Important Stability Analysis of Infinite Slopes in Prism Formulas PDF

Formulas
Examples
with Units

List of 23
Important Stability Analysis of Infinite Slopes in Prism Formulas

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1) Angle of Inclination given Horizontal Length of Prism Formula ⟫

Formula

$$I = a\cos\left(\frac{L}{b}\right)$$

Example with Units

$$78.463° = a\cos\left(\frac{2\,\text{m}}{10\,\text{m}}\right)$$

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2) Angle of Inclination given Vertical Stress on Surface of Prism Formula ⟫

Formula

$$I = a\cos\left(\frac{\sigma_{\text{vertical}}}{z \cdot \gamma}\right)$$

Example with Units

$$89.9894° = a\cos\left(\frac{10\,\text{Pa}}{3\,\text{m} \cdot 18\,\text{kN/m}^3}\right)$$

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3) Angle of Inclination given Volume per Unit Length of Prism Formula ⟫

Formula

$$I = a\cos\left(\frac{V_l}{z \cdot b}\right)$$

Example with Units

$$80.4059° = a\cos\left(\frac{5\,\text{m}^2}{3\,\text{m} \cdot 10\,\text{m}}\right)$$

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4) Angle of Inclination given Weight of Soil Prism Formula ⟫

Formula

$$I = a\cos\left(\frac{W}{\gamma \cdot z \cdot b}\right)$$

Example with Units

$$79.3281° = a\cos\left(\frac{100\,\text{kg}}{18\,\text{kN/m}^3 \cdot 3\,\text{m} \cdot 10\,\text{m}}\right)$$

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5) Cohesion given Factor of Safety for Cohesive Soil Formula ➤

Formula

$$c = \left(f_s - \left(\frac{\tan\left(\frac{\varphi \cdot \pi}{180} \right)}{\tan\left(\frac{I \cdot \pi}{180} \right)} \right) \right) \cdot \left(\gamma \cdot z \cdot \cos\left(\frac{I \cdot \pi}{180} \right) \cdot \sin\left(\frac{I \cdot \pi}{180} \right) \right)$$

Example with Units

$$2.9269\,{}_{kPa} = \left(2.8 - \left(\frac{\tan\left(\frac{46° \cdot 3.1416}{180} \right)}{\tan\left(\frac{80° \cdot 3.1416}{180} \right)} \right) \right) \cdot \left(18\,{}_{kN/m^3} \cdot 3\,{}_{m} \cdot \cos\left(\frac{80° \cdot 3.1416}{180} \right) \cdot \sin\left(\frac{80° \cdot 3.1416}{180} \right) \right)$$

6) Depth of Prism given Factor of Safety for Cohesive Soil Formula ➤

Formula

$$z = \frac{c_u}{\left(f_s - \left(\frac{\tan\left(\left(\Phi_i \right) \right)}{\tan\left(\left(I \right) \right)} \right) \right) \cdot \gamma \cdot \cos\left(\left(I \right) \right) \cdot \sin\left(\left(I \right) \right)}$$

Example with Units

$$2.3365\,{}_{m} = \frac{10\,{}_{Pa}}{\left(2.8 - \left(\frac{\tan\left(\left(82.87° \right) \right)}{\tan\left(\left(80° \right) \right)} \right) \right) \cdot 18\,{}_{kN/m^3} \cdot \cos\left(\left(80° \right) \right) \cdot \sin\left(\left(80° \right) \right)}$$

7) Depth of Prism given Vertical Stress on Surface of Prism Formula ➤

Formula

$$z = \frac{\sigma_{vertical}}{\gamma \cdot \cos\left(\left(I \right) \right)}$$

Example with Units

$$3.1993\,{}_{m} = \frac{10\,{}_{Pa}}{18\,{}_{kN/m^3} \cdot \cos\left(\left(80° \right) \right)}$$

8) Depth of Prism given Volume per Unit Length of Prism Formula ➤

Formula

$$z = \frac{V_l}{b \cdot \cos\left(\left(I \right) \right)}$$

Example with Units

$$2.8794\,{}_{m} = \frac{5\,{}_{m^2}}{10\,{}_{m} \cdot \cos\left(\left(80° \right) \right)}$$

