Important Terzaghi's Analysis: Purely Cohesive Soil Formulas PDF

Formulas
Examples
with Units

List of 23
Important Terzaghi's Analysis: Purely Cohesive Soil Formulas

1) Angle of Shearing Resistance given Bearing Capacity Factor Formula

Evaluate Formula

Formula

$$\varphi = a\cot\left(\frac{N_c}{N_q - 1}\right)$$

Example with Units

$$6.4031^\circ = a\cot\left(\frac{9}{2.01 - 1}\right)$$

2) Bearing Capacity Factor Dependent on Cohesion for Cohesive Soil given Depth of Footing Formula

Evaluate Formula

Formula

$$N_c = \frac{q_f - \left(\left(\gamma \cdot D\right) \cdot N_q\right)}{C_s}$$

Example with Units

$$4.6916 = \frac{60\,\text{kPa} - \left(\left(18\,\text{kN/m}^3 \cdot 1.01\,\text{m}\right) \cdot 2.01\right)}{5.0\,\text{kPa}}$$

3) Bearing Capacity Factor Dependent on cohesion for Purely Cohesive Soil Formula

Evaluate Formula

Formula

$$N_c = \frac{q_{fc} - \left(\left(\sigma_s\right) \cdot N_q\right)}{C_s}$$

Example with Units

$$7.1082 = \frac{127.8\,\text{kPa} - \left(\left(45.9\,\text{kN/m}^2\right) \cdot 2.01\right)}{5.0\,\text{kPa}}$$

4) Bearing Capacity Factor Dependent on cohesion given Angle of Shearing Resistance Formula

Evaluate Formula

Formula

$$N_c = \left(N_q - 1\right) \cdot \cot\left(\left(\varphi\right)\right)$$

Example with Units

$$1.01 = \left(2.01 - 1\right) \cdot \cot\left(\left(45^\circ\right)\right)$$

5) Bearing Capacity Factor Dependent on Surcharge for Cohesive Soil given Depth of Footing Formula

Evaluate Formula

Formula

$$N_q = \frac{q_f - \left(C_s \cdot N_c\right)}{\gamma \cdot D}$$

Example with Units

$$0.8251 = \frac{60\,\text{kPa} - \left(5.0\,\text{kPa} \cdot 9\right)}{18\,\text{kN/m}^3 \cdot 1.01\,\text{m}}$$

6) Bearing Capacity Factor Dependent on Surcharge for Purely Cohesive Soil Formula

Evaluate Formula

Formula

$$N_q = \frac{q_f - \left(C_s \cdot N_c\right)}{\sigma_s}$$

Example with Units

$$0.3268 = \frac{60\,\text{kPa} - \left(5.0\,\text{kPa} \cdot 9\right)}{45.9\,\text{kN/m}^2}$$

7) Bearing Capacity Factor Dependent on Surcharge given Angle of Shearing Resistance Formula

Evaluate Formula

Formula

$$N_q = \left(\frac{N_c}{\cot\left(\frac{\varphi \cdot \pi}{180}\right)}\right) + 1$$

Example with Units

$$1.1234 = \left(\frac{9}{\cot\left(\frac{45° \cdot 3.1416}{180}\right)}\right) + 1$$

8) Bearing Capacity Factor Dependent on Weight given Passive Earth Pressure Coefficient Formula

Evaluate Formula

Formula

$$N_\gamma = \left(\frac{\tan\left(\left(\varphi\right)\right)}{2}\right) \cdot \left(\left(\frac{K_P}{\left(\cos\left(\left(\varphi\right)\right)\right)^2}\right) - 1\right)$$

Example with Units

$$1.6 = \left(\frac{\tan\left(\left(45°\right)\right)}{2}\right) \cdot \left(\left(\frac{2.1}{\left(\cos\left(\left(45°\right)\right)\right)^2}\right) - 1\right)$$

