Seepage Analysis Formulas

List of 52 Seepage Analysis Formulas

Seepage Analysis

Factor of Steady Seepage Along the Slope

1) Angle of Inclination given Saturated Unit Weight

Open Calculator

fx $$i = a\cos\left(\frac{W_{prism}}{\gamma \cdot z \cdot b}\right)$$

ex $$52.82234° = a\cos\left(\frac{0.62\text{kN}}{18\text{kN/m}^3 \cdot 3\text{m} \cdot 0.019\text{m}}\right)$$

2) Angle of Inclination given Shear Strength and Submerged Unit Weight

Open Calculator

fx $$i = a\tan\left(\frac{\gamma' \cdot \tan((\varphi))}{\gamma_{sat} \cdot \left(\frac{T_f}{\zeta_{soil}}\right)}\right)$$

ex $$80.07088° = a\tan\left(\frac{5.01\text{N/m}^3 \cdot \tan((46°))}{32.24\text{N/m}^3 \cdot \left(\frac{20\text{Pa}}{0.71\text{kN/m}^2}\right)}\right)$$

3) Angle of Inclination given Vertical Stress and Saturated Unit Weight

Open Calculator

fx $$i = a\cos\left(\frac{\sigma_z}{\gamma \cdot z}\right)$$

ex $$89.99873° = a\cos\left(\frac{1.2\text{Pa}}{18\text{kN/m}^3 \cdot 3\text{m}}\right)$$

4) Depth of Prism given Effective Normal Stress

Open Calculator

fx $$z = \frac{\sigma'}{(\gamma_{saturated} - \gamma_{water}) \cdot \left(\cos\left(\frac{i \cdot \pi}{180}\right)\right)^2}$$

ex $$11.86509\text{m} = \frac{24.67\text{kN/m}^2}{(11.89\text{kN/m}^3 - 9.81\text{kN/m}^3) \cdot \left(\cos\left(\frac{64° \cdot \pi}{180}\right)\right)^2}$$

5) Depth of Prism given Normal Stress and Saturated Unit Weight

Open Calculator

fx $$z = \frac{\sigma_n}{\gamma_{saturated} \cdot \left(\cos\left(\frac{i \cdot \pi}{180}\right)\right)^2}$$

ex $$6.508781\text{m} = \frac{77.36\text{kN/m}^2}{11.89\text{kN/m}^3 \cdot \left(\cos\left(\frac{64° \cdot \pi}{180}\right)\right)^2}$$

6) Depth of Prism given Saturated Unit Weight

Open Calculator

fx $$z = \frac{W_{prism}}{\gamma_{sat} \cdot b \cdot \cos\left(\frac{i \cdot \pi}{180}\right)}$$

ex $$1012.338\text{m} = \frac{0.62\text{kN}}{32.24\text{N/m}^3 \cdot 0.019\text{m} \cdot \cos\left(\frac{64° \cdot \pi}{180}\right)}$$

7) Depth of Prism given Shear Stress and Saturated Unit Weight

Open Calculator

fx $$z = \frac{\zeta_{soil}}{\gamma_{saturated} \cdot \cos\left(\frac{i \cdot \pi}{180}\right) \cdot \sin\left(\frac{i \cdot \pi}{180}\right)}$$

ex $$3.063739\text{m} = \frac{0.71\text{kN/m}^2}{11.89\text{kN/m}^3 \cdot \cos\left(\frac{64° \cdot \pi}{180}\right) \cdot \sin\left(\frac{64° \cdot \pi}{180}\right)}$$

8) Depth of Prism given Submerged Unit Weight and Effective Normal Stress

Open Calculator

fx $$z = \frac{\sigma'}{y_S \cdot \left(\cos\left(\frac{i \cdot \pi}{180}\right)\right)^2}$$

ex $$4.935876\text{m} = \frac{24.67\text{kN/m}^2}{5.00\text{kN/m}^3 \cdot \left(\cos\left(\frac{64° \cdot \pi}{180}\right)\right)^2}$$

