Appello 12/01/2010

Un pendio indefinito è costituito da uno strato di terreno ($\gamma = 19\ kN/m^3$; $\gamma_{sat} = 19{,}5\ kN/m^3$) di spessore $h = 4\ m$ e $\beta = 30°$. Determinare il FS del pendio nelle seguenti condizioni:

a) terreno asciutto;

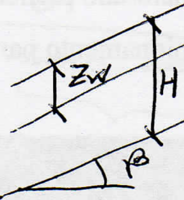
b) livello di falda coincidente con il piano campagna e moto di filtrazione parallelo al pendio;

c) livello di falda ad 1 m ($z_w = 1\ m$) dal piano campagna e moto di filtrazione parallelo al pendio;

d) pendio sommerso.

Per la caratterizzazione geotecnica del terreno si può fare riferimento ai risultati di prove di taglio riportati in tabella

	σ' (KPa)	τ (KPa)	σ'^2	$\tau_{fi} \cdot \sigma_i'$
1° provino	50	50	2500	2500
2° prov.	100	78	10000	7800
3° prov.	150	115	22500	17250
Σ	300	243	35000	27550



Applico il metodo dei minimi quadrati

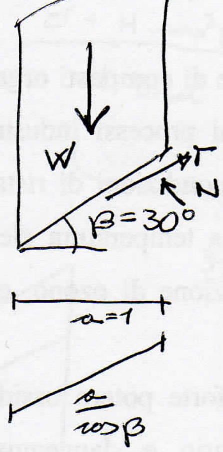
$$c' = \frac{\Sigma \tau_{fi} \cdot \Sigma(\sigma_i')^2 - \Sigma \sigma_i' \cdot \Sigma(\sigma_i' \cdot \tau_{fi})}{n\,\Sigma(\sigma_i')^2 - (\Sigma(\sigma_i'))^2} \qquad n = n° \text{ prove}$$

$$\tan \phi' = \frac{n\,\Sigma(\sigma_i' \cdot \tau_{fi}) - \Sigma \sigma_i' \cdot \Sigma \tau_{fi}}{n\,\Sigma(\sigma_i')^2 - (\Sigma \sigma_i')^2}$$

$$c' = \frac{243 \cdot 35000 - \overset{8265000}{300 \cdot 27550}}{3 \cdot 35000 - 300^2} = 16\ KPa$$

$$\tan \phi' = \frac{3 \cdot 27550 - \overset{72900}{300 \cdot 243}}{3 \cdot 35000 - 300^2} = 0{,}65 \implies \phi' = 33°$$

a) terreno asciutto



$N = W\cos\beta$

$T = W \operatorname{sen}\beta$

$$\sigma = \frac{N}{A} = \frac{W\cos\beta}{\frac{a}{\cos\beta}} = W\cos^2\beta$$

$W = \gamma \cdot H$

$$\tau = \frac{T}{A} = \frac{W\operatorname{sen}\beta}{\frac{a}{\cos\beta}} = W\operatorname{sen}\beta\cos\beta$$

$$F_S = \frac{c' + \sigma'\tan\phi'}{\tau} = \frac{c' + (\sigma - \underbrace{\cancel{u}}_{=0})\tan\phi'}{\tau}$$

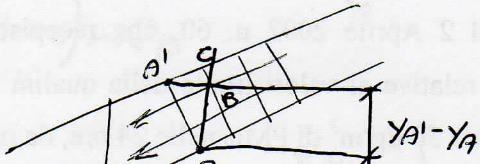
$$F_S = \frac{c' + [\gamma \cdot H\cos^2\beta]\tan\phi'}{\gamma \cdot H\operatorname{sen}\beta\cos\beta} = \frac{c'}{\gamma \cdot H\operatorname{sen}\beta \cdot \cos\beta} + \frac{\tan\phi\cos\beta}{\operatorname{sen}\beta}$$

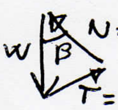
$$= \underbrace{\frac{c'}{\gamma \cdot H \cdot \operatorname{sen}\beta \cdot \cos\beta}} + \frac{\tan\phi}{\tan\beta} =$$

