



Slope Stability Analysis using Culman's Method Formulas

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List of 29 Slope Stability Analysis using Culman's Method Formulas

Slope Stability Analysis using Culman's Method 🗗

1) Angle of Inclination given Critical Slope Angle

fx
$$i=(2\cdot heta_{
m cr})-\phi_{
m m}$$

Open Calculator 🚰

Open Calculator

$$\mathbf{ex} \ 64.2^{\circ} = (2 \cdot 52.1^{\circ}) - 40^{\circ}$$

2) Angle of Internal Friction given Angle of Inclination and Slope Angle

2) Angle of Internal Friction given Angle of Inclination and Slope Angle

$$\Phi_{
m i} = a an \left(\left({
m F_s} - \left(rac{{
m C_s}}{\left(rac{1}{2}
ight) \cdot \gamma \cdot {
m H} \cdot \left(rac{{
m sin} \left(rac{({
m e}_{
m i} - {
m e}_{
m slope}) \cdot \pi}{180}
ight)}{{
m sin} \left(rac{{
m e}_{
m i} - {
m e}_{
m slope} \cdot \pi}{180}
ight)}
ight) \cdot {
m sin} \left(rac{{
m e}_{
m slope} \cdot \pi}{180}
ight)
ight)$$

ex

$$egin{align*} 88.88139\,^{\circ} = a an \left(\left(2.8 - \left(rac{5.0 \mathrm{kPa}}{\left(rac{1}{2}
ight) \cdot 18 \mathrm{kN/m^3} \cdot 10 \mathrm{m} \cdot \left(rac{\sin \left(rac{(36.85^{\circ} - 36.89^{\circ}) \cdot \pi}{180}
ight)}{\sin \left(rac{36.85^{\circ} \cdot \pi}{180}
ight)}
ight) \cdot \sin \left(rac{36.89^{\circ} \cdot \pi}{180}
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ight) \cdot an \left(rac{36.89^{\circ} \cdot \pi}{180}
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3) Angle of Internal Friction given Effective Normal Stress

$$\Phi_{
m i} = a anigg(rac{{
m F_s}\cdot \zeta_{
m soil}}{\sigma_{
m effn}}igg)$$

Open Calculator

$$\mathbf{ex} = 76.87856^{\circ} = a \tan \left(\frac{2.8 \cdot 250.09 \text{MPa}}{163.23 \text{MPa}} \right)$$

4) Angle of Mobilized Friction given Critical Slope Angle

fx
$$\phi_m = (2 \cdot \theta_{cr}) - i$$

Open Calculator

$$extbf{ex} \left[40.2\degree = \left(2\cdot52.1\degree
ight) - 64\degree
ight]$$





5) Cohesion of Soil given Angle of Inclination and Slope angle

Open Calculator 🗹

$$ext{C}_{ ext{eff}} = \left(ext{F}_{ ext{s}} - \left(rac{ an\left(rac{\phi \cdot \pi}{180}
ight)}{ an\left(rac{\theta \cdot \pi}{180}
ight)}
ight)
ight) \cdot \left(\left(rac{1}{2}
ight) \cdot \gamma \cdot ext{H} \cdot \left(rac{\sin\left(rac{(ext{i} - heta) \cdot \pi}{180}
ight)}{ ext{sin}\left(rac{ ext{i} \cdot \pi}{180}
ight)}
ight) \cdot \sin\left(rac{ heta \cdot \pi}{180}
ight)
ight)$$

ex

$$\boxed{0.400929 \text{kPa} = \left(2.8 - \left(\frac{\tan\left(\frac{46^* \cdot \pi}{180}\right)}{\tan\left(\frac{25^* \cdot \pi}{180}\right)}\right)\right) \cdot \left(\left(\frac{1}{2}\right) \cdot 18 \text{kN/m}^3 \cdot 10 \text{m} \cdot \left(\frac{\sin\left(\frac{(64^* - 25^*) \cdot \pi}{180}\right)}{\sin\left(\frac{64^* \cdot \pi}{180}\right)}\right) \cdot \sin\left(\frac{25^\circ \cdot \pi}{180}\right)\right)}$$

