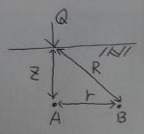
압밀소요시간

$$t = \frac{T_v H^2}{C_v}$$

50% → $T_v = 0.197$

90% → $T_v = 0.848$

$$C_v = \frac{k}{m_v \gamma_w} \qquad m_v = \frac{a_v}{1+e_1}$$



$$\Delta\sigma_A = \frac{3Q}{2\pi z^2}$$

$$\Delta\sigma_B = \frac{3Q}{2\pi} \cdot \frac{z^3}{R^5}$$

압축지수 $C_c = \frac{e_1 - e_2}{\log P_2 - \log P_1}$

불교란 $C_c = 0.009(W_L - 10)$

교란 $C_c = 0.007(W_L - 10)$

점성토의 1차 압밀침하량 S_c (점토층 두께 H)

① 초기간극비법 (e_0) $S_c = \frac{e_0 - e_1}{1+e_0} H$

② 압축지수법 (C_c) $S_c = \frac{C_c H}{1+e} \log \frac{P+\Delta P}{P}$

③ 체적압축계수법 (m_v) $S_c = m_v \cdot \Delta P \cdot H$

$$t_1 : t_2 = H_1^2 : H_2^2$$

얕은 기초

극한지지력 q_u

$$q_u = \alpha c N_c + \beta \gamma_1 B N_r + \gamma_2 D_f N_q$$

연속 – $\alpha = 1.0$ $\beta = 0.5$

정방 – $\alpha = 1.3$ $\beta = 0.4$

허용지지력 q_a

$$q_a = \frac{Q_a}{A} = \frac{q_u}{F_s}$$

국부전단 파괴의 점착력 $= \frac{2}{3} c$

$B > d$ 일때

$$\gamma_1 = \gamma_{sub} + \frac{d}{B}(\gamma_t - \gamma_{sub})$$

깊은 기초

Meyerhof 극한지지력 $Q_u = Q_p + Q_f$ [t] 선단 마찰

$$Q_u = 40 N A_p + \frac{1}{5} \overline{N} \cdot A_s$$

$N = N_3$ $\overline{N} = \frac{N_1 h_1 + N_2 h_2 + N_3 h_3}{h_1 + h_2 + h_3}$

$A_p = \frac{\pi D^2}{4}$ $A_s = \pi D L$

허용지지력 $Q_a = \frac{Q_u}{F_s}$

부마찰력 $R_{nf} = f_s A_s = \frac{q_u}{2} \cdot \pi D L$

히빙 현상

$$F_s = \frac{M_r}{M_d} = \frac{C_1 HR + C_2 \pi R^2}{\frac{R^2}{2}(\gamma_1 H + q)}$$

최대 굴착 깊이

$$\sigma = \gamma_{sat}(H-h)$$

$$u = \gamma_\omega \Delta h$$

$$\bar{\sigma} = \gamma_{sat}(H-h) - \gamma_\omega \Delta h$$

$\bar{\sigma} = 0$ 일 때 히빙현상 발생하므로 h가 최대굴착 깊이

$$\bar{\sigma} = 0 \Rightarrow h = \frac{\gamma_{sat} H - \gamma_\omega \Delta h}{\gamma_{sat}}$$

파이핑 현상

$F_s \le 1 \Rightarrow$ boiling

$$F_s = \frac{i_{cr}}{i} = \frac{\frac{\gamma_{sub}}{\gamma_\omega}}{\frac{H}{H+2d}}, \quad i_{cr} = \frac{G_s - 1}{1+e}$$

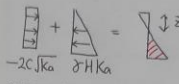
한계고

$P_a = 0$ 일 때 $z_c = \frac{2c}{\gamma}\sqrt{K_P}$

인장균열 고려O $H_c = 2z_c = \frac{4c}{\gamma}\tan\left(45+\frac{\phi}{2}\right)$

고려X $H_c' = \frac{2}{3}H_c$

$$\sigma_h = \gamma H K_a - 2c\sqrt{K_a}$$



① 균열 발생 전

$$P_a = \frac{1}{2}\gamma H^2 K_a - 2cH\sqrt{K_a}$$

② 균열 발생 후

$$P_a = \frac{1}{2}(\gamma H K_a - 2c\sqrt{K_a})(H - z_c)$$

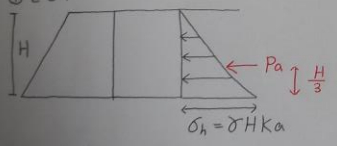
③ 균열 발생 & 상재하중 고려

$$P_a = \frac{1}{2}\gamma(H-z_c)^2 K_a + \gamma z_c (H - z_o) K_a$$

주동토압 모래 ($c = 0$)

