Important The Swedish Slip Circle Method Formulas PDF

Formulas
Examples
with Units

List of 38
Important The Swedish Slip Circle Method Formulas

1) Angle of Internal Friction given Resisting Moment Formula

Evaluate Formula

Formula

$$\Phi_i = atan\left(\frac{\left(\frac{M_R}{r}\right) - \left(c_u \cdot L'\right)}{\Sigma N}\right)$$

Example with Units

$$89.9962° = atan\left(\frac{\left(\frac{45.05\,kN*m}{0.6\,m}\right) - \left(10\,Pa \cdot 3.0001\,m\right)}{5.01\,N}\right)$$

2) Arc Angle given Length of Slip Arc Formula

Evaluate Formula

Formula

$$\delta = \frac{360 \cdot L'}{2 \cdot \pi \cdot d_{radial}} \cdot \left(\frac{\pi}{180}\right)$$

Example with Units

$$2.0001\,rad = \frac{360 \cdot 3.0001\,m}{2 \cdot 3.1416 \cdot 1.5\,m} \cdot \left(\frac{3.1416}{180}\right)$$

3) Curve Length of Each Slice given Resisting Force from Coulomb's Equation Formula

Evaluate Formula

Formula

$$\Delta L = \frac{F_r - \left(N \cdot \tan\left(\left(\varphi\right)\right)\right)}{c_u}$$

Example with Units

$$3.4126\,m = \frac{35\,N - \left(4.99\,N \cdot \tan\left(\left(9.93°\right)\right)\right)}{10\,Pa}$$

4) Distance between Line of Action and Line Passing through Center given Driving Moment Formula

Evaluate Formula

Formula

$$x' = \frac{M_D}{W}$$

Example with Units

$$1.25\,m = \frac{10.0\,kN*m}{8\,N}$$

5) Distance between Line of Action and Line Passing through Center given Mobilized Cohesion Formula

Evaluate Formula

Formula

$$x' = \frac{c_m}{\frac{W \cdot d_{radial}}{L'}}$$

Example with Units

$$0.8925\,\text{m} = \frac{3.57\,\text{Pa}}{\frac{8\,\text{N} \cdot 1.5\,\text{m}}{3.0001\,\text{m}}}$$

6) Distance between Line of Action of Weight and Line Passing through Center Formula

Evaluate Formula

Formula

$$x' = \frac{c_u \cdot L' \cdot d_{radial}}{W \cdot f_s}$$

Example with Units

$$2.009\,\text{m} = \frac{10\,\text{Pa} \cdot 3.0001\,\text{m} \cdot 1.5\,\text{m}}{8\,\text{N} \cdot 2.8}$$

7) Driving Moment given Factor of Safety Formula

Evaluate Formula

Formula

$$M_D = \frac{M_R}{f_s}$$

Example with Units

$$16.0893\,\text{kN*m} = \frac{45.05\,\text{kN*m}}{2.8}$$

8) Driving Moment given Radius of Slip Circle Formula

Evaluate Formula

Formula

$$M_D = r \cdot F_t$$

Example with Units

$$6.6\,\text{kN*m} = 0.6\,\text{m} \cdot 11.0\,\text{N}$$

9) Driving Moment given Weight of Soil on Wedge Formula

Evaluate Formula

Formula

$$M_D = W \cdot x'$$

Example with Units

$$10\,\text{kN*m} = 8\,\text{N} \cdot 1.25\,\text{m}$$

10) Factor of Safety given Mobilized Shear resistance of Soil Formula

Evaluate Formula

Formula

$$f_s = \frac{c_u}{c_m}$$

Example with Units

$$2.8011 = \frac{10\,\text{Pa}}{3.57\,\text{Pa}}$$

11) Factor of Safety given Moment of Resistance Formula

Evaluate Formula

Formula

$$f_s = \frac{M_R}{M_D}$$

Example with Units

$$4.505 = \frac{45.05\,\text{kN*m}}{10.0\,\text{kN*m}}$$

12) Factor of Safety given Sum of Tangential Component Formula

Evaluate Formula

Formula

$$f_s = \frac{\left(c_u \cdot L'\right) + \left(\Sigma N \cdot \tan\left(\frac{\varphi \cdot \pi}{180}\right)\right)}{F_t}$$

Example with Units

$$2.7287 = \frac{\left(10\,\text{Pa} \cdot 3.0001\,\text{m}\right) + \left(5.01\,\text{N} \cdot \tan\left(\frac{9.93^\circ \cdot 3.1416}{180}\right)\right)}{11.0\,\text{N}}$$

