Birzeit University
Faculty of Engineering
Department of Civil and Environmental Engineering

ENCE 331, Soil Mechanics

Homework assignment #2
Due on Tuesday, Oct. 6th , 2020 @ 11:59 PM.

Problem 1:

For a given soil show that:

$$\gamma_d = \frac{e\, S\, \gamma_w}{(1+e)\omega}$$

$$e = \frac{\gamma_{sat} - \gamma_d}{\gamma_d - \gamma_{sat} + \gamma_w}$$

Problem 2:

A 0.4 m^3 moist soil sample was tested in the lab, and the following data was observed:

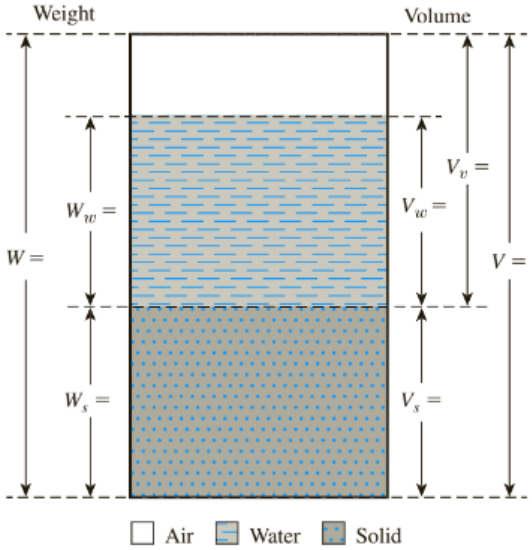
- Moist mass: 711.2 kg
- Dry mass: 623.9 kg
- Specific gravity of soil solids: 2.68

Calculate the following soil parameters: Moisture content, Bulk (Moist) density, Dry density, Void ratio, Porosity, and Degree of saturation.

Problem 3:

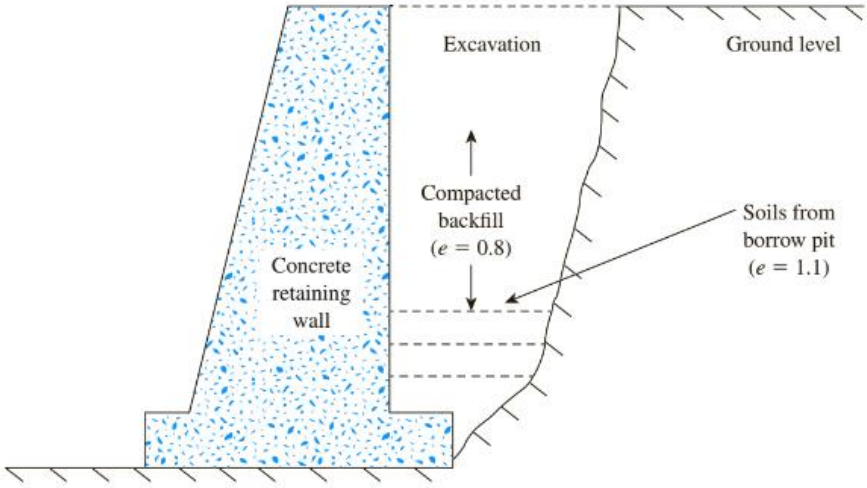
The bulk (moist) unit weight of a soil is 17.8 kN/m^3, and the moisture content is 14%. If the specific gravity of the soil solids is 2.69, calculate the Dry unit weight, Void ratio, Degree of saturation.

For 1 m^3 of this soil, fill the quantities in the block diagram shown below.



Problem 4:

After the construction of a concrete retaining wall, backfill material from a nearby borrow pit was brought into the excavation behind the wall and compacted to a final void ratio of 0.8. Given that the soil in the borrow pit has void ratio of 1.1, determine the volume of borrow material needed to fully compact backfill, knowing that the total volume of the backfill is 30 m^3.



Problem 5:

For the given problem before, the borrow pit soil has a moisture content of 11% and $G_s = 2.7$, determine: the bulk (moist) unit weight of the borrow soil, Degree of saturation of the borrow soil, Bulk (Moist) unit weight of the compacted backfill. The total weight of borrowed soil to fill the volume behind the retaining wall.

Problem 6:

In a construction project, the field Bulk (moist) unit weight was 17.5 kN/m^3 and the moisture content was 11%. If maximum and minimum dry unit weights determined in the laboratory were 19.2 kN/m^3 and 14.1 kN/m^3, respectively. What was the field relative density?

Problem 7:

A 3-m high sandy fill material was placed loosely at a relative density of 55%. Laboratory studies indicated that the maximum and minimum void ratios of the fill material are 0.94 and 0.66, respectively. Construction specifications required that the fill be compacted to a relative density of 85%. If $G_s = 2.65$, determine:

- Dry unit weight of the fill before and after compaction
- Final height of the fill after compaction