9) Depth of Prism given Upward Force

Open Calculator

fx $$z = \frac{\sigma_n - F_u}{y_S \cdot \left(\cos\left(\frac{i \cdot \pi}{180}\right)\right)^2}$$

ex $$4.895861\text{m} = \frac{77.36\text{kN/m}^2 - 52.89\text{kN/m}^2}{5.00\text{kN/m}^3 \cdot \left(\cos\left(\frac{64° \cdot \pi}{180}\right)\right)^2}$$

10) Depth of Prism given Upward Force due to Seepage Water

Open Calculator

fx $$z = \frac{F_u}{\gamma_{water} \cdot \left(\cos\left(\frac{i \cdot \pi}{180}\right)\right)^2}$$

ex $$5.393487\text{m} = \frac{52.89\text{kN/m}^2}{9.81\text{kN/m}^3 \cdot \left(\cos\left(\frac{64° \cdot \pi}{180}\right)\right)^2}$$

11) Depth of Prism given Vertical Stress and Saturated Unit Weight

Open Calculator

fx $$z = \frac{\sigma_{zkp}}{\gamma_{saturated} \cdot \cos\left(\frac{i \cdot \pi}{180}\right)}$$

ex $$4.458375\text{m} = \frac{53\text{kPa}}{11.89\text{kN/m}^3 \cdot \cos\left(\frac{64° \cdot \pi}{180}\right)}$$

12) Saturated Unit Weight given Effective Normal Stress

Open Calculator

fx $$\gamma_{saturated} = \gamma_{water} + \left(\frac{\sigma'}{z \cdot \left(\cos\left(\frac{i \cdot \pi}{180}\right)\right)^2}\right)$$

ex $$18.03646\text{kN/m}^3 = 9.81\text{kN/m}^3 + \left(\frac{24.67\text{kN/m}^2}{3\text{m} \cdot \left(\cos\left(\frac{64° \cdot \pi}{180}\right)\right)^2}\right)$$

13) Saturated Unit Weight given Factor of Safety

Open Calculator

fx $$\gamma_{saturated} = \frac{y_S \cdot \tan\left(\frac{\Phi_i \cdot \pi}{180}\right)}{F_s \cdot \tan\left(\frac{i \cdot \pi}{180}\right)}$$

ex $$2.312419\text{kN/m}^3 = \frac{5.00\text{kN/m}^3 \cdot \tan\left(\frac{82.87° \cdot \pi}{180}\right)}{2.8 \cdot \tan\left(\frac{64° \cdot \pi}{180}\right)}$$

14) Saturated Unit Weight given Normal Stress Component

Open Calculator

fx $$\gamma_{saturated} = \frac{\sigma_n}{z \cdot \left(\cos\left(\frac{i \cdot \pi}{180}\right)\right)^2}$$

ex $$25.79647\text{kN/m}^3 = \frac{77.36\text{kN/m}^2}{3\text{m} \cdot \left(\cos\left(\frac{64° \cdot \pi}{180}\right)\right)^2}$$

15) Saturated Unit Weight given Shear Strength

Open Calculator

$$\gamma_{saturated} = \frac{y_S \cdot \zeta_{soil} \cdot \tan\left(\frac{\Phi_i \cdot \pi}{180}\right)}{\tau_f \cdot \tan\left(\frac{i \cdot \pi}{180}\right)}$$

$$0.934368\text{kN/m}^3 = \frac{5.00\text{kN/m}^3 \cdot 0.71\text{kN/m}^2 \cdot \tan\left(\frac{82.87^\circ \cdot \pi}{180}\right)}{4.92\text{kN/m}^2 \cdot \tan\left(\frac{64^\circ \cdot \pi}{180}\right)}$$

16) Saturated Unit Weight given Shear Stress Component

Open Calculator

$$\gamma_{saturated} = \frac{\zeta_{soil}}{z \cdot \cos\left(\frac{i \cdot \pi}{180}\right) \cdot \sin\left(\frac{i \cdot \pi}{180}\right)}$$

$$12.14262\text{kN/m}^3 = \frac{0.71\text{kN/m}^2}{3\text{m} \cdot \cos\left(\frac{64^\circ \cdot \pi}{180}\right) \cdot \sin\left(\frac{64^\circ \cdot \pi}{180}\right)}$$

