IV-7 BEARING CAPACITY

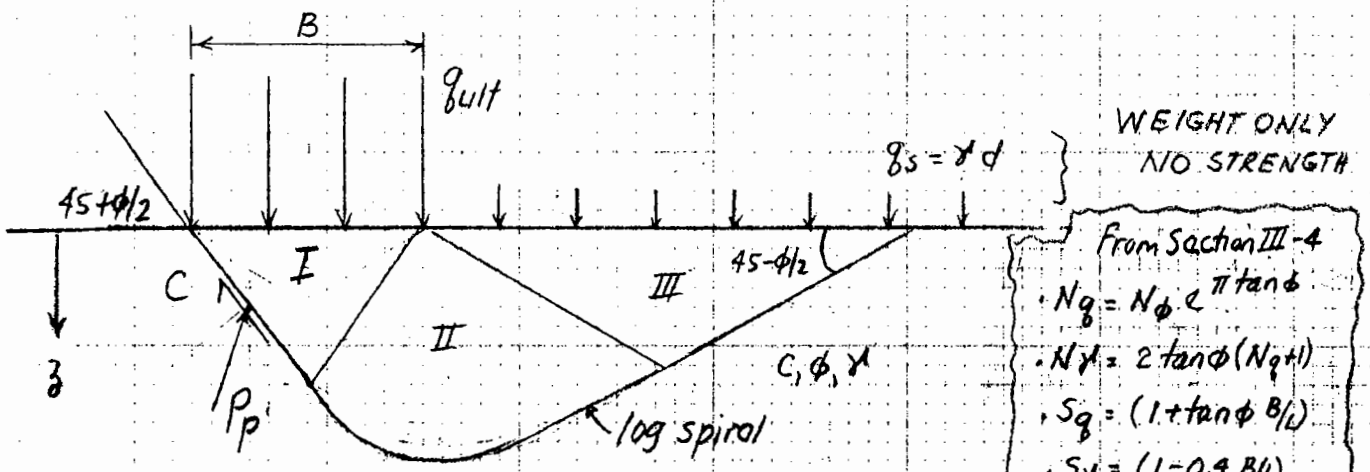
CCL 11/15/83 11/5/84 11/85 11/88 11/89 11/96 11/00 1.361-1.366

Part IV-7 BEARING CAPACITY (p 1/3)

1. BEARING CAPACITY OF SHALLOW FOUNDATIONS

1.1 Effect of Cohesion : Strip Footing

· Modified Terzaghi = Vesic (1973: JSMFD, ASCE, V 99, SM1)



From Section III-4

· $N_q = N_\phi e^{\pi \tan\phi}$

· $N_\gamma = 2\tan\phi(N_q+1)$

· $S_q = (1+\tan\phi\, B/L)$

· $S_\gamma = (1-0.4\, B/L)$

· $q_{ult} = cN_c + \frac{1}{2}\gamma B N_\gamma + \gamma d N_q$

· $N_c = \cot\phi\,(N_q - 1)$ For $\phi = 0$, $N_c = 2+\pi = 5.14$, $N_q = 1$, $N_\gamma = 0$

1.2 Shape Factor for Cohesion (Vesic, 1973)

· $S_c = \left[1 + \frac{B}{L}\frac{N_q}{N_c}\right]$ For $\phi = 0$, $S_c = 1.2 \rightarrow$ "N_c" $= 6.2$ Approximate

$B/L = 1.0$

1.3 Physical Significance of c, ϕ, γ

SOURCE OF SIGNIFICANT ERRORS IN PRACTICE!

