Chapter-7

Shear Strength

Two types of stresses developed inside a soil mass -

1. Normal stress
2. Shear stress

Normal stress

Compressive in nature because soil mass can not take any tensile stresses.

related to effective stress ($\bar{\sigma}$).

Shear stress

Case of sliding.

tend to displace a part of soil mass relative to rest of the soil mass.

ex dam, canal, embankment, foundation.

Shear strength

- It is defined as the maximum shear stress that can be withstand by the soil mass.
- If this value is equalled by the shear stress on any plane or a surface at a point, failure will occur in the soil because of movement of a portion of the soil mass along that particular plane.
- It enables the soil mass to keep its equilibrium whe

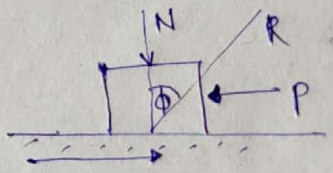
its surface is not level or for that matter, under any loading situation which produces shearing stresses.

✓ Soil does not fail by compression or crushing of particle before this happen soil will fail ~~by~~ due to shear stress.

✓ So in soil, the failure is always due to shear.

Mechanism of shear resistance :-

analogous to shearing resistance of a solid block of material, frictional in nature.



friction coefficient 'μ'

if P is sufficient to move the block i.e $P = \mu N$

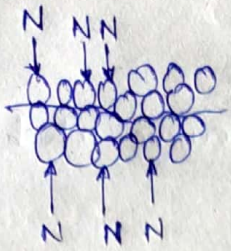
here p is similar to shear force.

here, shear force ∝ friction coefficient (μ)
∝ normal force. (N)

so if μ ↑ shear force ↑
N ↑ shear force ↑

here soil, $\mu = \tan\phi$

where ϕ = angle of internal friction
i.e angle between the normal & resultant force.



this is not the linear surface

If more shear is resisted by the soil mass then the contact force is more i.e N ↑ so as contact bet" Particle increases so more shear can be resisted.

So more no. of particles in contact with each other.

in case of soil it is not just about angle of internal friction, it is also about interlocking.

If the shear failure will happen - then the interlocking has to be broken.

This interlocking is more prevalent in dense sand as angle of internal friction is more.

in case of clay soil - some attractive force between the particle exist - i.e known as cohesion. so even if $N = 0$, shear strength (τ) $\neq 0$ because of cohesion i.e $\tau = C$.

So in order to resist shear failure =>

we should know limiting shear strength.

know the failure plane and try to strengthen the plane.

Concept of failure in Soils

Requires - (a) defining the point on the σ-ε curve which corresponds to failure.

(b) identifying the plane on which such a failure has occurred.