17) Saturated Unit Weight given Vertical Stress on Prism

Open Calculator

$$\gamma_{saturated} = \frac{\sigma_{zkp}}{z \cdot \cos\left(\frac{i \cdot \pi}{180}\right)}$$

$$17.67002\text{kN/m}^3 = \frac{53\text{kPa}}{3\text{m} \cdot \cos\left(\frac{64^\circ \cdot \pi}{180}\right)}$$

18) Saturated Unit Weight given Weight of Soil Prism

Open Calculator

$$\gamma_{saturated} = \frac{W_{prism}}{z \cdot b \cdot \cos\left(\frac{i \cdot \pi}{180}\right)}$$

$$10.87926\text{kN/m}^3 = \frac{0.62\text{kN}}{3\text{m} \cdot 0.019\text{m} \cdot \cos\left(\frac{64^\circ \cdot \pi}{180}\right)}$$

Steady State Seepage Analysis Along The Slopes

19) Cohesion of Soil for Steady Seepage along Slope

Open Calculator

fx

$$C = h_c \cdot \left(\left(\gamma_{saturated} \cdot \tan\left(\frac{i \cdot \pi}{180} \right) \cdot \left(\cos\left(\frac{i \cdot \pi}{180} \right) \right)^2 \right) - \left(y_S \cdot \tan\left(\frac{\varphi \cdot \pi}{180} \right) \cdot \left(\cos\left(\frac{i \cdot \pi}{180} \right) \right)^2 \right.$$

ex

$$0.16332\text{kPa} = 1.01\text{m} \cdot \left(\left(11.89\text{kN/m}^3 \cdot \tan\left(\frac{64° \cdot \pi}{180} \right) \cdot \left(\cos\left(\frac{64° \cdot \pi}{180} \right) \right)^2 \right) - \left(5.00\text{kN/m}^3 \cdot \tan\left(\frac{46° \cdot \pi}{180} \right) \right. \right.$$

20) Cohesion of Soil given Saturated Unit Weight

Open Calculator

fx

$$C = \left(F_s \cdot \gamma_{saturated} \cdot z \cdot \cos\left(\frac{i \cdot \pi}{180} \right) \cdot \sin\left(\frac{i \cdot \pi}{180} \right) \right) - \left(y_S \cdot z \cdot \tan\left(\frac{\varphi \cdot \pi}{180} \right) \cdot \left(\cos\left(\frac{i \cdot \pi}{180} \right) \right)^2 \right)$$

ex

$$1.736521\text{kPa} = \left(2.8 \cdot 11.89\text{kN/m}^3 \cdot 3\text{m} \cdot \cos\left(\frac{64° \cdot \pi}{180} \right) \cdot \sin\left(\frac{64° \cdot \pi}{180} \right) \right) - \left(5.00\text{kN/m}^3 \cdot 3\text{m} \cdot \tan\left(\frac{46° \cdot \pi}{180} \right. \right.$$

21) Critical Depth given Saturated Unit Weight

Open Calculator

fx

$$h_c = \frac{C}{\left(\gamma_{saturated} \cdot \tan\left(\frac{i \cdot \pi}{180} \right) \cdot \left(\cos\left(\frac{i \cdot \pi}{180} \right) \right)^2 \right) - \left(y_S \cdot \tan\left(\frac{\varphi \cdot \pi}{180} \right) \cdot \left(\cos\left(\frac{i \cdot \pi}{180} \right) \right)^2 \right)}$$

ex

$$7.853906\text{m} = \frac{1.27\text{kPa}}{\left(11.89\text{kN/m}^3 \cdot \tan\left(\frac{64° \cdot \pi}{180} \right) \cdot \left(\cos\left(\frac{64° \cdot \pi}{180} \right) \right)^2 \right) - \left(5.00\text{kN/m}^3 \cdot \tan\left(\frac{46° \cdot \pi}{180} \right) \cdot \left(\cos\left(\frac{64° \cdot \pi}{180} \right) \right)^2 \right)}$$