13) Factor of Safety given Unit Cohesion Formula

Evaluate Formula

Formula

$$f_s = \frac{c_u \cdot L_{s'} \cdot d_{radial}}{W \cdot x'}$$

Example with Units

$$2.799 = \frac{10\,\text{Pa} \cdot 1.866\,\text{m} \cdot 1.5\,\text{m}}{8\,\text{N} \cdot 1.25\,\text{m}}$$

14) Length of Slip Arc Formula

Evaluate Formula

Formula

$$L' = \frac{2 \cdot \pi \cdot d_{radial} \cdot \delta \cdot \left(\frac{180}{\pi}\right)}{360}$$

Example with Units

$$3.0002\,\text{m} = \frac{2 \cdot 3.1416 \cdot 1.5\,\text{m} \cdot 2.0001\,\text{rad} \cdot \left(\frac{180}{3.1416}\right)}{360}$$

15) Length of Slip Arc given Factor of Safety Formula

Evaluate Formula

Formula

$$L_{s'} = \frac{f_s}{\frac{c_u \cdot d_{radial}}{W \cdot x'}}$$

Example with Units

$$1.8667\,\text{m} = \frac{2.8}{\frac{10\,\text{Pa} \cdot 1.5\,\text{m}}{8\,\text{N} \cdot 1.25\,\text{m}}}$$

16) Length of Slip Circle given Sum of Tangential Component Formula

Evaluate Formula

Formula

$$L' = \frac{\left(f_s \cdot F_t\right) - \left(\Sigma N \cdot \tan\left(\frac{\varphi \cdot \pi}{180}\right)\right)}{c_u}$$

Example with Units

$$3.0785\,\text{m} = \frac{\left(2.8 \cdot 11.0\,\text{N}\right) - \left(5.01\,\text{N} \cdot \tan\left(\frac{9.93^\circ \cdot 3.1416}{180}\right)\right)}{10\,\text{Pa}}$$

17) Mobilized Shear Resistance of Soil given Factor of Safety Formula

Evaluate Formula

Formula

$$c_m = \frac{c_u}{f_s}$$

Example with Units

$$3.5714\,\text{Pa} = \frac{10\,\text{Pa}}{2.8}$$

18) Mobilized Shear Resistance of Soil given Weight of Soil on Wedge Formula

Evaluate Formula

Formula

$$c_m = \frac{W \cdot x' \cdot d_{radial}}{L'}$$

Example with Units

$$4.9998\,\text{Pa} = \frac{8\,\text{N} \cdot 1.25\,\text{m} \cdot 1.5\,\text{m}}{3.0001\,\text{m}}$$

19) Moment of Resistance given Factor of Safety Formula

Evaluate Formula

Formula

$$M_{r'} = f_s \cdot M_D$$

Example with Units

$$28\,\text{kN*m} = 2.8 \cdot 10.0\,\text{kN*m}$$

20) Moment of Resistance given Unit Cohesion Formula

Evaluate Formula

Formula

$$M_R = \left(c_u \cdot L' \cdot d_{radial} \right)$$

Example with Units

$$45.0015\,\text{kN*m} = \left(10\,\text{Pa} \cdot 3.0001\,\text{m} \cdot 1.5\,\text{m} \right)$$

21) Normal Component given Resisting Force from Coulomb's Equation Formula

Evaluate Formula

Formula

$$F_N = \frac{F_r - \left(c_u \cdot \Delta L \right)}{\tan\left(\left(\varphi \right) \right)}$$

Example with Units

$$5.0266\,\text{N} = \frac{35\,\text{N} - \left(10\,\text{Pa} \cdot 3.412\,\text{m} \right)}{\tan\left(\left(9.93° \right) \right)}$$

22) Radial Distance from Center of Rotation given Length of Slip Arc Formula

Evaluate Formula

Formula

$$d_{radial} = \frac{360 \cdot L'}{2 \cdot \pi \cdot \delta \cdot \left(\frac{180}{\pi} \right)}$$

Example with Units

$$1.5\,\text{m} = \frac{360 \cdot 3.0001\,\text{m}}{2 \cdot 3.1416 \cdot 2.0001\,\text{rad} \cdot \left(\frac{180}{3.1416} \right)}$$

23) Radial Distance from Centre of Rotation given Factor of Safety Formula

Evaluate Formula

Formula

$$d_{radial} = \frac{f_s}{\frac{c_u \cdot L'}{W \cdot x'}}$$

Example with Units

$$0.9333\,\text{m} = \frac{2.8}{\frac{10\,\text{Pa} \cdot 3.0001\,\text{m}}{8\,\text{N} \cdot 1.25\,\text{m}}}$$

