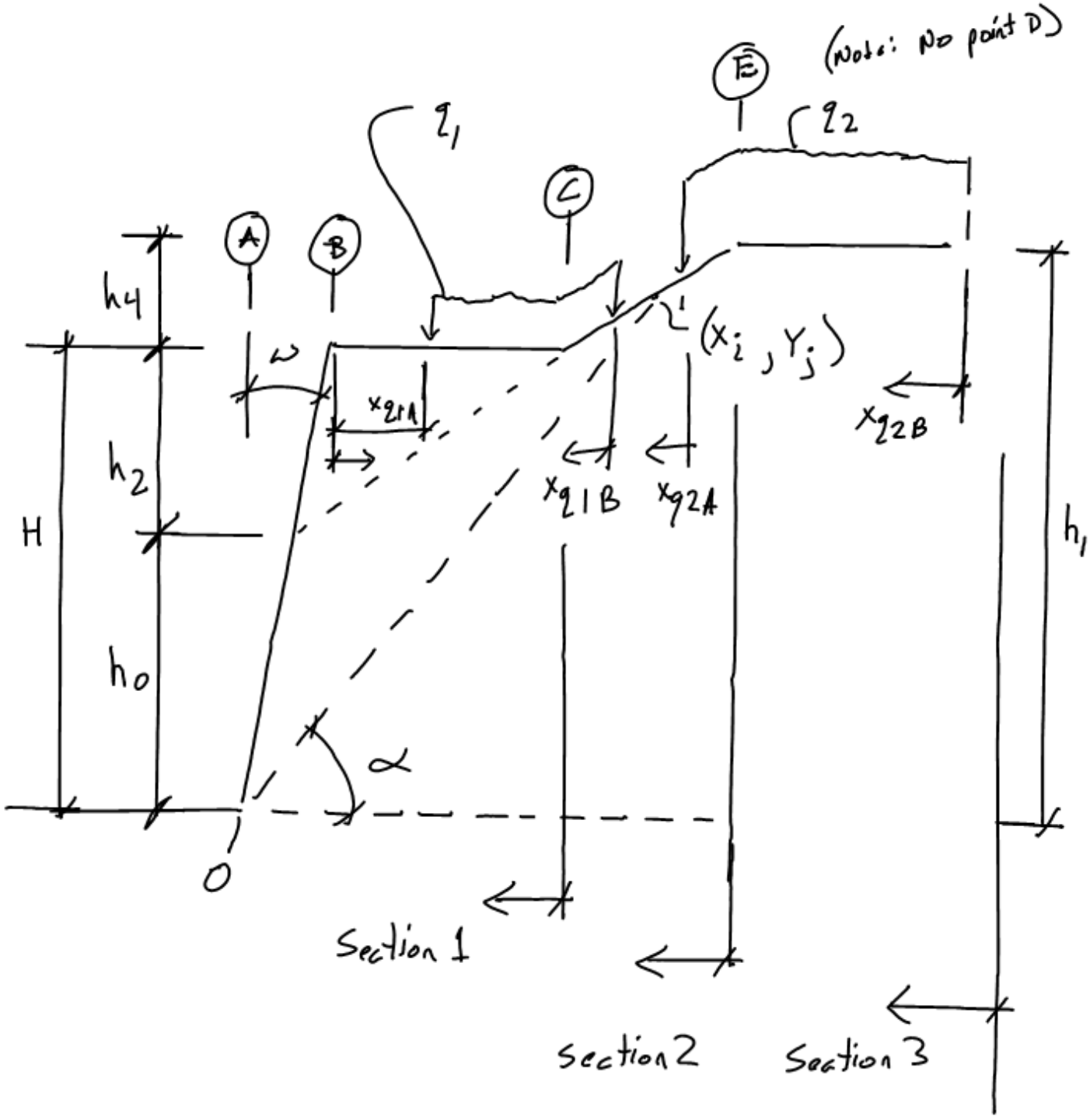
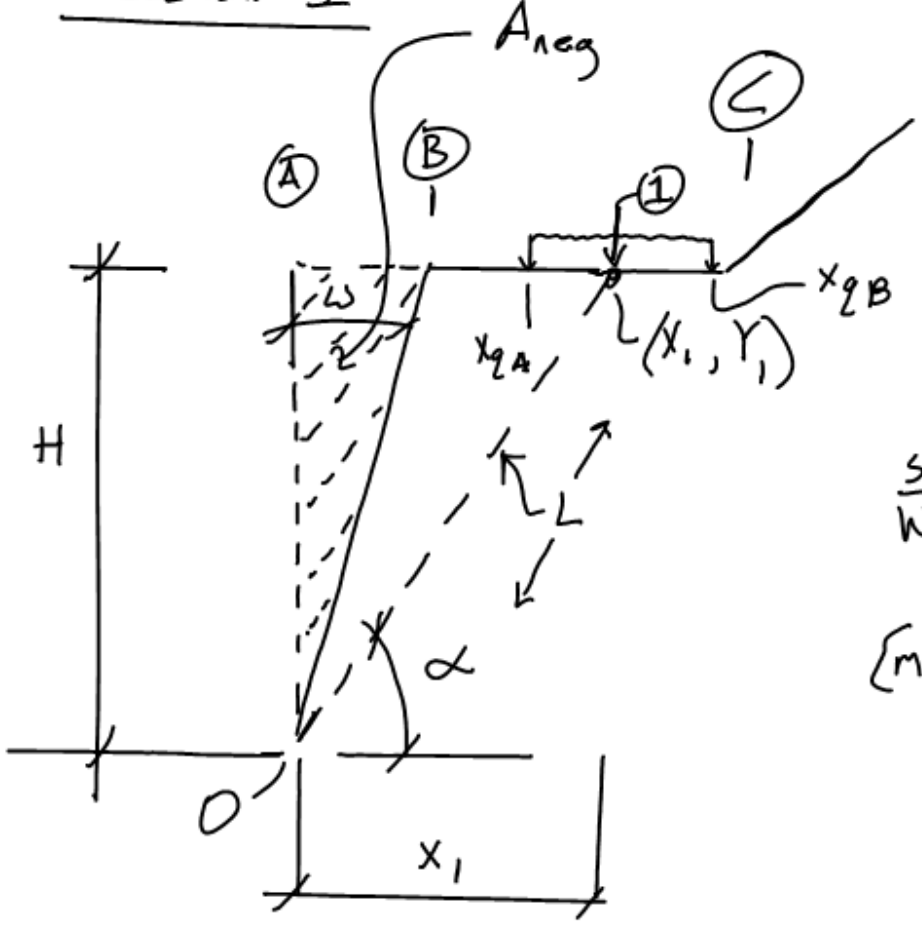
How To Engineer	Project				Job Ref.	
	Trial Wedge Analysis					
	Section				Sheet no./rev.	
					1	
	Calc. by	Date	Chk'd by	Date	App'd by	Date
	RSF	10/21/2012	You			

