INVESTIGATION OF SOIL BY USING CORE CUTTER METHOD

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Abstract ; The core cutter method is a technique used for sampling soil in order to determine its density and moisture content. It involves the use of a cylindrical device, known as a core cutter, which is driven into the soil to extract a sample of a known volume. The sample is then weighed and dried in an oven to determine its dry weight and moisture content. By knowing the volume of the sample, the density of the soil can be calculated. The core cutter method is commonly used in geotechnical engineering, construction, and agriculture to evaluate the properties of soil for various applications.

1.INTRODUCTION

This method is only used on fine-grained cohesive soils which do not contain stones. It is, therefore, very useful for control of earthworks and sub grade materials but is not suitable for coarse grained pavement materials. The test involves jacking or hammering a steel cylinder of known mass and volume into the soil, excavating it and finding the mass of soil contained in the cylinder.

Important of soil density test: The field density of material soil is necessary for the estimation of soil bearing capacity. With the aim of evaluation of pressures on under laying strate for computation and settlement analysis of natural scope and there are three methods to find out the soil density and they are

1. Core cutter method
2. Sand Replacement method
3. Water displacement method

Among the above methods, we have selected the core cutter method because compared to the sand replacement and water displacement method core cutter method can be done in a simple way to find out soil density and Our college has only core cutter method equipment and that's why we selected core cutter method.

PROBLEM STATEMENT

The core cutter method is a technique used for sampling soil in order to determine its density and moisture content. It involves the use of a cylindrical device, known as a core cutter, which is driven into the soil to extract a sample of a known volume. The sample is then weighed and dried in an oven to determine its dry weight and moisture content. By knowing the volume of the sample, the density of the soil can be calculated. The core cutter method is commonly used in geotechnical engineering, construction, and agriculture to evaluate the properties of soil for various applications.

It is a technique used to determine the bulk density of soil in the field. It involves taking a cylindrical soil sample using a metal core cutter of a specific size, and then measuring the mass and volume of the sample to calculate its bulk density. The method is widely used in soil science, agronomy, and geotechnical engineering to assess soil quality, compaction, and porosity. The core cutter method is relatively simple and inexpensive, but it requires careful sample handling and measurement to ensure accurate results. It is also important to take multiple samples in a given area to account for spatial variability in soil properties.

To use the core cutter method, a metal core cutter is first driven into the soil to the desired depth using a hammer or other tool. The core cutter is then carefully extracted from the ground with the soil sample intact, and the soil sample is weighed to determine its mass. The volume of the core cutter is also measured, either by using a water displacement method or by measuring its dimensions and calculating its volume. Finally, the bulk density of the soil is calculated by dividing the mass of the soil sample by the volume of the core cutter.

While the core cutter method is a relatively simple and straightforward technique for measuring the in-situ density of soil, it is important to note that it may not be accurate in all soil types and conditions. Factors such as soil composition, moisture content, and compaction can all affect the results of the core cutter method, and it is important to carefully consider these factors when interpreting the results.

The porosity of the soil is calculated by determining the volume of the voids in the sample (i.e., the space between soil particles) and dividing it by the total volume of the sample. This can be done by subtracting the weight of the soil particles from the weight of the sample and dividing the result by the density of the soil particles.

The core cutter method is commonly used in agriculture, civil engineering, and environmental science to determine soil properties such as compaction, permeability, and water holding capacity. It is a simple and cost-effective method that can be used in the field or laboratory.

2.1 LITERATURE SURVEY

Soil quality is frequently over-looked in a society that places more emphasis on water and air quality, likely because these resources have a more apparent connection to human health and existence. However, soil quality and land management both have a direct influence on water and atmospheric quality and, by extension, to human and animal health (Doran and Parkin, 1994; Kennedy & Papendick, 1995).

The core cutter method is a widely used method in geotechnical engineering for obtaining undisturbed soil samples for laboratory testing. As such, there is a substantial body of literature available on the subject. Here are some selected publications related to the core cutter method

These publications cover topics such as the theory and application of the core cutter method, the

development of new samplers, the effect of sampling techniques on soil properties, and the use of the method in practical engineering applications.

