

Soil Mechanics

HW5

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Problem ①: (A) The maximum dry unit = 1.6222 g/cm^3

The optimum moisture content = 20%

(B) doesn't intersect the compaction curve

(C) I attach an Excel file contain all the figures

$$(d) e_{omc} = 0.6641$$

$$S_{omc} = 0.82$$

$$(e) DOC = \frac{\gamma_d(\text{field})}{\gamma_d(\text{max})}$$

$$\rightarrow \gamma_d(\text{field}) = 0.95 \times 1.6222 = 1.54109 \text{ g/cm}^3$$

Problem (2): Given: * Calibration density of sand = 1667 Kg/m^3

$$\begin{aligned} \text{* mass of sand needed to fill the cone} &= m_1 \\ &= 0.117 \text{ Kg} \end{aligned}$$

$$\begin{aligned} \text{* mass of jar + cone + sand before use} &= m_2 \\ &= 6.1 \text{ Kg} \end{aligned}$$

$$\begin{aligned} \text{* mass of jar + cone + sand after use} &= m_3 \\ &= 2.83 \text{ Kg} \end{aligned}$$

$$\begin{aligned} \text{* mass of moist soil from the hole} &= m_4 \\ &= 3.35 \text{ Kg} \end{aligned}$$

$$\text{* } W = 16.1 \% = 0.161$$

* Volume of sand:

$$V = \frac{m_2 - m_3 - m_1}{\rho_{\text{sand}}} = 1.89 \times 10^{-3} \text{ m}^3$$

* mass of dry soil:

$$m_d = \frac{m_4}{1+W} = 2.885 \text{ Kg}$$

$$\begin{aligned} \text{(A) } \gamma_d: \gamma_{\text{dry}} &= \frac{m_d \cdot g}{V_t} = \frac{2.885 \times 9.81}{1.89 \times 10^{-3}} \\ &= 14.98 \text{ KN/m}^3 \\ &= 1.527 \text{ Kg/m}^3 \end{aligned}$$

$$\textcircled{B} (\gamma_d)_{\max} = \frac{G_s \gamma_w}{1 + e_{\min}}$$

$$e_{\min} \text{ when } S = 1: \quad e = W G_s$$

$$= 0.161 * 2.65$$

$$= 0.427$$

$$\rightarrow \gamma_d(\max) = \frac{2.65 * 9.81}{1.427}$$

$$= 18.218 \text{ kN/m}^3 = 1.857 \text{ Kg/m}^3$$

$$* \text{ Doc} = \frac{1.527}{1.857} = 0.822 * 100\%$$

$$= 82.2\%$$

$\textcircled{C}$ Doesn't met

$$\textcircled{d} * \gamma_d = \frac{G_s \gamma_w}{1 + e} \rightarrow 1 + e = \frac{G_s \gamma_w}{\gamma_d}$$

$$e = \frac{2.65 * 1}{1.527} - 1$$

$$\rightarrow e = 0.735$$

$$* S = \frac{2.65 * 0.161}{0.735} = 0.58 * 100\% = 58\%$$

Problem ③:- $e_{\text{embankment}} = \frac{V_T - V_s}{V_s}$

$$0.7 V_s + V_s = 7500$$

$$V_s = 4411.76 \text{ m}^3$$

	$e = \frac{V_T - V_s}{V_s}$	Cost
borrow pit ①	$V_T = 8161.756 \text{ m}^3$	89779.316 \$
borrow pit ②	$V_T = 8470.58 \text{ m}^3$	67764.64 \$
borrow pit ③	$V_T = 9749.990 \text{ m}^3$	87749.91 \$
borrow pit ④	$V_T = 8338.23 \text{ m}^3$	83382.3 \$

borrow pit ② → lower Cost

Problem (4):- (An Excel file attach with the Sol.)

The maximum dry unit = 17.38 kN/m^3

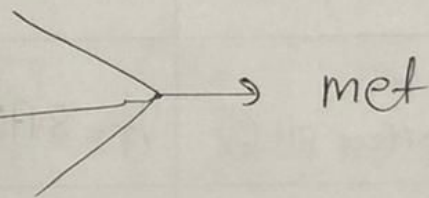
The optimum moisture content = 16.9%

* From the second Curve:

location (1)

location (2)

location (3)



location (4)

location (5)

Rejected

Problem (5):- Given: $\gamma_{d \max} = 16.9 \text{ KN/m}^3$
 $\gamma_{d \min} = 14.2 \text{ KN/m}^3$
field Relative density, $D_r = 82\%$

$$(A): D_r = \frac{\gamma_{d \max}}{\gamma_d} \left(\frac{\gamma_d - \gamma_{d \min}}{\gamma_{d \max} - \gamma_{d \min}} \right)$$

γ_d
field dry density

$$\rightarrow 0.82 = \frac{16.9}{\gamma_d} \left(\frac{\gamma_d - 14.2}{16.9 - 14.2} \right)$$

$$0.131 \gamma_d = \gamma_d - 14.2$$

$$\gamma_d = 16.34 \text{ KN/m}^3$$

* Degree of compaction:

$$D_c = \frac{\gamma_d}{\gamma_{d \max}} \times 100\% = \frac{16.34}{16.9} \times 100\% \\ = 96.86\%$$

$$(B) \gamma_d = 16.34 \text{ KN/m}^3$$

$$(C) \gamma = \gamma_d (1 + w) = 16.34 (1.15) \\ = 18.791 \text{ KN/m}^3$$