6) Cohesive Force along Slip Plane

fx
$$F_{
m c} = c_{
m m} \cdot L$$

$$=$$
 1.5kN $=$ 0.30kN/ $\mathrm{m}^2\cdot5\mathrm{m}$

7) Critical Slope Angle given Angle of Inclination

$$\textbf{fx} \boxed{\theta_{cr} = \frac{i + \phi_m}{2}}$$

$$\texttt{ex} \boxed{52° = \frac{64° + 40°}{2}}$$

8) Factor of Safety given Angle of Mobilized Friction

آم
$$F_{
m s}=rac{ an\left(rac{\Phi_{
m i}\cdot\pi}{180}
ight)}{ an\left(rac{\phi_{
m m}\cdot\pi}{180}
ight)}$$

9) Factor of Safety given Length of Slip Plane

$$\mathbf{F}_{s} = \left(\frac{c \cdot L}{W_{wedge} \cdot sin\left(\frac{\theta_{cr} \cdot \pi}{180}\right)}\right) + \left(\frac{tan\left(\frac{\phi \cdot \pi}{180}\right)}{tan\left(\frac{\theta_{cr} \cdot \pi}{180}\right)}\right)$$

$$\boxed{\textbf{ax} \ 3.301915 = \left(\frac{2.05 \text{Pa} \cdot 5 \text{m}}{267 \text{N} \cdot \sin \left(\frac{52.1^* \cdot \pi}{180}\right)}\right) + \left(\frac{\tan \left(\frac{46^* \cdot \pi}{180}\right)}{\tan \left(\frac{52.1^* \cdot \pi}{180}\right)}\right)}$$





10) Height from Toe of Wedge to Top of Wedge

 $\mathrm{Fx} \left[\mathrm{H} = rac{\mathrm{h}}{rac{\sin\left(rac{(heta_i - heta) \cdot \pi}{180}
ight)}{\sin\left(rac{ heta_i \cdot \pi}{180}
ight)}}
ight]$

Open Calculator 🗗

11) Height from Toe of Wedge to Top of Wedge given Factor of Safety

 $\mathbf{H} = \left(\frac{C_{eff}}{\left(\frac{1}{2}\right) \cdot \left(F_s - \left(\frac{\tan\left(\frac{\phi \cdot \pi}{180}\right)}{\tan\left(\frac{\theta_{cr} \cdot \pi}{180}\right)}\right)\right) \cdot \gamma \cdot \left(\frac{\sin\left(\frac{(i - \theta_{cr}) \cdot \pi}{180}\right)}{\sin\left(\frac{i \cdot \pi}{180}\right)}\right) \cdot \sin\left(\frac{\theta_{cr} \cdot \pi}{180}\right)} \right)$

Open Calculator

12) Height from Toe of Wedge to Top of Wedge given Weight of Wedge

 $\mathbf{K} = rac{\mathbf{W}_{\mathrm{we}}}{rac{\gamma \cdot \mathrm{L} \cdot \left(\sin \left(rac{(heta_1 - heta) \cdot \pi}{180}
ight)
ight)}{2 \cdot \sin \left(rac{ heta_1 \cdot \pi}{180}
ight)}}$

Open Calculator

$$9.542467m = \frac{138.09kN}{\frac{18kN/m^3 \cdot 5m \cdot \left(\sin\left(\frac{(36.85^{\circ} - 25^{\circ}) \cdot \pi}{180}\right)\right)}{2 \cdot \sin\left(\frac{36.85^{\circ} \cdot \pi}{180}\right)} }$$

13) Height from Toe to Top of Wedge given Angle of Mobilized Friction $oldsymbol{C}$

$$\mathbf{H} = \frac{c_{m}}{0.5 \cdot \cos ec\left(\frac{i \cdot \pi}{180}\right) \cdot \sec\left(\frac{\phi_{mob} \cdot \pi}{180}\right) \cdot \sin\left(\frac{(i - \theta) \cdot \pi}{180}\right) \cdot \sin\left(\frac{(\theta_{slope} - \phi_{mob}) \cdot \pi}{180}\right) \cdot \gamma}$$

Open Calculator





14) Height of Wedge of Soil given Angle of Inclination and Slope angle

 \mathbf{f} $\mathbf{h} = rac{\mathbf{H} \cdot \sin\left(rac{(heta_i - heta) \cdot \pi}{180}
ight)}{\sin\left(rac{ heta_i \cdot \pi}{180}
ight)}$

Open Calculator

$$\boxed{\textbf{ex}} 3.2158 \text{m} = \frac{10 \text{m} \cdot \sin \left(\frac{(36.85^{\circ} - 25^{\circ}) \cdot \pi}{180} \right)}{\sin \left(\frac{36.85^{\circ} \cdot \pi}{180} \right)}$$