A critical analysis and summary of the existing research and literature on a particular topic. It involves identifying, evaluating, and synthesizing the key findings, theories, and concepts presented in previous studies and publications related to the topic.

The purpose of a literature review is to provide a comprehensive overview of the current state of knowledge and understanding on a particular topic, and to identify any gaps or areas where further research is needed. It is an important step in the research process, as it helps to inform the development of research questions, hypotheses, and study design.

To conduct a literature review, researchers typically begin by conducting a systematic search of relevant databases, journals, and publications. They then review and analyze the identified studies and publications, looking for common themes, trends, and patterns in the findings. They may also identify areas where conflicting or contradictory findings exist, and attempt to reconcile these differences through further analysis.

A literature review may be structured in various ways, depending on the specific research question or topic. It may be organized chronologically, thematically, or methodologically, for example. Regardless of the structure, a good literature review should be comprehensive, objective, and well-organized, and should provide a clear summary of the current state of knowledge on the topic.

2.2 COMPONENTS

The core cutter method is a commonly used technique for determining the bulk density of soil. The components of this method are Core cutter: A cylindrical metal tube with a cutting edge at one end and a handle at the other. The core cutter is used to extract a soil sample from the ground.

The core cutter method is a technique used to determine the bulk density and the dry density of soil. The components of the core cutter method include:

Core cutter: A cylindrical tool made of steel, which is used to cut a soil sample from the ground. Driving hammer: A hammer used to drive the core cutter into the soil to obtain a soil sample. Cutting edge: The sharp edge at the bottom of the core cutter that is used to cut through the soil. Ejector: A rod used to eject the soil sample from the core cutter.

Weighing balance: A balance used to weigh the soil sample obtained from the core cutter. Measuring cylinder: A cylinder used to measure the volume of the soil sample. Laboratory equipment: Equipment used to determine the moisture content of the soil sample.

These components are used in conjunction with one another to obtain accurate readings of soil bulk density and dry density using the core cutter method.

2.3 COMPONENTS REQUIRED

STEEL RAMMER;

A heavy rammer issued to drive the core cutter into the soil.

Fig- 1 steel rammaer

Balance:

A balance isused to weigh the soils ample extract educing the core cutter

Water:

Water issued to saturate the soils ample before weighing it. By using the components, the core cutter method can used to determine the bulk density

2.4 PROPERTIES COMPONENTS

Core cutters allow one to determine the soil's density quickly. First, a calculation of void percentage is computed. A high void percentage indicates poor compaction of the soil. It is a rapid method for the field and helps find the field density of cohesive soils such as clay.

Core cutter method is used for finding field density of cohesive/clayey soils placed as fill. It is rapid method conducted on field. It cannot be applied to coarse grained soil as the penetration of core cutter becomes difficult due to increased resistance at the tip of core cutter leading to damage to core cutter.

The apparatus for core cutter method consists of a: Cylindrical steel core cutter. Steel dolly 25 mm high and 100 mm in diameter.

Core Cutter Method of Field Density test is conducted in the field to know whether the specified compaction is achieved or not. In certain cases, it is necessary to determine the density of soil either as it exists naturally in the ground or as it may be compacted in the fill.

The primary objective of the core cutter method is to determine the dry density of soil. It is used as a control test to check if the soil has acquired the designated dry density or not. The determined in situ dry density is necessary for the design of pavement and highways.

3.CHARACTERISTICS OF SOIL

The physical characteristics of soils include all the aspects that you can see and touch such as:

- texture.
- colour.
- depth.
- structure.
- porosity (the space between the particles)
- stone content.

Soil characteristics - color, texture, odor - are important to understand for anyone who works in agriculture or horticulture. Gardeners, for example, must develop a basic understanding of what soil is and how to manage the fertility of their soils in order to successfully grow crops and ornamental plants.

