

Soil Mechanics

Assignment 3

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Q 1:-) ① The flow curve is attached as a picture

$$LL = 29.1\%$$

$$② PL_{avg} = \frac{17.2 + 17.8}{2} = 17.5\%$$

$$PI = LL - PL = 29.1\% - 17.5\%$$

$$\rightarrow PI = 11.6\%$$

$$③ I_f = \frac{w_1 - w_2}{\log_{10} N_1 - \log_{10} N_2} = \frac{38.4 - 36.5}{\log_{10} \left(\frac{14}{16} \right)} = 32.76$$

$$④ LI = \frac{w - PL}{LL - PL} = \frac{21\% - 17.5\%}{29.1\% - 17.5\%} = 0.302$$

∴ The soil statuse is plastic, because $0 < LI < 1$

Q 2:-) $m_1 = 37g$, $V_1 = 19.3 \text{ cm}^3$

$m_2 = 28g$, $V_2 = 16 \text{ cm}^3$

$\rho_w = 1 \text{ g/cm}^3$

$$\textcircled{1} \quad SL = \frac{m_1 - m_2}{m_2} (100) - \frac{V_1 - V_2}{m_2} (100) (\rho_w)$$

$$= 32.143 - 11.786$$

→ $SL = 20.357\%$

$$\textcircled{2} \quad SR = \frac{m_2}{V_2 \rho_w} = \frac{28}{(16)(1)} = 1.75 = SR$$

Q 3:-) $m_{\text{dry}} = 22.5g$ / $V_f = 10.3 \text{ cm}^3$ / $\rho_w = 1 \text{ g/cm}^3$

$G_s = 2.72$

$$\ast \quad SR = \frac{m_{\text{dry}}}{V_f \rho_w} = \frac{22.5}{(10.3)(1)} = 2.184$$

$$\ast \quad G_s = \frac{1}{\frac{1}{SR} - \left(\frac{SL}{100}\right)} \rightarrow 2.72 = \frac{1}{\frac{1}{2.184} - \frac{SL}{100}}$$

$$\rightarrow \frac{1}{2.184} - \frac{SL}{100} = \frac{1}{2.72} \rightarrow \frac{SL}{100} = 0.0902$$

→ $SL = 9.02\%$

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Q 4:-) * Soil ①: Percent finer on No. 200 = 50 % $\geq$ 36 %

$$LL = 38 \leq 40 / PI = 29 \geq 11$$

→ A-6

$$GI = 15 [0.2 + 0.005(-2)] + 0.01(35)(19) \\ = 9.5$$

→ A-6 (10)

* Soil ②: Percent finer on No. 200 = 80 % $\geq$ 36 %

$$LL = 56 \geq 41 / PI = 23 \geq 11$$

$$23 \leq 26$$

→ A-7-5

$$GI = 45 [0.2 + 0.005(16)] + 0.01(65)(13) \\ = 21$$

→ A-7-5 (21)

* Soil ③: Percent finer on No. 200 = 65 % $\geq$ 36 %

$$LL = 37 \leq 40 / PI = 22 \geq 11$$

→ A-6

$$GI = 30 [0.2 + 0.005(-3)] + 0.01(50)(12) \\ = 12$$

→ A-6 (12)

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* Soil ④: Percent finer on No. 200 = 45% $\geq$ 36%

$$LL = 28 \leq 40 / PI = 20 \geq 11$$

→ A-6

$$GI = 10 [0.2 + 0.005(-12)] + 0.01(30)(10) \\ = 4$$

→ A-6(4)

* Soil ⑤: Percent finer on No. 200 = 62% $\geq$ 36%

$$LL = 43 \geq 41 / PI = 28 \geq 11$$

$$\rightarrow 28 > (43^{13} - 30) \checkmark$$

→ A-7-6

$$GI = (27) [0.2 + 0.005(3)] + 0.01(47)(18) \\ = 14$$

→ A-7-6(14)

* Soil ⑥: Percent finer on No. 200 = 30% $\leq$ 35%

$$LL = 25 \leq 40 / PI = 16 \geq 11$$

→ A-2-6

$$GI = 0.01(15)(6) \\ = 1$$

→ A-2-6(1)

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* Soil ⑦: Percent finer on No. 200 = $8\% \leq 35\%$

$$LL = - / PI = NP$$

→ A-3(0)

* Soil ⑧: Percent finer on No. 200 = $63\% \geq 36\%$

$$LL = 40 \leq 40 / PI = 21 \geq 11$$

→ A-6

$$GI = 28[0.2 + 0] + 0.01(48)(11) = 11$$

→ A-6(11)

* Soil ⑨: Percent finer on No. 200 = $20\% \leq 35\%$

$$LL = 20 \leq 40 / PI = 15 \geq 11$$

→ A-2-6

$$GI = 0.01(5)(5) = 0$$

→ A-2-6(0)

* Soil ⑩: Percent finer on No. 200 = $86\% \geq 36\%$

$$LL = 70 \geq 41 / PI = 38 \geq 11$$

$$38 \leq (70 - 30) \checkmark$$

$$GI = 51[0.2 + 0.005(30)] + 0.01(71)(28) = 38$$

→ A-7-5(38)

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Q 5:-) Soil (A): Percent of Gravel = 6% < 15%
// // Sand = 91% > 50%
// // fines = 3% < 5%

from Excel sheet (Attach with the answer)

$$C_u = 4.471 < 6$$

$$C_c = 1.391$$

∴ SP → Poorly graded Sand

Soil (B): Percent of gravel = 2% < 15%
// // Sand = 88% > 50%
// // fines = 10%

from Excel Sheet (Attach with the answer)

$$C_u = 14.67 > 6$$

$$C_c = 2.678, 1 \leq C_c \leq 3$$

∴ SW → Well-graded Sand

* Soil ③: Percent of Gravel = 0

// // Sand = 23%

// // fines = 77% $\geq$ 50%

LL = 63% $\geq$ 50%

PI = 25%

Elastic silt with sand

→ MH, because PI plots below
or OH "A" line (Figure 5.3)

↓
Plasticity Chart

* Soil ④: Percent of Gravel = 0

// // Sand = 14%

// // fines = 86% $\geq$ 50%

LL = 55% $\geq$ 50%

PI = 28%

→ CH, because PI Plots above

↓
"A" line in plasticity chart
fat clay

* Soil E: Percent of Gravel = 0

// // Sand = 55% > 50%

// // fines = 45%

LL = 36%

PI = 22% > 7

→ SC : Clayey Sand

Q6:-) (A) Percent Passing on No. 200 = 13% ≤ 35%

LL = 23% ≤ 40

PI = 4% ≤ 10

→ A-2-4 (o) „ AA SHTO ..

(B) Percent of gravel = 0 < 15%

// // Sand = 87% > 50%

// // fines = 13%

LL = 23%

PI = 4% , 4 ≤ PI ≤ 7

→ SC - SM

Silty Clayey Sand

Q7:-) Percent of gravel = 9% < 15%

// // fines = 11%

// // Sand = 80%

$$C_u = \frac{D_{60}}{D_{10}} = \frac{1.9}{0.1} = 19 > 6$$

$$C_c = \frac{(D_{30})^2}{D_{60} D_{10}} = \frac{0.64}{0.19} = 3.368 > 3$$

$$LL = 32\%$$

$$PI = 8\% > 7$$

∴ The soil satisfy the condition

$$C_u < 6 \text{ and/or } C_c < 1 \text{ or } C_c > 3$$

∴ SP - SC

Poorly graded sand with clay

(or silty clay)