



Slope Stability Analysis using Bishops Method Formulas

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List of 35 Slope Stability Analysis using Bishops Method Formulas

Slope Stability Analysis using Bishops Method 🗗

1) Change in Normal Stress given Overall Pore Pressure Coefficient

$$\Delta \sigma_1 = rac{\Delta u}{B}$$

 $ex 6Pa = \frac{3Pa}{0.50}$

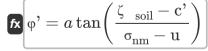
2) Change in Pore Pressure given Overall Pore Pressure Coefficient

fx $\left| \Delta \mathbf{u} = \Delta \mathbf{\sigma}_1 \cdot \mathbf{B}
ight|$

$$\phi' = a anigg(rac{(ext{S} \cdot ext{f}_{ ext{s}}) - (ext{c}' \cdot ext{l})}{ ext{P} - (ext{u} \cdot ext{l})}igg)$$

 $\boxed{ 9.874119^\circ = a \tan \bigg(\frac{(11.07 \mathrm{N} \cdot 2.8) - (4 \mathrm{Pa} \cdot 9.42 \mathrm{m})}{150 \mathrm{N} - (20 \mathrm{Pa} \cdot 9.42 \mathrm{m})} \bigg) }$

4) Effective Angle of Internal Friction given Shear Strength



 $oxed{ex} 1.301768^{\circ} = a anigg(rac{0.025 ext{MPa} - 4 ext{Pa}}{1.1 ext{MPa} - 20 ext{Pa}}igg)$





5) Effective Cohesion of Soil given Normal Stress on Slice

 $\mathbf{c}' = au - \left(\left(\sigma_{
m normal} - u
ight) \cdot an \left(rac{\phi' \cdot \pi}{180}
ight)
ight)$

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6) Effective Cohesion of Soil given Shear Force in Bishop's Analysis

 $\mathbf{c'} = \frac{(S \cdot f_s) - \left((P - (u \cdot l)) \cdot tan\left(\frac{\phi' \cdot \pi}{180}\right)\right)}{l}$

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7) Effective Stress on Slice

 $\mathbf{f}\mathbf{x}$ $\mathbf{\sigma}^{'}=\left(rac{\mathrm{P}}{\mathrm{I}}
ight)-\Sigma\mathrm{U}$

ex 13.92357Pa = $\left(\frac{150\text{N}}{9.42\text{m}}\right) - 2\text{N}$

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8) Factor of Safety given by Bishop

 $\mathbf{f}_{\mathrm{s}} = \mathbf{m} - (\mathbf{n} \cdot \mathbf{r}_{\mathrm{u}})$

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 $\boxed{2.71 = 2.98 - (0.30 \cdot 0.9)}$

9) Factor of Safety given Shear Force in Bishop's Analysis

 $\mathbf{f}_{\mathrm{s}} = rac{\left(\mathrm{c'}\cdot\mathrm{l}
ight) + \left(\mathrm{P} - \left(\mathrm{u}\cdot\mathrm{l}
ight)
ight) \cdot an\left(rac{\phi'\cdot\pi}{180}
ight)}{\mathrm{S}}$

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 $= \frac{(4 \text{Pa} \cdot 9.42 \text{m}) + (150 \text{N} - (20 \text{Pa} \cdot 9.42 \text{m})) \cdot \tan \left(\frac{9.99^{\circ} \cdot \pi}{180}\right)}{11.07 \text{N}}$



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10) Height of Slice given Pore Pressure Ratio

 $\mathbf{z} = \left(rac{F_{\mathrm{u}}}{r_{\mathrm{u}} \cdot \gamma}
ight)$

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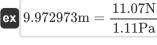
11) Horizontal Distance of Slice from Centre of Rotation

12) Length of Arc of Slice

13) Length of Arc of Slice given Effective Stress

= 12.5m = $\frac{150N}{10Pa + 2N}$

14) Length of Arc of Slice given Shear Force in Bishop's Analysis







15) Normal Stress on Slice

$$\sigma_{
m normal} = rac{P}{l}$$

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16) Normal Stress on Slice given Shear Strength

$$\sigma_{
m normal} = \left(rac{ au - c}{ an \left(rac{\phi' \cdot \pi}{180}
ight)}
ight) + u$$