15) Height of Wedge of Soil given Weight of Wedge

 $h = rac{W_{we}}{rac{L \cdot \gamma}{2}}$

Open Calculator 🗗

$$= \frac{138.09 kN}{\frac{5m \cdot 18 kN/m^3}{2}}$$

16) Length of Slip Plane given Cohesive Force along Slip Plane

 $\mathbf{L} = rac{F_c}{C_{mob}}$

Open Calculator

$$\boxed{ 5m = \frac{1.5kN}{0.3kPa} }$$

17) Length of Slip Plane given Shear Strength along Slip Plane

 $\mathbf{x} = rac{\mathrm{T_f} - \left(\mathrm{W} \cdot \mathrm{cos} \Big(rac{\mathrm{ heta_{slope} \cdot \pi}}{180} \Big) \cdot \mathrm{tan} \Big(rac{\mathrm{\phi} \cdot \pi}{180} \Big)
ight)}{\mathrm{c}}$

Open Calculator 🗗

$$\boxed{ 9.687676 m = \frac{20 Pa - \left(10.01 kg \cdot \cos\left(\frac{36.89^{\circ} \cdot \pi}{180}\right) \cdot \tan\left(\frac{46^{\circ} \cdot \pi}{180}\right)\right)}{2.05 Pa} }$$

18) Length of Slip Plane given Weight of Wedge of Soil

$$\mathbf{f}$$
 $\mathbf{L} = rac{\mathbf{W}_{we}}{rac{\mathbf{h}\cdot\mathbf{\gamma}}{2}}$

Open Calculator 🗗

$$= \frac{138.09 \text{kN}}{\frac{3.01 \text{m} \cdot 18 \text{kN/m}^3}{2}}$$





Open Calculator

Open Calculator

Open Calculator G

19) Mobilized Cohesion given Angle of Mobilized Friction

R

$$c_{\rm m} = \left(0.5 \cdot \cos ec \left(\frac{\mathrm{i} \cdot \pi}{180}\right) \cdot \sec \left(\frac{\phi_{\rm mob} \cdot \pi}{180}\right) \cdot \sin \left(\frac{\left(\mathrm{i} - \theta_{\rm slope}\right) \cdot \pi}{180}\right) \cdot \sin \left(\frac{\left(\theta_{\rm slope} - \phi_{\rm mob}\right) \cdot \pi}{180}\right)$$

ex

$$\boxed{0.285231 \text{kN/m}^2 = \left(0.5 \cdot \cos ec \left(\frac{64^\circ \cdot \pi}{180}\right) \cdot \sec \left(\frac{12.33^\circ \cdot \pi}{180}\right) \cdot \sin \left(\frac{(64^\circ - 36.89^\circ) \cdot \pi}{180}\right) \cdot \sin \left(\frac{(36.89^\circ - 12.33^\circ) \cdot \pi}{180}\right) \cdot \sin \left(\frac{(36.89^\circ - 12.33^\circ) \cdot \pi}{180}\right) \cdot \sin \left(\frac{(36.89^\circ) \cdot \pi}{180}\right) \cdot \sin \left(\frac{(36.$$

20) Mobilized Cohesion given Cohesive Force along Slip Plane

 $c_{m}=rac{F_{c}}{L}$

$$\boxed{ \textbf{ex} \ 0.3 \text{kN/m}^{_2} = \frac{1.5 \text{kN}}{5 \text{m}} }$$

21) Mobilized Cohesion given Safe Height from Toe to Top of Wedge

$$\boxed{\kappa} C_{mob} = \frac{H}{4 \cdot \sin \left(\frac{\theta_i \cdot \pi}{180} \right) \cdot \cos \left(\frac{\phi_{mob} \cdot \pi}{180} \right)} / \left(\gamma_w \cdot \left(1 - \cos \left(\frac{\left(\theta_i - \phi_{mob} \right) \cdot \pi}{180} \right) \right) \right) } \qquad \text{Open Calculator } \boxed{\sigma}$$

$$\boxed{\texttt{ex} \left[0.813903 \text{kPa} = \frac{10 \text{m}}{4 \cdot \sin \left(\frac{36.85^\circ \cdot \pi}{180} \right) \cdot \cos \left(\frac{12.33^\circ \cdot \pi}{180} \right)} / \left(9810 \text{N/m}^3 \cdot \left(1 - \cos \left(\frac{\left(36.85^\circ - 12.33^\circ \right) \cdot \pi}{180} \right) \right) \right) \right]} \right]$$