GEOMETRY



How To Engineer	Project: Trial Wedge Analysis				Job Ref.	
	Section				Sheet no./rev.: 2	
	Calc. by: RSF	Date: 10/21/2012	Chk'd by: You	Date	App'd by	Date

Section 1



Surcharge

$W_q = X_1 < X_{qA} = 0$ lb

$X_1 > X_{qA} = D$

$\left[\min(X_{qB\,(Toe)}, X_1) - X_{qA\,(Toe)}\right]$

$X_{q\,PSF} = W_q$ lb

Area

$A_{neg} = H \times L_{AB} / 2$

$A_{OA1} = H \times X_1 / 2 \quad = D \quad \tan\alpha = \frac{H}{X_1}$

$X_1 = \frac{H}{\tan\alpha}$

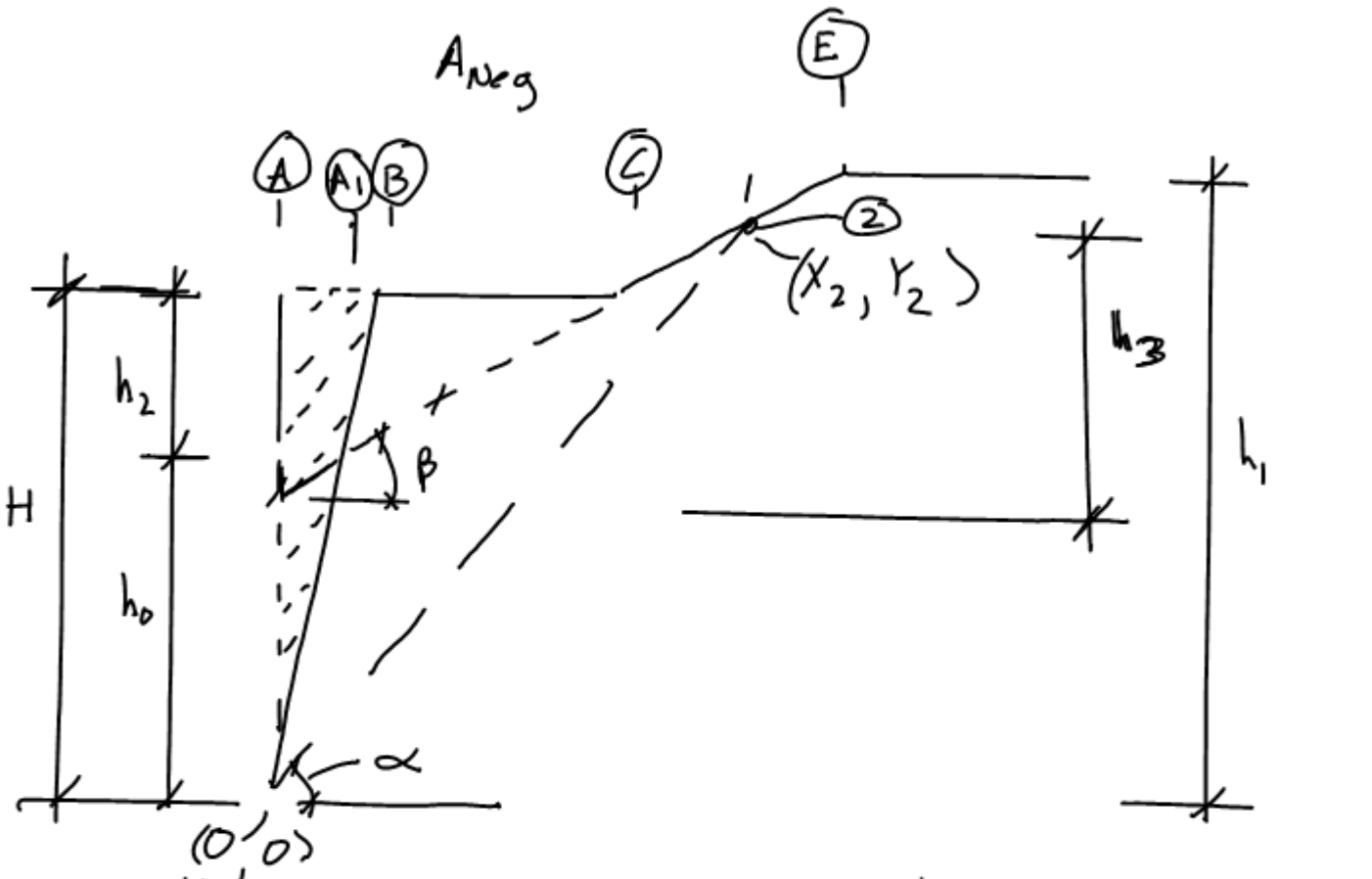
$L \Rightarrow \quad \sin\alpha = \frac{Y}{L}$

$L = \frac{Y}{\sin\alpha}$, $Y = 1$

$A_{net} = A_{OA1} - A_{neg}$

How To Engineer	Project: Trial Wedge Analysis				Job Ref.	
	Section				Sheet no./rev.: 3	
	Calc. by: RSF	Date: 10/21/2012	Chk'd by: You	Date:	App'd by:	Date:

Section 2



$Y_2 = h_3 + h_o \quad \Rightarrow \quad \tan\beta = \frac{h_3}{X_2} \qquad h_3 = X_2 \tan\beta$

$Y_2 = X_2 \tan\beta + h_o$ EQ 2.0

$Y_2 = X_2 \tan\alpha$ EQ 2.1

↔ Solve For X_2

$X_2 \tan\beta + h_o = X_2 \tan\alpha$

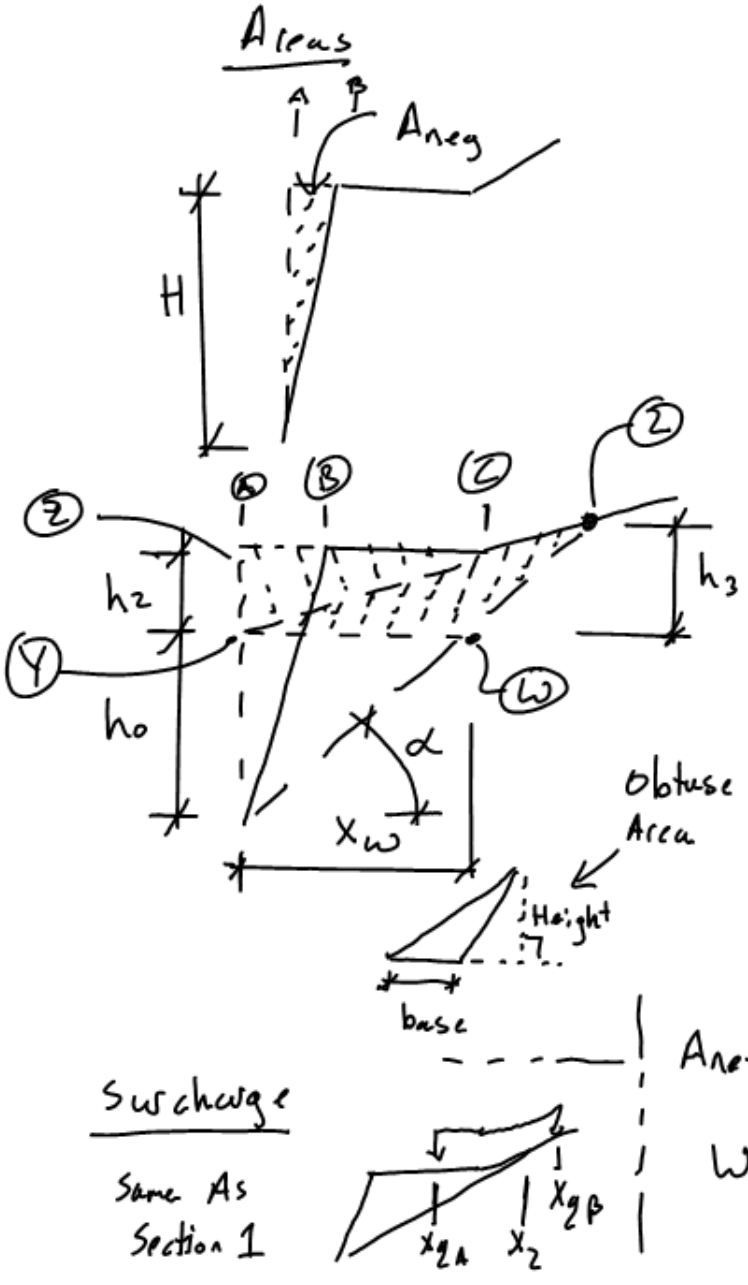
$X_2 \tan\alpha - X_2 \tan\beta = h_o$

$X_2 = \frac{h_o}{(\tan\alpha - \tan\beta)}$ EQ 2.2

Sub Eq 2.2 into Eq 2.1

$$Y_2 = \tan\alpha \times \frac{h_o}{(\tan\alpha - \tan\beta)}$$

Eq 2.3



$h_2 \Rightarrow \tan\beta = \frac{h_2}{L_{AC}} \Rightarrow h_2 = L_{AC}\tan\beta$