22) Effective Normal Stress given Factor of Safety

Open Calculator

fx

$$\sigma' = \frac{F_s}{\frac{\tan\left(\frac{\Phi_i \cdot \pi}{180} \right)}{\zeta_{soil}}}$$

ex

$$78.73576\text{kN/m}^2 = \frac{2.8}{\frac{\tan\left(\frac{82.87° \cdot \pi}{180} \right)}{0.71\text{kN/m}^2}}$$

23) Effective Normal Stress given Saturated Unit Weight

Open Calculator

$$\sigma' = \left((\gamma_{saturated} - \gamma_{water}) \cdot z \cdot \left(\cos\left(\frac{i \cdot \pi}{180} \right) \right)^2 \right)$$

$$6.237629\text{kN/m}^2 = \left((11.89\text{kN/m}^3 - 9.81\text{kN/m}^3) \cdot 3\text{m} \cdot \left(\cos\left(\frac{64° \cdot \pi}{180} \right) \right)^2 \right)$$

24) Effective Normal Stress given Submerged Unit Weight

Open Calculator

$$\sigma' = \left(y_S \cdot z \cdot \left(\cos\left(\frac{i \cdot \pi}{180} \right) \right)^2 \right)$$

$$14.9943\text{kN/m}^2 = \left(5.00\text{kN/m}^3 \cdot 3\text{m} \cdot \left(\cos\left(\frac{64° \cdot \pi}{180} \right) \right)^2 \right)$$

25) Effective Normal Stress given Upward Force due to Seepage Water

Open Calculator

$$\sigma' = \sigma_n - F_u$$

$$24.47\text{kN/m}^2 = 77.36\text{kN/m}^2 - 52.89\text{kN/m}^2$$

26) Factor of Safety for Cohesive Soil given Saturated Unit Weight

Open Calculator

$$F_s = \frac{c' + \left(\gamma' \cdot z \cdot \tan((\varphi)) \cdot (\cos((i)))^2 \right)}{\gamma_{sat} \cdot z \cdot \cos((i)) \cdot \sin((i))}$$

$$0.183449 = \frac{4\text{Pa} + \left(5.01\text{N/m}^3 \cdot 3\text{m} \cdot \tan((46°)) \cdot (\cos((64°)))^2 \right)}{32.24\text{N/m}^3 \cdot 3\text{m} \cdot \cos((64°)) \cdot \sin((64°))}$$

27) Factor of Safety given Effective Normal Stress

Open Calculator

$$F_s = \frac{\sigma' \cdot \tan\left(\frac{\varphi \cdot \pi}{180} \right)}{\zeta_{soil}}$$

$$0.486913 = \frac{24.67\text{kN/m}^2 \cdot \tan\left(\frac{46° \cdot \pi}{180} \right)}{0.71\text{kN/m}^2}$$

28) Factor of Safety given Submerged Unit Weight

Open Calculator

$$F_s = \frac{y_S \cdot \tan\left(\frac{\Phi_i \cdot \pi}{180}\right)}{\gamma_{saturated} \cdot \tan\left(\frac{i \cdot \pi}{180}\right)}$$

$$0.544556 = \frac{5.00\text{kN/m}^3 \cdot \tan\left(\frac{82.87^\circ \cdot \pi}{180}\right)}{11.89\text{kN/m}^3 \cdot \tan\left(\frac{64^\circ \cdot \pi}{180}\right)}$$

29) Inclined Length of Prism given Saturated Unit Weight

Open Calculator

$$b = \frac{W_{prism}}{\gamma_{saturated} \cdot z \cdot \cos\left(\frac{i \cdot \pi}{180}\right)}$$

$$0.017385\text{m} = \frac{0.62\text{kN}}{11.89\text{kN/m}^3 \cdot 3\text{m} \cdot \cos\left(\frac{64^\circ \cdot \pi}{180}\right)}$$

