**CIVIL ENGINEERING EDUCATION IN NIGERIA.**

**A TERM PAPER ON SOIL PERMEABILITY AND CAPILLARITY**

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**ABSTRACT**

This work examines soil permeability and soil capillarity for a little deeper understanding. Here we work on different relations to these things.

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**INTRODUCTION**

Soil Permeability is the property of the soil to transmit water and air and is one of the most important qualities to consider for fish culture. The more permeable the soil, the greater the seepage. Some soil are so permeable and seepage so great.

Soils are generally made up of layers and soil quality often varies greatly from one layer to another. Before a construction is made on a soil, it is important to determine how permeable or nor permeable it is.

Understanding permeability means understanding the structure of the soil and how water passes through the different layers. Soil, as we know, has a layered structure, and water pressure at the surface would not be the same at the middle portion. Determination of permeability in soil enables engineers and agriculturists study fluid-flow characteristics through a soil mass and thus helps in improving workability of the soil.

Soil Capillarity is the ability of various soils and rocks to allow water to move up through them. It is somewhat dependent upon a rock’s porosity and permeability. The forces involved in capillarity are gravity pulling downward on the water, and attraction between water molecules and the molecules of the rock.

Tress ‘drink’ from capillary water. Their instrument to drink from the capillary water is the primary root. In soil, there are millions of vertical channels which are called capillary tubes. Whenever there is a downpour, excess water runs underground through these capillary tubes. When it is dry, these same tubes transport water to the surface.

**What is Soil Permeability?**

The permeability of a soil is the ability of water to move through it (permeate it). It depends on the physical and chemical properties of the soil, notably particle size distribution (the range of particle sizes present), pore space, pore size and the community of spaces.

**Importance of Soil Permeability**

1. Almost all the civil engineering structures are constructed on the soil and if the soil below them is pervious, may result in the percolation of the water, and may also result in the piping action, which will reduce the strength of the soil to take the structural weight.
2. Soil embankments are likely to get failed if the soil used to construct them is of high permeability, because it will reduce their shear strength. So it is important to study the permeability of the soil to be used for the pavement construction.
3. The canals are likely to get failed if there is any leakage from the embankments, so it is important to study the soil used to construct them.
4. The earth dams use the material which has zero permeability to store the water.

 **Factors affecting Soil Permeability**

* Size of soil particle
* Specific surface area of soil particle
* Void ratio
* Shape of soil particle
* Soil structure
* Degree of saturation
* Water properties
* Temperature
* Organic Matter
* Adsorbed water

**Test for Soil Permeability**

The constant head permeability test is a laboratory experiment conducted to determine the permeability of soil. The soils suitable for this tests are sand and gravels. Soils with slit content cannot be tested with this method. The test can be employed to test granular soils either reconstituted or disturbed.

**Formula and determining of hydraulic conductivity (k)**

To determine the flow of a fluid through a porous media, Darcy’s Law is used. Darcy’s Law is derived from the popular Navier-Stokes equation, which basically makes use of Newton’s Second Law to study fluid substances. The formula used to determine permeability is given below:

Q=-kA [(Pb-Pa) / (µ.L)

Q- Discharge, µ- Viscosity, k- Coefficient of permeability of the medium

**What is Soil Capillarity?**

It is the phenomenon by which water rises in a cylindrical column. The narrower the column, the higher the capillarity. Similarly, the denser the substratum present in the column, the higher the capillary effect.

**Capillarity in different soils**

* Clay soil has a high soil capillarity
* Loamy and Sandy soil have a low soil capillarity

**Effects of Capillarity rise in soil**

It causes an increase in the surface area.

**Surface Tension in Soils**

It is a tensile force developed along the surface of water due to unbalanced cohesive attraction among water molecules.

**Calculation of Capillary Rise Height of soils**

A liquid of density and surface tension rises in capillarity of inner radius to a height. The formula for capillary rise can be derived by balancing forces on the liquid column. The weight of the liquid (πr₂hpg) is balanced by the upward force due to the surface tension.

**Relationship between soil permeability and capillarity**

The ability of various soils and rocks to allow water to move up through them is Capillarity. Capillarity is somewhat dependent upon the rock’s porosity and permeability.

**Summary and Conclusion**

Soil permeability and capillarity are important, one is the primary force that enables the soil to retain water, as well as to regulate its movement (capillarity); while the other helps in transmitting water and air into the soil (permeability)