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Terzaghi's Analysis: Water Table is Below the Base of Footing Formulas

Calculators! Examples! Conversions!

List of 25 Terzaghi's Analysis: Water Table is Below the Base of Footing Formulas

Terzaghi's Analysis: Water Table is Below the Base of Footing

1) Cohesion of Soil given Depth and Width of Footing

Open Calculator

fx $$C_s = \frac{q_f - \left((\gamma \cdot D \cdot N_q) + (0.5 \cdot \gamma \cdot B \cdot N_\gamma)\right)}{N_c}$$

ex $$-0.573333\text{kPa} = \frac{60\text{kPa} - ((18\text{kN/m}^3 \cdot 1.01\text{m} \cdot 2.0) + (0.5 \cdot 18\text{kN/m}^3 \cdot 2\text{m} \cdot 1.6))}{9}$$

2) Cohesion of Soil given Net Ultimate Bearing Capacity

Open Calculator

fx $$C_s = \frac{q_{nf} - \left((\sigma_s \cdot (N_q - 1)) + (0.5 \cdot \gamma \cdot B \cdot N_\gamma)\right)}{N_c}$$

ex $$8.366667\text{kPa} = \frac{150\text{kN/m}^2 - ((45.9\text{kN/m}^2 \cdot (2.0 - 1)) + (0.5 \cdot 18\text{kN/m}^3 \cdot 2\text{m} \cdot 1.6))}{9}$$

3) Cohesion of Soil given Safe Bearing Capacity

Open Calculator

fx

$C_s = (((q_{sa} \cdot f_s) - (f_s \cdot \sigma$"))-(("σ"_{"s"}*("N"_{"q"}-1))+(0.5*"γ"*"B"*"N"_{"γ"})))/"N"_{"c"}`

ex

$$13.47467\text{kPa} = \frac{((70\text{kN/m}^2 \cdot 2.8) - (2.8 \cdot 10.0\text{Pa})) - ((45.9\text{kN/m}^2 \cdot (2.0 - 1)) + (0.5 \cdot 18\text{kN/m}^3 \cdot 2\text{m} \cdot 1.6))}{9}$$

4) Depth of Footing given Bearing Capacity Factor

Open Calculator

fx $$D = \frac{q_f - \left((C_s \cdot N_c) + (0.5 \cdot \gamma \cdot B \cdot N_\gamma)\right)}{\gamma \cdot N_q}$$

ex $$-0.383333\text{m} = \frac{60\text{kPa} - ((5.0\text{kPa} \cdot 9) + (0.5 \cdot 18\text{kN/m}^3 \cdot 2\text{m} \cdot 1.6))}{18\text{kN/m}^3 \cdot 2.0}$$

5) Depth of Footing given Bearing Capacity Factor and Width of Footing

Open Calculator

fx $$D = \frac{q_{nf} - \left((C_s \cdot N_c) + (0.5 \cdot \gamma \cdot B \cdot N_\gamma)\right)}{\gamma \cdot (N_q - 1)}$$

ex $$4.233333\text{m} = \frac{150\text{kN/m}^2 - ((5.0\text{kPa} \cdot 9) + (0.5 \cdot 18\text{kN/m}^3 \cdot 2\text{m} \cdot 1.6))}{18\text{kN/m}^3 \cdot (2.0 - 1)}$$

6) Depth of Footing given Factor of Safety and Safe Bearing Capacity

Open Calculator

fx $$D = \frac{(q_{sa} \cdot f_s) - \left((C_s \cdot N_c) + (0.5 \cdot \gamma \cdot B \cdot N_\gamma)\right)}{\gamma \cdot N_q}$$

ex $$3.394444\text{m} = \frac{(70\text{kN/m}^2 \cdot 2.8) - ((5.0\text{kPa} \cdot 9) + (0.5 \cdot 18\text{kN/m}^3 \cdot 2\text{m} \cdot 1.6))}{18\text{kN/m}^3 \cdot 2.0}$$

7) Effective Surcharge given Bearing Capacity Factor

Open Calculator

fx $$\sigma_s = \frac{q_{nf} - \left((C_s \cdot N_c) + (0.5 \cdot \gamma \cdot B \cdot N_\gamma)\right)}{N_q - 1}$$

ex $$104.7176\text{kN/m}^2 = \frac{150\text{kN/m}^2 - ((5.0\text{kPa} \cdot 9) + (0.5 \cdot 18\text{kN/m}^3 \cdot 2\text{m} \cdot 1.6))}{2.0 - 1}$$