$h_o = H - h_2$

$A_{neg} = H \times L_{AB}/2$

where $L_{AB} = H \tan\omega$

$A_{ZYC} = \frac{1}{2} h_2 L_{AC}$

$A_{Y2W} = \frac{1}{2} X_w \times h_3$

where $X_w = \frac{h_o}{\tan\alpha}$

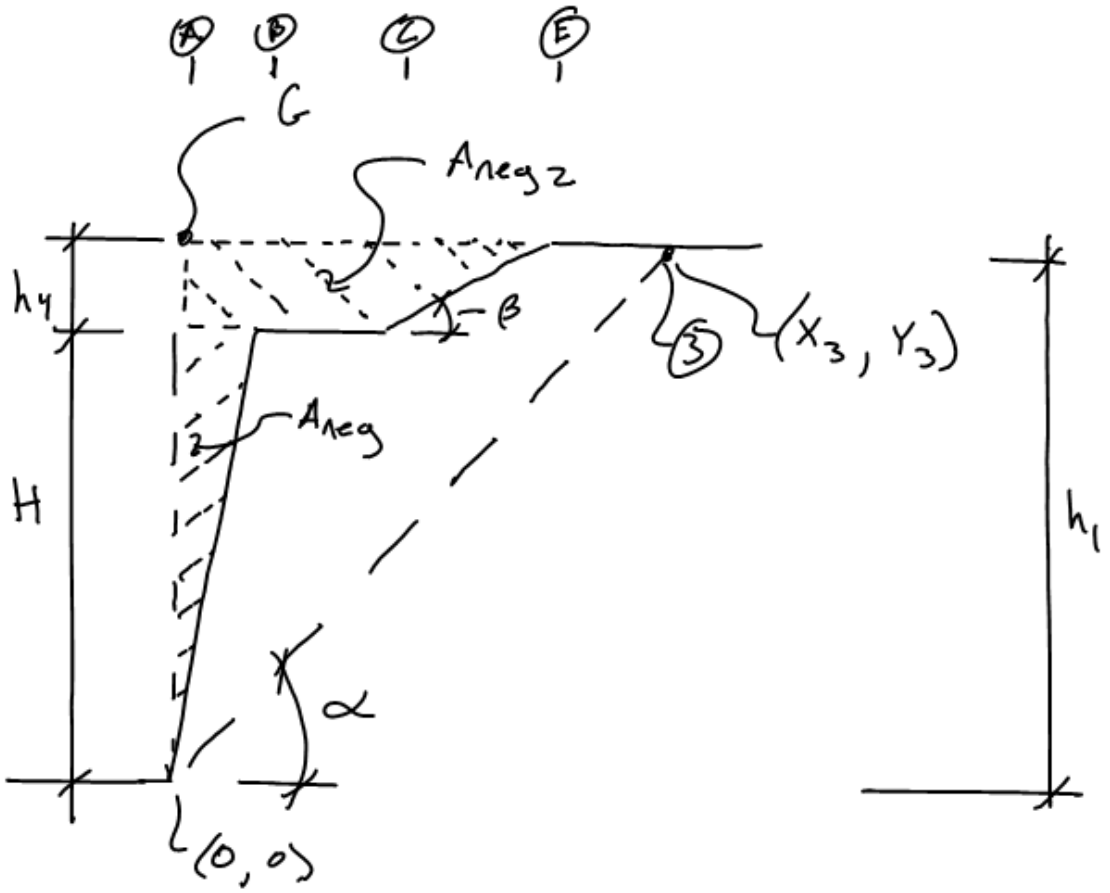
$A_{OYW} = \frac{1}{2} h_o \times X_w$

$A_{net} = A_{ZYC} + A_{Y2W} + A_{OYW} - A_{neg}$

$W_{soil} = A_{net} \times \gamma$

How To Engineer	Project: Trial Wedge Analysis				Job Ref.	
	Section				Sheet no./rev.: 5	
	Calc. by: RSF	Date: 10/21/2012	Chk'd by: You	Date	App'd by	Date

Section 3



$$h_1 = H + h_y$$

$$h_y = D \quad \tan\beta = \frac{h_y}{L_{CE}} \quad = D \quad h_y = L_{CE} \times \tan\beta$$

