INTRODUCTION

***S**hear strength is the capacity to resist shear stress. The maximum inclined stress that a soil can resist or bear upto shear failure of a soil mass is called shear strength of a soil. The shear failure of a soil mass occurs when the stress induced due to the applied compressive load exceeds the shear strength of the soil. It may be noted that the failure occur in a soil mass by the relative movement of the particle but not due to the breaking of the particles.*

Shear strength is the principal engineering property which controls the stability of a soil mass under the loads. It governs the bearing capacity of the soil, stability of a slope of soil, earth pressure against retaining structure etc.

MECHANICS OF SHEAR RESISTANCE

Soil derives their shear resistance due to the following points:

a. *Interlocking between the particles [negligible] shear strength of a soil due to interlocking get diminished once it is overcome by applied force.*
b. *Frictional resistance (Φ).*
c. *Intermolecular force of attraction or cohesion (c).*
d. *In case of a coarse grained soil there is no intermolecular force of a attraction or cohesion (c) so soil derive its shear strength due to only frictional resistance. Therefore it is also called frictional soil or cohesion less soil e.g. Sand and gravel.*
e. *In case of a fine grained soil the shear strength is not due to the frictional resistance of intermolecular force or cohesion. So it is called C-soil e.g. Clay.*
f. *The soil that derives their strength due to the both friction and cohesion is called C- Φ soil.*

To calculate the shear strength of a soil and take preventive measure such that the soil mass does not fail in shear, we have to derive state of a failure upon stressing to a certain.

- *At what stress the failure will occur: By knowing the stress at failure, we can design the system such that failure stress does not generate.*
- *On what plane failure will occur: By knowing orientation of potential failure plane we can take suitable strengthening to prevent failure on that plane.*

STRESS – SYSTEM WITH PRINCIPAL PLANES PARALLEL TO THE COORDINATION

At every point in a stressed body, there are three planes on which the shear stresses are zero. These planes are known as principal planes, the plane with maximum compressive stress (σ_1) is called the major principal plane and that with the minimum compressive stress (σ_3) is called minor principal plane. The third plane is subjected to a stress value which has a value intermediate between s_1 and s_3 is called intermediate principal plane. Generally the stress on a plane perpendicular to the intermediate principal plane are required for the analysis.

Let σ_1 be the major principal stress and σ_2 be the minor principal stress. Let AB be a plane which inclined at an angle $\boldsymbol{\theta}$ with the major principal plane.

Mathematically,

$$\tau = \frac{1}{2}(\sigma_1 - \sigma_3) \sin 2\boldsymbol{\theta}$$

$$\sigma = \frac{\sigma 1 - \sigma 3}{2} + \frac{\sigma 1 + \sigma 3}{2} \sin 2\boldsymbol{\theta}$$