22) Safe Height from Toe to Top of Wedge

$$\mathbf{K} H = \frac{4 \cdot c_m \cdot \sin\left(\frac{i \cdot \pi}{180}\right) \cdot \cos\left(\frac{\phi_{mob} \cdot \pi}{180}\right)}{\gamma \cdot \left(1 - \cos\left(\frac{(i - \phi_{mob}) \cdot \pi}{180}\right)\right)}$$

$$= \frac{4 \cdot 0.30 \text{kN/m}^2 \cdot \sin\left(\frac{64^* \cdot \pi}{180}\right) \cdot \cos\left(\frac{12.33^* \cdot \pi}{180}\right)}{18 \text{kN/m}^3 \cdot \left(1 - \cos\left(\frac{(64^* - 12.33^*) \cdot \pi}{180}\right)\right)}$$

23) Shear Strength along Slip Plane

$$\zeta_{soil} = (C_s \cdot L) + \left(W \cdot \cos \left(\frac{\theta \cdot \pi}{180}\right) \cdot \tan \left(\frac{\phi \cdot \pi}{180}\right)\right)$$

$$\boxed{0.025 \text{MPa} = (5.0 \text{kPa} \cdot 5 \text{m}) + \left(10.01 \text{kg} \cdot \cos\left(\frac{25^{\circ} \cdot \pi}{180}\right) \cdot \tan\left(\frac{46^{\circ} \cdot \pi}{180}\right)\right)}$$



24) Slope Angle given Shear Strength along Slip Plane 🚰

 $ag{fx} hinspace{0.2cm} hinspace{0.2$

Open Calculator 🗗

$$\mathbf{ex} = 30^{\circ} = a \cos \left(\frac{0.025 \mathrm{MPa} - (5.0 \mathrm{kPa} \cdot 5\mathrm{m})}{267 \mathrm{N} \cdot \tan \left(\frac{46^{\circ} \cdot \pi}{180} \right)} \right)$$

25) Slope Angle given Shear Stress along Slip Plane

 $ag{k} extstyle{ extstyle below} extstyle extstyle$

Open Calculator

$$= a \sin \left(\frac{160 \text{N/m}^2}{267 \text{N}} \right)$$

26) Unit Weight of Soil given Angle of Mobilized Friction

 $\gamma = rac{c_{
m m}}{0.5 \cdot \cos ec \left(rac{{
m i} \cdot \pi}{180}
ight) \cdot \sec \left(rac{\phi_{
m mob} \cdot \pi}{180}
ight) \cdot \sin \left(rac{\left({
m i} - \theta_{
m slope}
ight) \cdot \pi}{180}
ight) \cdot \sin \left(rac{\left({ heta_{
m slope} - \phi_{
m mob}}
ight) \cdot \pi}{180}
ight) \cdot {
m H}}$

Open Calculator

$$= \frac{0.30 \text{kN/m}^2}{0.5 \cdot \cos ec \left(\frac{64^* \cdot \pi}{180}\right) \cdot \sec \left(\frac{12.33^* \cdot \pi}{180}\right) \cdot \sin \left(\frac{(64^* - 36.89^*) \cdot \pi}{180}\right) \cdot \sin \left(\frac{(36.89^* - 12.33^*) \cdot \pi}{180}\right) \cdot 10 \text{m} }$$

27) Unit Weight of Soil given Safe Height from Toe to Top of Wedge

 $\gamma = rac{4 \cdot c_{
m m} \cdot \sin\left(rac{{
m i} \cdot \pi}{180}
ight) \cdot \cos\left(rac{\phi_{
m mob} \cdot \pi}{180}
ight)}{{
m H} \cdot \left(1 - \cos\left(rac{({
m i} - \phi_{
m mob}) \cdot \pi}{180}
ight)
ight)}$

Open Calculator

$$\boxed{ 18.88591 kN/m^3 = \frac{4 \cdot 0.30 kN/m^2 \cdot \sin \left(\frac{64^* \cdot \pi}{180} \right) \cdot \cos \left(\frac{12.33^* \cdot \pi}{180} \right) }{10 m \cdot \left(1 - \cos \left(\frac{(64^* - 12.33^*) \cdot \pi}{180} \right) \right) } }$$

28) Unit Weight of Soil given Weight of Wedge

 $\gamma = rac{W_{
m we}}{rac{L \cdot h}{2}}$

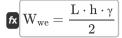
Open Calculator

ex
$$18.35083 \mathrm{kN/m^3} = \frac{138.09 \mathrm{kN}}{\frac{5 \mathrm{m} \cdot 3.01 \mathrm{m}}{2}}$$