24) Radial Distance from Centre of Rotation given Mobilized Shear Resistance of Soil Formula

Evaluate Formula

Formula

$$d_{radial} = \frac{c_m}{\frac{W \cdot x'}{L'}}$$

Example with Units

$$1.071\,\text{m} = \frac{3.57\,\text{Pa}}{\frac{8\,\text{N} \cdot 1.25\,\text{m}}{3.0001\,\text{m}}}$$

25) Radial Distance from Centre of Rotation given Moment of Resistance Formula

Evaluate Formula

Formula

$$d_{radial} = \frac{M_R}{c_u \cdot L'}$$

Example with Units

$$1.5016\,\text{m} = \frac{45.05\,\text{kN*m}}{10\,\text{Pa} \cdot 3.0001\,\text{m}}$$

26) Resisting Force from Coulomb's Equation Formula

Evaluate Formula

Formula

$$F_r = \left(\left(c_u \cdot \Delta L \right) + \left(N \cdot \tan\left(\left(\varphi \right) \right) \right) \right)$$

Example with Units

$$34.9936\,\text{N} = \left(\left(10\,\text{Pa} \cdot 3.412\,\text{m} \right) + \left(4.99\,\text{N} \cdot \tan\left(\left(9.93° \right) \right) \right) \right)$$

27) Resisting Moment given Radius of Slip Circle Formula

Evaluate Formula

Formula

$$M_R = r \cdot \left(\left(c_u \cdot L' \right) + \left(\Sigma N \cdot \tan\left(\left(\Phi_i \right) \right) \right) \right)$$

Example with Units

$$42.0316\,\text{kN*m} = 0.6\,\text{m} \cdot \left(\left(10\,\text{Pa} \cdot 3.0001\,\text{m} \right) + \left(5.01\,\text{N} \cdot \tan\left(\left(82.87° \right) \right) \right) \right)$$

28) Sum of Normal Component given Factor of Safety Formula

Evaluate Formula

Formula

$$\Sigma F_N = \frac{\left(f_s \cdot F_t \right) - \left(c_u \cdot L' \right)}{\tan\left(\frac{\Phi_i \cdot \pi}{180} \right)}$$

Example with Units

$$31.6448\,\text{N} = \frac{\left(2.8 \cdot 11.0\,\text{N} \right) - \left(10\,\text{Pa} \cdot 3.0001\,\text{m} \right)}{\tan\left(\frac{82.87° \cdot 3.1416}{180} \right)}$$

29) Sum of Normal Component given Resisting Moment Formula

Evaluate Formula

Formula

$$\Sigma N = \frac{\left(\frac{M_R}{r} \right) - \left(c_u \cdot L' \right)}{\tan\left(\left(\Phi_i \right) \right)}$$

Example with Units

$$5.6393\,\text{N} = \frac{\left(\frac{45.05\,\text{kN*m}}{0.6\,\text{m}} \right) - \left(10\,\text{Pa} \cdot 3.0001\,\text{m} \right)}{\tan\left(\left(82.87° \right) \right)}$$

30) Sum of Tangential Component given Driving Moment Formula

Evaluate Formula

Formula

$$F_t = \frac{M_D}{r}$$

Example with Units

$$16.6667\,\text{N} = \frac{10.0\,\text{kN*m}}{0.6\,\text{m}}$$

31) Sum of Tangential Component given Factor of Safety Formula

Evaluate Formula

Formula

$$F_t = \frac{\left(c_u \cdot L'\right) + \left(\Sigma N \cdot \tan\left(\frac{\varphi \cdot \pi}{180}\right)\right)}{f_s}$$

Example with Units

$$10.7201\,\text{N} = \frac{\left(10\,\text{Pa} \cdot 3.0001\,\text{m}\right) + \left(5.01\,\text{N} \cdot \tan\left(\frac{9.93^\circ \cdot 3.1416}{180}\right)\right)}{2.8}$$

32) Total Length of Slip Circle given Resisting Moment Formula

Evaluate Formula

Formula

$$L' = \frac{\left(\frac{M_R}{r}\right) - \left(\Sigma N \cdot \tan\left(\left(\Phi_i\right)\right)\right)}{c_u}$$

Example with Units

$$3.5032\,\text{m} = \frac{\left(\frac{45.05\,\text{kN*m}}{0.6\,\text{m}}\right) - \left(5.01\,\text{N} \cdot \tan\left(\left(82.87^\circ\right)\right)\right)}{10\,\text{Pa}}$$