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$$23.28608 \mathrm{Pa} = \left(\frac{2.06 \mathrm{Pa} - 2.05 \mathrm{Pa}}{\tan \left(\frac{9.99^{\circ} \cdot \pi}{180} \right)} \right) + 20 \mathrm{Pa}$$

17) Overall Pore Pressure Coefficient

$$\mathbf{f}\mathbf{x} \mathbf{B} = rac{\Delta \mathbf{u}}{\Delta \sigma_1}$$

Open Calculator

$$\boxed{\textbf{ex}} 0.5 = \frac{3 \text{Pa}}{6 \text{Pa}}$$

18) Pore Pressure given Effective Stress on Slice

$$\Sigma U = \left(\frac{P}{l}\right) - \sigma'$$

Open Calculator



19) Pore Pressure Ratio given Horizontal Width

fx $\mathbf{r}_{\mathrm{u}} = rac{\mathbf{u} \cdot \mathbf{w}}{\Sigma \mathbf{W}}$

Open Calculator 🗹

20) Pore Pressure Ratio given Unit Weight

 $\mathbf{r}_{\mathrm{u}} = \left(rac{F_{\mathrm{u}}}{\gamma \cdot \mathbf{z}}
ight)$

Open Calculator

 $\boxed{0.979444 = \left(\frac{52.89 \text{kN/m}^2}{18 \text{kN/m}^3 \cdot 3.0 \text{m}}\right)}$

21) Pore Water Pressure given Pore Pressure Ratio

fx $\left[\mathbf{F}_{\mathrm{u}} = (\mathbf{r}_{\mathrm{u}} \cdot \mathbf{\gamma} \cdot \mathbf{z})
ight]$

Open Calculator

ex $48.6 \text{kN/m}^2 = (0.9 \cdot 18 \text{kN/m}^3 \cdot 3.0 \text{m})$

22) Radius of Arc when Total Shear Force on Slice is Available

 $\mathbf{r} = \frac{\Sigma \mathbf{W} \cdot \mathbf{x}}{\Sigma \mathbf{S}}$

Open Calculator

 $= \frac{59.8 \text{N} \cdot 2.99 \text{m}}{32 \text{N}}$

23) Resultant Vertical Shear Force on Section N

fx

Open Calculator

 $ext{X}_{ ext{n}} = \left(ext{F}_{ ext{n}} \cdot ext{cos}igg(rac{ heta \cdot \pi}{180}igg)
ight) + \left(ext{S} \cdot ext{sin}igg(rac{ heta \cdot \pi}{180}igg)
ight) - ext{W} + ext{X}_{(ext{n}+1)}$

ex

 $2.110605 ext{N} = \left(12.09 ext{N} \cdot \cos\left(rac{45\degree \cdot \pi}{180}
ight)
ight) + \left(11.07 ext{N} \cdot \sin\left(rac{45\degree \cdot \pi}{180}
ight)
ight) - 20.0 ext{N} + 9.87 ext{N}$







24) Resultant Vertical Shear Force on Section N+1

fx

Open Calculator 🗗

$$\overline{ {
m X}_{(n+1)} = {
m W} + {
m X}_{
m n} - \left({
m F}_{
m n} \cdot \cos \! \left(rac{ heta \cdot \pi}{180}
ight)
ight) + \left({
m S} \cdot \sin \! \left(rac{ heta \cdot \pi}{180}
ight)
ight) }$$

ex

$$\left[10.95288 \text{N} = 20.0 \text{N} + 2.89 \text{N} - \left(12.09 \text{N} \cdot \cos\left(\frac{45° \cdot \pi}{180}\right)\right) + \left(11.07 \text{N} \cdot \sin\left(\frac{45° \cdot \pi}{180}\right)\right)\right]$$