29) Weight of Wedge of Soil



Open Calculator



Variables Used

- C Cohesion in Soil (Pascal)
- Ceff Effective Cohesion in Geotech as Kilopascal (Kilopascal)
- **c**_m Mobilized Cohesion in Soil Mechanics (Kilonewton per Square Meter)
- C_{mob} Mobilized Cohesion in Kilopascal (Kilopascal)
- C_s Cohesion of Soil (Kilopascal)
- Fc Cohesive Force in KN (Kilonewton)
- Fs Factor of Safety in Soil Mechanics
- h Height of Wedge (Meter)
- H Height from Toe of Wedge to Top of Wedge (Meter)
- i Angle of Inclination to Horizontal in Soil (Degree)
- L Length of Slip Plane (Meter)
- Tf Shear Strength of Soil (Pascal)
- W Weight of Wedge (Kilogram)
- Wwe Weight of Wedge in Kilonewton (Kilonewton)
- Wwedge Weight of Wedge in Newton (Newton)
- Y Unit Weight of Soil (Kilonewton per Cubic Meter)
- Vw Unit Weight of Water in Soil Mechanics (Newton per Cubic Meter)
- ζ soil Shear Strength (Megapascal)
- ζ_{SOII} Shear Stress of Soil in Megapascal (Megapascal)
- **0** Slope Angle (Degree)
- θ_{cr} Critical Slope Angle in Soil Mechanics (Degree)
- θ_i Angle of Inclination in Soil Mechanics (Degree)
- θ_{slope} Slope Angle in Soil Mechanics (Degree)
- σ_{effn} Effective Normal Stress of Soil in Megapascal (Megapascal)
- T S Average Shear Stress on Shear Plane in Soil Mech (Newton per Square Meter)
- **Φ** Angle of Internal Friction (Degree)
- Φ_i Angle of Internal Friction of Soil (Degree)
- φ_m Angle of Mobilized Friction (Degree)
- φ_{mob} Angle of Mobilized Friction in Soil Mechanics (Degree)





Constants, Functions, Measurements used

- Constant: pi, 3.14159265358979323846264338327950288
 Archimedes' constant
- Function: acos, acos(Number)

 Inverse trigonometric cosine function
- Function: asin, asin(Number)
 Inverse trigonometric sine function
- Function: atan, atan(Number)
 Inverse trigonometric tangent function
- Function: cos, cos(Angle)

 Trigonometric cosine function
- Function: cosec, cosec(Angle)

 Trigonometric cosecant function
- Function: sec, sec(Angle)

 Trigonometric secant function
- Function: sin, sin(Angle)

 Trigonometric sine function
- Function: tan, tan(Angle)

 Trigonometric tangent function
- Measurement: Length in Meter (m)
 Length Unit Conversion
- Measurement: Weight in Kilogram (kg)
 Weight Unit Conversion
- Measurement: Pressure in Kilopascal (kPa), Megapascal (MPa), Kilonewton per Square Meter (kN/m²), Pascal (Pa), Newton per Square Meter (N/m²)

 Pressure Unit Conversion
- Measurement: Force in Kilonewton (kN), Newton (N)
- Measurement: Angle in Degree (°)

 Angle Unit Conversion
- Measurement: Specific Weight in Kilonewton per Cubic Meter (kN/m³), Newton per Cubic Meter (N/m³)
 Specific Weight Unit Conversion
- Measurement: Stress in Megapascal (MPa), Kilopascal (kPa)
 Stress Unit Conversion





Check other formula lists

- Bearing Capacity for Strip Footing for C-Φ Soils Formulas
- Bearing Capacity of Cohesive Soil Formulas
- Bearing Capacity of Non-cohesive Soil Formulas
- Bearing Capacity of Soils: Meyerhof's Analysis Formulas
- Foundation Stability Analysis Formulas
- Atterberg Limits Formulas
- Bearing Capacity of Soil: Terzaghi's Analysis Formulas
- Compaction of Soil Formulas
- Earth Moving Formulas

- Lateral Pressure for Cohesive and Non Cohesive Soil Formulas
- Minimum Depth of Foundation by Rankine's Analysis
 Formulas
- Pile Foundations Formulas
- Scraper Production Formulas
- Slope Stability Analysis using Bishops Method Formulas
- Slope Stability Analysis using Culman's Method
 Formulas
- Vibration Control in Blasting Formulas
- Void Ratio of Soil Sample Formulas
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