33) Unit Cohesion given Factor of Safety Formula

Evaluate Formula

Formula

$$c_u = f_s \cdot \frac{W \cdot x'}{L' \cdot d_{radial}}$$

Example with Units

$$6.222\,\text{Pa} = 2.8 \cdot \frac{8\,\text{N} \cdot 1.25\,\text{m}}{3.0001\,\text{m} \cdot 1.5\,\text{m}}$$

34) Unit Cohesion given Mobilized Shear Resistance of Soil Formula

Evaluate Formula

Formula

$$c_u = f_s \cdot c_m$$

Example with Units

$$9.996\,\text{Pa} = 2.8 \cdot 3.57\,\text{Pa}$$

35) Unit Cohesion given Resisting Force from Coulomb's Equation Formula

Evaluate Formula

Formula

$$c_u = \frac{F_r - \left(N \cdot \tan\left(\left(\varphi\right)\right)\right)}{\Delta L}$$

Example with Units

$$10.0019\,\text{Pa} = \frac{35\,\text{N} - \left(4.99\,\text{N} \cdot \tan\left(\left(9.93^\circ\right)\right)\right)}{3.412\,\text{m}}$$

36) Unit Cohesion given Sum of Tangential Component Formula

Evaluate Formula

Formula

$$c_u = \frac{\left(f_s \cdot F_t\right) - \left(\Sigma N \cdot \tan\left(\frac{\varphi \cdot \pi}{180}\right)\right)}{L'}$$

Example with Units

$$10.2613\,\text{Pa} = \frac{\left(2.8 \cdot 11.0\,\text{N}\right) - \left(5.01\,\text{N} \cdot \tan\left(\frac{9.93° \cdot 3.1416}{180}\right)\right)}{3.0001\,\text{m}}$$

37) Weight of Soil on Wedge given Factor of Safety Formula

Evaluate Formula

Formula

$$W = \frac{c_u \cdot L' \cdot d_{radial}}{f_s \cdot x'}$$

Example with Units

$$12.8576\,\text{N} = \frac{10\,\text{Pa} \cdot 3.0001\,\text{m} \cdot 1.5\,\text{m}}{2.8 \cdot 1.25\,\text{m}}$$

38) Weight of Soil on Wedge given Mobilized Shear Resistance of Soil Formula

Evaluate Formula

Formula

$$W = \frac{c_m}{\frac{x' \cdot d_{radial}}{L'}}$$

Example with Units

$$5.7122\,\text{N} = \frac{3.57\,\text{Pa}}{\frac{1.25\,\text{m} \cdot 1.5\,\text{m}}{3.0001\,\text{m}}}$$

Variables used in list of The Swedish Slip Circle Method Formulas above

- c_m Mobilized Shear Resistance of Soil *(Pascal)*
- c_u Unit Cohesion *(Pascal)*
- d_{radial} Radial Distance *(Meter)*
- F_N Normal Component of Force in Soil Mechanics *(Newton)*
- F_r Resisting Force *(Newton)*
- f_s Factor of Safety
- F_t Sum of All Tangential Component in Soil Mechanics *(Newton)*
- $L_{s'}$ Length of Slip Arc with Factor of Safety *(Meter)*
- L' Length of Slip Arc *(Meter)*
- M_D Driving Moment *(Kilonewton Meter)*
- $M_{r'}$ Moment of Resistance with Factor of Safety *(Kilonewton Meter)*
- M_R Resisting Moment *(Kilonewton Meter)*
- N Normal Component of Force *(Newton)*
- r Radius of Slip Circle *(Meter)*
- W Weight of Body in Newtons *(Newton)*
- x' Distance between LOA and COR *(Meter)*
- δ Arc Angle *(Radian)*
- ΔL Curve Length *(Meter)*
- ΣF_N Sum of All Normal Component in Soil Mechanics *(Newton)*
- ΣN Sum of all Normal Component *(Newton)*
- φ Angle of Internal Friction *(Degree)*
- Φ_i Angle of Internal Friction of Soil *(Degree)*

Constants, Functions, Measurements used in list of The Swedish Slip Circle Method Formulas above

- constant(s): **pi**, 3.14159265358979323846264338327950288 *Archimedes' constant*
- Functions: **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.*
- 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: **Pressure** in Pascal (Pa) *Pressure Unit Conversion*
- Measurement: **Force** in Newton (N) *Force Unit Conversion*
- Measurement: **Angle** in Degree (°), Radian (rad) *Angle Unit Conversion*
- Measurement: **Moment of Force** in Kilonewton Meter (kN*m) *Moment of Force Unit Conversion*

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