9) Bearing Capacity for Purely Cohesive Soil Formula

Evaluate Formula

Formula

$$q_f = \left(\left(C_s \cdot N_c\right) + \left(\sigma_s \cdot N_q\right)\right)$$

Example with Units

$$137.259\,\text{kPa} = \left(\left(5.0\,\text{kPa} \cdot 9\right) + \left(45.9\,\text{kN/m}^2 \cdot 2.01\right)\right)$$

10) Bearing Capacity for Purely Cohesive Soil given Depth of Footing Formula

Evaluate Formula

Formula

$$q_f = \left(\left(C_s \cdot N_c\right) + \left(\left(\gamma \cdot D\right) \cdot N_q\right)\right)$$

Example with Units

$$81.5418\,\text{kPa} = \left(\left(5.0\,\text{kPa} \cdot 9\right) + \left(\left(18\,\text{kN/m}^3 \cdot 1.01\,\text{m}\right) \cdot 2.01\right)\right)$$

11) Bearing Capacity for Purely Cohesive Soil given Unit Weight of Soil Formula

Evaluate Formula

Formula

$$q_f = \left(5.7 \cdot C_s\right) + \sigma_s$$

Example with Units

$$74.4\,\text{kPa} = \left(5.7 \cdot 5.0\,\text{kPa}\right) + 45.9\,\text{kN/m}^2$$

12) Bearing Capacity for Purely Cohesive Soil given Value of Bearing Capacity Factor Formula

Evaluate Formula

Formula

$$q_f = \left(\left(C_s \cdot 5.7\right) + \left(\sigma_s\right)\right)$$

Example with Units

$$74.4\,\text{kPa} = \left(\left(5.0\,\text{kPa} \cdot 5.7\right) + \left(45.9\,\text{kN/m}^2\right)\right)$$

13) Cohesion of Soil for Purely Cohesive Soil given Depth of Footing Formula

Evaluate Formula

Formula

$$C_s = \frac{q_f - \left(\left(\gamma \cdot D\right) \cdot N_q\right)}{N_c}$$

Example with Units

$$2.6065\,\text{kPa} = \frac{60\,\text{kPa} - \left(\left(18\,\text{kN/m}^3 \cdot 1.01\,\text{m}\right) \cdot 2.01\right)}{9}$$

14) Cohesion of Soil for Purely Cohesive Soil given Unit Weight of Soil Formula

Evaluate Formula

Formula

$$C_s = \frac{q_f - \left(\gamma \cdot D\right)}{5.7}$$

Example with Units

$$7.3368\,\text{kPa} = \frac{60\,\text{kPa} - \left(18\,\text{kN/m}^3 \cdot 1.01\,\text{m}\right)}{5.7}$$

15) Cohesion of Soil given Bearing Capacity for Purely Cohesive Soil Formula

Evaluate Formula

Formula

$$C_s = \frac{q_{fc} - \left(\sigma_s \cdot N_q\right)}{N_c}$$

Example with Units

$$3.949\,\text{kPa} = \frac{127.8\,\text{kPa} - \left(45.9\,\text{kN/m}^2 \cdot 2.01\right)}{9}$$

16) Cohesion of Soil given Value of Bearing Capacity Factor Formula

Evaluate Formula

Formula

$$C_s = \frac{q_f - \left(\sigma_s\right)}{5.7}$$

Example with Units

$$2.4737\,\text{kPa} = \frac{60\,\text{kPa} - \left(45.9\,\text{kN/m}^2\right)}{5.7}$$

17) Depth of Footing given Bearing Capacity for Purely Cohesive Soil Formula

Evaluate Formula

Formula

$$D = \frac{q_f - \left(C_s \cdot N_c\right)}{\gamma \cdot N_q}$$

Example with Units

$$0.4146\,\text{m} = \frac{60\,\text{kPa} - \left(5.0\,\text{kPa} \cdot 9\right)}{18\,\text{kN/m}^3 \cdot 2.01}$$

