Index Properties of Soil

Properties which helps in classification and identification of the soil like Water content, sp. Gravity , unit wt. of soil, Consistency, sensitivity, particle size distribution thixotrophy, activity, collapsibility.

A) Water Content

Water content of soil can be determined by any of the following method

I. Oven drying Method

It is the most accurate method i.e used in lab to compute the moisture content.it is temperature controlled method.

It can be determined by this method in following step:-

1. Wt. of empty container is noted initially (ml)
2. Moist sample of the soil is placed in the container and is again weighted (m2)
3. Container with sample is placed in temperature controlled oven for drying. For inorganic soil drying is done at 105 to 110^0C (For sand ,drying is done for 4hrs, for silt and clay drying is required for 12 to 16hrs).ln general drying is done for 24hrs. to ensure the complete removal of the moisture.
4. For organic soil temp. is limited to 60^0c in order to avoid the oxidation of organic matter.

If soil has high gypsum content temperature is not increased beyond 40^0c in order to avoid the loss of water of crystallization.

In no case temperature is increased beyond 110^0c as it may result in destruction of soil structure leading loss of structural water (under normal engineering Activities all types of soil water (gravity water, capillary water,, adsorbed water) is lost except structural water and water of crystallization).

After drying wt. of the sample with container is again computed

2) Sand Bath Method

It is a quick field method ite generally used when the facility of oven is not available. In this method container with soil is placed in sand bath and is heated over carosine store. Since there is no control of temperature in this method, structural water of the soil may get lost, resulting in inaccurate result.
This method is not preferred for the soil having high gypsum content and organic matter.

3) Alcohol Method

It is also quick field method in which methylated spirit is added in the sample to increase its rate of evaporation, this method is also not prefered for soil and soils having high gypsum content. (Inaccurate Results)

4) Pycnometer Method

It is a 900ml flask having conical brass top with 6mm diameter whole at its center. This method is used for testing of the soils whose specific gravity is known.

- It is also quick method that gives the result with in 10 to 20 mins

- Methods of observation in this case are:-

1) Mass of empty pygppnpe!er is noted initially (Ml)
2) 200 to 400 gmof moisture sample is placed in the pycnpmeter and is again weighted (M2).

- Mass of pycometer filled with water is noted (M3)
- Pycnometer is completely emptied and is again refilled with water after its proper cleaning is again weighed (M4)

5) Calcium Carbide Method

It is quick field method , given result in 5-7min.

In this method 4-6 gm of moist sample of soil (fixed wt. is taken due to calibration) is placed in moisture meter and calcium carbide is added, which reacts with the water present in the soil, resulting in the formation of acetylene gas that exert pressure over the calibrated gauge which gives the moisture content of the soil in terms of total mass of soil

61 Radiation Method

This method is suitable to compute the water content of the soil in field in this method 2 steel casings are lowered into the field where water content is to be tested.

In the first casing radioactive material is placed and in the 1104 casing detector placed. When radioactive material is activated it emit neutrons that strikes with the hydrogen atom present in water molecule results in its loss of energy, that is further detected by the detector placed in 1104 casing.

This loss in energy of the neutrons is calibrated to give the moisture content of the soil.

71 Torsional Balance Method

➢ In this method , infrared radiations are used for drying the sample

> Infrared rays are generated by the use of 250watts bulb /operating at 220-230 volts50hz single phase power supply

➢ In this method drying and weighing of the sample is done simultaneously by the use of torsional gauge, which gives the water content of the soil terms of total mass of the soil

> This method is generally suitable for the soil which quickly reabsorb the moisture from the atmosphere.

B) Specific Gravity

It can be computed either by 50 ml density bottle or by 500 ml flask or by use of coneter.

Density bottle is suitable for testing of all types of soil where as flask and pycnometerr is used for coarse grained soil.

> If pycnometer and flask is to be used fine grained soil, then karosine is used instead of water as it is better reagent of water.

➢ Steps of observation in all density bottle, flask and pycnometer is same

1) Empty mass of device is noted initially (ml)
2) Oven dried sample soil is placed in pycnometer and is again weighed (m2)empty volume of the pycnometer is filled with water in multiple stages along with subsequent removal of air present in sample either by use of vaccum or by constant stirring of the sample pycnometer filled with water is again weighed (m3)
3) Pycnometer is completely emptied and is again refilled with the water after its proper cleaning and is again weighed (m4)

C) Unit wt of the Soil

It can be determined by any of the following method: •

l) **Core Cutter Method**

This method consist of cylindrical steel cutter open at top and bottom having specific volume of thousand ml (Height =13cm Dia = 10cm). & dolly of 2.5cm. The cutter is driven into the field yp!q.an extent dolly protrudes 1cm above the ground, with the help of hammer. Cutter with soil is taken out of the ground and mass of the soil in the cutter is noted (m)

II) Water Displacement Method

- This method is generally used for cohesive soils that are highly sticky in nature

In this method the sample of the soil is trimmed into more or less uniform shape and is weighed (m1)

- The sample is coated with the layer of parafinn wax and is again weighted(m_2).the coated specimen is immersed slowly in container completely filled with water and volume of water displaced by the specimen is noted(V_w)

III) Submerged Mass Density Method

This method is also used for cohesive soils, that is sticky in nature the firs 2 steps in this method is same as that of water displacement method. They only difference lies in method of computation of volume of water displaced by water specimen

In this case, submerged mass of the coated specimen is noted (m3) to compute the volume of the water displaced by the specimen

This method consist of pouring cylinder mounted over pouring cone and calibrating container of known volume

This test is carried out in 2 Stages

In the first stage of the test bulk density of the std sand passing through 600 u sieve and retained over 300 u sieve is computed and in the 2nd stage of the test bulk density of the soil computed.

Stage:- 1

Pouring cylinder with pouring cone is placed over level field and cylinder is completely filled with std sand mass of the sand filling the cylinder is noted (ml) shutter is opened to allow the sand to flow into pouring cone from cylinder and mass of the sand filling the cone is noted (m2)•

Pouring cylinder with cone is placed over calibrating container and sand is allowed to run into it . mass of the sand retained in the pouring cylinder is noted (m3)

Stage:-2

The soil to be tested is excavated and is weighed (m") pouring cylinder with cone is placed over the excavation and sand is allowed to run into the excavation. Mass of the sand retained in the pouring cylinder is noted (mg)