

ENGINEERING TRIPOS PART IIA 2005
NUMERICAL ANSWERS, MODULE 3D1: SOIL MECHANICS

1. (a) $\Gamma = 2.031, \lambda = 0.143, \kappa = 0.035$.
(b) $C_v = 6.2 \times 10^{-8} \text{ m}^2/\text{s}$.
(c) (i) $C_v = 25 \times 10^{-8} \text{ m}^2/\text{s}$

2. (a) $\rho = 2056 \text{ kg/m}^3, w = 0.2, G_s = 2.68, e = 0.564, S_r = 0.95$.
(b) at $z = 1 \text{ m}$, at $t_1, \sigma_v' = 60 \text{ kPa}$, $t_2, \sigma_v' = 20 \text{ kPa}$, at $t_3, \sigma_v' = 10 \text{ kPa}$
at $z = 3 \text{ m}$, at $t_1, \sigma_v' = 80 \text{ kPa}$, $t_2, \sigma_v' = 50 \text{ kPa}$, at $t_3, \sigma_v' = 30 \text{ kPa}$.
(c) $C_v = 2.4 \text{ m}^2/\text{day}$, duration = 5.5 days.

3. (b) (i) $\tau_{u,ult}/\sigma_o' = \tan \phi_{crit} (\sigma_c'/E\sigma_o')^{1-\kappa/\lambda}$
(ii) $\tau_{u,max}/\sigma_o' = \tan \phi_{crit} \ln (\sigma_c'/\sigma_o')$
(iii) $\tau_{d,ult}/\sigma_o' = \tan \phi_{crit}$
(iv) $\tau_{d,max}/\sigma_o' = \tan \phi_{crit} \ln (\sigma_c'/\sigma_o')$

For OCR = 1, (i) = (ii) = 0.23, (iii) = (iv) = 0.42,
For OCR = 10, (i) = 2.24, (ii) = 0.98, (iii) = 0.42, (iv) = 0.98.

4. (b) $M_{comp} = 6 \sin \phi_{crit}/(3 - \sin \phi_{crit})$, (b) $M_{extn} = 6 \sin \phi_{crit}/(3 + \sin \phi_{crit})$
(c) $q_{comp} = 2.69 \text{ MPa}$, $q_{extn} = -0.76 \text{ MPa}$
(d) $q_{comp,crit} = 7.09 \text{ MPa}$, $q_{extn,crit} = -4.95 \text{ MPa}$

PART IIA 2005

3D1 Soil mechanics

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