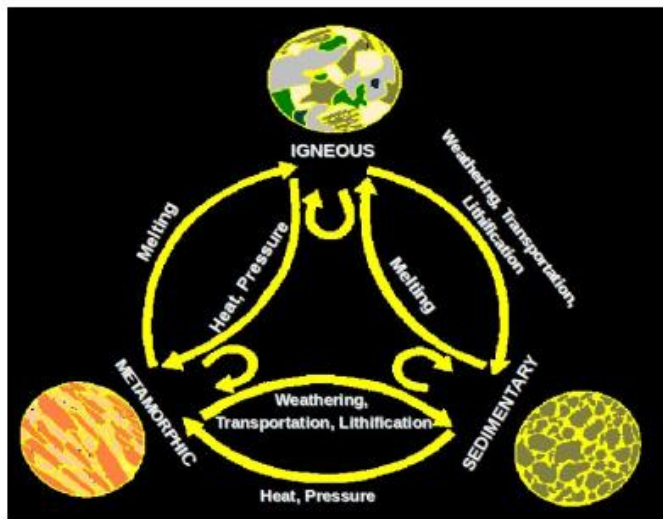Soil Mechanics Summary

Rock Cycle

-

Soil Profile

- Topsoil
- Subsoil
- Transition
- Bedrock

Clay minerals

- 2 basic units
    o SiO4
    o Al(OH)3
- 3 main minerals
    o Kaolinite (weathered tropical soil)
    o Illite (moderate rainfall)
    o Montmorillonite (arid areas, highly water absorbent

Phase relationships
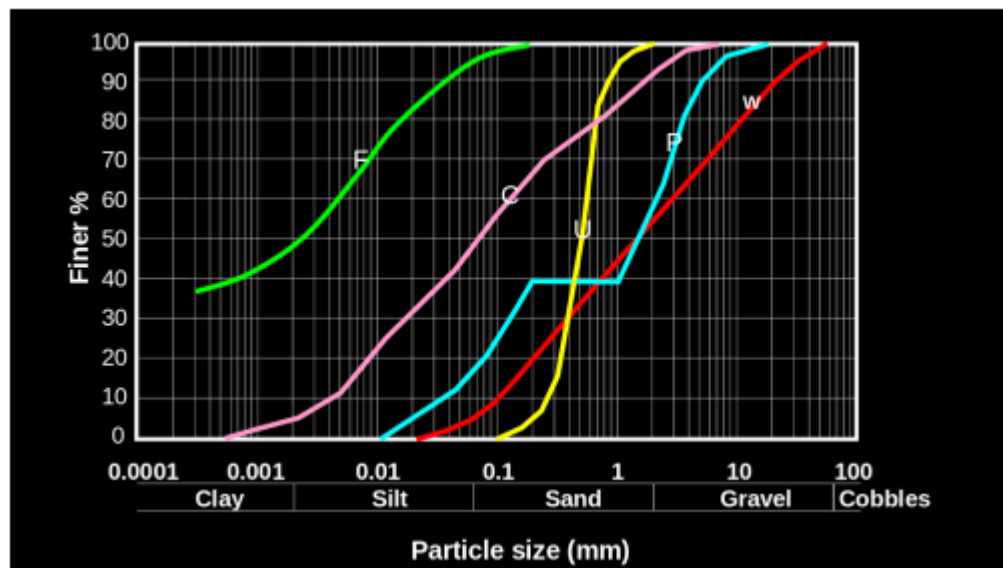
- Soil is soils and voids, filled with air or water
- Relationships
    o Void ratio = V_v/V_s
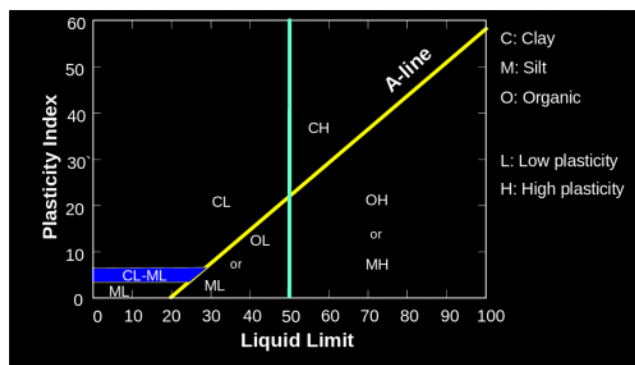   o Saturation rate = V_w/V_v
    o Moisture content (m) = W_w/W_s

