Introduction to Soil Mechanics

Soil mechanics applies **principles** of **engineering mechanics** to **predict** the physical **behaviour** of **soils**

Factors Influencing the Strength of Soil

- The **density** of the soil
- The **water content** of the soil
- The **size** of the **particles** and their **shape** (round, angular)
- **Composition** of the **soil** (relative proportions of each component)

Soil Instability

- **Wetting** → instability due to wetting is caused by an overall **volume increase** due to the take up of **additional soil water**
  (clay has an expansive nature)
- **Drying** → instability due to drying cause by overall **volume reduction** due to the **loss** of **water**
  (cracks may form)

Soil Strength

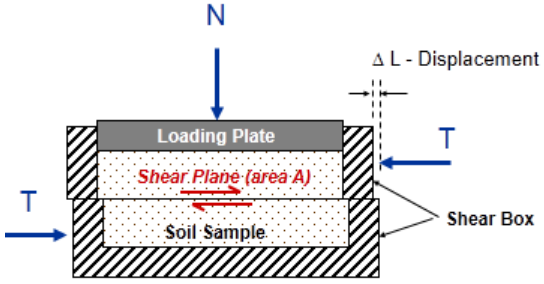
refers to the **ability** of the **soil** to **resist imposed forces** (tension, compressive, shear)
→ when looking at **soil** we are generally **concerned** with the **shear strength** of the soil

Soil Confinement

the **confined strength** of **soil** is much **higher**
→ the **higher** the **compressive strength** imposed on the soil the **higher** the **shear strength**
(the further down the soil the greater the shear strength due as the confining pressure increases)

Direct Shear Test

a soil is **confined** in a **shear box** which has a **loading plate** placed on the **top** and **shear stresses** are **imposed**
→ the **shear strength** can then be **calculated** from working out the **shear stress imposed** and the **shear plane area**



Soil Failure

soil **failure** generally **occurs** along a **shear plane**
→ may have a **foundation** or **slope failure** (from excavation)

- **Slope Failure** a slope may fail from it being
  - **Too steep** the resistive force by the soil in equilibrium is equal to the weight of the soil, if the slope is too steep the weight may exceed the maximum resistive force
  - **Too much load** the resistive force is not sufficient to hold the load
  - **Too much water content** too much water content increases the load but more importantly the water content will create pressure that has a tendency to push the involved interfaces apart
    (water pressure will affect fine and coarse grained soils differently)

Water Pressure

F will **increase** as **N increases** (Law of Friction)
→ if **F** is **sufficient** the **soil** will **not fail** along the **shear plane**
(assuming no water content)
→ when there **is water** there is a **force created** by the **water pressure** which **decreases** the **net contact force** and thus the F force will **decrease**
→ the offset of the N force and thus F force, will **reduce** the **shear strength** as the **water pressure pushes** the soil **particles apart**