30) Normal Stress Component given Effective Normal Stress

Open Calculator

$$\sigma_n = \sigma' + F_u$$

$$77.56\text{kN/m}^2 = 24.67\text{kN/m}^2 + 52.89\text{kN/m}^2$$

31) Normal Stress Component given Saturated Unit Weight

Open Calculator

$$\sigma_n = \left(\gamma_{saturated} \cdot z \cdot \left(\cos\left(\frac{i \cdot \pi}{180}\right)\right)^2\right)$$

$$35.65644\text{kN/m}^2 = \left(11.89\text{kN/m}^3 \cdot 3\text{m} \cdot \left(\cos\left(\frac{64^\circ \cdot \pi}{180}\right)\right)^2\right)$$

32) Normal Stress Component given Submerged Unit Weight and Depth of Prism

Open Calculator

$$\sigma_n = F_u + \left(y_S \cdot z \cdot \left(\cos\left(\frac{i \cdot \pi}{180}\right)\right)^2\right)$$

$$67.8843\text{kN/m}^2 = 52.89\text{kN/m}^2 + \left(5.00\text{kN/m}^3 \cdot 3\text{m} \cdot \left(\cos\left(\frac{64^\circ \cdot \pi}{180}\right)\right)^2\right)$$

33) Saturated Unit Weight given Critical Depth

Open Calculator

$$\gamma_{saturated} = \frac{\left(\frac{C_{eff}}{h_c}\right) - \left(y_S \cdot \tan\left(\frac{\varphi \cdot \pi}{180}\right) \cdot \left(\cos\left(\frac{i \cdot \pi}{180}\right)\right)^2\right)}{\tan\left(\frac{i \cdot \pi}{180}\right) \cdot \left(\cos\left(\frac{i \cdot \pi}{180}\right)\right)^2}$$

$$12.66211\text{kN/m}^3 = \frac{\left(\frac{0.32\text{kPa}}{1.01\text{m}}\right) - \left(5.00\text{kN/m}^3 \cdot \tan\left(\frac{46° \cdot \pi}{180}\right) \cdot \left(\cos\left(\frac{64° \cdot \pi}{180}\right)\right)^2\right)}{\tan\left(\frac{64° \cdot \pi}{180}\right) \cdot \left(\cos\left(\frac{64° \cdot \pi}{180}\right)\right)^2}$$

34) Saturated Unit Weight given Factor of Safety for Cohesive Soil

Open Calculator

$$\gamma_{saturated} = \frac{C_{eff} + \left(y_S \cdot z \cdot \tan\left(\frac{\Phi_i \cdot \pi}{180}\right) \cdot \left(\cos\left(\frac{i \cdot \pi}{180}\right)\right)^2\right)}{F_s \cdot z \cdot \cos\left(\frac{i \cdot \pi}{180}\right) \cdot \sin\left(\frac{i \cdot \pi}{180}\right)}$$

$$4.266966\text{kN/m}^3 = \frac{0.32\text{kPa} + \left(5.00\text{kN/m}^3 \cdot 3\text{m} \cdot \tan\left(\frac{82.87° \cdot \pi}{180}\right) \cdot \left(\cos\left(\frac{64° \cdot \pi}{180}\right)\right)^2\right)}{2.8 \cdot 3\text{m} \cdot \cos\left(\frac{64° \cdot \pi}{180}\right) \cdot \sin\left(\frac{64° \cdot \pi}{180}\right)}$$

35) Shear Strength given Submerged Unit Weight

Open Calculator

$$\tau_f = \frac{\zeta_{soil} \cdot y_S \cdot \tan\left(\frac{\varphi \cdot \pi}{180}\right)}{\gamma_{saturated} \cdot \tan\left(\frac{i \cdot \pi}{180}\right)}$$

$$0.214584\text{kN/m}^2 = \frac{0.71\text{kN/m}^2 \cdot 5.00\text{kN/m}^3 \cdot \tan\left(\frac{46° \cdot \pi}{180}\right)}{11.89\text{kN/m}^3 \cdot \tan\left(\frac{64° \cdot \pi}{180}\right)}$$