-
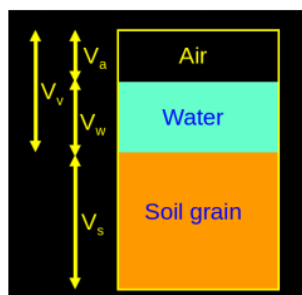
- Classifications
    - Cohesive – clays
    - Non-cohesive – everything else
    -

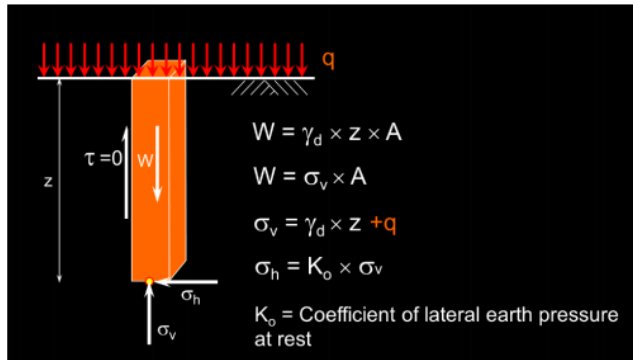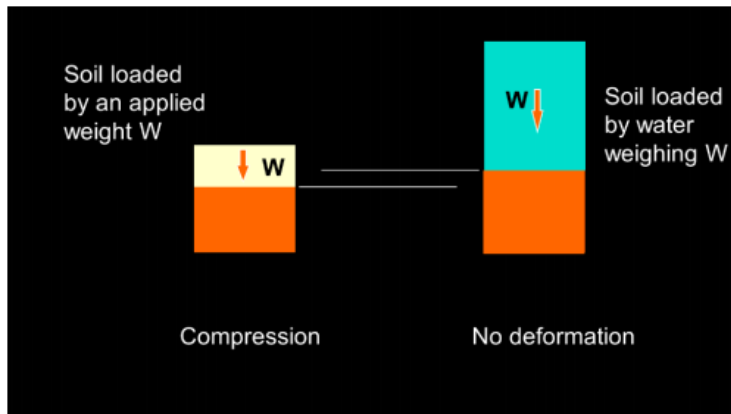| Soil type	Grain size (mm)	
	Min	Max
Gravel	2	60
Sand	0.06	2
Silt	0.002	0.06
Clay	-	0.002

-
- Fine soils:

Stresses in soil

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- Deformation is a function of stresses applied to soil

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- Effective stress: F' = F – Fw
- Vertical and horizontal stresses:

  - Effective vertical stress:

    $$\sigma'_v = \sigma_v - u$$

    where:
    - σ'_v : Effective stress
    - σ_v : Total stress
    - u : Pore water pressure $= \gamma_w z_w$

  - Horizontal stress by earth pressure coefficients:
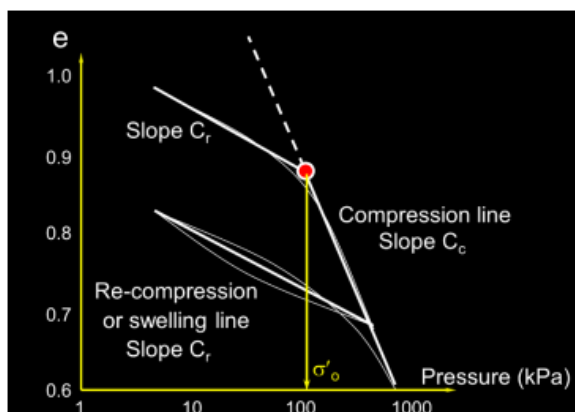
    $$\sigma'_h = K_0 \times \sigma'_v$$

