Geology and Soil Mechanics
Prof. P. Ghosh
Department of Civil Engineering
Indian Institute of Technology Kanpur
Lecture - 07
Classification of Soils- A

Welcome to the course Geology and Soil Mechanics. So, today in the lecture we will be talking about the classification of soils, soil structure, and clay mineralogy. So, first we will see that how to classify the soil and what for we need the classification of soil. Otherwise, what will happen if we do not classify the soil.

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Now what is the classification of soil and what is the objective of classification of soil. The sorting of soils into groups, each of which would show similar behaviour is the objective of soil classification. Now the soil classification basically will tell you will I mean making the group of particular type of soil which will tell you okay this soil will be behaving very similar to this soil because they are coming to the same group or this group will be behaving as completely different behaviour or different say characteristics it will show than the other group.

So, this is the basic objective because you are sorting out the soil based on some scientific way. Now any soil classification system must provide us with information about the probable engineering behaviour of soil. Now any soil classification system, there are several classification system available in the world, so any soil classification system if you if you think of or if you look at, they should provide okay the information about the (()) (1:46) engineering behaviour,

engineering behaviour means whether the soil is having plasticity or whether the soil is having some organic characteristics or whether the soil is having some I mean kind of say cohesionless or fine grained or the coarse grained or the sticky kind of nature. So, those kind of properties we will be getting from the soil classification system and this information must be provided or must I mean the soil classification system must provide these informations.

Now there are several, as I told you there are several soil classification system available in the world though I mean we can have we know that the first one is unified soil classification system which is known as USCS. Then we have American Association of State Highway and Transport Officials System that is known as AASHTO System and we have Indian Standard Soil Classification System ISSCS. So, we will not be concentrating on the other 2 classification system.

So, we will not be considering first 2 classification system because these are international classification system. Rather we will be concentrating more on the third category that is Indian Standard Soil Classification System that is ISSCS and we will see the I mean detailed analysis or the detailed step by step calculation or the analysis for Indian Standard Soil Classification System.

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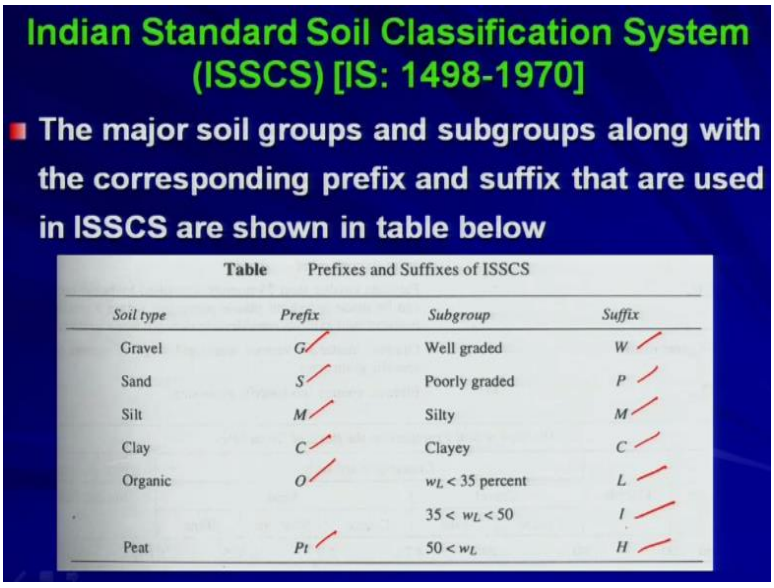

Now the major soil groups because Indian Standard Soil Classification System is as per IS: 1498-1970. So, this says the major soil groups and subgroups along with the corresponding

prefix and suffix that are used in ISSCS are shown in table below. Now what is this prefix and what is this suffix, what does it mean actually?

So, we have several prefix, say gravel, it is known as say G it will be denoted as G; sand will be denoted as S; silt will be denoted as M; clay will be denoted as C; organic soil will be denoted as O; and peat will be will denoted as Pt okay. So, these terminology or these terms will be always coming as prefix. So, we will discuss this thing then it will be more clear why what is prefix and what is suffix, anyway.

Now this is basically the group of soil and the subgroups is basically whether it is well graded then it will be denoted as W; whether it is poorly graded, then it will be denoted as P; whether it is silty, then it will be denoted as M; whether it is clayey, it will be denoted as C; and if the water content that is the liquid limit at water content I mean water content at liquid limit that is W L if it is W L is less than 35% then it will be classified as L; if it is between 35 and 50, then it will be classified as I; and if it is greater than 50, then it will be classified as H.

So, what does it mean? If liquid limit is less than 35% it is low plastic soil. It is generally known as low plastic soil. If it is between 35 and 50 then it will be intermediate plasticity or intermediate plastic soil and then if it is more than 50 then it will be known as highly plastic soil.

So, now from this table we have got the idea that there are different terminologies or say different say prefix and suffix. Now how to arrange this prefix and suffix, that will be more clear if we take or if we talk about this.

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Indian Standard Soil Classification System (ISSCS) [IS: 1498-1970]

Description of gravel and sand

Symbol	Description
GW	Well graded gravel
GP	Poorly graded gravel
GM	Silty gravel
GC	Clayey gravel
SW	Well graded sand
SP	Poorly graded sand
SM	Silty sand
SC	Clayey sand

Description of clay

Symbol	Description
ML	Inorganic silt with w_L<35%
CL	Inorganic clay with w_L<35%
OL	Organic soil with w_L<35%
MH	Inorganic silt with w_L>50%
CH	Inorganic clay with w_L>50%
OH	Organic soil with w_L>50%
P_T	Peat

Now description of gravel and sand. Now if I say if my soil is gravely soil and if the gravely soil is well graded and by this time we know what is well graded sample, what is poorly graded sample. So, those things are quite clear to us at this moment. So, if I have well graded gravel, then the prefix will be G as we have seen in the table, the prefix will be G and your suffix will be W. So, we have got GW, GW will be considered as well graded gravel.

