Shear Strength of soil

INTRODUCTION

When soil is loaded, shearing stresses are induced in it. When the shearing stress reaches a maximum value, failure of the soil mass taking place.

All stability analysis in soil mechanics involves a basic knowledge of the shearing properties of the soil. The shear strength is the most important soil characteristics.

The method used to determine the shear characteristics in the laboratory must be understood in detail.

The Shearing behavior of depends on the following factors,

a) **Frictional** Resistance (ϕ)
b) **Cohesion** between the particles (C)

The shear strength in cohesion less soil is purely due to **friction.**

The shear strength in cohesive soil is purely due to **cohesion.**

Shear strength of cohesive and cohesion less soils:

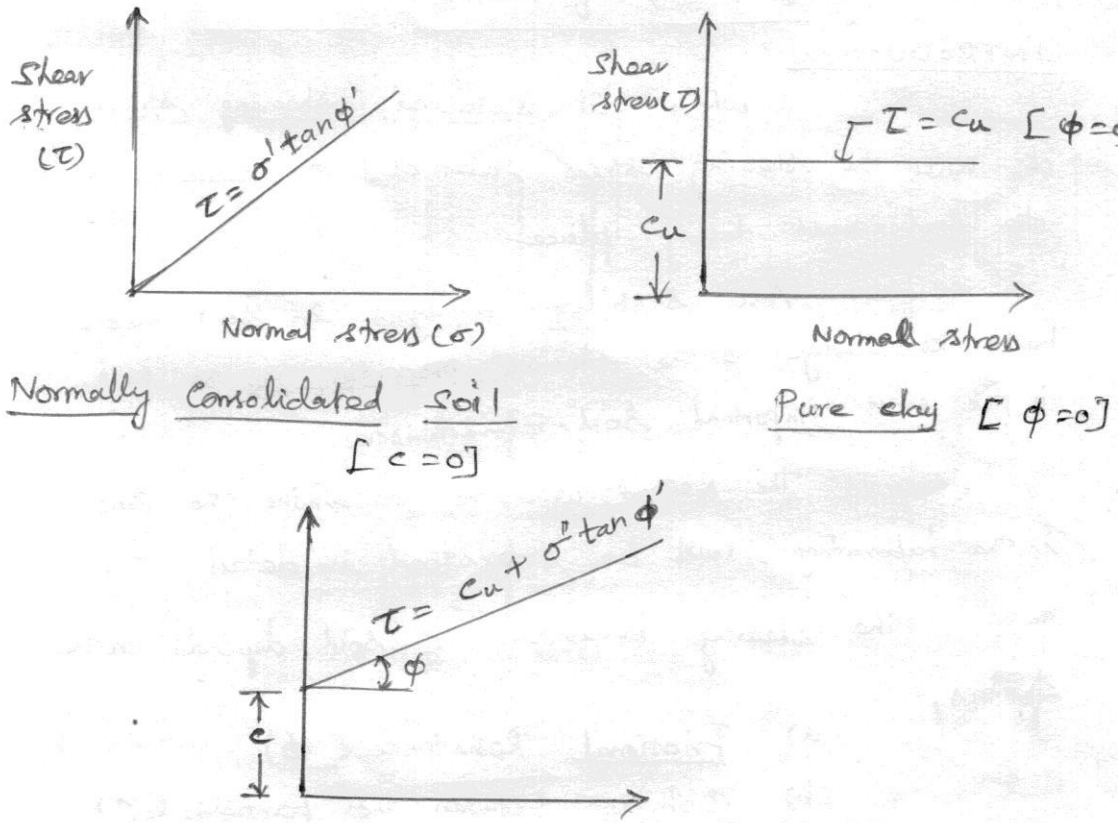
Shear Strength of COHESIVE soil:

The shear strength of a cohesive soil depends upon whether the soil is **normally consolidated** or **over consolidated**. The shear strain curve for an over consolidated clay is similar to that of a dense sand and that of a normally consolidated clay is identical. to that of a **loose sand**. However, the strain required to **reach peak stress** are generally **greater** in **clay** than in **sand.** The

$$S \text{ or } \tau = C' + \sigma \tan \phi'$$

effective stress parameters (c,ϕ) for an over consolidated clay are determined from the failure envelope.

