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The Swedish Slip Circle Method Formulas

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List of 38 The Swedish Slip Circle Method Formulas

The Swedish Slip Circle Method

1) Angle of Internal Friction given Resisting Moment

Open Calculator

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

ex $$89.99618^\circ = a\tan\left(\frac{\left(\frac{45.05\text{kN*m}}{0.6\text{m}}\right) - (10\text{Pa} \cdot 3.0001\text{m})}{5.01\text{N}}\right)$$

2) Arc Angle given Length of Slip Arc

Open Calculator

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

ex $$2.000067\text{rad} = \frac{360 \cdot 3.0001\text{m}}{2 \cdot \pi \cdot 1.5\text{m}} \cdot \left(\frac{\pi}{180}\right)$$

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

Open Calculator

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

ex $$3.412641\text{m} = \frac{35\text{N} - (4.99\text{N} \cdot \tan((9.93^\circ)))}{10\text{Pa}}$$

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

Open Calculator

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

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

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

Open Calculator

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

ex $$0.89253\text{m} = \frac{3.57\text{Pa}}{\frac{8\text{N} \cdot 1.5\text{m}}{3.0001\text{m}}}$$

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

Open Calculator

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

$$2.008996\text{m} = \frac{10\text{Pa} \cdot 3.0001\text{m} \cdot 1.5\text{m}}{8\text{N} \cdot 2.8}$$

7) Driving Moment given Factor of Safety

Open Calculator

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

$$16.08929\text{kN*m} = \frac{45.05\text{kN*m}}{2.8}$$

8) Driving Moment given Radius of Slip Circle

Open Calculator

$$M_D = r \cdot F_t$$

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

9) Driving Moment given Weight of Soil on Wedge

Open Calculator

$$M_D = W \cdot x'$$

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

10) Factor of Safety given Mobilized Shear resistance of Soil

Open Calculator

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

$$2.80112 = \frac{10\text{Pa}}{3.57\text{Pa}}$$

11) Factor of Safety given Moment of Resistance

Open Calculator

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

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

12) Factor of Safety given Sum of Tangential Component

Open Calculator

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

$$2.728741 = \frac{(10\text{Pa} \cdot 3.0001\text{m}) + \left(5.01\text{N} \cdot \tan\left(\frac{9.93^\circ \cdot \pi}{180}\right)\right)}{11.0\text{N}}$$

13) Factor of Safety given Unit Cohesion

Open Calculator

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

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

14) Length of Slip Arc

Open Calculator

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

$$3.00015\text{m} = \frac{2 \cdot \pi \cdot 1.5\text{m} \cdot 2.0001\text{rad} \cdot \left(\frac{180}{\pi}\right)}{360}$$

15) Length of Slip Arc given Factor of Safety

Open Calculator

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

$$1.866667\text{m} = \frac{2.8}{\frac{10\text{Pa} \cdot 1.5\text{m}}{8\text{N} \cdot 1.25\text{m}}}$$

16) Length of Slip Circle given Sum of Tangential Component

Open Calculator

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

$$3.078485\text{m} = \frac{(2.8 \cdot 11.0\text{N}) - \left(5.01\text{N} \cdot \tan\left(\frac{9.93^\circ \cdot \pi}{180}\right)\right)}{10\text{Pa}}$$

17) Mobilized Shear Resistance of Soil given Factor of Safety

Open Calculator

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

$$3.571429\text{Pa} = \frac{10\text{Pa}}{2.8}$$

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

Open Calculator

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

$$4.999833\text{Pa} = \frac{8\text{N} \cdot 1.25\text{m} \cdot 1.5\text{m}}{3.0001\text{m}}$$

19) Moment of Resistance given Factor of Safety

Open Calculator

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

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

20) Moment of Resistance given Unit Cohesion

Open Calculator

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

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

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

Open Calculator

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

ex $$5.026632\text{N} = \frac{35\text{N} - (10\text{Pa} \cdot 3.412\text{m})}{\tan((9.93^\circ))}$$

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

Open Calculator

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

ex $$1.499975\text{m} = \frac{360 \cdot 3.0001\text{m}}{2 \cdot \pi \cdot 2.0001\text{rad} \cdot \left(\frac{180}{\pi}\right)}$$

