



Geotechnical Engineering–I

BSc Civil Engineering – 4th Semester

Lecture # 3

2-Feb-2015

by

Dr. Muhammad Irfan

Assistant Professor

Civil Engg. Dept. – UET Lahore

Email: mirfan1@msn.com

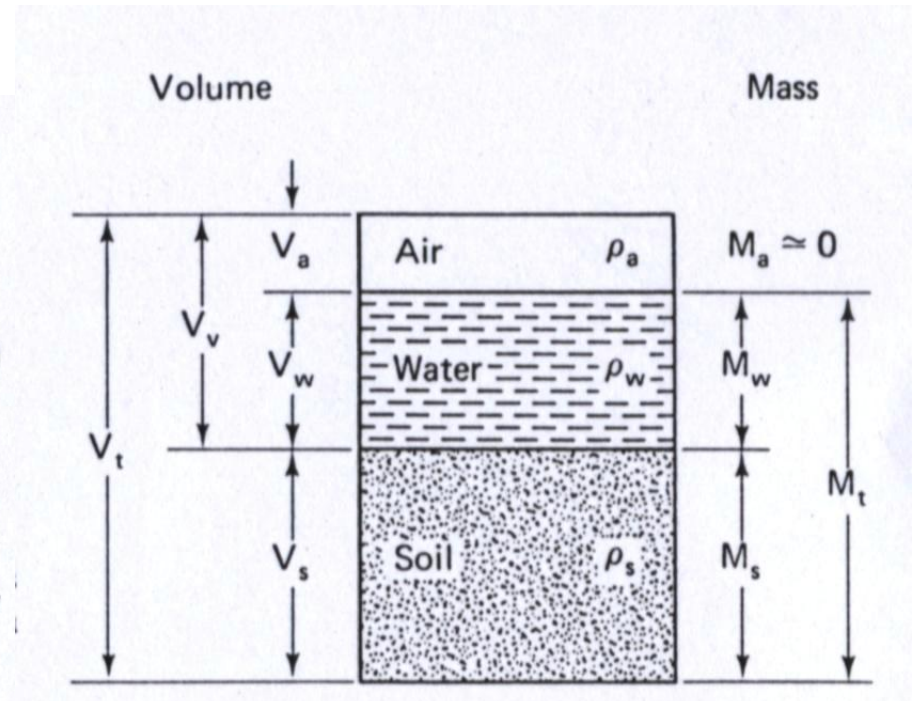
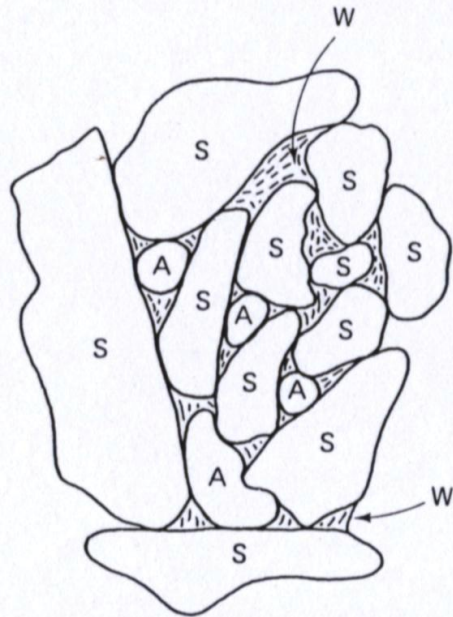
Lecture Handouts: <https://groups.google.com/d/forum/geotec-1>

REVIEW:

Soil as a Three Phase System

S: Solid
W: Liquid
A: Air

Soil particle
Water
Air



REVIEW:

Phase Relationships

$$e = \frac{n}{1-n}$$

$$n = \frac{e}{1+e}$$

$$\gamma_d = \frac{\gamma_b}{1+w}$$

$$n = 1 - \frac{W_s}{G_s \cdot \gamma_w} \bullet \frac{1}{V}$$

$$e = \frac{V \cdot G_s \cdot \gamma_w}{W_s} - 1$$

$$\gamma_b = G_s \cdot \gamma_w \left(\frac{1+w}{1+e} \right)$$

$$\gamma_d = \frac{G_s \cdot \gamma_w}{1+e}$$

$$e = \frac{w \cdot G_s}{S}$$

$$\gamma_{sat} = \frac{(G_s + e) \gamma_w}{1+e}$$

$$\gamma_{sub} = \frac{\gamma_w (G_s - 1)}{(1+e)}$$

$$\theta_v = n \cdot S_r$$

PHASE RELATIONSHIPS

Problem #1

The wet density of a glacial outwash soil is 1.92 gm/cc the specific gravity of the solid particles of the soil is $G_s = 2.67$, and the moisture content of the soil is $w = 12\%$ by dry weight.

CALCULATE:

a)	dry density	b)	porosity
c)	void ratio	d)	degree of saturation
e)	percent of air voids.		

Problem #2

From a borrow pit in which the void ratio is $e = 1.20$, 200,000 cu. meter of soil have to be excavated for building a fill with a void ratio of $e=0.70$. How many cubic meter of fill can be constructed?

PHASE RELATIONSHIPS

Problem #3

The moisture content of a saturated clay sample is 345%. The unit weight of the solids is 2.38gm/cc. Determine the unit weight of the saturated clay (gm/cc.).

Problem #4

The unit weight of the solids of a given sand is 2.69gm/cc. Its void ratio is 0.573.

- CALCULATE:
- the unit weight of the dry sand
 - the unit weight of the sand when saturated
 - the submerged unit weight of the sand.

PHASE RELATIONSHIPS

Problem #7

A cubic cm of soil in its natural moisture weighs 1.81 gm after being dried it weighs 1.54gm. The specific gravity of the soil is 2.70. Determine the degree of saturation, void ratio, porosity, and water content for the soil as it existed in its natural state.

Problem #8

A container of saturated soil weighed 113.27gms before it was placed in an oven and 100.06g after it remained in the oven overnight. The container alone weighs 49.31gms, the specific gravity of the soil is 2.80. Determine the void ratio, porosity, and water content of the original soil sample.

PHASE RELATIONSHIPS

Problem #9

A saturated soil has a unit weight of 1.92gm/cc and water content of 32.5% . Determine the void ratio and specific gravity of the soil.

Problem #10

A sample of dry sand having a unit weight of 1.68gm/cc and a specific gravity of 2.70 is placed in the rain. During the rain the volume of the sample remains constant but the degree of saturation increases to 40% . Determine the unit weight and water content of the soil after being in the rain.

PHASE RELATIONSHIPS

Problem #11

A soil sample taken from a borrow pit has an in situ void ratio of 1.15. The soil is to be used for a compaction project where a total of $100,000 \text{ m}^3$ is needed in a compacted state with the void ratio predetermined to be 0.73. Determine how much volume is to be excavated from the borrow pit.

Problem #12

Laboratory tests determined the water content in a certain soil to be 14% at a degree of saturation of 62 percent. The density of the soil solids is 1.7 gm/cc . Determine.

- a) The specific gravity b) The porosity c) The void ratio of the soil.

PHASE RELATIONSHIPS

Problem #13

Laboratory tests determined the water content in a certain soil to be 14% at a degree of saturation of 62 percent. The density of the soil solids is 1.7 gm/cc. Determine.

a) The specific gravity b) The porosity c) The void ratio of the soil.



CONCLUDED