9) Depth of Prism given Weight of Soil Prism Formula ➤

Formula

$$z = \frac{W}{\gamma \cdot b \cdot \cos\left(\left(I \right) \right)}$$

Example with Units

$$3.1993\,{}_{m} = \frac{100\,{}_{kg}}{18\,{}_{kN/m^3} \cdot 10\,{}_{m} \cdot \cos\left(\left(80° \right) \right)}$$

10) Factor of Safety for Cohesive Soil given Cohesion Formula 🔗

$$f_s = \left(\frac{c_u}{\gamma \cdot z \cdot \cos(\,(\,I\,)\,) \cdot \sin(\,(\,I\,)\,)} \right) + \left(\frac{\tan(\,(\,\Phi_i\,)\,)}{\tan(\,(\,I\,)\,)} \right)$$

Example with Units

$$1.4107 = \left(\frac{10\,\text{Pa}}{18\,\text{kN/m}^3 \cdot 3\,\text{m} \cdot \cos(\,(\,80°\,)\,) \cdot \sin(\,(\,80°\,)\,)} \right) + \left(\frac{\tan(\,(\,82.87°\,)\,)}{\tan(\,(\,80°\,)\,)} \right)$$

11) Horizontal Length of Prism Formula 🔗

Formula

$$L = b \cdot \cos(\,(\,I\,)\,)$$

Example with Units

$$1.7365\,\text{m} = 10\,\text{m} \cdot \cos(\,(\,80°\,)\,)$$

12) Inclined Length along Slope given Horizontal Length of Prism Formula 🔗

Formula

$$b = \frac{L}{\cos(\,(\,I\,)\,)}$$

Example with Units

$$11.5175\,\text{m} = \frac{2\,\text{m}}{\cos(\,(\,80°\,)\,)}$$

13) Inclined Length along Slope given Vertical Stress on Surface of Prism Formula 🔗

Formula

$$b = \frac{W}{\sigma_z} \cdot 5$$

Example with Units

$$50\,\text{m} = \frac{100\,\text{kg}}{10\,\text{MPa}} \cdot 5$$

14) Inclined Length along Slope given Volume Per Unit Length of Prism Formula 🔗

Formula

$$b = \frac{V_l}{z \cdot \cos(\,(\,I\,)\,)}$$

Example with Units

$$9.598\,\text{m} = \frac{5\,\text{m}^2}{3\,\text{m} \cdot \cos(\,(\,80°\,)\,)}$$

15) Inclined Length along Slope given Weight of Soil Prism Formula 🔗

Formula

$$b = \frac{W}{\gamma \cdot z \cdot \cos(\,(\,I\,)\,)}$$

Example with Units

$$10.6644\,\text{m} = \frac{100\,\text{kg}}{18\,\text{kN/m}^3 \cdot 3\,\text{m} \cdot \cos(\,(\,80°\,)\,)}$$

Evaluate Formula 🔗

16) Unit Weight of Soil given Factor of Safety for Cohesive Soil Formula

Formula

$$\gamma = \frac{c}{\left(f_s - \left(\frac{\tan\left(\frac{\varphi \cdot \pi}{180} \right)}{\tan\left(\frac{I \cdot \pi}{180} \right)} \right) \right) \cdot z \cdot \cos\left(\frac{I \cdot \pi}{180} \right) \cdot \sin\left(\frac{I \cdot \pi}{180} \right)}$$

Evaluate Formula

Example with Units

$$18.5109 \,{}_{kN/m^3} = \frac{3.01 \,{}_{kPa}}{\left(2.8 - \left(\frac{\tan\left(\frac{46° \ \cdot 3.1416}{180} \right)}{\tan\left(\frac{80° \ \cdot 3.1416}{180} \right)} \right) \right) \cdot 3\,{}_{m} \cdot \cos\left(\frac{80° \ \cdot 3.1416}{180} \right) \cdot \sin\left(\frac{80° \ \cdot 3.1416}{180} \right)}$$

17) Unit Weight of Soil given Vertical Stress on Surface of Prism Formula

Formula

$$\gamma = \frac{\sigma_{vertical}}{z \cdot \cos\left(\left(I \right) \right)}$$

Example with Units

$$19.1959 \,{}_{kN/m^3} = \frac{10\,{}_{Pa}}{3\,{}_{m} \cdot \cos\left(\left(80° \right) \right)}$$

