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SOIL EVALUATION;

Segmental Walls (See NCMA) Coulomb;

Wall batter;	ω=10deg	
Wall Height;	Hf=10ft;	
Backslope;	β=10deg;	
Distance to broken back;	d=10ft;	
Equivalent Backslope;	βeq=if(d<2*Hf,atan(d*tan(β)/(2*Hf)),β);	βeq=**5.038**deg
Reinforced Soil (infill soil);	ϕi=28deg	
Retained Soil friction angle (Conventional/Gravity);	ϕrc=28deg;	
Retained Soil friction angle (reinforced wall);	ϕr=28deg;	
Foundation Soil friction angle;	ϕd=40deg;	
Interface friction angle (Conventional/Gravity);	δc=ϕr*2/3;	δc=**18.667**deg
Interface friction angle (Reinforced);	δe=min(ϕr,ϕi);	δe=**28.000**deg
Interface friction angle (Reinforced);	δi=min(2/3*ϕi);	δi=**18.667**deg

Gravity walls;

Kag=cos(ϕrc+ω)^2/[(cos(ω)^2)*cos(ω-δc)*[1+[(sin(ϕrc+δc)*sin(ϕrc-βeq))/(cos(ω-δc)*cos(ω+βeq))]^(0.5)]^2];;

Kag=**0.271**

Kagh=Kag*cos(δc-ω);	Kagh=**0.268**
Kagv= Kag*sin(δc-ω);	Kagv=**0.041**

Reinforced - External;

Kar=cos(ϕr+ω)^2/[(cos(ω)^2)*cos(ω-δe)*[1+[(sin(ϕr+δe)*sin(ϕr-βeq))/(cos(ω-δe)*cos(ω+βeq))]^(0.5)]^2];

Kar=**0.265**

Karh=Kar*cos(δe-ω);	Karh=**0.252**
Karv= Kar*sin(δe-ω);	Karv=**0.082**

Reinforced - Internal;

Kar=cos(ϕi+ω)^2/[(cos(ω)^2)*cos(ω-δi)*[1+[(sin(ϕi+δi)*sin(ϕi-βeq))/(cos(ω-δi)*cos(ω+βeq))]^(0.5)]^2];

Kar=**0.271**

Karh=Kar*cos(δi-ω);	Karh=**0.268**
Karv= Kar*sin(δi-ω);	Karv=**0.041**;

Internal failure plane;

α_i=atan((-1*tan(ϕi-βeq)+(tan(ϕi-βeq)*(tan(ϕi-βeq)+cot(ϕi+ω))*(1+tan(δi-ω)*cot(ϕi+ω)))$^{0.5}$)/(1+tan(δi-ω)*(tan(ϕi-βeq)+cot(ϕi+ω))))+ϕi=**49.849**deg;

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GENERAL SOIL ANALYSIS

NCMA nomenclature and coulomb analysis.

Active Condition;

Wall batter; ω=10deg

Wall Height; Hf=10ft;

Soil (infill soil); ϕi=28deg

Interface friction angle; δi=0deg;

Backslope; β=10deg;

Distance to broken back; X=10ft;

Equivalent Backslope; βeq=if(X<2*Hf,atan(X*tan(β)/(2*Hf)),β); βeq=**5.038**deg

Active pressure coefficient;

Ka=cos(ϕi+ω)^2/[(cos(ω)^2)*cos(ω-δi)*[1+[(sin(ϕi+δi)*sin(ϕi-βeq))/(cos(ω-δi)*cos(ω+βeq))]^(0.5)]^2];

Ka=**0.314**

Kah=Ka*cos(δi-ω); Kah=**0.309**

Kav= Ka*sin(δi-ω); Kav=**-0.055**;

Internal failure plane;