    where:
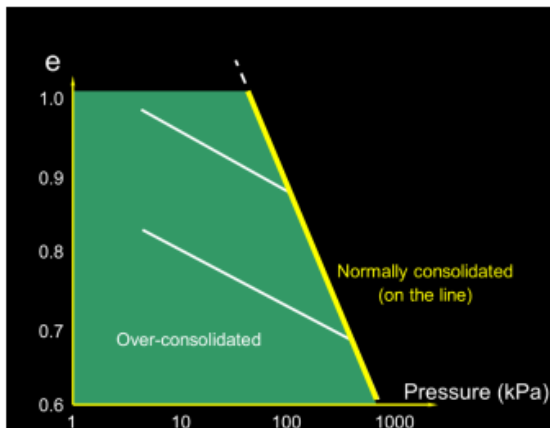   - K_0 : Coefficient of lateral earth pressure at rest

  - Total horizontal stress:

    $$\sigma_h = \sigma'_h + u$$
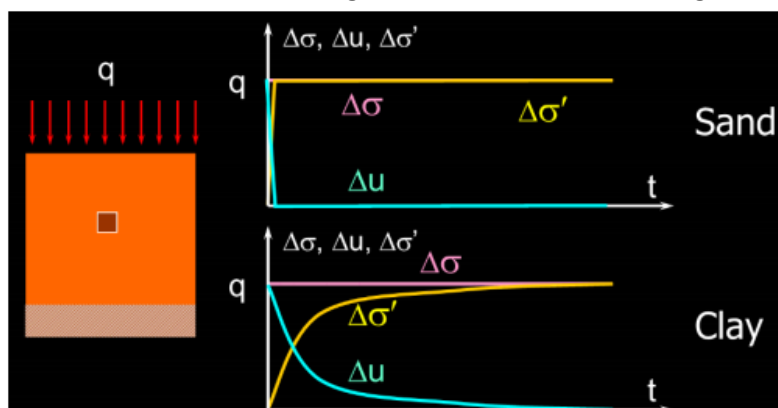
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Settlement and consolidation

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Coefficient of volume change

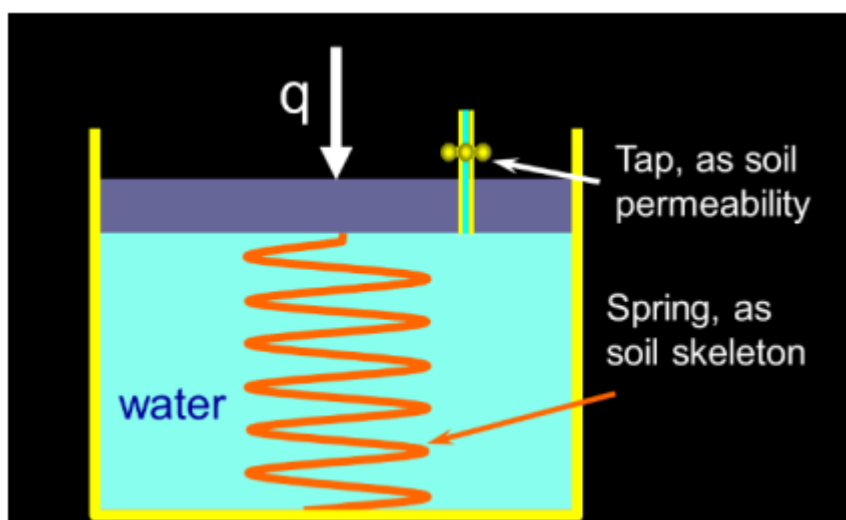$$m_v = \frac{\Delta V/V}{\Delta \sigma'}$$

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- Depends on stress level

Rate of settlement

- Granular soils is instant, fine grained soils settle over a long time

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Consolidation model

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- Consolidation over time