8) Effective Surcharge given Safe Bearing Capacity

Open Calculator

fx $$\sigma_s = \frac{(q_{sa} \cdot f_s) - \left((C_s \cdot N_c) + (0.5 \cdot \gamma \cdot B \cdot N_\gamma)\right)}{f_s + N_q - 1}$$

ex $$32.15789\text{kN/m}^2 = \frac{(70\text{kN/m}^2 \cdot 2.8) - ((5.0\text{kPa} \cdot 9) + (0.5 \cdot 18\text{kN/m}^3 \cdot 2\text{m} \cdot 1.6))}{2.8 + 2.0 - 1}$$

9) Factor of Safety given Bearing Capacity Factor

Open Calculator

fx $$f_s = \frac{(C_s \cdot N_c) + (\sigma_s \cdot (N_q - 1)) + (0.5 \cdot \gamma \cdot B \cdot N_\gamma)}{q_{sa} - \sigma_s}$$

ex $$4.966805 = \frac{(5.0\text{kPa} \cdot 9) + (45.9\text{kN/m}^2 \cdot (2.0 - 1)) + (0.5 \cdot 18\text{kN/m}^3 \cdot 2\text{m} \cdot 1.6)}{70\text{kN/m}^2 - 45.9\text{kN/m}^2}$$

10) Factor of Safety given Depth and Width of Footing

Open Calculator

fx $$f_s = \frac{(C_s \cdot N_c) + ((\gamma \cdot D) \cdot (N_q - 1)) + (0.5 \cdot \gamma \cdot B \cdot N_\gamma)}{q_{sa} - (\gamma \cdot D)}$$

ex $$1.77499 = \frac{(5.0\text{kPa} \cdot 9) + ((18\text{kN/m}^3 \cdot 1.01\text{m}) \cdot (2.0 - 1)) + (0.5 \cdot 18\text{kN/m}^3 \cdot 2\text{m} \cdot 1.6)}{70\text{kN/m}^2 - (18\text{kN/m}^3 \cdot 1.01\text{m})}$$

11) Net Ultimate Bearing Capacity given Bearing Capacity Factor

Open Calculator

fx $$q_{nf} = (C_s \cdot N_c) + (\sigma_s \cdot (N_q - 1)) + (0.5 \cdot \gamma \cdot B \cdot N_\gamma)$$

ex $$119.7\text{kN/m}^2 = (5.0\text{kPa} \cdot 9) + (45.9\text{kN/m}^2 \cdot (2.0 - 1)) + (0.5 \cdot 18\text{kN/m}^3 \cdot 2\text{m} \cdot 1.6)$$

12) Net Ultimate Bearing Capacity given Depth and Width of Footing

Open Calculator

fx $$q_{nf} = \left((C_s \cdot N_c) + ((\gamma \cdot D) \cdot (N_q - 1)) + (0.5 \cdot \gamma \cdot B \cdot N_\gamma)\right)$$

ex $$91.98\text{kN/m}^2 = ((5.0\text{kPa} \cdot 9) + ((18\text{kN/m}^3 \cdot 1.01\text{m}) \cdot (2.0 - 1)) + (0.5 \cdot 18\text{kN/m}^3 \cdot 2\text{m} \cdot 1.6))$$

13) Safe Bearing Capacity given Bearing Capacity Factor

Open Calculator

fx $$q_{sa} = \left(\frac{(C_s \cdot N_c) + (\sigma_s \cdot (N_q - 1)) + (0.5 \cdot \gamma \cdot B \cdot N_\gamma)}{f_s}\right) + \sigma_s$$

ex $$88.65\text{kN/m}^2 = \left(\frac{(5.0\text{kPa} \cdot 9) + (45.9\text{kN/m}^2 \cdot (2.0 - 1)) + (0.5 \cdot 18\text{kN/m}^3 \cdot 2\text{m} \cdot 1.6)}{2.8}\right) + 45.9\text{kN/m}^2$$