18) Depth of Footing given Value of Bearing Capacity Factor Formula

Evaluate Formula

Formula

$$D = \frac{q_f - \left(C_s \cdot 5.7\right)}{\gamma}$$

Example with Units

$$1.75\,\text{m} = \frac{60\,\text{kPa} - \left(5.0\,\text{kPa} \cdot 5.7\right)}{18\,\text{kN/m}^3}$$

19) Effective Surcharge given Bearing Capacity for Purely Cohesive Soil Formula

Evaluate Formula

Formula

$$\sigma_s = \frac{q_f - \left(C_s \cdot N_c\right)}{N_q}$$

Example with Units

$$7.4627\,\text{kN/m}^2 = \frac{60\,\text{kPa} - \left(5.0\,\text{kPa} \cdot 9\right)}{2.01}$$

20) Effective Surcharge given Value of Bearing Capacity Factor Formula

Evaluate Formula

Formula

$$\sigma_s = q_f - \left(5.7 \cdot C_s\right)$$

Example with Units

$$31.5\,\text{kN/m}^2 = 60\,\text{kPa} - \left(5.7 \cdot 5.0\,\text{kPa}\right)$$

21) Passive Earth Pressure Coefficient given Bearing Capacity Factor Formula

Evaluate Formula

Formula

$$K_P = \left(\left(\frac{N_\gamma}{\tan\left(\left(\varphi\right)\right)} + 1\right) \cdot \left(\cos\left(\left(\varphi\right)\right)\right)^2\right)^2$$

Example with Units

$$2.1 = \left(\left(\frac{1.6}{\tan\left(\left(45°\right)\right)} + 1\right) \cdot \left(\cos\left(\left(45°\right)\right)\right)^2\right)^2$$

22) Unit Weight of Soil given Bearing Capacity for Purely Cohesive Soil Formula

Evaluate Formula

Formula

$$\gamma = \frac{q_f - \left(C_s \cdot N_c\right)}{D \cdot N_q}$$

Example with Units

$$7.3888\,\text{kN/m}^3 = \frac{60\,\text{kPa} - \left(5.0\,\text{kPa} \cdot 9\right)}{1.01\,\text{m} \cdot 2.01}$$

23) Unit Weight of Soil given Value of Bearing Capacity Factor Formula

Evaluate Formula

Formula

$$\gamma = \frac{q_f - \left(C_s \cdot 5.7\right)}{D}$$

Example with Units

$$31.1881\,\text{kN/m}^3 = \frac{60\,\text{kPa} - \left(5.0\,\text{kPa} \cdot 5.7\right)}{1.01\,\text{m}}$$

Variables used in list of Terzaghi's Analysis: Purely Cohesive Soil Formulas above

- C_s Cohesion of Soil *(Kilopascal)*
- **D** Depth of Footing *(Meter)*
- K_P Coefficient of Passive Pressure
- N_c Bearing Capacity Factor dependent on Cohesion
- N_q Bearing Capacity Factor dependent on Surcharge
- N_γ Bearing Capacity Factor dependent on Unit Weight
- q_f Ultimate Bearing Capacity *(Kilopascal)*
- q_{fc} Ultimate Bearing Capacity in Soil *(Kilopascal)*
- γ Unit Weight of Soil *(Kilonewton per Cubic Meter)*
- σ_s Effective Surcharge in KiloPascal *(Kilonewton per Square Meter)*
- φ Angle of Shearing Resistance *(Degree)*

Constants, Functions, Measurements used in list of Terzaghi's Analysis: Purely Cohesive Soil Formulas above

- constant(s): **pi**, 3.14159265358979323846264338327950288 *Archimedes' constant*
- Functions: **acot**, acot(Number) *The ACOT function calculates the arccotangent of a given number which is an angle given in radians from 0 (zero) to pi.*
- 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: **cot**, cot(Angle) *Cotangent is a trigonometric function that is defined as the ratio of the adjacent side to the opposite side in a 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 Kilopascal (kPa), Kilonewton per Square Meter (kN/m²) *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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