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Slope Stability Analysis using Bishops Method Formulas

Calculators!

Examples!

Conversions!

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

Open Calculator

fx $$\Delta\sigma_1 = \frac{\Delta u}{B}$$

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

2) Change in Pore Pressure given Overall Pore Pressure Coefficient

Open Calculator

fx $$\Delta u = \Delta\sigma_1 \cdot B$$

ex $$3\text{Pa} = 6\text{Pa} \cdot 0.50$$

3) Effective Angle of Internal Friction given Shear Force in Bishop's Analysis

Open Calculator

fx $$\varphi' = a\tan\left(\frac{(S \cdot f_s) - (c' \cdot l)}{P - (u \cdot l)}\right)$$

ex $$9.874119° = a\tan\left(\frac{(11.07\text{N} \cdot 2.8) - (4\text{Pa} \cdot 9.42\text{m})}{150\text{N} - (20\text{Pa} \cdot 9.42\text{m})}\right)$$

4) Effective Angle of Internal Friction given Shear Strength

Open Calculator

fx $$\varphi' = a\tan\left(\frac{\zeta_{soil} - c'}{\sigma_{nm} - u}\right)$$

ex $$1.301768° = a\tan\left(\frac{0.025\text{MPa} - 4\text{Pa}}{1.1\text{MPa} - 20\text{Pa}}\right)$$

5) Effective Cohesion of Soil given Normal Stress on Slice

Open Calculator

fx $$c' = \tau - \left((\sigma_{normal} - u) \cdot \tan\left(\frac{\varphi' \cdot \pi}{180} \right) \right)$$

ex $$2.073055\text{Pa} = 2.06\text{Pa} - \left((15.71\text{Pa} - 20\text{Pa}) \cdot \tan\left(\frac{9.99° \cdot \pi}{180} \right) \right)$$

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

Open Calculator

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

ex $$3.302851\text{Pa} = \frac{(11.07\text{N} \cdot 2.8) - \left((150\text{N} - (20\text{Pa} \cdot 9.42\text{m})) \cdot \tan\left(\frac{9.99° \cdot \pi}{180} \right) \right)}{9.42\text{m}}$$

7) Effective Stress on Slice

Open Calculator

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

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

8) Factor of Safety given by Bishop

Open Calculator

fx $$f_s = m - (n \cdot r_u)$$

ex $$2.71 = 2.98 - (0.30 \cdot 0.9)$$

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

Open Calculator

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

ex $$3.393238 = \frac{(4\text{Pa} \cdot 9.42\text{m}) + (150\text{N} - (20\text{Pa} \cdot 9.42\text{m})) \cdot \tan\left(\frac{9.99° \cdot \pi}{180} \right)}{11.07\text{N}}$$

10) Height of Slice given Pore Pressure Ratio

Open Calculator

fx $$z = \left(\frac{F_u}{r_u \cdot \gamma}\right)$$

ex $$3.264815\text{m} = \left(\frac{52.89\text{kN/m}^2}{0.9 \cdot 18\text{kN/m}^3}\right)$$

11) Horizontal Distance of Slice from Centre of Rotation

Open Calculator

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

ex $$1.059532\text{m} = \frac{32\text{N} \cdot 1.98\text{m}}{59.8\text{N}}$$

12) Length of Arc of Slice

Open Calculator

fx $$l = \frac{P}{\sigma_{normal}}$$

ex $$9.548059\text{m} = \frac{150\text{N}}{15.71\text{Pa}}$$

13) Length of Arc of Slice given Effective Stress

Open Calculator

fx $$l = \frac{P}{\sigma' + \Sigma U}$$

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

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

Open Calculator

fx $$l = \frac{S}{\tau}$$

ex $$9.972973\text{m} = \frac{11.07\text{N}}{1.11\text{Pa}}$$

15) Normal Stress on Slice

Open Calculator

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

$$15.92357\text{Pa} = \frac{150\text{N}}{9.42\text{m}}$$

16) Normal Stress on Slice given Shear Strength

Open Calculator

$$\sigma_{normal} = \left(\frac{\tau - c}{\tan\left(\frac{\varphi' \cdot \pi}{180}\right)}\right) + u$$

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

17) Overall Pore Pressure Coefficient

Open Calculator

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

$$0.5 = \frac{3\text{Pa}}{6\text{Pa}}$$

18) Pore Pressure given Effective Stress on Slice

Open Calculator

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

$$5.923567\text{N} = \left(\frac{150\text{N}}{9.42\text{m}}\right) - 10\text{Pa}$$