14) Safe Bearing Capacity given Depth and Width of Footing

Open Calculator

fx $$q_{sa} = \left(\frac{(C_s \cdot N_c) + ((\gamma \cdot D) \cdot (N_q - 1)) + (0.5 \cdot \gamma \cdot B \cdot N_\gamma)}{f_s}\right) + (\gamma \cdot D)$$

ex

$$51.03\text{kN/m}^2 = \left(\frac{(5.0\text{kPa} \cdot 9) + ((18\text{kN/m}^3 \cdot 1.01\text{m}) \cdot (2.0 - 1)) + (0.5 \cdot 18\text{kN/m}^3 \cdot 2\text{m} \cdot 1.6)}{2.8}\right) + (18\text{kN/m}^3 \cdot$$

15) Ultimate Bearing Capacity given Bearing Capacity Factor

Open Calculator

fx $$q_f = (C_s \cdot N_c) + (\gamma \cdot D \cdot N_q) + (0.5 \cdot \gamma \cdot B \cdot N_\gamma)$$

ex $$110.16\text{kPa} = (5.0\text{kPa} \cdot 9) + (18\text{kN/m}^3 \cdot 1.01\text{m} \cdot 2.0) + (0.5 \cdot 18\text{kN/m}^3 \cdot 2\text{m} \cdot 1.6)$$

16) Unit Weight of Soil given Bearing Capacity Factor, Depth and Width of Footing

Open Calculator

fx $$\gamma = \frac{q_{nf} - (C_s \cdot N_c)}{(0.5 \cdot B \cdot N_\gamma) + (D \cdot (N_q - 1))}$$

ex $$0.04023\text{kN/m}^3 = \frac{150\text{kN/m}^2 - (5.0\text{kPa} \cdot 9)}{(0.5 \cdot 2\text{m} \cdot 1.6) + (1.01\text{m} \cdot (2.0 - 1))}$$

17) Unit Weight of Soil given Depth and Width of Footing

Open Calculator

fx $$\gamma = \frac{q_f - (C_s \cdot N_c)}{(D \cdot N_q) + (0.5 \cdot B \cdot N_\gamma)}$$

ex $$4.143646\text{kN/m}^3 = \frac{60\text{kPa} - (5.0\text{kPa} \cdot 9)}{(1.01\text{m} \cdot 2.0) + (0.5 \cdot 2\text{m} \cdot 1.6)}$$

18) Unit Weight of Soil given Factor of Safety and Safe Bearing Capacity

Open Calculator

fx $$\gamma = \frac{(q_{sa} \cdot f_s) - ((C_s \cdot N_c))}{(N_q \cdot D) + (0.5 \cdot B \cdot N_\gamma)}$$

ex $$41.71271\text{kN/m}^3 = \frac{(70\text{kN/m}^2 \cdot 2.8) - ((5.0\text{kPa} \cdot 9))}{(2.0 \cdot 1.01\text{m}) + (0.5 \cdot 2\text{m} \cdot 1.6)}$$

19) Unit Weight of Soil given Net Ultimate Bearing Capacity

Open Calculator

fx $$\gamma = \frac{q_{nf} - ((C_s \cdot N_c) + (\sigma_s \cdot (N_q - 1)))}{0.5 \cdot B \cdot N_\gamma}$$

ex $$36.9375\text{kN/m}^3 = \frac{150\text{kN/m}^2 - ((5.0\text{kPa} \cdot 9) + (45.9\text{kN/m}^2 \cdot (2.0 - 1)))}{0.5 \cdot 2\text{m} \cdot 1.6}$$

20) Unit Weight of Soil given Safe Bearing Capacity

Open Calculator

fx $$\gamma = \frac{((q_{sa} \cdot f_s) - (f_s \cdot \sigma_s)) - ((C_s \cdot N_c) + (\sigma_s \cdot (N_q - 1)))}{0.5 \cdot B \cdot N_\gamma}$$

ex $$-14.6375\text{kN/m}^3 = \frac{((70\text{kN/m}^2 \cdot 2.8) - (2.8 \cdot 45.9\text{kN/m}^2)) - ((5.0\text{kPa} \cdot 9) + (45.9\text{kN/m}^2 \cdot (2.0 - 1)))}{0.5 \cdot 2\text{m} \cdot 1.6}$$

