**Advanced Soil Mechanics**
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**Lecture - 32**
**Summary of Module 2**

Welcome back in the last few lectures, we were discussing about shear strength of soil. So, now, we have almost finished this particular module. Before winding up, we will just see what are things we have learned from this module?

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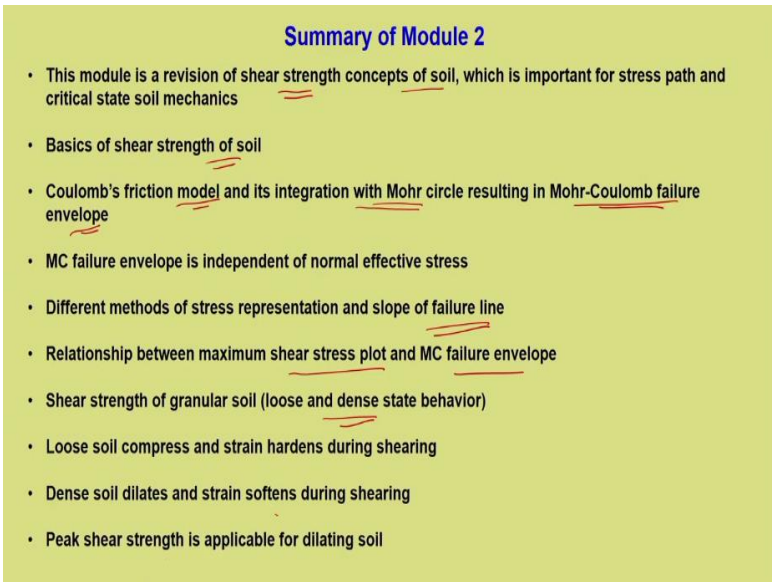


So, let me make it very clear like this module is a revision of shear strength concepts of soil. Now, why I call it as revision is for some participants of this course, these concepts may not be very clear during the undergraduate. So, we are just trying to bridge that gap so that certain concepts are clear. And these concepts, the understanding of these concepts are very important to appreciate the stress path and the critical state modules which are going to subsequently come up.

So, it is important that even though if you have learned it is important for me to explain those shear strength concept which is relevant for the upcoming modules. So, basics of shear strength we started off with stating what are the important basics of shear strength. The Coulomb's friction model where we started off with and we have seen it gets integrated with Mohr circle resulting in the very popular Mohr Coulomb failure envelope.

And the integration was done essentially to represent what is the stress acting on the soil. That is $\sigma'_1$and $\sigma'_3$. And MC failure envelope is independent of normal effective stress. I wanted to add the statement here so that you do not confuse this. What it means is that the failure envelope as a whole it is linear with the inclination a constant slope. So, whatever be the normal stress this particular envelope is not going to change.

So, that is what it means. And always Mohr Coulomb is expressed in terms of effective stresses only. Different methods of stress representation and slope of failure line has been determined. The relationship between maximum shear stress plot and Mohr Coulomb failure envelope, the plot that is s-t plot or t-s' plot, $\sigma'_1 + \sigma'_3 /2$ versus $\sigma'_1 - \sigma'_3 /2$.

So, the relationship between that plot and the shear strength parameters c and phi has been determined. And we have also told that this is quite handy, because one can always find out c and φ without plotting Mohr circle. Shear strength of granular soil, we have discussed in detail, how the loose and dense state of the soil influences the shear strength. Loose soil compress and strain hardens during shearing.

Dense soil dilates and strain softens during shearing. So, these aspects we have seen in this lecture. Peak shear strength is applicable for dilating soil.

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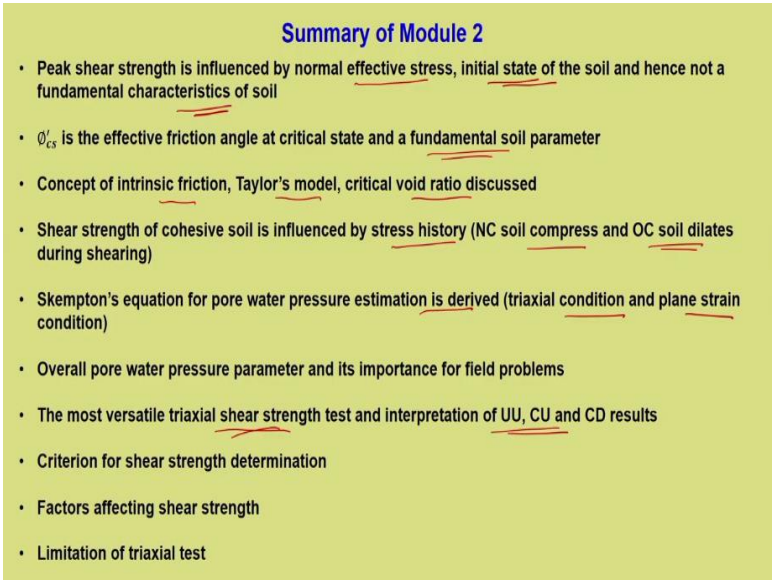


Now, peak shear strength is influenced by 2 important aspects. One is the normal effective stress and the other one is initial state of the soil. Now, when I say normal effective stress that confinement restricts the dilation and when I say initial state it has something to do with how

over consolidated the soil is. Both this influences how much dilation and the dilation angle. And this dilation angle influences the peak angle of friction.

And hence, it is not a fundamental characteristics of soil. $\varphi'_{cs}$ is a $\varphi$ corresponding to critical state the effective friction angle you will see shortly that it is it can be considered as a fundamental soil parameter. Concept of intrinsic friction, Taylor's model and critical void ratio was discussed. Shear strength of course, if soil is influenced by stress history, essentially normally consolidated soil compress and over consolidate soil dilates during shearing.

Skempton's equation for pore water pressure estimation is derived both for the triaxial condition and plane strain condition. Overall pore water pressure parameter and its importance for field problems have been discussed. The most versatile among all that is the triaxial shear strength test and the interpretation of the important test which are UU, CU and CD results have been done.

The criterion for shear strength determination is clearly explained. There are 5 criteria for determining the shear strength. Factors affecting the shear strength has been summarized. And the limitation of triaxial test has been explained. So, this is all what we have learned in Module 2. So, with this background, now if you do not remember some of the concepts of Module 1, it is still.

But it is invariably necessary that you remember all these concepts when we move on to the next module that is Module 3 on stress paths. So, we will see in the next lecture. That is all for now. Thank you.