Area

$$A_{req} = H \times L_{AB} \times 1/2$$

$$A_{req2} = h_y \times (L_{AC} + L_{AE}) \, 1/2$$

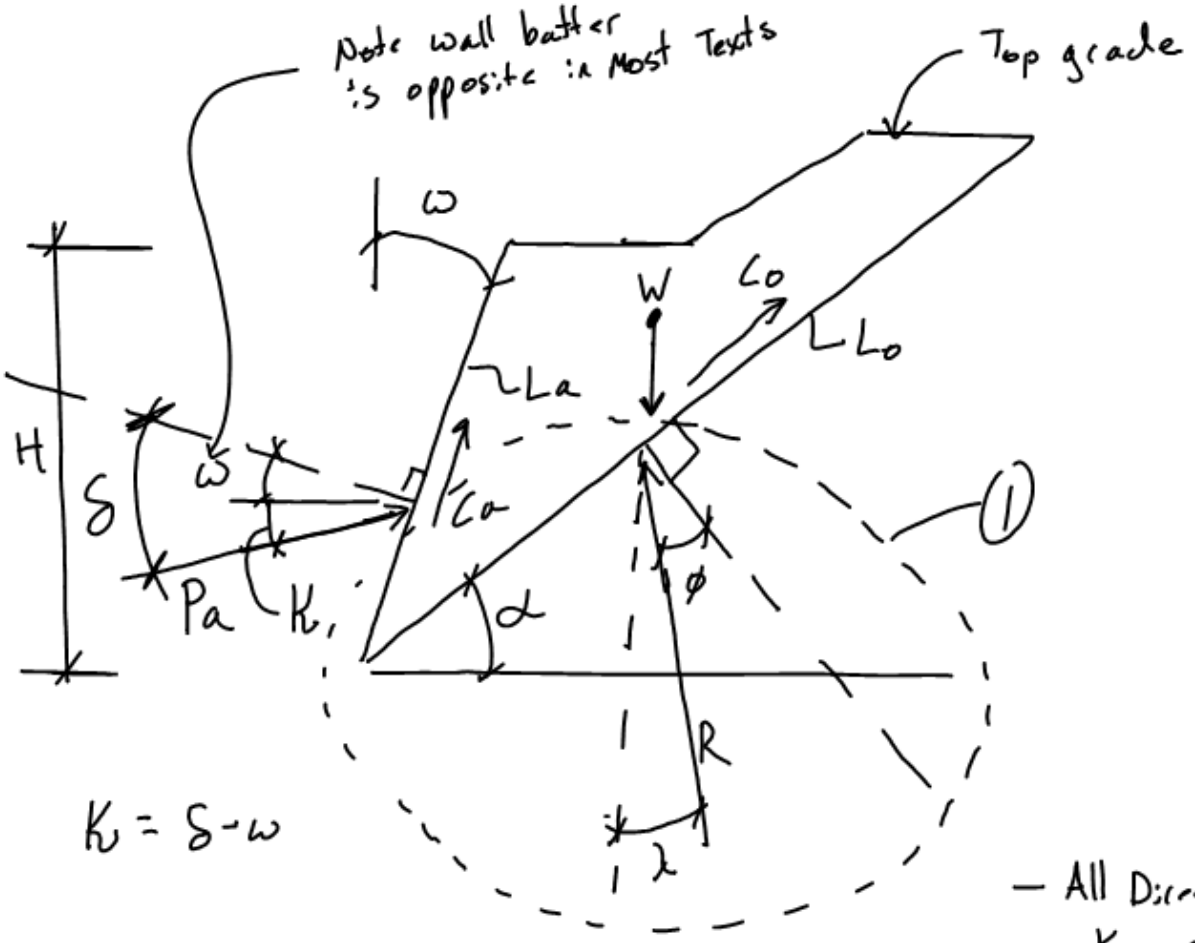
$$A_{OG3} = 1/2 \times X_3 \times h_1$$

$$X_3 = \frac{h_1}{\tan\alpha}$$

$$A_{net} = A_{OG3} - A_{req} - A_{req2}$$

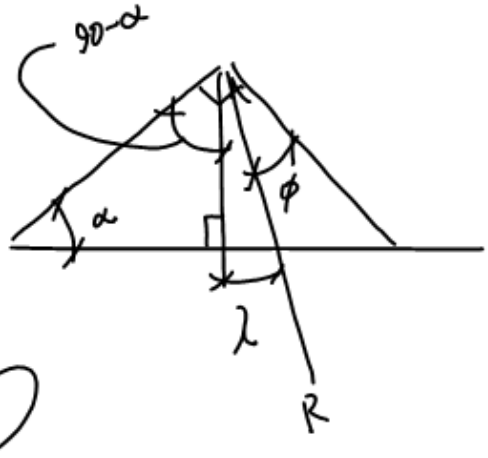
How To Engineer	Project: Trial Wedge Analysis				Job Ref.	
	Section				Sheet no./rev.: 6	
	Calc. by: RSF	Date: 10/21/2012	Chk'd by: You	Date	App'd by	Date

FORCES



$K_h = \delta - \omega$

- All Directions are Known
- P_a & R are only unknowns
- Sum Forces in 2-directions & Solve



$\lambda = 90 - (90 - \alpha) - \phi$

$\lambda = \alpha - \phi$

Eq1 $\xrightarrow[+]{} \Sigma F_H = P_{aH} + C_a L_a \sin\omega + C_o L_o \cos\alpha - R\sin\lambda = 0$ ($P_{aH} = P_a \cos K_v$)

Eq2 $+\uparrow \Sigma F_V = P_{aV} + C_a L_a \cos\omega + C_o L_o \sin\alpha + R\cos\lambda - W = 0$ ($P_{aV} = P_a \sin K_v$)

_ Use Eq 1, solve for R

$$R\sin\lambda = P_a \cos K_v + C_a L_a \sin\omega + C_o L_o \cos\alpha$$

Eq 3 $$R = \frac{P_a \cos K_v + C_a L_a \sin\omega + C_o L_o \cos\alpha}{\sin\lambda}$$

sub into Eq 2

EQ 2 w/ EQ 3 3