21) Width of Footing given Bearing Capacity Factor and Depth of Footing

Open Calculator

fx $$B = \frac{q_{nf} - ((C_s \cdot N_c) + ((\gamma \cdot D) \cdot (N_q - 1)))}{0.5 \cdot \gamma \cdot N_\gamma}$$

ex $$6.029167\text{m} = \frac{150\text{kN/m}^2 - ((5.0\text{kPa} \cdot 9) + ((18\text{kN/m}^3 \cdot 1.01\text{m}) \cdot (2.0 - 1)))}{0.5 \cdot 18\text{kN/m}^3 \cdot 1.6}$$

22) Width of Footing given Effective Surcharge

Open Calculator

fx $$B = \frac{q_{nf} - ((C_s \cdot N_c) + (\sigma_s \cdot (N_q - 1)))}{0.5 \cdot \gamma \cdot N_\gamma}$$

ex $$4.104167\text{m} = \frac{150\text{kN/m}^2 - ((5.0\text{kPa} \cdot 9) + (45.9\text{kN/m}^2 \cdot (2.0 - 1)))}{0.5 \cdot 18\text{kN/m}^3 \cdot 1.6}$$

23) Width of Footing given Factor of Safety and Safe Bearing Capacity

Open Calculator

fx $$B = \frac{((q_{sa} \cdot f_s) - (f_s \cdot (\gamma \cdot D))) - ((C_s \cdot N_c) + ((\gamma \cdot D) \cdot (N_q - 1)))}{0.5 \cdot \gamma \cdot N_\gamma}$$

ex $$5.688611\text{m} = \frac{((70\text{kN/m}^2 \cdot 2.8) - (2.8 \cdot (18\text{kN/m}^3 \cdot 1.01\text{m}))) - ((5.0\text{kPa} \cdot 9) + ((18\text{kN/m}^3 \cdot 1.01\text{m}) \cdot (2.0 - 1}{0.5 \cdot 18\text{kN/m}^3 \cdot 1.6}$$

24) Width of Footing given Safe Bearing Capacity

Open Calculator

fx $$B = \frac{((q_{sa} \cdot f_s) - (f_s \cdot \sigma_s)) - ((C_s \cdot N_c) + (\sigma_s \cdot (N_q - 1)))}{0.5 \cdot \gamma \cdot N_\gamma}$$

ex $$-1.626389\text{m} = \frac{((70\text{kN/m}^2 \cdot 2.8) - (2.8 \cdot 45.9\text{kN/m}^2)) - ((5.0\text{kPa} \cdot 9) + (45.9\text{kN/m}^2 \cdot (2.0 - 1)))}{0.5 \cdot 18\text{kN/m}^3 \cdot 1.6}$$

25) Width of Footing given Ultimate Bearing Capacity

Open Calculator

fx $$B = \frac{q_f - ((C_s \cdot N_c) + (\gamma \cdot D \cdot N_q))}{0.5 \cdot \gamma \cdot N_\gamma}$$

ex $$-1.483333\text{m} = \frac{60\text{kPa} - ((5.0\text{kPa} \cdot 9) + (18\text{kN/m}^3 \cdot 1.01\text{m} \cdot 2.0))}{0.5 \cdot 18\text{kN/m}^3 \cdot 1.6}$$

Variables Used

- **B** Width of Footing *(Meter)*
- C_s Cohesion of Soil *(Kilopascal)*
- **D** Depth of Footing *(Meter)*
- f_s Factor of Safety
- 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_{nf} Net Ultimate Bearing Capacity *(Kilonewton per Square Meter)*
- q_{sa} Safe Bearing Capacity *(Kilonewton per Square Meter)*
- γ Unit Weight of Soil *(Kilonewton per Cubic Meter)*
- σ_s Effective Surcharge in KiloPascal *(Kilonewton per Square Meter)*
- $\sigma`$ Effective Surcharge *(Pascal)*

Constants, Functions, Measurements used

- Measurement: **Length** in Meter (m)
  Length Unit Conversion
- Measurement: **Pressure** in Kilopascal (kPa), Kilonewton per Square Meter (kN/m²), Pascal (Pa)
  Pressure Unit Conversion
- Measurement: **Specific Weight** in Kilonewton per Cubic Meter (kN/m³)
  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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