* These should relate the strength of the soil to the magnitude of the *initial* stress gradient and the *applied* stresses from footing

1) Drained loading ($\Delta u = 0$) - Use c = ____ ϕ = ____

γ = ____ → z vs $\Delta\sigma_v'$ and $q_s = \sigma_v'$ at $z = 0$ for $u \geq 0$

(2) Undrained loading of saturated clay ($\Delta w = 0$, $B = 1.00$)

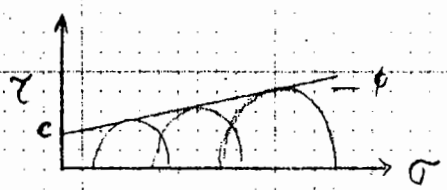
c = ____ ϕ = ____ N_γ = ____ q_{ult} (strip) = ____

N_q = ____ " (B≠L) = ____

(3) Undrained loading, S<100%

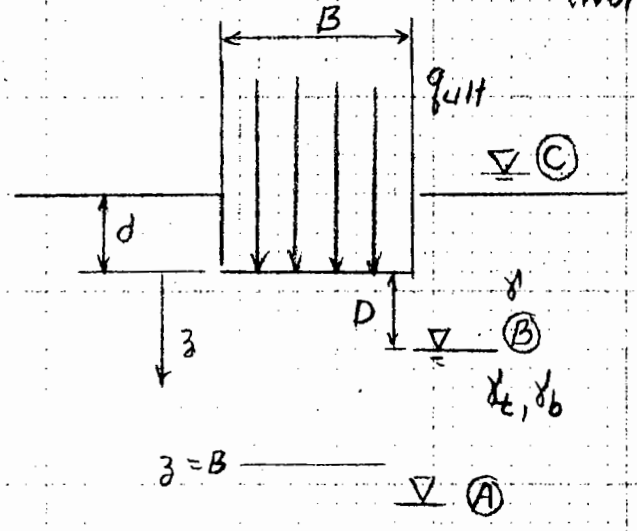
UU tests → c & ϕ, $\gamma = \gamma_t$

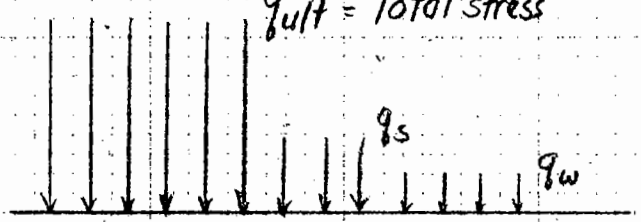
(Covered later)



1.4 Effect of Water Table: Cohesionless: No Capillarity

(Not in LTW text)





- $\bar{\gamma} = \bar{\gamma} \rightarrow \Delta\sigma_v'$ vs z
- $q_s = \sigma_v'$ due wgt soil above footing
- $q_w = u$ at $z = 0$

