

150点満点

問1 (6点×4=24点)

(1) $D_r = (e_{\max} - e) / (e_{\max} - e_{\min}) = (0.91 - 0.56) / (0.91 - 0.43) = \underline{72.92 \%}$

(2) $m_s = m / (1 + w/100) = 1560 / (1 + 112/100) = 735.849 \text{ g}$

$m_w = m - m_s = 1560 - 735.849 = 824.151 \text{ g}$

$\Delta m_s = 1/w \cdot m_w - m_s = \underline{532.08 \text{ g}}$

(3) $V = (\pi D^2/4) \cdot H = 3.14 \cdot 4.93^2/4 \cdot 10.01 = 190.98 \text{ cm}^3$

$\rho = m / V = 334.6 / 190.98 = 1.752 \text{ g/cm}^3$

$\rho_d = \rho / (1 + w/100) = 1.752 / (1 + 29.50/100) = 1.353 \text{ g/cm}^3$

$e = \rho_s / \rho_d - 1 = 2.580 / 1.353 - 1 = \underline{0.907}$

$S_r = (w \cdot \rho_s) / (e \cdot \rho_w) = (29.50 \cdot 2.580) / (0.907 \cdot 1.000) = \underline{83.91 \%}$

問2 (6点×2=12点, 9点:合計21点)

(1) $i = \Delta H / L = (1.6 - 0.7) / (1.2 / \cos 30^\circ) = \underline{0.65}$

(2) $v = k \cdot i = 7.40 \times 10^{-4} \cdot 0.65 = \underline{4.8 \times 10^{-4} \text{ m/s}}$

(3) $q = k \cdot i \cdot A \cdot t = 7.40 \times 10^{-4} \cdot 0.65 \cdot 0.0313 \cdot 14 \cdot 24 \cdot 60 \cdot 60 = \underline{18.3 \text{ m}^3}$

問3 (15点×2=20点)

$\sigma_1 = \sigma_d - \sigma_c = 200 + 200 = 400 \text{ kN/m}^2, \quad \sigma_3 = \sigma_c = 200 \text{ kN/m}^2$

$\sigma'_1 = \sigma_1 - \Delta u_w = 400 - 100 = 300 \text{ kN/m}^2, \quad \sigma'_3 = \sigma_3 - \Delta u_w = 200 - 100 = 100 \text{ kN/m}^2$

全応力表示の内部摩擦角 ϕ : $\sin \phi = (\sigma_1 - \sigma_3) / (\sigma_1 + \sigma_3) = (400 - 200) / (400 + 200) = 0.333$

$\phi = \underline{19.5^\circ}$

有効応力表示による内部摩擦角 ϕ' : $\sin \phi' = (\sigma'_1 - \sigma'_3) / (\sigma'_1 + \sigma'_3) = (300 - 100) / (300 + 100) = 0.5$

$\phi' = \underline{30.0^\circ}$

問4 (6点×4=24点, 11点:合計35点)

(1) 正規圧密領域: B-C, 過圧密領域: A-B, 圧密降伏応力: B, 圧縮指数: BCの傾き

(2) $\Delta H = H_0 \{(e_0 - e) / (e_0 + 1)\} = 6 \cdot \{(1.52 - 1.13) / (1.52 + 1)\} = \underline{0.928 \text{ m}}$

問5 (5点×8=40点)

ア: 緩く, イ: 地下水位, ウ: せん断応力, エ: 負, オ: 収縮, カ: 非排水, キ: 間隙水圧, ケ: 有効応力