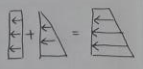
$$K_a = \frac{1-\sin\phi}{1+\sin\phi} = \tan^2\left(45-\frac{\phi}{2}\right)$$

① 일반식



$$P_a = \frac{1}{2}\gamma H^2 K_a \quad (\text{넓이})$$

② 등분포 q



$$\sigma_h = (\gamma H + q) K_a$$

$$P_a = qHK_a + \frac{1}{2}\gamma H^2 K_a$$

③ 지하수위

$$\sigma_h = \gamma_{sub} H K_a \quad u = \gamma_\omega H$$

$$P_a = \frac{1}{2}\gamma_{sub} H^2 K_a + \frac{1}{2}\gamma_\omega H^2$$

옹벽의 안정

전단) $F_s = \frac{W \cdot b + P_v \cdot B}{P_A \cdot y} \ge 2.0$

수평활동) $F_s = \frac{W\tan\phi + P_P}{P_A} \ge 1.5$

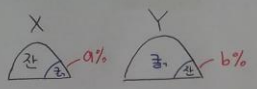
반 중력식 교대

$$\frac{\text{교대폭} - (\text{피복두께} \times 2)}{\text{배근 간격}} + 1$$

$$TF = LFT - (EST + D)$$

$$FF = EST_j - (EST_i + D)$$

골재량



$X + Y = S + G \quad -①$

$\left(1 - \frac{a}{100}\right) X + \frac{b}{100} Y = S \quad -②$

잔골재량 $\Rightarrow \quad X = \frac{100S - b(S+G)}{100 - (a+b)}$

굵은골재량 $\Rightarrow \quad Y = \frac{100G - a(S+G)}{100 - (a+b)}$

단위수량 $= W - W_S - W_G$

콘크리트

$V = \frac{W}{1000\,G}$

$G_C = \frac{\rho_c}{\rho_w}$

단위골재(S+G)의 절대체적

$V_a = 1 - \left(\frac{\text{단위수량}}{1000} + \frac{\text{단위시멘트}}{\text{C비중} \times 1000} + \frac{\text{공기량}}{100}\right)$

단위 잔골재량 $= V_a \times$ 잔골재율 $\times$ 잔골재 $\rho \times 1000$

잔골재량 $= X +$ 잔골재의 표면수량

배합강도 f_{cr}

①

$f_{ck} \le 35$	$f_{ck} > 35$
$f_{ck} + 1.34S$	$f_{ck} + 1.34S$
$(f_{ck} - 3.5) + 2.33S$	$0.9 f_{ck} + 2.33S$

큰값

② 표준편차 모를때 시험횟수 ≤ 14

f_{ck}	f_{cr}
$x < 21$	$f_{ck} + 7$
$21 \le x \le 35$	$f_{ck} + 8.5$
$35 < x$	$1.1 f_{ck} + 5.0$

③ 시험횟수 ≤ 29

직선보간으로 구한 보정계수 $\times S$ 해서 ①식으로

변동계수 $C_v = \frac{\sigma}{\bar{x}} \times 100\ (\%)$

$\bar{x}$ 관리도

$UCL = \bar{\bar{x}} + A_2 \cdot \bar{R} \qquad LCL = \bar{\bar{x}} - A_2 \cdot \bar{R}$

R 관리도

$UCL = D_4 \cdot \bar{R} \qquad LCL = D_3 \cdot \bar{R}$

여유치

양측 : $\frac{|SU - SL|}{\delta} \ge 6$ 편측 : $\frac{|SU - \bar{x}|}{\delta} \ge 3$

공정능력 지수 C_p

양측 : $C_p = \frac{SU - SL}{6\sigma}$ 편측 : $C_p = \frac{SU - \bar{x}}{3\sigma}$

건설기계

① 불도저

$$Q_D = \frac{60 \times q \times f \times E}{Cm}, \quad f = \frac{1}{L}$$

② 리핑

$$Q_R = \frac{60 \times An \times l \times f \times E}{Cm}, \quad f = 1$$

③ 덤프트럭

$$Q = \frac{60 \cdot q_t \cdot f \cdot E}{C_{mt}}, \quad q_t = \frac{I}{\gamma_t} L$$

$$C_{mt} = \frac{n\, C_{ms}}{60 E_s} + t_2 + t_3 + t_4, \quad n = \frac{q_t}{q \times K}$$

④ 래머

$$Q = \frac{ANHfE}{P}$$

P → 되풀이 찍기 다짐횟수