36) Shear Stress Component given Saturated Unit Weight

Open Calculator

$$\zeta_{soil} = \left(\gamma_{saturated} \cdot z \cdot \cos\left(\frac{i \cdot \pi}{180}\right) \cdot \sin\left(\frac{i \cdot \pi}{180}\right)\right)$$

$$0.695229\text{kN/m}^2 = \left(11.89\text{kN/m}^3 \cdot 3\text{m} \cdot \cos\left(\frac{64° \cdot \pi}{180}\right) \cdot \sin\left(\frac{64° \cdot \pi}{180}\right)\right)$$

37) Shear Stress given Submerged Unit Weight

Open Calculator

$$\zeta_{soil} = \frac{\tau_f}{\frac{y_S \cdot \tan((\varphi))}{\gamma_{saturated} \cdot \tan((i))}}$$

$$23.165\text{kN/m}^2 = \frac{4.92\text{kN/m}^2}{\frac{5.00\text{kN/m}^3 \cdot \tan((46°))}{11.89\text{kN/m}^3 \cdot \tan((64°))}}$$

38) Stability Number for Failure on Slope with Seepage of Water

Open Calculator

fx $$S_n = (\cos(\delta))^2 \cdot \left(\tan(\delta) - \left(\frac{\gamma_b \cdot \tan(\Phi_i)}{\gamma_{saturated}}\right)\right)$$

ex $$0.041214 = (\cos(87°))^2 \cdot \left(\tan(87°) - \left(\frac{6\text{kN/m}^3 \cdot \tan(82.87°)}{11.89\text{kN/m}^3}\right)\right)$$

39) Stability Number for Failure on Slope without Seepage Water

Open Calculator

fx $$S_n = (\cos(\delta))^2 \cdot (\tan(\delta) - \tan(\Phi_i))$$

ex $$0.030367 = (\cos(87°))^2 \cdot (\tan(87°) - \tan(82.87°))$$

40) Submerged Unit Weight for Steady Seepage along Slope

Open Calculator

fx $$y_S = \frac{\left(F_s \cdot \gamma_{saturated} \cdot z \cdot \cos\left(\frac{i \cdot \pi}{180}\right) \cdot \sin\left(\frac{i \cdot \pi}{180}\right)\right) - C}{z \cdot \tan\left(\frac{\Phi_i \cdot \pi}{180}\right) \cdot \left(\cos\left(\frac{i \cdot \pi}{180}\right)\right)^2}$$

ex $$8.936297\text{kN/m}^3 = \frac{\left(2.8 \cdot 11.89\text{kN/m}^3 \cdot 3\text{m} \cdot \cos\left(\frac{64° \cdot \pi}{180}\right) \cdot \sin\left(\frac{64° \cdot \pi}{180}\right)\right) - 1.27\text{kPa}}{3\text{m} \cdot \tan\left(\frac{82.87° \cdot \pi}{180}\right) \cdot \left(\cos\left(\frac{64° \cdot \pi}{180}\right)\right)^2}$$

41) Submerged Unit Weight given Critical Depth and Cohesion

Open Calculator

fx $$y_S = \frac{\left(\gamma_{saturated} \cdot \tan\left(\frac{i \cdot \pi}{180}\right) \cdot \left(\cos\left(\frac{i \cdot \pi}{180}\right)\right)^2\right) - \left(\frac{C}{h_c}\right)}{-\tan\left(\frac{\Phi_i \cdot \pi}{180}\right) \cdot \left(\cos\left(\frac{i \cdot \pi}{180}\right)\right)^2}$$

ex $$40.63814\text{kN/m}^3 = \frac{\left(11.89\text{kN/m}^3 \cdot \tan\left(\frac{64° \cdot \pi}{180}\right) \cdot \left(\cos\left(\frac{64° \cdot \pi}{180}\right)\right)^2\right) - \left(\frac{1.27\text{kPa}}{1.01\text{m}}\right)}{-\tan\left(\frac{82.87° \cdot \pi}{180}\right) \cdot \left(\cos\left(\frac{64° \cdot \pi}{180}\right)\right)^2}$$

