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Terzaghi's Analysis: Purely Cohesive Soil Formulas

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

Terzaghi's Analysis: Purely Cohesive Soil

1) Angle of Shearing Resistance given Bearing Capacity Factor

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

Open Calculator 

$$\text{ex } 6.340192^\circ = a \cot \left(\frac{9}{2.0 - 1} \right)$$

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

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

Open Calculator 

$$\text{ex } 4.728 = \frac{60\text{kPa} - ((18\text{kN}/\text{m}^3 \cdot 1.01\text{m}) \cdot 2.0)}{5.0\text{kPa}}$$



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

$$fx \quad N_c = \frac{q_f - ((\sigma_s) \cdot N_q)}{C_s}$$

[Open Calculator !\[\]\(cbe80b694ebd74fcfe136a095b608235_img.jpg\)](#)

$$ex \quad -6.36 = \frac{60\text{kPa} - ((45.9\text{kN/m}^2) \cdot 2.0)}{5.0\text{kPa}}$$

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

$$fx \quad N_c = (N_q - 1) \cdot \cot((\phi))$$

[Open Calculator !\[\]\(3e2231b1ad3ca8da8658228c00dd08e0_img.jpg\)](#)

$$ex \quad 1 = (2.0 - 1) \cdot \cot((45^\circ))$$

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

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

[Open Calculator !\[\]\(0d5ec72f61334709c3fc9450209b754f_img.jpg\)](#)

$$ex \quad 0.825083 = \frac{60\text{kPa} - (5.0\text{kPa} \cdot 9)}{18\text{kN/m}^3 \cdot 1.01\text{m}}$$



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

$$fx \quad N_q = \frac{q_f - (C_s \cdot N_c)}{\sigma_s}$$

[Open Calculator !\[\]\(e78f798d4ea5c530c9db49e7d26e6b95_img.jpg\)](#)

$$ex \quad 0.326797 = \frac{60\text{kPa} - (5.0\text{kPa} \cdot 9)}{45.9\text{kN/m}^2}$$

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

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

[Open Calculator !\[\]\(05be7c7a8995decd503647c99211f7c2_img.jpg\)](#)

$$ex \quad 1.123378 = \left(\frac{9}{\cot\left(\frac{45^\circ \cdot \pi}{180}\right)} \right) + 1$$

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

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

[Open Calculator !\[\]\(fe3aebe81acea8d45108cd2768939da7_img.jpg\)](#)

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



9) Bearing Capacity for Purely Cohesive Soil

$$fx \quad q_f = ((C_s \cdot N_c) + (\sigma_s \cdot N_q))$$

[Open Calculator !\[\]\(e2376d476d06eb31946dc01a69a4403a_img.jpg\)](#)

$$ex \quad 136.8kPa = ((5.0kPa \cdot 9) + (45.9kN/m^2 \cdot 2.0))$$

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

$$fx \quad q_f = ((C_s \cdot N_c) + ((\gamma \cdot D) \cdot N_q))$$

[Open Calculator !\[\]\(0b5e7e25e8775f7e7e80906ada4f0021_img.jpg\)](#)

$$ex \quad 81.36kPa = ((5.0kPa \cdot 9) + ((18kN/m^3 \cdot 1.01m) \cdot 2.0))$$

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

$$fx \quad q_f = (5.7 \cdot C_s) + \sigma_s$$

[Open Calculator !\[\]\(bd3b31712ad9bab5a241210fa6925cdd_img.jpg\)](#)

$$ex \quad 74.4kPa = (5.7 \cdot 5.0kPa) + 45.9kN/m^2$$

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

$$fx \quad q_f = ((C_s \cdot 5.7) + (\sigma_s))$$

[Open Calculator !\[\]\(7bc43b319a082987e20f7bf78f4bab80_img.jpg\)](#)

$$ex \quad 74.4kPa = ((5.0kPa \cdot 5.7) + (45.9kN/m^2))$$

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

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

[Open Calculator !\[\]\(4a7b4ce770af8456e11a71f9565c8c2b_img.jpg\)](#)

$$ex \quad 2.626667kPa = \frac{60kPa - ((18kN/m^3 \cdot 1.01m) \cdot 2.0)}{9}$$



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

$$fx \quad C_s = \frac{q_f - (\gamma \cdot D)}{5.7}$$

[Open Calculator !\[\]\(d3fb9f94af8b26d1c844efa9a98805b0_img.jpg\)](#)