For a **normally consolidated soil** (or) **clay**, the failure envelope passes through the origin and hence $\mathbf{c' = 0.}$ sometimes, for pure **clay** soil, $\phi = 0$ *and* $r = c_u$.



The following parameters that affects the shear strength of cohesive soils,

i) Structure of clay
ii) Clay Content
iii) Drainage Condition
iv) Rate of strain
v) Repeated loading
vi) Confining pressure
vii) Stress history
viii) Disturbance

Plastic undrained clay does not possess internal friction.

Shear strength of COHESIONLESS soil:

Shear strength in sand may be said to **consist** of **two parts,**

i) **Internal frictional resistance** between the soil, to **translocation** between the individual soil particles at their **contact points**.

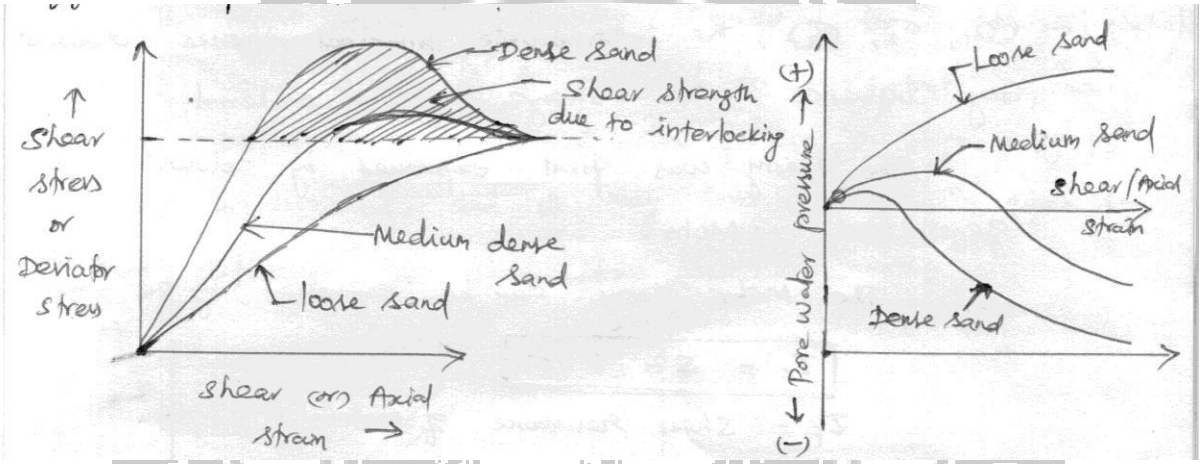
ii) Structural resistance to **displacement** of the soil because of the

interlocking of theparticles.

The shear strength in cohesion less soil results from inter granular friction alone, [c=0] while in all other soils it results both from **internal friction** as well as cohesion. [**c = ϕ soil**]

However, **Plastic** undrained **clay** does not possess internal **friction**. [φ=0]

The stress – strain behavior of sand is given by the following fig. as expressed below.



STRESS – STRAIN CHARACTERISTICS OF SANDS

It can be observed from the fig (a), the **shear stress increases** gradually for **loose sand**. while for an initially dense sand, it **reaches** a **peak value** and **decreases** at **greater value** of **strain**. The hatched portion represents the **additional strength** due to the phenomenon of **inter locking**.

The changes in pore water pressure as shown in the **fig (b) positive** pore pressure pore pressure develop in the case of an **loose specimen** and **negative** pore pressure developed. in the case of **dense sand** due to the permeability of soil.

The Following Parameters are affects the shear strength of cohesion less soils.

i) Shape of particles ii) Gradation iii) Density iv) Confining pressure

v) Deviator stress vi) Loading vii) Type of minerals viii) Moisture