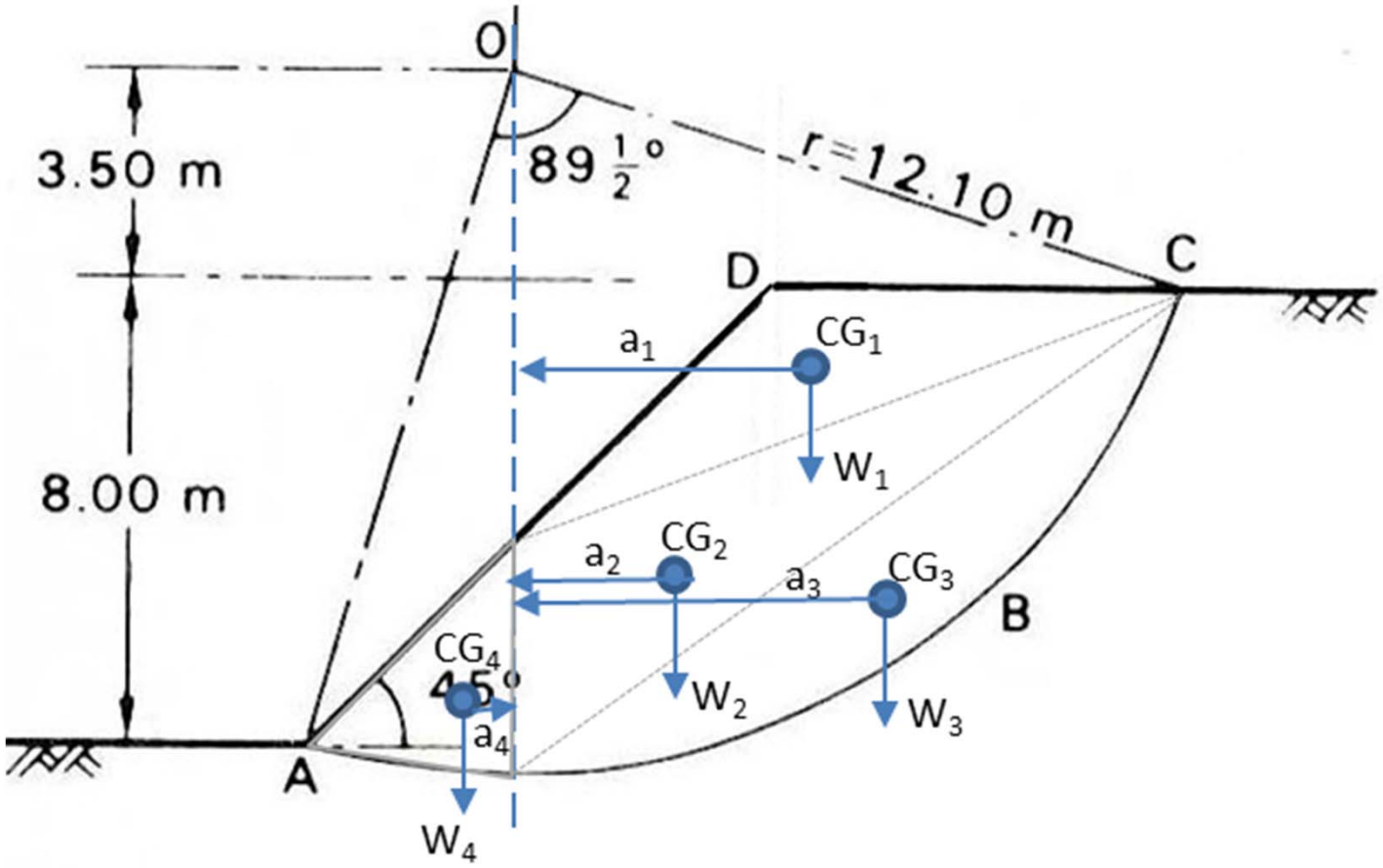

O
3.50 m
8.00 m
89 1/2 °
r=12.10 m
C
D
a1
CG1
W1
a2
CG2
W2
a3
CG3
W3
B
CG4
45°
a4
W4
A

$$H = \frac{c_{dev}}{\gamma_{soil}[sin\beta\ cos\beta\ -\ tan\emptyset_{dev}(cos^2\beta\ -\ r_u)]}$$

← Use this equation

$$r_u = \frac{u}{\gamma_{soil}\ H}$$

See next page

How to solve slope stability problems:

1- Given

γ_{soil} = ✓

$\emptyset$ = ✓

c = ✓

r_u = ✓

$F.S.$ = ✓

Find: H = ???