42) Submerged Unit Weight given Effective Normal Stress

Open Calculator

fx $$y_S = \frac{\sigma'}{z \cdot \left(\cos\left(\frac{i \cdot \pi}{180}\right)\right)^2}$$

ex $$8.22646\text{kN/m}^3 = \frac{24.67\text{kN/m}^2}{3\text{m} \cdot \left(\cos\left(\frac{64° \cdot \pi}{180}\right)\right)^2}$$

43) Submerged Unit Weight given Factor of Safety

Open Calculator

fx $$y_S = \frac{F_s}{\frac{\tan\left(\frac{\Phi_i \cdot \pi}{180}\right)}{\gamma_{saturated} \cdot \tan\left(\frac{i \cdot \pi}{180}\right)}}$$

ex $$25.70901 \text{kN/m}^3 = \frac{2.8}{\frac{\tan\left(\frac{82.87° \cdot \pi}{180}\right)}{11.89 \text{kN/m}^3 \cdot \tan\left(\frac{64° \cdot \pi}{180}\right)}}$$

44) Submerged Unit Weight given Shear Strength

Open Calculator

fx $$y_S = \frac{\frac{\tau_f}{\zeta_{soil}}}{\frac{\tan((\Phi_i))}{\gamma_{saturated} \cdot \tan((i))}}$$

ex $$21.13118 \text{kN/m}^3 = \frac{\frac{4.92 \text{kN/m}^2}{0.71 \text{kN/m}^2}}{\frac{\tan((82.87°))}{11.89 \text{kN/m}^3 \cdot \tan((64°))}}$$

45) Submerged Unit Weight given Upward Force

Open Calculator

fx $$y_S = \frac{\sigma_n - F_u}{z \cdot \left(\cos\left(\frac{i \cdot \pi}{180}\right)\right)^2}$$

ex $$8.159768 \text{kN/m}^3 = \frac{77.36 \text{kN/m}^2 - 52.89 \text{kN/m}^2}{3 \text{m} \cdot \left(\cos\left(\frac{64° \cdot \pi}{180}\right)\right)^2}$$

46) Unit Weight of Water given Effective Normal Stress

Open Calculator

fx $$\gamma_{water} = \gamma_{saturated} - \left(\frac{\sigma'}{z \cdot \left(\cos\left(\frac{i \cdot \pi}{180}\right)\right)^2}\right)$$

ex $$3.66354 \text{kN/m}^3 = 11.89 \text{kN/m}^3 - \left(\frac{24.67 \text{kN/m}^2}{3 \text{m} \cdot \left(\cos\left(\frac{64° \cdot \pi}{180}\right)\right)^2}\right)$$

47) Unit Weight of Water given Upward Force due to Seepage Water

Open Calculator

fx $$\gamma_{water} = \frac{F_u}{z \cdot \left(\cos\left(\frac{i \cdot \pi}{180}\right)\right)^2}$$

ex $$17.6367 \text{kN/m}^3 = \frac{52.89 \text{kN/m}^2}{3 \text{m} \cdot \left(\cos\left(\frac{64° \cdot \pi}{180}\right)\right)^2}$$

48) Upward Force due to Seepage Water

Open Calculator

fx $$F_u = \left(\gamma_{water} \cdot z \cdot \left(\cos\left(\frac{i \cdot \pi}{180}\right)\right)^2\right)$$

ex $$29.41882\text{kN/m}^2 = \left(9.81\text{kN/m}^3 \cdot 3\text{m} \cdot \left(\cos\left(\frac{64° \cdot \pi}{180}\right)\right)^2\right)$$

49) Upward Force due to Seepage Water given Effective Normal Stress

Open Calculator

fx $$F_u = \sigma_n - \sigma'$$

ex $$52.69\text{kN/m}^2 = 77.36\text{kN/m}^2 - 24.67\text{kN/m}^2$$

50) Upward Force due to Seepage Water given Submerged Unit Weight

Open Calculator

fx $$F_u = \sigma_n - \left(y_S \cdot z \cdot \left(\cos\left(\frac{i \cdot \pi}{180}\right)\right)^2\right)$$

ex $$62.3657\text{kN/m}^2 = 77.36\text{kN/m}^2 - \left(5.00\text{kN/m}^3 \cdot 3\text{m} \cdot \left(\cos\left(\frac{64° \cdot \pi}{180}\right)\right)^2\right)$$

