cases we have discussed.

Now to end this module 3, the major reference books that I have used for this module is Holtz and others, J. Atkinson, R.H.G. Parry and M. Budhu. All these reference textbooks are there in the reference list, if you want to know more or if you want to enhance your reading you are free to do that and these are the textbooks which I have referred a lot for developing this module. I have referred to others as well but for basic textbooks you can refer to these.

So, this is all for now, so we have finished our module 3 and we are fully prepared now to move onto the next module and the last module where we will discuss about critical state soil mechanics. So, thanks a lot for now.