25) Shear Force in Bishop's Analysis

fx $S = au \cdot 1$

Open Calculator

 $= 1.11 \text{Pa} \cdot 9.42 \text{m}$

26) Shear Force in Bishop's Analysis given Factor of Safety

 $ext{S} = rac{(ext{c'} \cdot ext{l}) + (ext{P} - (ext{u} \cdot ext{l})) \cdot ext{tan} \left(rac{\phi' \cdot \pi}{180}
ight)}{ ext{f}_{ ext{s}}}$

Open Calculator 🗗

27) Shear Strength given Normal Stress on Slice 🗗

 $au = \left(c' + (\sigma_{normal} - u) \cdot tan\left(rac{\phi' \cdot \pi}{180}
ight)
ight)$

Open Calculator

$$\boxed{\textbf{ax} \quad 3.986945 \text{Pa} = \left(4 \text{Pa} + (15.71 \text{Pa} - 20 \text{Pa}) \cdot \tan\left(\frac{9.99^{\circ} \cdot \pi}{180}\right)\right)}$$



28) Shear Stress given Shear Force in Bishop's Analysis 🗗

fx $au=rac{ ext{S}}{1}$

Open Calculator

= 1.175159Pa = $\frac{11.07N}{9.42m}$

 $P = \sigma_{normal} \cdot l$

29) Total Normal Force Acting at Base of Slice 🖸

Open Calculator

 $147.9882N = 15.71Pa \cdot 9.42m$

30) Total Normal Force Acting at Base of Slice given Effective Stress

 $\mathbf{f}\mathbf{x} \ \mathrm{P} = \left(\mathbf{\sigma}^{'} + \Sigma \mathrm{U} \right) \cdot \mathrm{l}^{'}$

[a] 113.04N = $(10Pa + 2N) \cdot 9.42m$

31) Total Normal Force Acting on Slice given Weight of Slice

 $\boxed{ 12.86947 \mathrm{N} = \frac{20.0 \mathrm{N} + 2.89 \mathrm{N} - 9.87 \mathrm{N} - \left(11.07 \mathrm{N} \cdot \sin\left(\frac{45^{\circ} \cdot \pi}{180}\right)\right)}{\cos\left(\frac{45^{\circ} \cdot \pi}{180}\right)} }$

 $\mathbf{F}_{n} = rac{W + X_{n} - X_{(n+1)} - \left(S \cdot sin\left(rac{\theta \cdot \pi}{180}
ight)
ight)}{cos\left(rac{\theta \cdot \pi}{180}
ight)}$

Open Calculator

Open Calculator 🗗

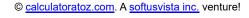
32) Total Shear Force on Slice given Radius of Arc

 $\Sigma S = rac{\Sigma W \cdot x}{r}$

Open Calculator







33) Total Weight of Slice given Total Shear Force on Slice

 $\Sigma W = rac{\Sigma S \cdot r}{x}$

Open Calculator 🗗

34) Unit weight of Soil given Pore Pressure Ratio

 $\mathbf{f}\mathbf{x} \boxed{\gamma = \left(\frac{F_u}{r_u \cdot z}\right)}$

Open Calculator

 $oxed{ex} 19.58889 \mathrm{kN/m^3} = \left(rac{52.89 \mathrm{kN/m^2}}{0.9 \cdot 3.0 \mathrm{m}}
ight)$

35) Weight of Slice given Total Normal Force Acting on Slice

fx

Open Calculator

$${
m W} = \left({
m F_n} \cdot \cos \!\left(rac{ heta \cdot \pi}{180}
ight)
ight) + \left({
m S} \cdot \sin \!\left(rac{ heta \cdot \pi}{180}
ight)
ight) - {
m X_n} + {
m X_{(n+1)}}$$

ex

$$19.2206 \text{N} = \left(12.09 \text{N} \cdot \cos\left(\frac{45° \cdot \pi}{180}\right)\right) + \left(11.07 \text{N} \cdot \sin\left(\frac{45° \cdot \pi}{180}\right)\right) - 2.89 \text{N} + 9.87 \text{N}$$