Evaluate Formula

18) Unit Weight of Soil given Weight of Soil Prism Formula

Formula

$$\gamma = \frac{W}{z \cdot b \cdot \cos\left(\left(I \right) \right)}$$

Example with Units

$$19.1959 \,{}_{kN/m^3} = \frac{100\,{}_{kg}}{3\,{}_{m} \cdot 10\,{}_{m} \cdot \cos\left(\left(80° \right) \right)}$$

Evaluate Formula

19) Vertical Stress on Surface of Prism Formula

Formula

$$\sigma_z = \frac{W}{b}$$

Example with Units

$$1E\text{-}5 \,{}_{MPa} = \frac{100\,{}_{kg}}{10\,{}_{m}}$$

Evaluate Formula

20) Vertical Stress on Surface of Prism given Unit Weight of Soil Formula

Formula

$$\sigma_z = \left(z \cdot \gamma \cdot \cos\left(\left(I \right) \right) \right)$$

Example with Units

$$9.377 \,{}_{MPa} = \left(3\,{}_{m} \cdot 18\,{}_{kN/m^3} \cdot \cos\left(\left(80° \right) \right) \right)$$

Evaluate Formula

21) Volume Per Unit Length of Prism Formula

Formula

$$V_l = \left(z \cdot b \cdot \cos\left(\left(I \right) \right) \right)$$

Example with Units

$$5.2094 \,{}_{m^2} = \left(3\,{}_{m} \cdot 10\,{}_{m} \cdot \cos\left(\left(80° \right) \right) \right)$$

Evaluate Formula

22) Weight of Soil Prism given Vertical Stress on Surface of Prism Formula

Formula

$$W = \sigma_{vertical} \cdot b$$

Example with Units

$$100\,{}_{kg} = 10\,{}_{Pa} \cdot 10\,{}_{m}$$

Evaluate Formula

Formula

$$W = (\gamma \cdot z \cdot b \cdot \cos ((I)))$$

Example with Units

$$93.77 \, \text{kg} = (18 \, \text{kN/m}^3 \cdot 3 \, \text{m} \cdot 10 \, \text{m} \cdot \cos ((80°)))$$

Evaluate Formula 📤

Variables used in list of Stability Analysis of Infinite Slopes in Prism Formulas above

- **b** Inclined Length *(Meter)*
- **c** Cohesion of Soil *(Kilopascal)*
- **c$_u$** Unit Cohesion *(Pascal)*
- **f$_s$** Factor of Safety
- **l** Angle of Inclination *(Degree)*
- **L** Horizontal Length of Prism *(Meter)*
- **V$_l$** Volume per unit length of prism *(Square Meter)*
- **W** Weight of Prism *(Kilogram)*
- **z** Depth of Prism *(Meter)*
- **γ** Unit Weight of Soil *(Kilonewton per Cubic Meter)*
- **σ$_{vertical}$** Vertical Stress at a Point in Pascal *(Pascal)*
- **σ$_z$** Vertical Stress at a Point *(Megapascal)*
- **φ** Angle of Internal Friction *(Degree)*
- **Φ$_i$** Angle of Internal Friction of Soil *(Degree)*

Constants, Functions, Measurements used in list of Stability Analysis of Infinite Slopes in Prism Formulas above

- constant(s): **pi**, 3.14159265358979323846264338327950288 *Archimedes' constant*
- Functions: **acos**, acos(Number) *The inverse cosine function, is the inverse function of the cosine function. It is the function that takes a ratio as an input and returns the angle whose cosine is equal to that ratio.*
- Functions: **cos**, cos(Angle) *Cosine of an angle is the ratio of the side adjacent to the angle to the hypotenuse of the triangle.*
- Functions: **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.*
- Functions: **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: **Weight** in Kilogram (kg) *Weight Unit Conversion* 📤
- Measurement: **Area** in Square Meter (m²) *Area Unit Conversion* 📤
- Measurement: **Pressure** in Pascal (Pa), Kilopascal (kPa), Megapascal (MPa) *Pressure Unit Conversion* 📤
- Measurement: **Angle** in Degree (°) *Angle Unit Conversion* 📤
- Measurement: **Specific Weight** in Kilonewton per Cubic Meter (kN/m³) *Specific Weight Unit Conversion* 📤

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