David Dammon

ENCE 4340 Foundation Engineering Fall 2011 Homework # 3 (due: 10-3-2011)

Problem #1: Refer to Figure 7.10. Given: H = 22ft; $\gamma = 115\,pcf$; $\phi' = 25^0$; c' = 250 psf; and $\alpha = 10^0$

Calculate the Rankine active force per unit length of the wall after the occurence of tensile crack

$c' = 250\,psf$

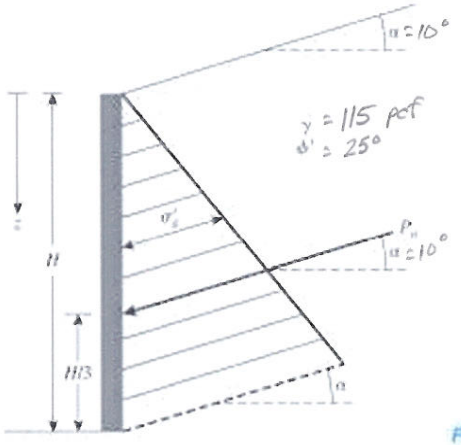

Figure 7.10 Notations for active pressure—Eqs. (7.19), (7.20), (7.21)

[7.24] $z_c = \frac{2c'}{\gamma}\sqrt{\frac{1+\sin\phi'}{1-\sin\phi'}} = \frac{2(250)}{115}\sqrt{\frac{1+\sin 25}{1-\sin 25}} = 6.82\,ft$

@ $z = 22\,ft$ $\quad \frac{c'}{\gamma z} = \frac{250}{115 \times 22} = 0.0988 \approx 0.01$

Tbl 7.2

$\phi' = 25$

$\alpha = 10^\circ$

$K'_a = 0.296$

[7.22] $\sigma'_a = \gamma z K'_a \cos\alpha = (115)(22)(0.296)\cos 10^\circ = 737.5$

$P_a = \frac{1}{2}(\sigma'_a)(H - z_c)$

$= \frac{1}{2}\left(737.5\ \#/ft^2\right)(22\,ft - 6.82\,ft) = 5597.6\ \#/ft$

$\bar{z} = \frac{22\,ft - 6.82\,ft}{3} = 5.06\,ft$ from bottom

Note: the wall will not feel the total effects of P_a until the wall has yielded between 0.1 H : 0.04 H

0.22 : 0.88

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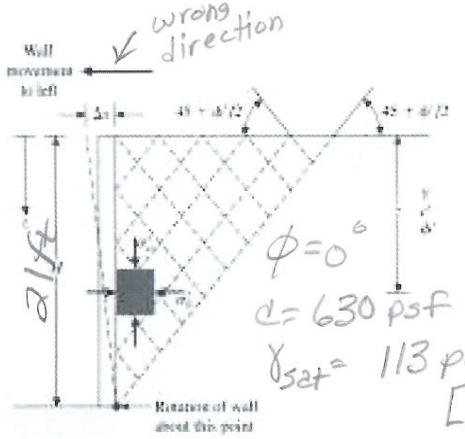

Problem #2 : Given the height of the retaining wall, H is 21 ft; the backfill is a saturated clay with $\phi' = 0^0$; $c' = 630$ psf; $\gamma_{sat} = 113$pcf.

(a) Determine the Rankine passive pressure distribution diagram behind the wall.

(b) Estimate the Rankine passive force per foot length of the wall and also the location of the resultant.

[7.61] $K_p = \tan^2\left(45 + \frac{\phi'}{2}\right) = \tan^2(45+0) = 1$

$2c'\sqrt{K_p} = (2)(630)(1) = 1260$ psf

$K_p \gamma H = (1)(113)(21) = 2373$ psf

① $= (21)(1260) = 26.5$ k/ft

② $= \frac{1}{2}(21)(2373) = 24.9$ k/ft

$P_p = 26.5$ k/ft $+ 24.9$ k/ft $=$ **51.4 k/ft**

$\Sigma m_{Bot} = \bar{z} \times 51.4 = (26.5 \times 10.5) + (24.9 \times \frac{1}{3}(21))$

$\bar{z} = 8.8$ ft from bottom