$$ex \quad 7.336842kPa = \frac{60kPa - (18kN/m^3 \cdot 1.01m)}{5.7}$$

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

$$fx \quad C_s = \frac{q_f - (\sigma_s \cdot N_q)}{N_c}$$

[Open Calculator !\[\]\(e1d6102fe77919492c04879c8450f1f5_img.jpg\)](#)

$$ex \quad -3.533333kPa = \frac{60kPa - (45.9kN/m^2 \cdot 2.0)}{9}$$

16) Cohesion of Soil given Value of Bearing Capacity Factor 

$$fx \quad C_s = \frac{q_f - (\sigma_s)}{5.7}$$

[Open Calculator !\[\]\(ab4e2b3fc7e7887b7a72f548aa6f5e60_img.jpg\)](#)

$$ex \quad 2.473684kPa = \frac{60kPa - (45.9kN/m^2)}{5.7}$$

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

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

[Open Calculator !\[\]\(5abce1a84a655b073239ab33e1199487_img.jpg\)](#)

$$ex \quad 0.416667m = \frac{60kPa - (5.0kPa \cdot 9)}{18kN/m^3 \cdot 2.0}$$




18) Depth of Footing given Value of Bearing Capacity Factor 

$$fx \quad D = \frac{q_f - (C_s \cdot 5.7)}{\gamma}$$

[Open Calculator !\[\]\(9dfdaff1d86ba3c1f8353b4d1b61b8c5_img.jpg\)](#)

$$ex \quad 1.75m = \frac{60kPa - (5.0kPa \cdot 5.7)}{18kN/m^3}$$

19) Effective Surcharge given Bearing Capacity for Purely Cohesive Soil 

$$fx \quad \sigma_s = \frac{q_f - (C_s \cdot N_c)}{N_q}$$

[Open Calculator !\[\]\(2b376d1a92330ab09dad2665d2f89bf5_img.jpg\)](#)


$$ex \quad 7.5kN/m^2 = \frac{60kPa - (5.0kPa \cdot 9)}{2.0}$$

20) Effective Surcharge given Value of Bearing Capacity Factor 

$$fx \quad \sigma_s = q_f - (5.7 \cdot C_s)$$

[Open Calculator !\[\]\(c444627dab9fee9a1550c053ffaaaae2_img.jpg\)](#)

$$ex \quad 31.5kN/m^2 = 60kPa - (5.7 \cdot 5.0kPa)$$

21) Passive Earth Pressure Coefficient given Bearing Capacity Factor 

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

[Open Calculator !\[\]\(06a315363e7801bba8c7489a6694af19_img.jpg\)](#)

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



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

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

[Open Calculator !\[\]\(6605b201d6f14d9b3bcb8ab5f274d107_img.jpg\)](#)

$$\text{ex } 7.425743 \text{ kN/m}^3 = \frac{60 \text{ kPa} - (5.0 \text{ kPa} \cdot 9)}{1.01 \text{ m} \cdot 2.0}$$

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

$$\text{fx } \gamma = \frac{q_f - (C_s \cdot 5.7)}{D}$$

[Open Calculator !\[\]\(e8fb589d58dad1692debababa5e928b6_img.jpg\)](#)

$$\text{ex } 31.18812 \text{ kN/m}^3 = \frac{60 \text{ kPa} - (5.0 \text{ kPa} \cdot 5.7)}{1.01 \text{ m}}$$







Variables Used

- 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*)
- 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

- **Constant:** **pi**, 3.14159265358979323846264338327950288
Archimedes' constant
- **Function:** **acot**, $\text{acot}(\text{Number})$
Inverse trigonometric cotangent function
- **Function:** **cos**, $\text{cos}(\text{Angle})$
Trigonometric cosine function
- **Function:** **cot**, $\text{cot}(\text{Angle})$
Trigonometric cotangent function
- **Function:** **tan**, $\text{tan}(\text{Angle})$
Trigonometric tangent function
- **Measurement:** **Length** in Meter (m)
Length Unit Conversion 
- **Measurement:** **Pressure** in Kilopascal (kPa), Kilonewton per Square Meter (kN/m^2)
Pressure Unit Conversion 
- **Measurement:** **Angle** in Degree ($^\circ$)
Angle Unit Conversion 
- **Measurement:** **Specific Weight** in Kilonewton per Cubic Meter (kN/m^3)
Specific Weight Unit Conversion 



Check other formula lists

- [Terzaghi's Analysis: Purely Cohesive Soil Formulas](#) 
- [Terzaghi's Analysis: Water Table is Below the Base of Footing Formulas](#) 

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