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

Open Calculator

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

ex $$0.933302\text{m} = \frac{2.8}{\frac{10\text{Pa} \cdot 3.0001\text{m}}{8\text{N} \cdot 1.25\text{m}}}$$

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

Open Calculator

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

$$1.071036\text{m} = \frac{3.57\text{Pa}}{\frac{8\text{N} \cdot 1.25\text{m}}{3.0001\text{m}}}$$

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

Open Calculator

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

$$1.501617\text{m} = \frac{45.05\text{kN*m}}{10\text{Pa} \cdot 3.0001\text{m}}$$

26) Resisting Force from Coulomb's Equation

Open Calculator

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

$$34.99359\text{N} = ((10\text{Pa} \cdot 3.412\text{m}) + (4.99\text{N} \cdot \tan((9.93^\circ))))$$

27) Resisting Moment given Radius of Slip Circle

Open Calculator

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

$$42.03162\text{kN*m} = 0.6\text{m} \cdot ((10\text{Pa} \cdot 3.0001\text{m}) + (5.01\text{N} \cdot \tan((82.87^\circ))))$$

28) Sum of Normal Component given Factor of Safety

Open Calculator

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

$$31.64481\text{N} = \frac{(2.8 \cdot 11.0\text{N}) - (10\text{Pa} \cdot 3.0001\text{m})}{\tan\left(\frac{82.87^\circ \cdot \pi}{180}\right)}$$

29) Sum of Normal Component given Resisting Moment

Open Calculator

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

$$5.639274\text{N} = \frac{\left(\frac{45.05\text{kN*m}}{0.6\text{m}}\right) - (10\text{Pa} \cdot 3.0001\text{m})}{\tan((82.87^\circ))}$$

30) Sum of Tangential Component given Driving Moment

Open Calculator

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

$$16.66667\text{N} = \frac{10.0\text{kN*m}}{0.6\text{m}}$$

31) Sum of Tangential Component given Factor of Safety

Open Calculator

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

$$10.72006\text{N} = \frac{(10\text{Pa} \cdot 3.0001\text{m}) + \left(5.01\text{N} \cdot \tan\left(\frac{9.93^\circ \cdot \pi}{180}\right)\right)}{2.8}$$

32) Total Length of Slip Circle given Resisting Moment

Open Calculator

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

$$3.503164\text{m} = \frac{\left(\frac{45.05\text{kN*m}}{0.6\text{m}}\right) - (5.01\text{N} \cdot \tan((82.87^\circ)))}{10\text{Pa}}$$

33) Unit Cohesion given Factor of Safety

Open Calculator

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

$$6.222015\text{Pa} = 2.8 \cdot \frac{8\text{N} \cdot 1.25\text{m}}{3.0001\text{m} \cdot 1.5\text{m}}$$

34) Unit Cohesion given Mobilized Shear Resistance of Soil

Open Calculator

$$c_u = f_s \cdot c_m$$

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

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

Open Calculator

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

ex $$10.00188\text{Pa} = \frac{35\text{N} - (4.99\text{N} \cdot \tan((9.93^\circ)))}{3.412\text{m}}$$

36) Unit Cohesion given Sum of Tangential Component

Open Calculator

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

ex $$10.26127\text{Pa} = \frac{(2.8 \cdot 11.0\text{N}) - \left(5.01\text{N} \cdot \tan\left(\frac{9.93^\circ \cdot \pi}{180}\right)\right)}{3.0001\text{m}}$$

37) Weight of Soil on Wedge given Factor of Safety

Open Calculator

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

ex $$12.85757\text{N} = \frac{10\text{Pa} \cdot 3.0001\text{m} \cdot 1.5\text{m}}{2.8 \cdot 1.25\text{m}}$$

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

Open Calculator

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

ex $$5.71219\text{N} = \frac{3.57\text{Pa}}{\frac{1.25\text{m}\cdot 1.5\text{m}}{3.0001\text{m}}}$$

Variables Used

- 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

- 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: **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

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
- Porosity of Soil Sample 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 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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