Strip $q_{ult} = \frac{1}{2}\bar{\gamma} B N_\gamma + q_s N_q + q_w$

Case A ($D > B$) $\bar{\gamma} =$ ___ $q_s =$ ___ $q_w =$ ___

Case C (Negative D) $\bar{\gamma} =$ ___ $q_s =$ ___ $q_w =$ ___

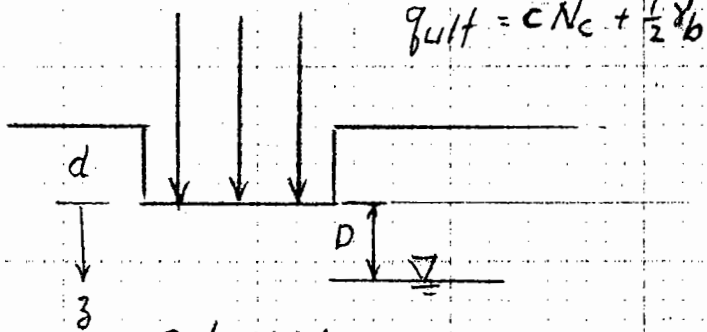
Case B ($D < B$) $\bar{\gamma} =$ ___

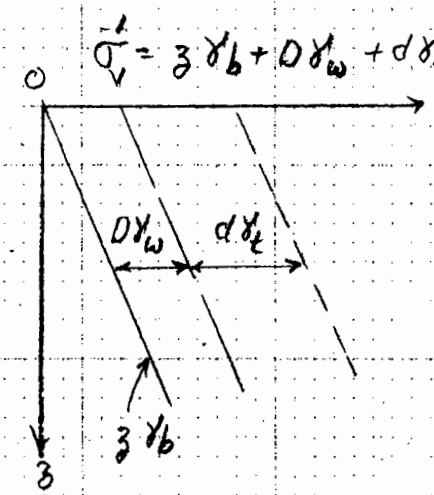
Note: Rising WT → decrease in q_{ult}

1.5 Effect of Water Table: Cohesive: Full Capillarity (Strip)

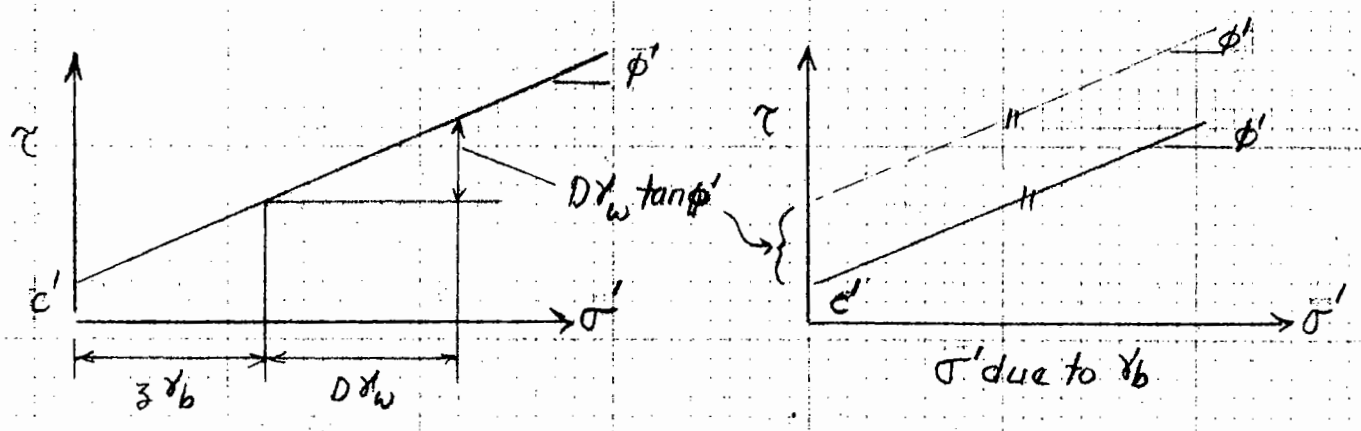
(1) Problem

$q_{ult} = c' N_c + \frac{1}{2}\gamma_b B N_\gamma + d\gamma_t N_q + [\text{Effect of } D\gamma_w = \Delta q_{ult}(C)]$



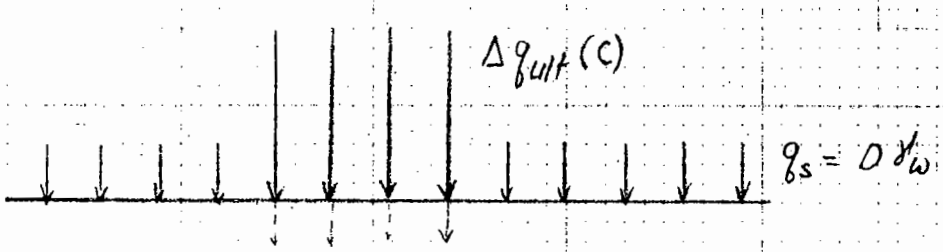


(2) Apparent "cohesion" = added $\bar{\sigma}'$ within clay → increased strength



$\Delta q_{ult}(C)$ = _____

(3) Treat as "surcharge"



$\Delta q_{ult}(C) = D\gamma_w N_q$ - Why incorrect? What did CCL forget?

Actual $\Delta q_{ult}(C)$ = _____

(4) Do (3) & (4) check?