- $P_a \sin K_v + C_a L_a \cos\omega + C_o L_o \sin\alpha + \left[\frac{P_a \cos K_v + C_o L_a \sin\omega + C_o L_o \cos\alpha}{\sin\lambda}\right]\cos\lambda - W = 0$

- $P_a \sin K_v = W - C_a L_a \cos\omega - C_o L_o \sin\alpha - \left[\frac{P_a \cos K_v + C_o L_a \sin\omega + C_o L_o \cos\alpha}{\sin\lambda}\right]\cos\lambda$

- $P_a \sin K_v = W - C_a L_a \cos\omega - C_o L_o \sin\alpha - \frac{P_a \cos K_v \cos\lambda}{\sin\lambda} - \frac{C_o L_a \sin\omega \cos\lambda}{\sin\lambda} - \frac{C_o L_o \cos\alpha \cos\lambda}{\sin\lambda}$

- $P_a\left(\sin K_v + \frac{\cos K_v \cos\lambda}{\sin\lambda}\right) = W - C_a L_a \cos\omega - C_o L_o \sin\alpha - \frac{C_o L_a \sin\omega \cos\lambda}{\sin\lambda} - \frac{C_o L_o \cos\alpha \cos\lambda}{\sin\lambda}$

How To Engineer	Project				Job Ref.	
	Trial Wedge Analysis					
	Section				Sheet no./rev.	
					9	
	Calc. by	Date	Chk'd by	Date	App'd by	Date
	RSF	10/21/2012	You			

- $$P_a = \left[W - C_a L_a \cos\omega - C_o L_o \sin\alpha - \frac{C_a L_a \sin\omega \cos\lambda}{\sin\lambda} - \frac{C_o L_o \cos\alpha \cos\lambda}{\sin\lambda} \right] \left(\frac{1}{\sin k_c + \frac{\cos k_c \cos\lambda}{\sin\lambda}} \right)$$