19) Pore Pressure Ratio given Horizontal Width

Open Calculator

fx $$r_u = \frac{u \cdot w}{\Sigma W}$$

ex $$0.976923 = \frac{20\text{Pa} \cdot 2.921\text{m}}{59.8\text{N}}$$

20) Pore Pressure Ratio given Unit Weight

Open Calculator

fx $$r_u = \left(\frac{F_u}{\gamma \cdot z}\right)$$

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

21) Pore Water Pressure given Pore Pressure Ratio

Open Calculator

fx $$F_u = (r_u \cdot \gamma \cdot z)$$

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

Open Calculator

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

ex $$5.587562\text{m} = \frac{59.8\text{N} \cdot 2.99\text{m}}{32\text{N}}$$

23) Resultant Vertical Shear Force on Section N

Open Calculator

fx
$$X_n = \left(F_n \cdot \cos\left(\frac{\theta \cdot \pi}{180}\right)\right) + \left(S \cdot \sin\left(\frac{\theta \cdot \pi}{180}\right)\right) - W + X_{(n+1)}$$

ex
$$2.110605\text{N} = \left(12.09\text{N} \cdot \cos\left(\frac{45^\circ \cdot \pi}{180}\right)\right) + \left(11.07\text{N} \cdot \sin\left(\frac{45^\circ \cdot \pi}{180}\right)\right) - 20.0\text{N} + 9.87\text{N}$$

24) Resultant Vertical Shear Force on Section N+1

Open Calculator

fx
$$X_{(n+1)} = W + X_n - \left(F_n \cdot \cos\left(\frac{\theta \cdot \pi}{180}\right)\right) + \left(S \cdot \sin\left(\frac{\theta \cdot \pi}{180}\right)\right)$$

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

25) Shear Force in Bishop's Analysis

Open Calculator

fx
$$S = \tau \cdot l$$

ex
$$10.4562\text{N} = 1.11\text{Pa} \cdot 9.42\text{m}$$

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

Open Calculator

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

ex
$$13.41541\text{N} = \frac{(4\text{Pa} \cdot 9.42\text{m}) + (150\text{N} - (20\text{Pa} \cdot 9.42\text{m})) \cdot \tan\left(\frac{9.99^\circ \cdot \pi}{180}\right)}{2.8}$$

27) Shear Strength given Normal Stress on Slice

Open Calculator

fx
$$\tau = \left(c' + (\sigma_{normal} - u) \cdot \tan\left(\frac{\varphi' \cdot \pi}{180}\right)\right)$$

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

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

Open Calculator

fx $$\tau = \frac{S}{l}$$

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

29) Total Normal Force Acting at Base of Slice

Open Calculator

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

ex $$147.9882\text{N} = 15.71\text{Pa} \cdot 9.42\text{m}$$

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

Open Calculator

fx $$P = \left(\sigma' + \Sigma U\right) \cdot l$$

ex $$113.04\text{N} = (10\text{Pa} + 2\text{N}) \cdot 9.42\text{m}$$

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

Open Calculator

fx $$F_n = \frac{W + X_n - X_{(n+1)} - \left(S \cdot \sin\left(\frac{\theta \cdot \pi}{180}\right)\right)}{\cos\left(\frac{\theta \cdot \pi}{180}\right)}$$

ex $$12.86947\text{N} = \frac{20.0\text{N} + 2.89\text{N} - 9.87\text{N} - \left(11.07\text{N} \cdot \sin\left(\frac{45° \cdot \pi}{180}\right)\right)}{\cos\left(\frac{45° \cdot \pi}{180}\right)}$$

32) Total Shear Force on Slice given Radius of Arc

Open Calculator

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

ex $$90.30404\text{N} = \frac{59.8\text{N} \cdot 2.99\text{m}}{1.98\text{m}}$$

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

Open Calculator

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

ex $$21.19064\text{N} = \frac{32\text{N} \cdot 1.98\text{m}}{2.99\text{m}}$$

34) Unit weight of Soil given Pore Pressure Ratio

Open Calculator

fx $$\gamma = \left(\frac{F_u}{r_u \cdot z}\right)$$

ex $$19.58889\text{kN/m}^3 = \left(\frac{52.89\text{kN/m}^2}{0.9 \cdot 3.0\text{m}}\right)$$

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

Open Calculator

fx $$W = \left(F_n \cdot \cos\left(\frac{\theta \cdot \pi}{180}\right)\right) + \left(S \cdot \sin\left(\frac{\theta \cdot \pi}{180}\right)\right) - X_n + X_{(n+1)}$$

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

Variables Used

- **B** Pore Pressure Coefficient Overall
- **c** Cohesion in Soil *(Pascal)*
- **c'** Effective Cohesion *(Pascal)*
- **F_n** Total Normal Force in Soil Mechanics *(Newton)*
- **f_s** Factor of Safety
- **F_u** Upward Force in Seepage Analysis *(Kilonewton per Square Meter)*
- **l** 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)*
- **γ** Unit Weight of Soil *(Kilonewton per Cubic Meter)*
- **Δu** Change in Pore Pressure *(Pascal)*
- **$\Delta\sigma_1$** Change in Normal Stress *(Pascal)*
- **ζ_{soil}** Shear Strength *(Megapascal)*
- **θ** 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)*
- **т** 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/m^2)
  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/m^3)
  Specific Weight Unit Conversion
- Measurement: **Stress** in Pascal (Pa)
  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 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
- 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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