

CVEN 3202 Notes

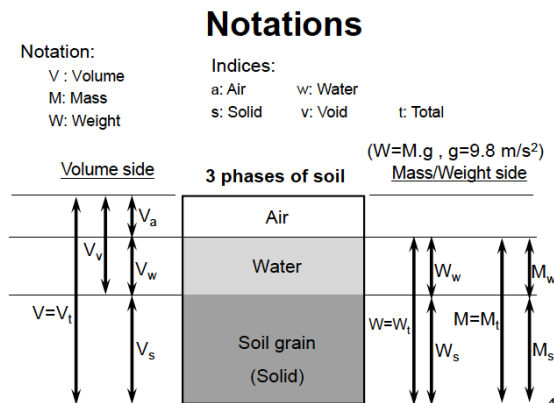
Week 1, 18/2/19

Phase relationships and soil classification

Phase relationships

Phases

- Soil consists of **solid particles** (rocks, minerals) and **voids**
 - Voids may be filled with water and/or air
 - They affect the engineering properties of soils
- Soil can be simplified into a **phase diagram** showing the relative proportions of each material or phase
 - Typically the three phases of soil are air, water and soil grain (solid)
 - Keep units consistent – volume on left, mass/weight on right
 - N.b. mass/weight of air assumed 0



- Typical units can be SI or cgs (centimetre gram second)

	SI System	cgs System
Length (L)	metres (m)	centimetres (cm)
Volume (V)	cubic metre (m ³)	cubic centimetre (cm ³) = ml
Mass (M)	Kilograms (kg) (1000 kg = 1 tonne (t))	Grams (gr)
Density (ρ) = M/V	kg/m ³ (or t/m ³)	gr/cm ³
Weight (W)	W = M.g (g = 9.81 m/s ²) Newton (N) 1 N = 1 kg x g (1 kN = 1 t x g)	W = M.g (g = 981 cm/s ²) Dyne (dyn) 1 dyn = 1 gr x g
Stress (σ)	Pascal (Pa) 1 Pa= 1 N / m ² (1 kPa= 1 kN / m ²)	dyn/cm ²
Density (ρ) (M / V)	Density of water, $\rho_w = 1000 \text{ kg/m}^3 = 1 \text{ t/m}^3$	Density of water, $\rho_w = 1 \text{ gr/cm}^3$
Unit weight (γ) (W / V)	Unit weight of water, $\gamma_w = \rho_w \times g = 9.8 \text{ kN/m}^3$	Unit weight of water, $\gamma_w = \rho_w \times g = 981 \text{ gr/cm}^2.\text{s}^2$

Volumetric relationships

- Simple volume, mass and weight ratios are derived from sums and totals
 - Total volume: $V_t = V_s + V_w + V_a$
 - Total mass/weight: $M_t = M_s + M_w + M_a$ and $W_t = W_s + W_w + W_a$
- The ratios between the **volumes** of the different phases are more important