Similarly, if you have poorly graded gravel that means you have the gravely soil but that is poorly graded. Then of course the prefix will be what, G fine and what will be suffix, P. So, GP will be denoting that poorly graded gravel. So, if you have poorly graded gravel it will become, it will be totally denoted as GP.

Similarly, you have silty gravel, so gravel which is having which is mixed with some silt, so it is silty gravel. So, that will be denoted as GM. Why not MG? Because if you recall the table that silty part will be coming as suffix whereas gravely part will be coming as prefix. So, in silty gravel basically you have got GM. Similarly, clayey gravel will be always GC. Similarly, these are the categories for gravel. Now coming to the sand, if you have well graded sand, it will be classified as SW. Then poorly graded sand SP. Then silty sand SM, clayey sand SC. So, now I hope you have understood what is the business of suffix, what is the business of prefix okay.

Now the description of clay. So, if you have inorganic silt with liquid limit less than 35% then that will be classified as ML. Now M is coming as prefix whereas L is coming as suffix. Now why it is ML because you are dealing with inorganic silt fine so that is why the M is coming as I told you for silt it will be M, for clay it will be C, for gravel it will be G, for sand it will be S.

Now you are dealing with inorganic silt. So, that is why the prefix has come as M and at the same time you are dealing with the low plastic silt. So, that is why your L, I mean WL that is the liquid limit value is less than 35% and that is why the suffix is L. Similarly, if you are dealing with inorganic clay with liquid limit less than 35% then it will be classified as CL.

Similarly, if you are dealing with organic soil with liquid limit less than 35% then OL. Then inorganic silt with WL greater than 50% it will be MH. That means you are dealing with inorganic silt that is fine, that is for that you have got the prefix as M whereas you are dealing with highly plastic soil so that is why H is coming into the picture. So, the notation will be MH.

Similarly, if you are dealing with inorganic clay with WL greater than 50% then it should be classified as or it should be denoted as CH. Then organic soil with WL greater than 50% it will be OH and if you are dealing with peat so that is P T that is all. So, I hope at this moment you

have understood the notation that is how the if I have this kind of soil what should be the notation and how to fix the suffix and prefix.

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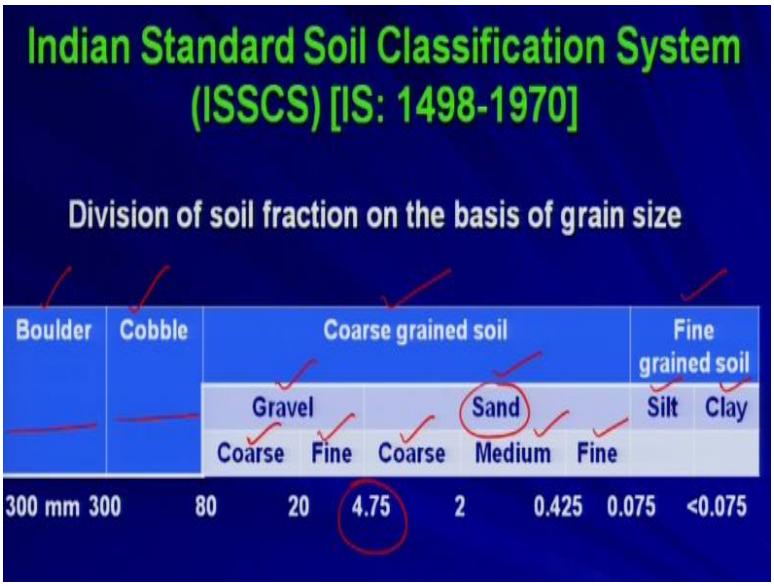

Now division of soil fraction on the basis of grain size. This is as per Indian Standard Soil Classification System. So, if you see the boulder is basically anything is greater than 300 mm size is classified as boulder. So, this is the category as boulder. Now anything any particle or any say soil if you do the gradation and after gradation if you get this kind of say gradation thing or the retained on say particular sieve then basically 80 to 300 mm that will be classified or that will be known as cobble.

Then you have gravel. Say gravel basically there are 2 different say category. One is the coarse gravel, another one is the fine gravel. So, coarse gravel is spanning from 20 to 80 mm size whereas fine gravel is spanning from 4.75 to 20 mm size and that is why you might remember that we did the sieve analysis based on 2 categories, one is the gravel fraction, another one is the fine fraction something like that where we consider 4.75 mm sieve as the separator okay.

Then we have sand okay. Sand is also having 3 categories. One is coarse, medium, and fine. So, coarse sand is spanning from 2 mm to 4.75 mm. The medium sand is spanning from 0.425 mm to 2 mm and then fine sand is spanning from 0.075 mm to 0.425 mm that is 75 micron to 425 micron.

Similarly, we have fine grained soil. So, now you have now it is very clear to you how to classify, so boulder is something different, cobble is something different, then we have coarse

grained coarse-grained soil where coarse in the coarse-grained soil category we have gravel and sand and then we have another category that is fine grained soil. Under this head we have silt and clay. It is basically 0.075 mm okay.

So, we have seen the preliminary things for the soil classification system particularly the Indian Soil Classification System and we have seen what is coarse grained, what is fine grained. Now it is very clear to you. Now in the next lecture we will be talking more about the soil classification system as how we can proceed to get the actual classification of or the groupism of the soil. Thank you very much.