Solution

$$tan\emptyset_{dev} = \frac{tan\emptyset}{F.S._{\emptyset}}$$

$$c_{dev} = \frac{c}{F.S._c}$$

$$H = \frac{c_{dev}}{\gamma_{soil}[sin\beta\ cos\beta\ -\ tan\emptyset_{dev}(cos^2\beta\ -\ r_u)]}$$

2- Given

γ_{soil} = ✓

$\emptyset$ = ✓

c = ✓

r_u = ✓

H = ✓

Solution

1- Assume $F.S._{\phi}$ = …

$$tan\emptyset_{dev} = \frac{tan\emptyset}{F.S._{\emptyset}}$$

??

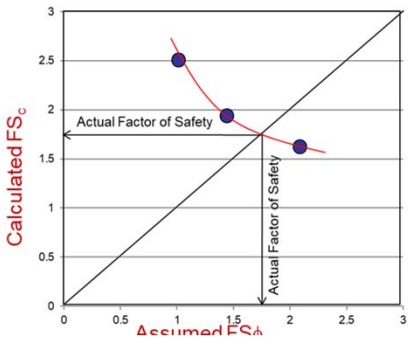
$$H = \frac{c_{dev}}{\gamma_{soil}[sin\beta\ cos\beta\ -\ tan\emptyset_{dev}(cos^2\beta\ -\ r_u)]}$$

Find …… c_{dev} = ….. and $F.S._c = \frac{c}{c_{dev}}$

If $FS_c \neq FS_{\varphi}$ ….. *Assume different value for* FS_{φ} *and repeat the trial and error*

Find: F.S. = ???

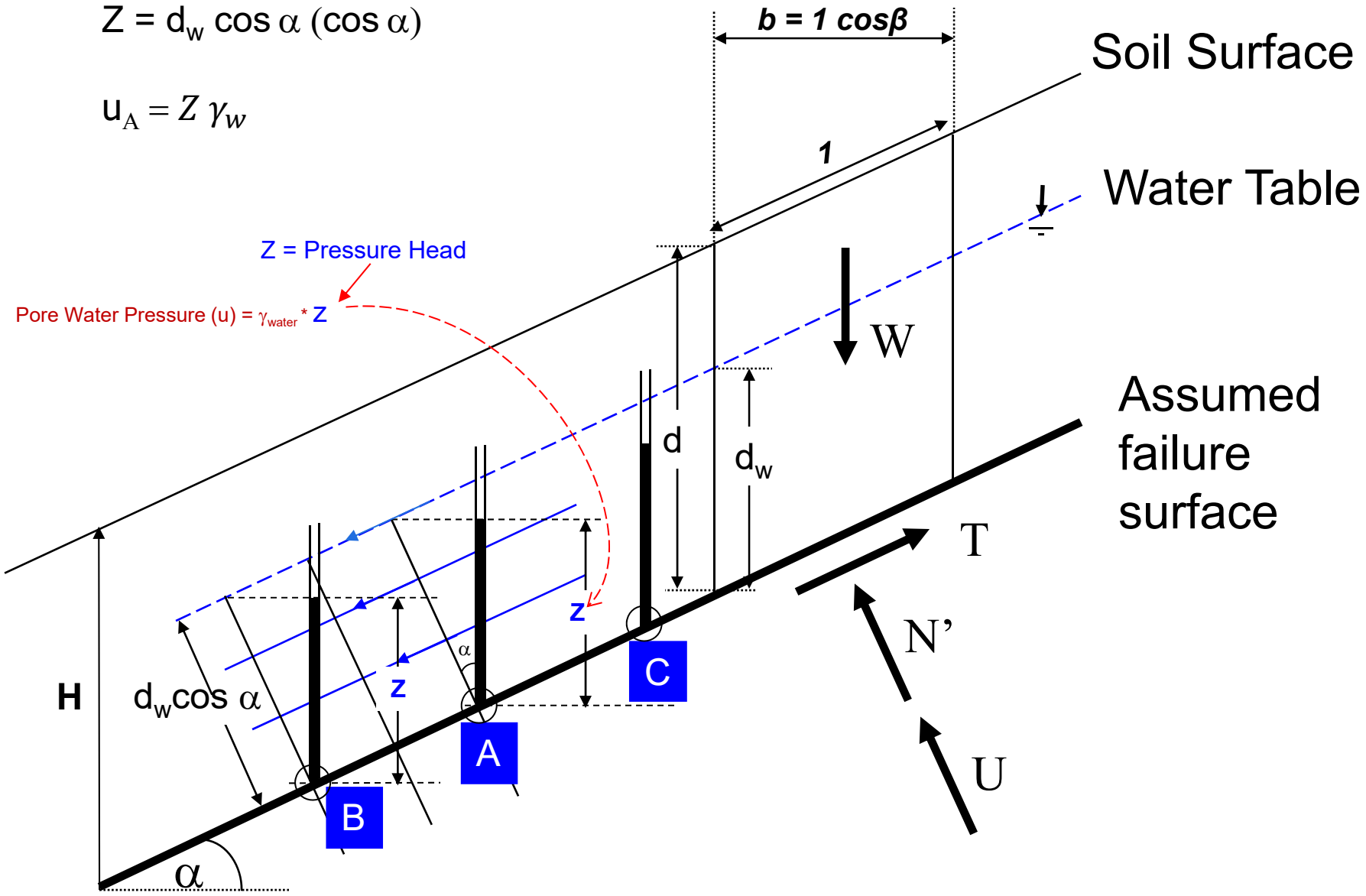
Assumed FSϕ	Calculated FS_c
1.0	2.5
2	xx
3	xx