1,1248

1,0789

b) PF = PC





$H \cdot \gamma_{sat} = W$

$N = H\gamma_{sat}\cos\beta$

$T = H\gamma_{sat}\operatorname{sen}\beta$

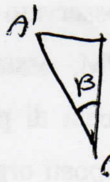
$$\sigma = \frac{N}{A} = \frac{H\gamma_{sat}\cos\beta}{\frac{a}{\cos\beta}} = H\gamma_{sat}$$

$$\tau = \frac{T}{A} = \frac{H\gamma_{sat}\operatorname{sen}\beta}{\frac{a}{\cos\beta}} =$$

$H_A = H_{A'}$

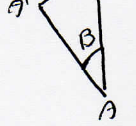
$$z_A + \frac{u_A}{\gamma_w} = z_{A'} + \underbrace{\frac{u_{A'}}{\gamma_w}}_{=0} \Rightarrow u_A = \gamma_w\underbrace{(z_{A'} - z_A)}_{AB = H\cos^2\beta}$$

$u_A = \gamma_w \cdot H \cdot \cos^2\beta$



$AB = AA'\cos\beta$

$AA' = \frac{AB}{\cos\beta}$



$AA' = AC\cos\beta$, $AC = H$

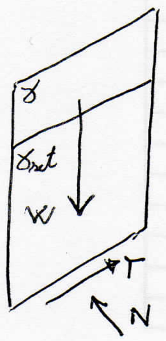
$$F_S = \frac{c' + (H\gamma_{sat}\cos^2\beta - \gamma_w H \cdot \cos^2\beta)\tan\phi}{H\gamma_{sat} \cdot \operatorname{sen}\beta \cdot \cos\beta} = 1,58$$

$$\cancel{F_S = \frac{c' + H\cos^2\beta\,\gamma'\tan\phi}{H\,\gamma_{sat}\,\mathrm{sen}\beta\cos\beta}}$$

$$F_S = \frac{c' + H\cos^2\beta\,\gamma'\tan\phi}{\underbrace{H\,\gamma_{sat}\,\mathrm{sen}\beta\cos\beta}_{0{,}4045}} = 0{,}56$$

c)

31,551



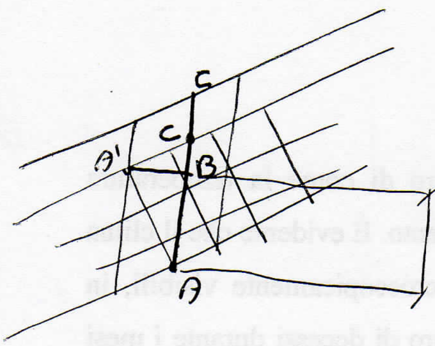
$$W = \gamma\,z_w + \gamma_{sat}(H - z_w)$$

$$N = W\cos\beta = [\gamma\cdot z_w + \gamma_{sat}(H - z_w)]\cos\beta$$

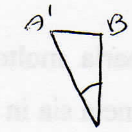
$$T = W\,\mathrm{sen}\beta = [\gamma\cdot z_w + \gamma_{sat}(H - z_w)]\,\mathrm{sen}\beta$$

$$\sigma = \frac{N}{A} = \frac{}{\frac{1}{\cos\beta}} = [\gamma\cdot z_w + \gamma_{sat}(H - z_w)]\cos^2\beta$$

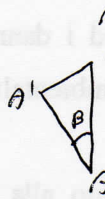
$$\tau = \frac{T}{A} = \quad = [\gamma\cdot z_w + \gamma_{sat}(H - z_w)]\,\mathrm{sen}\beta\cdot\cos\beta$$



$$Y_{A'} - Y_A = AB$$



$$AB = AA'\cos\beta$$



$$AA' = AC\cos\beta$$

$$H - z_w$$

$$AB = (H - z_w)\cos^2\beta$$

$$u_A = \gamma_w\cdot(H - z_w)\cos^2\beta$$

$$F_S = \frac{c' + \cos^2\beta\,[\overbrace{\gamma\cdot z_w + \gamma_{sat}(H - z_w) - \gamma_w(H - z_w)}^{\gamma'(H - z_w)}]\tan\phi}{\underbrace{\gamma z_w + \gamma_{sat}(H - z_w)\,\mathrm{sen}\beta\cos\beta}_{42{,}063}} = 0{,}958$$