Soil consists of minerals, water, air, organic matter and living organisms. Covering most of the Earth, soil forms the uppermost layer of the crust of our planet. By providing nutrients and water to plants, soil supports all life on Earth. Soil is essential not only for the plants that grow in it but also for the humans and other organisms that rely on plants for food and shelter.

4. MATERIAL COLLECTION

The core cutter and dolly is dig out without disturbing the soil sample.

And the top and bottom surface of soil in the cutter is leveled by trim with straight edge clean the outer portion of core cutter.

To find the soil density of The classification of entire soils of the world splits into clay or sandy type of soils. The latter hardly posses any problem due to seepage of water in tout, which is mainly rock. Rather the clayey type of soils are formed by chemical weathering which involves chemical reactions constituting hydration, carbonation and leaching. Due to these aspects the clayey soils swell when it comes in contact with water during winter season and shrink when water is lost due to evaporation during summer. A lot of investigation has been carried out by researches in modifying the swelling and shrinkage properties of clayey soils. The last option is sorted in study which is found to be economical in certain aspects when the quantum of soil to be stabilized is larger, especially in the case of laying flexible pavement. Red soil may occur from the soil, often mixed with sand clay or as sediment mixed in suspension with water in rivers and streams and as deposits in the bottom. Red soil has a moderate specific area with a typically, non sticky, plastic feel. Red soil usually has a flowly feel when dry and a slippery feel when wet. In soil material, 80% of the particles range from 2 to 50µm. The particle size fractionation with in this size range allows determination of the main minerals bearers of natural trace element tin red soil. This moisture may come from rains, floods, leaking sewer lines, or from the reduction of surface evaporation when an area is covered by a building or pavement. Frequently, the se expansive soils cause the cracking and braking up of pavement, railways, highway embankments,

5.CONCLUSION

In principle, the bulk density of the soil. r (in Mg / m 3) , is calculated from the equation :

r = ms – m/ V c

where,

ms is the mass of soil and core cutter (in g);

mc is the mass of core cutter (in g);

Vc is the internal volume of core cutter (in mL).

lternatively, using the mould factor ratio. the bulk density of the soil, r (in Kg / m 3), can be calculated from the equation.

s a second alternative, using the mould factor F, the bulk density of the soil, r (in kg / m 3) can be calculated from the equation :

r = ms - m F

Value in kg/m 3 are converted to Mg/m3 by dividing by 1000.

Calculate the dry density, rd (Mg/m3) from equation

r = 100/ 100 + w

here, w is the moisture content of the soil (in %).

The in-situ bulk and dry densities of the soil (Mg/m3), are expressed to the nearest 0.01 Mg/

Cylindrical core cutters of 130mm long and 100mm diameter are used for testing the in-situ compaction of cohesive and clay soils placed as fill. By using core cutter method, bulk density of soil can be quickly calculated and by determining the moisture content of the soil the dry density of the fill can be calculated and hence the voids percentage. A high percentage of voids indicates poor compaction of soil. A cylindrical core cutter is a seamless steel tube. For determination of the dry density of the soil, the cutter is pressed into the soil mass so that it is filled with the soil without disturbing the core contents. The cutter filled with the soil is lifted up. The mass of the soil in the cutter is determined. The dry density is obtained as

$$\rho = \frac{\gamma}{1+w} = \frac{(M/V)}{1+w}$$

REFERENCES

- ASTM D6169-18: Standard Guide for Selection of Soil and Rock Sampling Devices Used With Drill Rigs for Environmental Investigations.
- ASTM D3550-20: Standard Practice for Thick Wall, Ring-Lined, Split Barrel, Drive Sampling of Soils
- British Standards Institution. BS 1377-1:1990. Methods of test for soils for civil engineering purposes. General requirements and sample preparation.
- Indian Standard Institution. IS: 2131-1981. Method of Standard Penetration Test for Soil.
- Canadian Geotechnical Society. Recommended Practice for Soft Ground Site Investigation (1995)

These references provide guidance and standards for the use of the core cutter method in soil sampling and testing