α_a=atan((-1*tan(ϕi-βeq)+(tan(ϕi-βeq)*(tan(ϕi-βeq)+cot(ϕi+ω))*(1+tan(δi-ω)*cot(ϕi+ω)))$^{0.5}$)/(1+tan(δi-ω)*(tan(ϕi-βeq)+cot(ϕi+ω))))+ϕi=**52.844**deg;

Passive Condition

Wall batter; ω=10deg

Wall Embedment; Hf'=10ft;

Soil; ϕi=28deg

Interface friction angle; δi=0deg;

Toeslope (use negative); β'=-10deg;

Horizontal distance to flat toeslope; X'=10ft;

Coeffcient of embedment for broken toeslope; k=1.0

Equivalent toeslope; βeq'=if(X'<k*Hf',atan(X'*tan(β')/(k*Hf')),β'); βeq'=**-10.000**deg

Passive pressure coefficient;

Kp=cos(ϕi-ω)^2/[(cos(ω)^2)*cos(ω+δi)*[1-[(sin(ϕi+δi)*sin(ϕi+βeq'))/(cos(ω+δi)*cos(ω+βeq'))]^(0.5)]^2];

Kp=**2.494**

Kph=Kp*cos(δi-ω); Kph=**2.456**

Kpv= Kp*sin(δi-ω); Kpv=**-0.433**;

Internal failure plane;

α_p=atan((-1*tan(ϕi+βeq')-(tan(ϕi+βeq')*(tan(ϕi+βeq')+cot(ϕi+ω))*(1+tan(δi-ω)*cot(ϕi-ω)))$^{0.5}$)/(1+tan(δi-ω)*(tan(ϕi+βeq')+cot(ϕi-ω))))+ϕi=**-35.808**deg;

<u>General equations (See Bowles, Retaining and Flood Wall Manual and Tedds);</u>

<u>Active Soils (high side);</u>

Backslope; β=10deg;

Distance to broken back; d=10ft;

Equivalent Backslope; βeq=if(d<2*Hf,atan(d*tan(β)/(2*Hf)),β); βeq=**5.038**deg

Batter from low side horizontal; α=80deg

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Strength mobilization factor; $M = 1$

Angle of internal friction; $\phi = 28$ deg

Angle of wall friction; $\delta = 0$deg

Developed angle of internal friction; $\phi' = \text{atan}(M \times \tan(\phi)) =$ **28.0** deg

Passive Soils (low side);

Angle of internal friction; $\phi_b = 28$ deg

Design base friction; $\delta_b = 0$deg

Slope for passive pressure (use negative); $\beta pp = -15$deg;

Developed angle of internal friction; $\phi'_b = \text{atan}(M \times \tan(\phi_b)) =$ **28.0** deg

Active pressure coefficient for retained material;

$K_a = \sin(\alpha + \phi')^2 / (\sin(\alpha)^2 \times \sin(\alpha - \delta) \times [1 + \sqrt{(\sin(\phi' + \delta) \times \sin(\phi' - \beta eq) / (\sin(\alpha - \delta) \times \sin(\alpha + \beta eq)))}]^2)$;

Active pressure coefficient; $K_a =$ **0.462**

Horizontal component; $K_{ah} = K_a * \cos(\delta - (90\text{deg} - \alpha))$; $K_{ah} =$ **0.455**

Passive pressure coefficient for base material;

$K_p = \sin(\alpha - \phi'_b)^2 / (\sin(\alpha)^2 \times \sin(\alpha + \delta_b) \times [1 - \sqrt{(\sin(\phi'_b + \delta_b) \times \sin(\phi'_b + \beta pp) / (\sin(\alpha + \delta_b) \times \sin(\alpha + \beta pp)))}]^2)$;

Passive pressure coefficient; $K_p =$ **1.511**

Horizontal component; $K_{ph} = K_p * \cos(\delta_b - (90\text{deg} - \alpha))$; $K_{ph} =$ **1.488**

At-rest pressure

At-rest pressure for retained material; $K_0 = 1 - \sin(\phi') =$ **0.531**