Solutions to Civil Engineering Licensure Exam – Day 50

Section A: Multiple Choice Questions (MCQs)

1. The liquid limit of a soil is defined as:
Answer: (a) The moisture content at which soil changes from plastic to liquid state.
YouTube Video: Atterberg Limits Test - Liquid Limit

2. The plasticity index (PI) of a soil is calculated as:
Answer: (a) The difference between liquid limit and plastic limit.
YouTube Video: Atterberg Limits Test - Plastic Limit

3. The soil classification system widely used for engineering purposes is:
Answer: (a) Unified Soil Classification System (USCS).
YouTube Video: Unified Soil Classification System

4. A fine-grained soil with a plasticity index greater than 50 is classified as:
Answer: (a) Highly plastic clay (CH).
YouTube Video: Soil Classification - High Plasticity Clays

5. The specific gravity of soil is defined as the ratio of:
Answer: (a) The unit weight of soil solids to the unit weight of water.
YouTube Video: Specific Gravity of Soil - Laboratory Test

Section B: Problem-Solving

1. A soil sample has a liquid limit of 45% and a plastic limit of 25%. Determine its plasticity index and classify the soil.
Solution:

$$PI = LL - PL = 45\% - 25\% = 20\% \tag{1}$$

Since the plasticity index is 20%, the soil is classified as **CH** (high plasticity clay).

YouTube Video: Atterberg Limits and Soil Classification

2. A soil has a dry unit weight of 16.5 kN/m³ and a moisture content of 12%. Calculate its bulk unit weight.

Solution:

$$\gamma = \gamma_d \times (1 + w) \tag{2}$$

where:
- $\gamma_d = 16.5$ kN/m³ (dry unit weight) - $w = 0.12$ (moisture content)

$$\gamma = 16.5 \times (1 + 0.12) = 16.5 \times 1.12 = 18.48 \text{ kN/m}^3 \tag{3}$$

YouTube Video: Calculating Bulk Unit Weight of Soil

3. A soil specimen has a void ratio of 0.7 and a specific gravity of 2.65. Determine the dry unit weight assuming the unit weight of water is 9.81 kN/m³.

Solution:

$$\gamma_d = \frac{G_s \times \gamma_w}{1 + e} \tag{4}$$

where:
- $G_s = 2.65$ (specific gravity) - $\gamma_w = 9.81$ kN/m³ (unit weight of water) - $e = 0.7$ (void ratio)

$$\gamma_d = \frac{2.65 \times 9.81}{1 + 0.7} = \frac{25.9965}{1.7} \approx 15.29 \text{ kN/m}^3 \tag{5}$$

YouTube Video: Calculating Dry Unit Weight of Soil

4. A soil sample has a liquid limit of 50% and a plastic limit of 22%. Calculate the plasticity index and describe the soil's plasticity.

Solution:

$$PI = LL - PL = 50\% - 22\% = 28\% \tag{6}$$

Since $PI = 28\%$, the soil is classified as highly plastic.

YouTube Video: Soil Plasticity and Classification

5. A clayey soil has a shrinkage limit of 15% and a plastic limit of 25%. Determine the shrinkage index (SI).

Solution:

$$SI = PL - SL \tag{7}$$

where:
- $PL = 25\%$ (Plastic Limit) - $SL = 15\%$ (Shrinkage Limit)

$$SI = 25\% - 15\% = 10\% \tag{8}$$

The shrinkage index of this soil is **10
YouTube Video: Shrinkage Limit Test for Soil