51) Vertical Stress on Prism given Saturated Unit Weight

Open Calculator

fx $$\sigma_{zkp} = \left(\gamma_{saturated} \cdot z \cdot \cos\left(\frac{i \cdot \pi}{180}\right)\right)$$

ex $$35.66322\text{kPa} = \left(11.89\text{kN/m}^3 \cdot 3\text{m} \cdot \cos\left(\frac{64° \cdot \pi}{180}\right)\right)$$

52) Weight of Soil Prism given Saturated Unit Weight

Open Calculator

fx $$W_{prism} = \left(\gamma_{saturated} \cdot z \cdot b \cdot \cos\left(\frac{i \cdot \pi}{180}\right)\right)$$

ex $$0.677601\text{kN} = \left(11.89\text{kN/m}^3 \cdot 3\text{m} \cdot 0.019\text{m} \cdot \cos\left(\frac{64° \cdot \pi}{180}\right)\right)$$

Variables Used

- **b** Inclined Length of Prism *(Meter)*
- **c'** Effective Cohesion *(Pascal)*
- **C** Cohesion in Soil as Kilopascal *(Kilopascal)*
- C_{eff} Effective Cohesion in Geotech as Kilopascal *(Kilopascal)*
- F_s Factor of Safety in Soil Mechanics
- F_u Upward Force in Seepage Analysis *(Kilonewton per Square Meter)*
- h_c Critical Depth *(Meter)*
- **i** Angle of Inclination to Horizontal in Soil *(Degree)*
- S_n Stability Number
- T_f Shear Strength of Soil *(Pascal)*
- W_{prism} Weight of Prism in Soil Mechanics *(Kilonewton)*
- y_S Submerged Unit Weight in KN per Cubic Meter *(Kilonewton per Cubic Meter)*
- **z** Depth of Prism *(Meter)*
- **γ** Unit Weight of Soil *(Kilonewton per Cubic Meter)*
- γ_b Buoyant Unit Weight *(Kilonewton per Cubic Meter)*
- γ_{sat} Saturated Unit Weight in Newton per Cubic Meter *(Newton per Cubic Meter)*
- $\gamma_{saturated}$ Saturated Unit Weight of Soil *(Kilonewton per Cubic Meter)*
- γ_{water} Unit Weight of Water *(Kilonewton per Cubic Meter)*
- γ' Submerged Unit Weight *(Newton per Cubic Meter)*
- **δ** Slope of Ground *(Degree)*
- ζ_{soil} Shear Stress in Soil Mechanics *(Kilonewton per Square Meter)*
- σ_n Normal Stress in Soil Mechanics *(Kilonewton per Square Meter)*
- σ_z Vertical Stress at Point *(Pascal)*
- σ_{zkp} Vertical Stress at a Point in Kilopascal *(Kilopascal)*
- σ' Effective Normal Stress in Soil Mechanics *(Kilonewton per Square Meter)*
- τ_f Shear Strength in KN per Cubic Meter *(Kilonewton per Square Meter)*
- **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: **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.
- 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), Kilonewton per Square Meter (kN/m²), Kilopascal (kPa)
  Pressure Unit Conversion
- Measurement: **Force** in Kilonewton (kN)
  Force Unit Conversion
- Measurement: **Angle** in Degree (°)
  Angle Unit Conversion
- Measurement: **Specific Weight** in Kilonewton per Cubic Meter (kN/m³), Newton per Cubic Meter (N/m³)
  Specific Weight Unit Conversion
- Measurement: **Stress** in Kilonewton per Square Meter (kN/m²)
  Stress Unit Conversion

Check other formula lists

PDF Available in

English Spanish French German Russian Italian Portuguese Polish Dutch

7/8/2024 | 7:43:30 AM UTC