For the infinite slope shown below, what is the pore water pressure at points A, B and C ?

$Z = d_w \cos\alpha\,(\cos\alpha)$

$u_A = Z\,\gamma_w$



Solved Example:

Given:

γ = 112 pcf

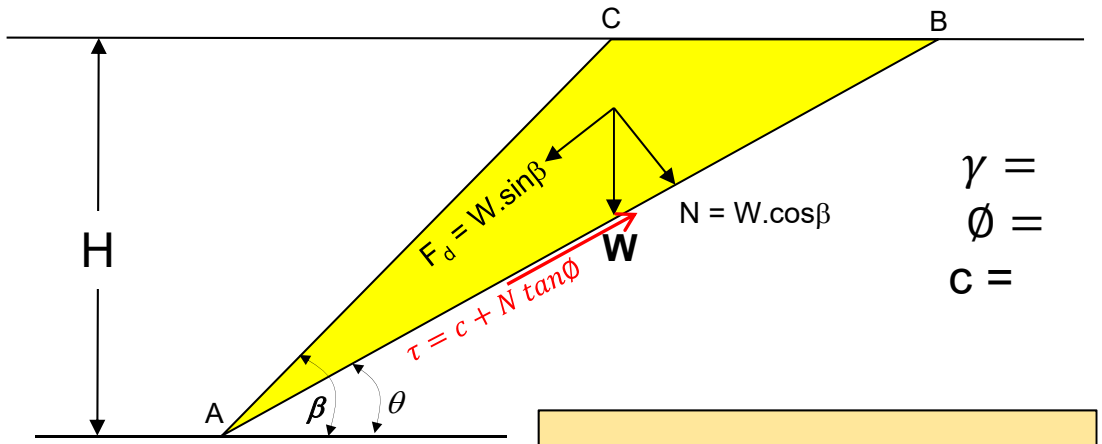
β= 55°

ϕ= 26°

θ = 35°

c = 520 psf

H = 8'



Find:

F.S. = ?????

$$H_{cr} = \frac{2c}{\gamma}\left[\frac{Sin\beta}{sin(\beta-\theta)(sin\theta - cos\theta tan\emptyset)}\right]$$

$$H_{des} = \frac{2c_d}{\gamma}\left[\frac{Sin\beta}{sin(\beta-\theta)(sin\theta - cos\theta tan\emptyset_d)}\right]$$

$$c_d = \frac{\gamma H}{2}\left[\frac{sin(\beta-\theta)(sin\theta - cos\theta tan\emptyset_d)}{Sin\beta}\right]$$

Solution 2:

Since we don't know the F.S of the slope ($F.S_c = F.S_\phi$), then

1- First Trial

Assume $F.S_\phi = 1$ ….. $\emptyset_d = tan^{-1}\left(\frac{tan\emptyset}{F.S}\right) = tan^{-1}\left(\frac{tan26}{1}\right) = 26^o$

2- Find $F.S_c$

$$c_d = \frac{\gamma\, H}{2}\left[\frac{sin(\beta-\theta)(sin\theta - cos\theta tan\emptyset_d)}{Sin\beta}\right] = \frac{112\ x\ 8}{2}\left[\frac{sin(55-35)(sin35 - cos35\ tan26)}{Sin55}\right] =$$

$$c_d = \frac{c}{F.S_c} \rightarrow\rightarrow\rightarrow\rightarrow F.S_c = \frac{520}{18.68} = 27.8$$

3- Second Trial

Assume $F.S_\phi = 2$ ….. $\emptyset_d = tan^{-1}\left(\frac{tan\emptyset}{F.S}\right) = tan^{-1}\left(\frac{tan26}{2}\right) = 13.7^o$

$$c_d = \frac{\gamma\, H}{2}\left[\frac{sin(\beta-\theta)(sin\theta - cos\theta tan\emptyset_d)}{Sin\beta}\right]$$

$$c_d = \frac{112\ x\ 8}{2}\left[\frac{sin(55-35)(sin35 - cos35\ \ tan13.7)}{Sin55}\right] =$$