Variables Used

- B Pore Pressure Coefficient Overall
- C Cohesion in Soil (Pascal)
- c' Effective Cohesion (Pascal)
- Fn Total Normal Force in Soil Mechanics (Newton)
- fs Factor of Safety
- Fu Upward Force in Seepage Analysis (Kilonewton per Square Meter)
- Length of Arc (Meter)
- m Stability Coefficient m in Soil Mechanics
- n Stability Coefficient n
- P Total Normal Force (Newton)
- r Radius of Soil Section (Meter)
- r_u Pore Pressure Ratio
- S Shear Force on Slice in Soil Mechanics (Newton)
- **u** Upward Force (Pascal)
- w Width of Soil Section (Meter)
- W Weight of Slice (Newton)
- X Horizontal Distance (Meter)
- X_(n+1) Vertical Shear Force at other Section (Newton)
- X_n Vertical Shear Force (Newton)
- Z Height of Slice (Meter)
- Y Unit Weight of Soil (Kilonewton per Cubic Meter)
- Δu Change in Pore Pressure (Pascal)
- Δσ₁ Change in Normal Stress (Pascal)
- ζ _{soil} Shear Strength (Megapascal)
- **0** Angle of Base (Degree)
- σ_{nm} Normal Stress in Mega Pascal (Megapascal)
- σ_{normal} Normal Stress in Pascal (Pascal)
- σ Effective Normal Stress (Pascal)





- ΣS Total Shear Force in Soil Mechanics (Newton)
- **ΣU** Total Pore Pressure (Newton)
- **ΣW** Total Weight of Slice in Soil Mechanics (Newton)
- **T** Shear Strength of Soil in Pascal (Pascal)
- φ' Effective Angle of Internal Friction (Degree)
- τ Shear Stress of Soil in Pascal (Pascal)





Constants, Functions, Measurements used

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

 Inverse tan is used to calculate the angle by applying the tangent ratio of the angle, which is the opposite side divided by the adjacent side of the right triangle.
- Function: cos, cos(Angle)
 Cosine of an angle is the ratio of the side adjacent to the angle to the hypotenuse of the triangle.
- Function: sin, sin(Angle)
 Sine is a trigonometric function that describes the ratio of the length of the opposite side of a right triangle to the length of the hypotenuse.
- Function: tan, tan(Angle)

 The tangent of an angle is a trigonometric ratio of the length of the side opposite an angle to the length of the side adjacent to an angle in a right triangle.
- Measurement: Length in Meter (m)
 Length Unit Conversion
- Measurement: Pressure in Pascal (Pa), Megapascal (MPa), Kilonewton per Square Meter (kN/m²)

Pressure Unit Conversion

- Measurement: Force in Newton (N)
 Force Unit Conversion
- Measurement: Angle in Degree (°)

 Angle Unit Conversion
- Measurement: Specific Weight in Kilonewton per Cubic Meter (kN/m³) Specific Weight Unit Conversion
- Measurement: Stress in Pascal (Pa)
 Stress Unit Conversion





Check other formula lists

- Bearing Capacity for Strip Footing for C-Φ
 Minimum Depth of Foundation by Soils Formulas
 Rankine's Analysis Formulas
- Bearing Capacity of Cohesive Soil Formulas
- Bearing Capacity of Non-cohesive Soil Formulas
- Bearing Capacity of Soils 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

- Rankine's Analysis Formulas L
 Pile Foundations Formulas L
- Scraper Production Formulas
- Seepage Analysis Formulas
- Slope Stability Analysis using Bishops Method Formulas
- Slope Stability Analysis using Culman's Method Formulas
- Soil Origin and Its Properties Formulas
- Specific Gravity of Soil Formulas
- Stability Analysis of Infinite Slopes in Prism Formulas
- Vibration Control in Blasting Formulas
- Void Ratio of Soil Sample Formulas
- Water Content of Soil and Related Formulas

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