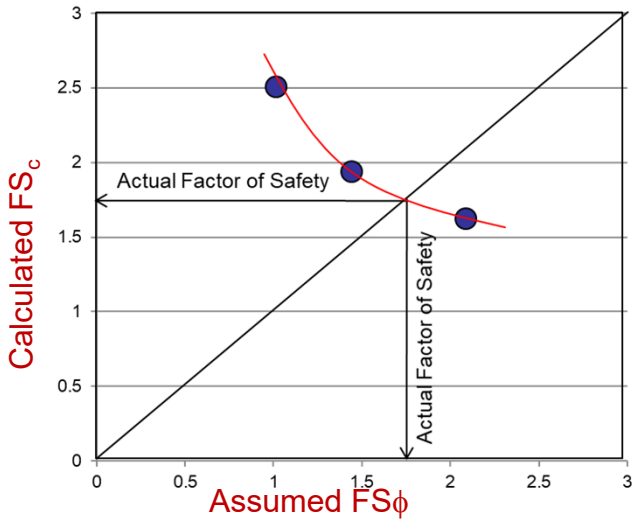
$$c_d = \frac{c}{F.S_c} \rightarrow\rightarrow\rightarrow\rightarrow\ F.S_c = \frac{520}{18.68} =$$

If $F.S_c \neq 2 \rightarrow\rightarrow \rightarrow \rightarrow \rightarrow \rightarrow$ Assume another value for F.Sϕ

Trial 3

After 3 or 4 trials, draw the relationship between Assumed FS_ϕ and Calculated FS_C

Assumed FSϕ	Calculated FS_c
1.0	2.5
2	xx
3	xx



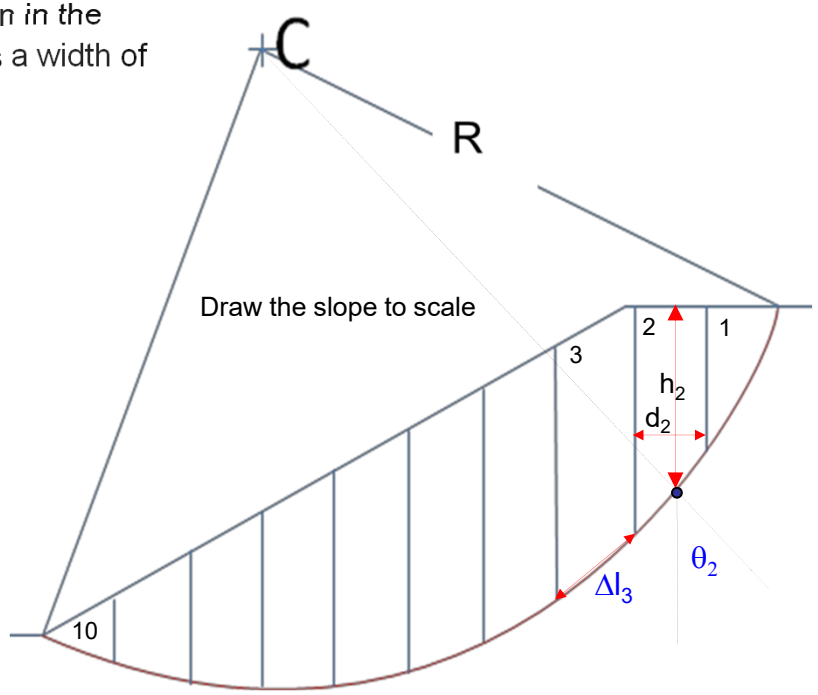
Problem 5

Find the factor of safety for a 20 meter high 2H - I V slope shown in the following figure using ordinary method of slices. Each slice has a width of 5 meters.

γ = 16 kN/m^3
c =20 kPa

$\phi = 20O$

R =38.1 m



Slice	Width Δx (ft)	Ave Height (ft)	Weight (Kips)	θ_i	$W_i \sin\theta_i$	$W_i \cos\theta_i$	u_i	Δl_i	$U_i = u_i \Delta l_i$	$N_i = W_i \cos\theta_i - U_i$
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										

$W_2 = h_2 \times b_2 \times \gamma_{soil}$

$$\text{F.S.} = \frac{cL + \tan\varphi \sum_{i=1}^{i=n}(W_i cos\theta_i - u_i \Delta l_i)}{\sum_{i=1}^{i=n} W_i sin\theta_i}$$